

Exhibit 1

PAUL HASTINGS

1(202) 551-1991
phillipcitroen@paulhastings.com

March 14, 2019

92861.00002

VIA E-MAIL

Kat Hacker
Bartlit Beck Herman Palenchar & Scott LLP
1801 Wewatta, Suite 1200
Denver, CO 80202

Re: Elm 3DS Innovations, LLC v. Samsung Elecs. Co. Ltd., et al., CA. No. 14-cv-1430-
LPS-CJB

Dear Kat:

We are sending you instructions on how to download our production bearing Bates number SAMSUNG-ELM-000058542 - SAMSUNG-ELM-000058543. These documents are highly confidential and designated "CONFIDENTIAL OUTSIDE COUNSEL ONLY, HIGHLY CONFIDENTIAL" and should be treated accordingly as provided in the Protective Order entered by the Court.

Please let us know if you have any questions.

Sincerely,

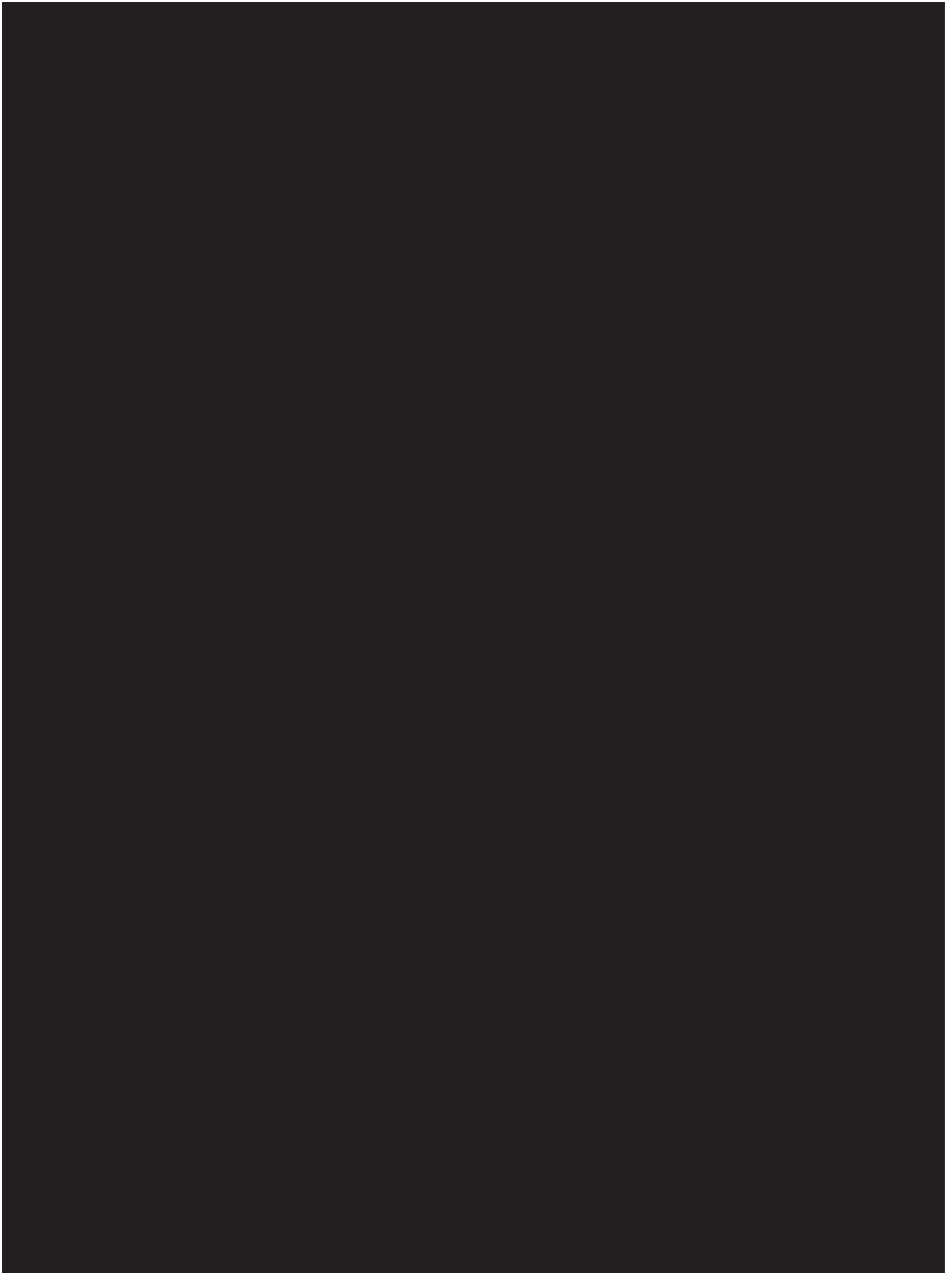
/s/ Phillip W. Citroen

Phillip W. Citroen
for PAUL HASTINGS LLP

PWC

cc: Counsel of Record (*via email*)

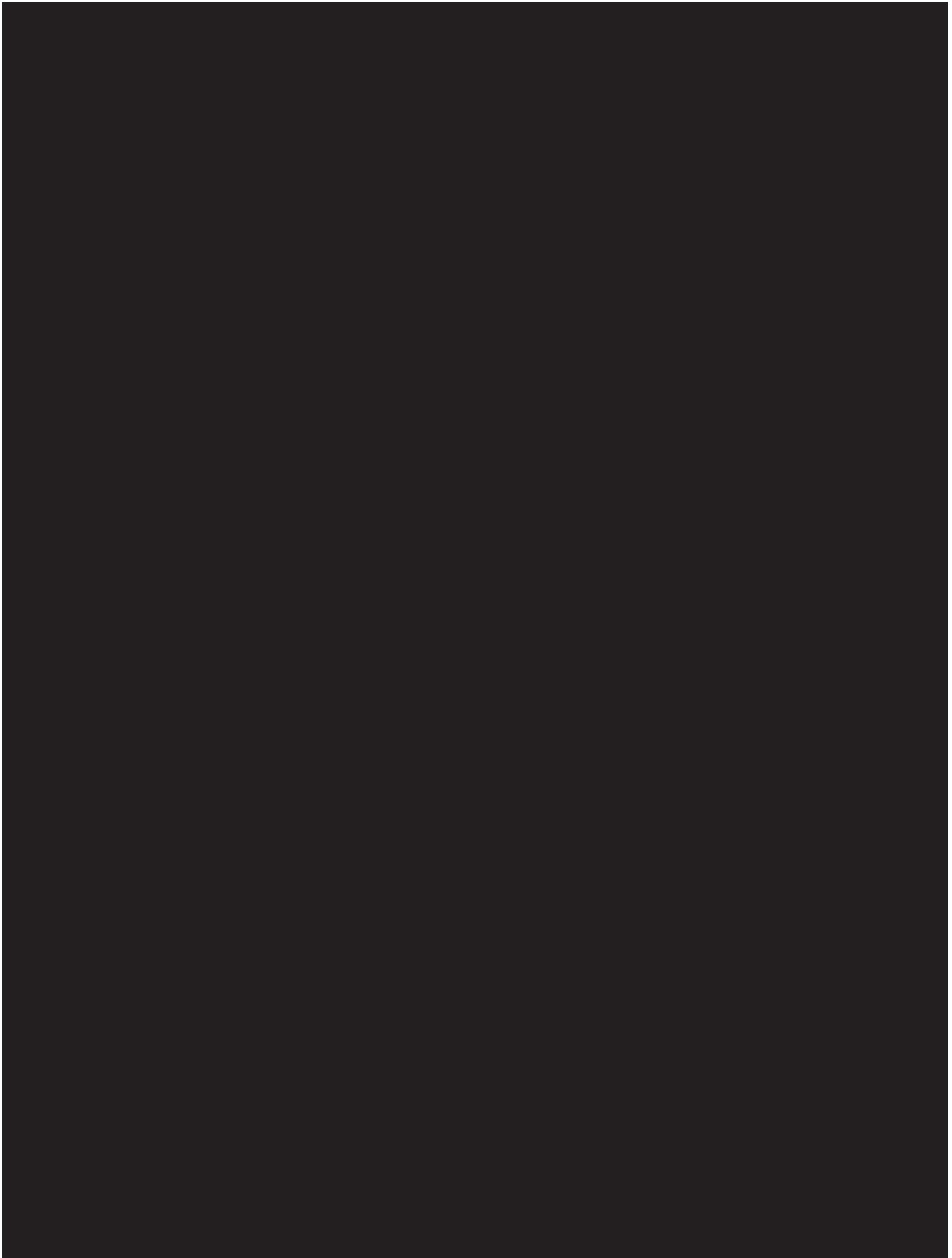
Exhibit 2



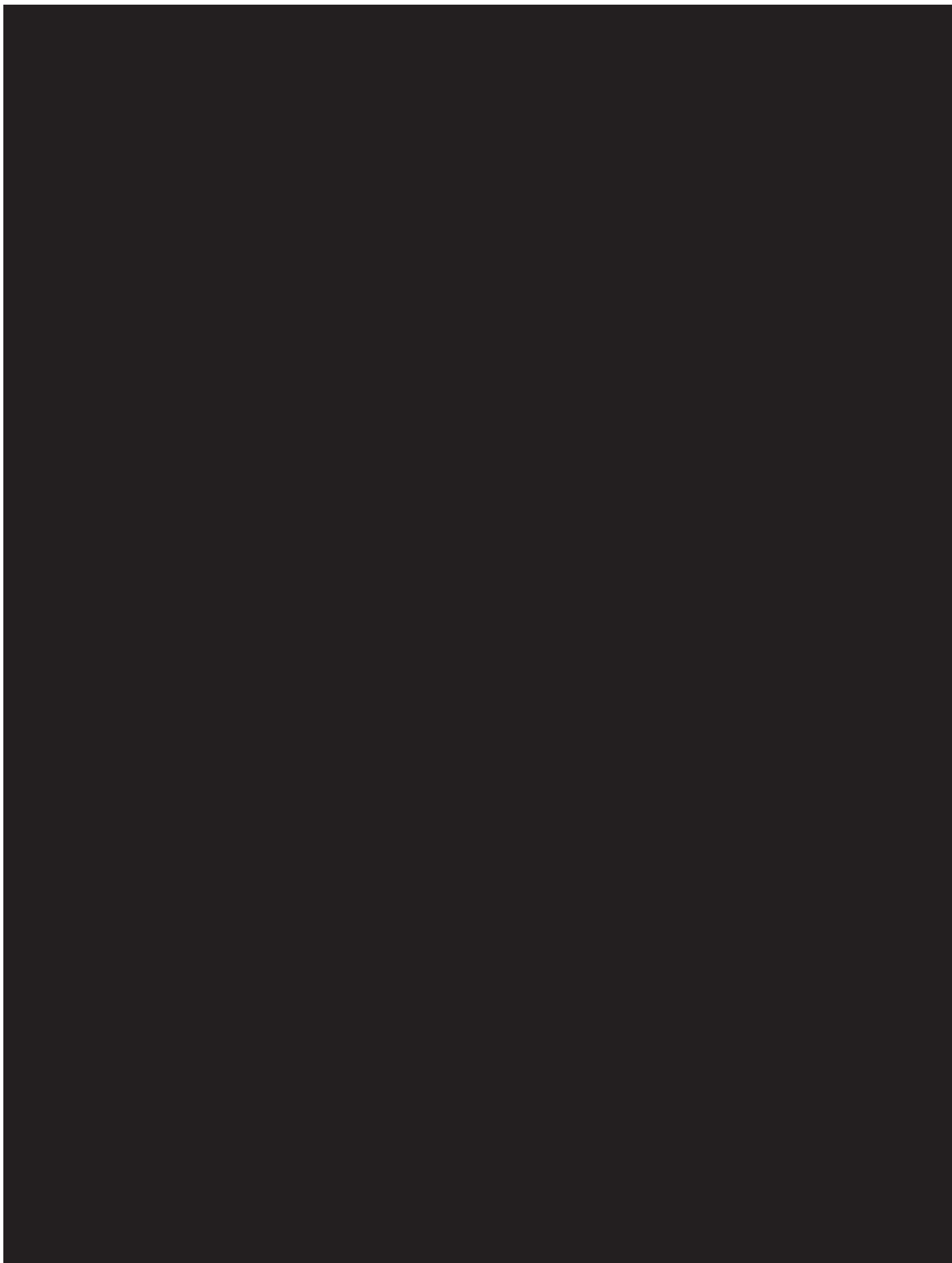












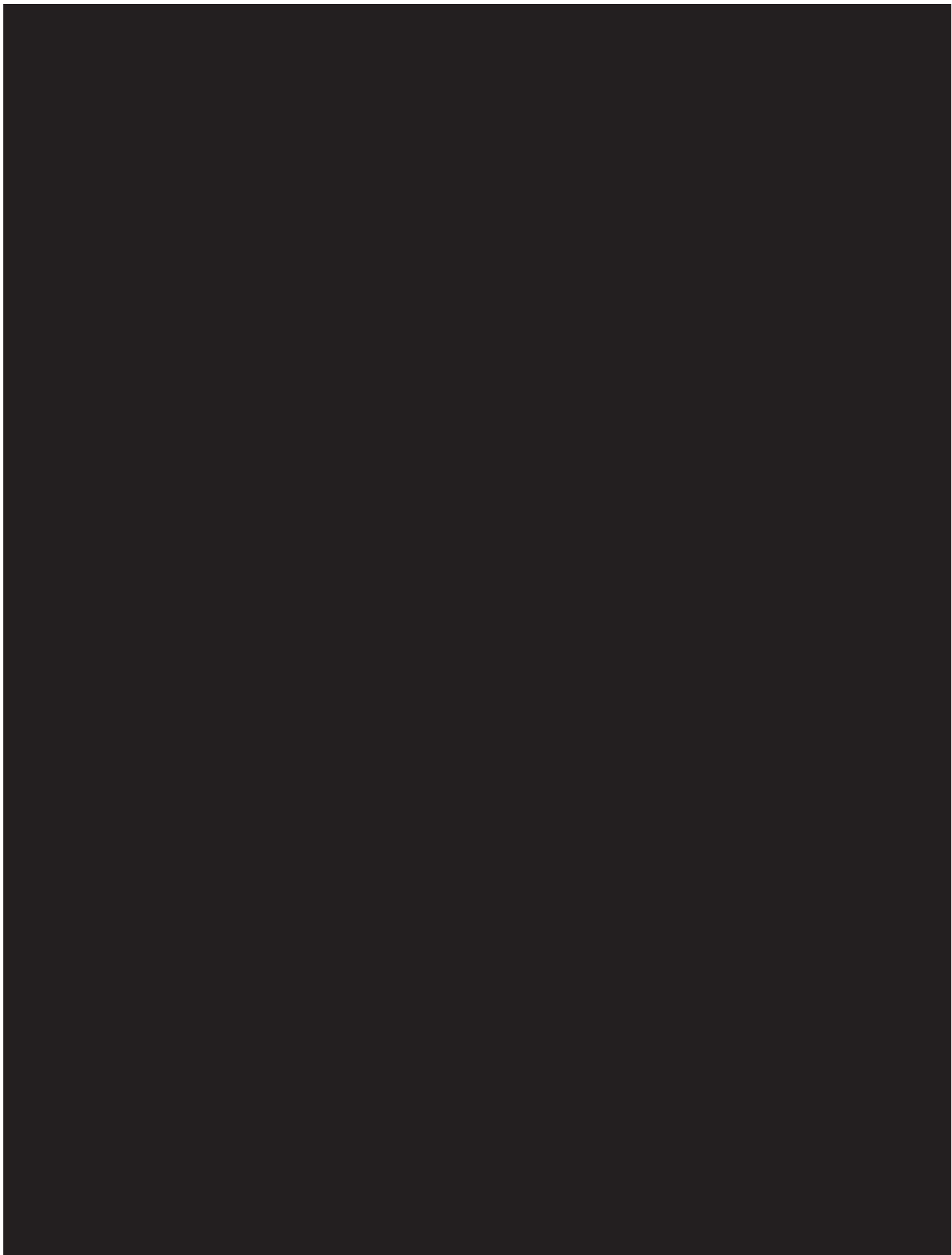
















Exhibit 3

**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE**

)	
)	
ELM 3DS INNOVATIONS, LLC,)	
	)	C.A. No. 14-cv-01430-LPS-CJB
Plaintiff,)	
)	
v.	)	Jury Trial Demanded
)	
SAMSUNG ELECTRONICS CO., LTD., et al.,)	
)	
Defendants.)	
)	
)	
)	

ELM’S THIRD SET OF INTERROGATORIES (NO. 4)

Under Federal Rules of Procedure 26 and 33, Plaintiff Elm 3DS Innovations, LLC, (“Elm 3DS”) requests that Defendants Samsung Electronics Co., Ltd., Samsung Semiconductor, Inc., Samsung Electronics America, Inc., and Samsung Austin Semiconductor, LLC (collectively “Samsung”) answer the following Interrogatories in writing and under oath under Rule 33 and serve a copy of your answers upon Robins Kaplan LLP, 800 LaSalle Avenue, 2800 LaSalle Plaza, Minneapolis, MN 55402 within 30 days of service of these Interrogatories upon you. These Interrogatories are continuing in nature and must be supplemented or corrected, or both, in a timely manner.

DEFINITIONS

1. The terms “Elm” and “Elm 3DS” refer to the Plaintiff in these actions and all parents, subsidiaries, affiliates, assignees, predecessors, employees, and agents thereof.
2. The term “Elm 3DS Patents” refers to the asserted patents in these actions.

3. The terms “you” and “your” mean the Samsung Defendants defined above, Samsung Electronics Co., Ltd., Samsung Semiconductor, Inc., Samsung Electronics America, Inc., and Samsung Austin Semiconductor, LLC (individually or collectively), and their parents, subsidiaries, divisions, affiliates, predecessors, assigns, successors, and acquired assets of business units, and any of their present or former officers, directors, trustees, employees, agents, representatives, attorneys, patent agents, and all other persons acting on their behalf.

4. The term “Stacked Integrated Circuit Product” means an integrated circuit product where multiple silicon die are vertically stacked in a single chip package and at least one silicon die is less than 150 microns in thickness.

5. Where used in these Requests, the singular also encompasses the plural and vice versa, the words “and” and “or” shall be conjunctive and disjunctive, the words “all” or “any” shall mean “all and any,” and the word “including” means “including without limitation.”

6. The use and definition of any of these words or terms is not contingent on the capitalization or lack of capitalization of those terms as used below. Some terms may be capitalized, including without limitation at the beginning of a sentence, or not capitalized—regardless, the above definitions should be considered to apply.

INSTRUCTIONS

1. *Lost or Destroyed Documents.* If any document or tangible thing for which identification is requested was formerly in existence or in your possession but no longer exists, or no longer is within your possession, custody or control, your response should state, for each such document or thing: (a) an identification of the document or thing and, if a document, its

author and addressee; (b) the date and circumstances of such loss or destruction; and (c) the reason or justification for such loss or destruction.

2. *Documents for Which a Privilege Is Claimed.* To the extent of any claim that any information or document is privileged or in any other way free from discovery under the Federal Rules of Civil Procedure, you are requested, in lieu of producing said information or document, to produce a description of the information or document sufficient to allow Elm 3DS a specific understanding of the nature of the objection; and if a document, the identification of the author, the date of the document, the addressee(s), the persons who received copies of the document, and the general subject matter of the document.

3. *Ongoing Duty to Supplement.* Pursuant to Rule 26(e), Federal Rules of Civil Procedure, you are required to supplement your response to include further information that may become available after the date of your response to these Interrogatories.

INTERROGATORIES

Interrogatory No. 4:

Identify by part number all Stacked Integrated Circuit Products that (A) are not included in the Second Amended Accused Product List served on June 3, 2016, and (B) that you (1) sell directly to an affiliate or third party, and/or (2) incorporate in products that you subsequently sell to an affiliate or a third party.

DATED: June 3, 2016

Respectfully submitted,

Counsel for Elm 3DS:

FARNAN LLP

Of Counsel:

s/ Brian E. Farnan

William H. Manning
Samuel L. Walling
Aaron R. Fahrenkrog
Sharon E. Roberg-Perez
Christine S. Yun Sauer
Logan J. Drew
Kelsey J. Thorkelson
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Minneapolis, MN 55402-2015
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ldrew@robinskaplan.com
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Joseph J. Farnan, Jr. (Bar No. 100245)
Brian E. Farnan (Bar No. 4089)
Michael J. Farnan (Bar No. 5165)
919 North Market Street, 12th Floor
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bfarnan@farnanlaw.com
[*mfarnan@farnanlaw.com*](mailto:mfarnan@farnanlaw.com)

Exhibit 4

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

ELM 3DS INNOVATIONS, LLC, a Delaware limited liability company,)	
)	
Plaintiff,	)	C.A. No. 14-cv-1430-LPS-CJB
)	
v.	)	JURY TRIAL DEMANDED
SAMSUNG ELECTRONICS CO., LTD., a Korean business entity,)	
SAMSUNG SEMICONDUCTOR, INC., a California Corporation,)	
SAMSUNG ELECTRONICS AMERICA, INC., a New York corporation, and)	
SAMSUNG AUSTIN SEMICONDUCTOR, LLC, a Delaware limited liability company,)	
Defendants.)	

**SAMSUNG’S SECOND SUPPLEMENTAL OBJECTIONS AND RESPONSES TO
ELM’S THIRD SET OF INTERROGATORIES**

Pursuant to Rules 26 and 33 of the Federal Rules of Civil Procedure, defendants Samsung Electronics Co., Ltd., Samsung Semiconductor, Inc., Samsung Electronics America, Inc., and Samsung Austin Semiconductor, LLC (collectively “Samsung”) hereby object and respond to Plaintiff ELM 3DS Innovations, LLC’s (“Elm”) Third Set of Interrogatories, dated June 3, 2016.

GENERAL OBJECTIONS

Samsung makes the following general responses and objections (“General Objections”) to each “Definition,” “Instruction,” and “Interrogatory” propounded in Elm’s Third Set of Interrogatories. These General Objections are hereby incorporated into each specific response.

The assertion of the same, similar or additional objections or partial responses to individual interrogatories does not waive any of Samsung's General Objections.

1. Samsung objects to Elm's definition of "Elm" and "Elm 3DS" as vague, ambiguous, overbroad, and unduly burdensome to the extent that they include "all parents, subsidiaries, affiliates, assignees, predecessors, employees, and agents thereof." Samsung further objects to the definition as not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to the extent that these terms may include persons or entities that are not parties to this action.

2. Samsung objects to Elm's definitions of "you" and "your" as overbroad, unduly burdensome, and oppressive to the extent that they include Samsung "and their parents, subsidiaries, divisions, affiliates, predecessors, assigns, successors, and acquired assets of business units, and any of their present or former officers, directors, trustees, employees, agents, representatives, attorneys, patent agents, and all other persons acting on their behalf." Samsung will respond, subject to and without waiving all other objections, only as to the named Samsung Defendants: Samsung Electronics Co., Ltd., Samsung Semiconductor, Inc., Samsung Electronics America, Inc., and Samsung Austin Semiconductor, LLC.

3. Samsung objects to Elm's Instruction No. 1 because it purports to impose requirements and obligations on Samsung other than as set forth in the Federal Rules of Civil Procedure.

4. Samsung provides these objections and responses to the best of its current knowledge. Discovery or further investigation may reveal additional or different information warranting amendment of these objections and responses. Samsung reserves the right to produce at trial and make reference to any evidence, facts, documents, or information not discovered at this time, omitted through good-faith error, mistake, or oversight, or the relevance of which Samsung has not presently identified.

5. By responding to these interrogatories, Samsung does not concede the relevance or materiality of any of the interrogatories or of the subjects to which it refers. Samsung's responses are made subject to, and without waiving any objections as to the competency, relevancy, materiality, privilege, or admissibility of any of the responses, or of the subject matter to which they concern, in any proceeding in this action or in any other proceeding.

6. Samsung objects to any interrogatory to the extent that it seeks information that is protected from disclosure by the attorney-client privilege, the attorney work product doctrine, the joint defense or common interest privilege, or any other applicable privilege, doctrine, or discovery immunity. The inadvertent production by Samsung of information protected from disclosure by any such privilege, doctrine, or immunity shall not be deemed a waiver by Samsung of such privileges or protections.

7. Samsung objects generally to the interrogatories to the extent they seek confidential, proprietary, or trade secret information of third parties. Samsung will endeavor to work with third parties in order to obtain their consent, if necessary, before providing such information. To the extent an interrogatory seeks information of a confidential or proprietary nature to Samsung, or to others to whom Samsung is under an obligation of confidentiality, Samsung will respond pursuant to the terms of the protective order entered in this case and subject to notice to third parties, as necessary.

8. Samsung objects to each interrogatory and to Elm's "Definitions" and "Instructions" to the extent they are vague, ambiguous, overbroad, unduly burdensome, are not proportional to the needs of this case, or purport to impose upon Samsung any duty or obligation that is inconsistent with or in excess of those obligations that are imposed by the Federal Rules of Civil Procedure, the Civil Local Rules and/or the Patent Local Rules of this Court, or any other applicable rule.

9. Samsung objects to any interrogatory to the extent it seeks irrelevant information about Samsung's products or business operations, or is not otherwise proportional to the needs of

this case. Such requests are overbroad and unduly burdensome. Samsung will only produce information that is relevant to the patents-in-suit, or that is otherwise related to the claims or defenses asserted by the parties in this litigation.

10. Samsung objects to each interrogatory to the extent that it would impose a duty on Samsung to undertake a search for or an evaluation of information, documents, or things for which Elm is equally able to search for and evaluate and/or is not proportional to the needs of this case. In particular, Samsung objects to each interrogatory to the extent that it seeks information or documents that are publicly available.

11. Samsung objects to each interrogatory to the extent that it seeks information that can be derived or ascertained from documents that will be produced in discovery, is not otherwise proportional to the needs of this case, or that is uniquely in Elm's possession, custody, and control.

12. Samsung objects to each interrogatory to the extent it would require Samsung to draw a legal conclusion or contention to make a proper response.

13. Samsung objects to each interrogatory to the extent that it purports to define words or phrases to have a meaning different from their commonly understood meaning, or to include more than their commonly understood definitions.

14. In Samsung's objections, the terms "and" and "or" are intended to be construed conjunctively or disjunctively as necessary to make the objections inclusive rather than exclusive.

15. Samsung objects to each interrogatory to the extent it purports to require Samsung to identify or describe or identify "every," "each," "any," or other similarly expansive, infinite, or all-inclusive terms as overbroad and unduly burdensome.

16. Samsung objects to Elm's "Instructions" and the interrogatories to the extent they seek information that is not in the possession, custody, or control of Samsung, purport to require Samsung to speculate about the identity of persons who might have responsive documents,

and/or purport to call for any description of documents that Samsung no longer possesses and/or was under no obligation to maintain.

17. Samsung objects to each interrogatory to the extent it is not limited in time and seeks information for periods of time that are not relevant to any claim or defense and is not otherwise proportional to the needs of this case.

18. Samsung objects to the interrogatories as a whole, and to each interrogatory contained therein, to the extent they are overbroad, unreasonably burdensome, and/or not proportional to the needs of this case. In particular, Samsung objects to the interrogatories as a whole, and to each interrogatory contained therein, to the extent they seek irrelevant information about accused products. By answering, objecting, and otherwise responding to the interrogatories, Samsung does not concede relevance or admissibility, both of which Samsung reserves the right to challenge.

19. Samsung objects to the interrogatories as a whole, and to each interrogatory contained therein, to the extent they are premature and/or to the extent they: (a) conflict with any schedule entered by the Court; (b) seek information that is the subject of expert testimony; (c) seek information and/or responses that are dependent on the Court's construction of the asserted claims of the patents-in-suit; or (d) are dependent on depositions and documents that have not been taken or produced.

20. Samsung's objections as set forth herein are made without prejudice to Samsung's right to assert any additional or supplemental objections pursuant to Rule 26(e).

21. Samsung will make, and has made, reasonable efforts to respond to Elm's Third Set of Interrogatories, to the extent that no objection is made, as Samsung reasonably understands and interprets each Interrogatory. If Elm subsequently asserts any interpretation of any interrogatory that differs from the interpretation of Samsung, then Samsung reserves the right to supplement and amend its objections and responses.

OBJECTIONS AND RESPONSES TO INTERROGATORIES

Subject to the foregoing qualifications and General Objections and the specific objections made below, Samsung objects and responds to Elm’s Third Set of Interrogatories as follows:

INTERROGATORY NO. 4:

Identify by part number all Stacked Integrated Circuit Products that (A) are not included in the Second Amended Accused Product List served on June 3, 2016, and (B) that you (1) sell directly to an affiliate or third party, and/or (2) incorporate in products that you subsequently sell to an affiliate or a third party.

OBJECTIONS AND RESPONSE TO INTERROGATORY NO. 4:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this interrogatory to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this interrogatory to the extent that it seeks private, privileged, and confidential commercial, financial, and/or proprietary business information. Samsung further objects to this interrogatory as overbroad, unduly burdensome, and not proportional to the needs of this case, particularly to the extent that it may include products that are not manufactured by Samsung and/or products that are not imported, sold, or offered for sale in the United States by Samsung. Samsung further objects to this interrogatory to the extent that it is duplicative and seeks information that can be derived or ascertained from documents that were produced in discovery and that is uniquely in Elm’s possession, custody and control. Samsung further objects to this interrogatory on the grounds that it is vague, ambiguous, and overbroad as to “affiliate,” “third party,” and “incorporate in products.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what

information is actually being requested. Samsung further objects to this interrogatory as overbroad to the extent it is unlimited with respect to time or geography.

Subject to and without in any way waiving the foregoing objections, and to the extent it understands this interrogatory, Samsung responds as follows: pursuant to Federal Rule of Civil Procedure 33(d), Samsung refers Elm to the documents bearing bates numbers SAMSUNG-ELM-000025176 – SAMSUNG-ELM-000050134, wherein information responsive to this interrogatory may be found. Samsung expressly reserves the right to supplement this response following further investigation and/or discovery.

FIRST SUPPLEMENTAL OBJECTIONS AND RESPONSE TO INTERROGATORY NO. 4:

Samsung further objects to this interrogatory as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired or will expire soon, Samsung objects to this interrogatory to the extent it seeks post-patent expiration data.

Subject to and without waiving the foregoing general and specific objections, and to the extent it understands this interrogatory, Samsung further responds as follows:

Appendix A, attached hereto, lists all stacked silicon die packages having two or more vertically stacked die that have been sold in the United States in the period between 2007 to present and that are not included in the Second Amended Accused Product List served on June 3, 2016.

Samsung expressly reserves the right to amend or supplement this response following further investigation and/or discovery.

SECOND SUPPLEMENTAL OBJECTIONS AND RESPONSE TO INTERROGATORY NO. 4:

Subject to and without waiving the foregoing general and specific objections, and to the extent it understands this interrogatory, Samsung further responds as follows: pursuant to Federal Rule of Civil Procedure 33(d), Samsung refers Elm to the documents bearing bates

numbers SAMSUNG-ELM-000058542 – SAMSUNG-ELM-000058543, wherein information responsive to this interrogatory may be found.

These documents provide a revised list of all stacked silicon die packages having two or more vertically stacked die that have been sold in the United States in the period between 2007 to present and that are not included in the Second Amended Accused Product List served on June 3, 2016, and replaces the list in Appendix A to Samsung’s First Supplemental Objections and Responses to Elm’s Third Set of Interrogatories served on August 9, 2018. These documents include certain information regarding the identified packages, including the number of stacked chips, process node, product type, whether the stacked die are interconnected by wiring or through-silicon vias, and die thickness, to the extent known after a reasonable search.

[REDACTED]

Die thickness is provided separately for each die in SAMSUNG-ELM-000058543 except where otherwise indicated. In particular, where indicated, a provided die thickness may apply to multiple stacked die in a package.

Samsung expressly reserves the right to amend or supplement this response following further investigation and/or discovery.

DATED: March 14, 2019

YOUNG CONAWAY STARGATT
& TAYLOR, LLP

OF COUNSEL:

Allan M. Soobert
Naveen Modi
Phillip W. Citroën
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*ServicePHSamsung-
ELM3DS@paulhastings.com*

*Attorneys for Defendants Samsung Electronics
Co., Ltd., Samsung Semiconductor, Inc.,
Samsung Electronics America, Inc., and
Samsung Austin Semiconductor, LLC*

/s/ Pilar G. Kraman

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Pilar G. Kraman (No. 5199)
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(302) 571-6600
*apoff@ycst.com
pkraman@ycst.com*

*Attorneys for Defendants Samsung Electronics
Co., Ltd., Samsung Semiconductor, Inc.,
Samsung Electronics America, Inc., and
Samsung Austin Semiconductor, LLC*

(AS TO OBJECTIONS ONLY)

CERTIFICATE OF SERVICE

I, Pilar G. Kraman, hereby certify that on March 14, 2019, I caused a true and correct copy of the foregoing document to be served on the following counsel of record in the manner indicated:

BY E-MAIL

Joseph J. Farnan, Jr. Esquire
Brian E. Farnan, Esquire
Michael J. Farnan, Esquire
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John M. Hughes, Esquire
Katherine L.I. Hacker, Esquire
Nosson D. Knobloch, Esquire
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nosson.knobloch@bartlit-beck.com

Attorneys for Plaintiff

YOUNG CONAWAY STARGATT
& TAYLOR, LLP

/s/ Pilar G. Kraman _____

Adam W. Poff (No. 3990)

Pilar G. Kraman (No. 5199)

Rodney Square

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Wilmington, Delaware 19801

(302) 571-6600

apoff@ycst.com

pkraman@ycst.com

Attorneys for Defendants




Exhibit 5

Kidokoro, Koichiro

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Wednesday, March 20, 2019 12:27 AM
To: Citroen, Phillip W.
Cc: Jung, Soyoung; Mailing List - Leedy; ServicePH Samsung-ELM 3DS
Subject: [EXT] RE: Follow-Up Re Samsung Production and Supp Rog Response

Phillip,

Thank you for taking the time to talk today about Samsung's recent document production and supplemental interrogatory response. I wanted to memorialize our discussion here to ensure that we're on the same page. Please let me know if the following misses or misstates any of the salient points we discussed:

1. 
2. You confirmed that "Chip Thick" in the -43 spreadsheet means the thickness of the die in microns.
3. You explained that the "remarks" in the -43 spreadsheet are intended to help explain which die in the stack the relevant thickness data relates to.
4. 
5. 

6. [REDACTED] I explained that the parties would need to find a way to deal with those products in the context of the representative products agreement.
7. Next steps to reaching a representative products agreement: We discussed the need for both parties to work expeditiously to reach a representative products agreement. I explained that appropriate representative products should be products for which physical samples and ample data are available. You requested that Elm update its accused products list and, after that, the parties further discuss how to select representative products. I agreed to provide updated lists as soon as possible, and reiterated my request that you think hard now about how best to reach a representative products agreement quickly.
8. I asked you whether you were aware of SK Hynix's March 18 letter concerning custodial document production, and explained that Elm was preparing to file a motion to compel on that issue. I asked you to let me know whether Samsung would be providing a substantive proposal on how to move forward with custodial document production this week or, like SK Hynix, intended instead to simply raise more questions and objections. You said you did not know, but would check with your team and get back to me as soon as possible.

Kind Regards,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 |
Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO
80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

-----Original Message-----

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Monday, March 18, 2019 7:55 AM

To: Citroen, Phillip W. <phillipcitroen@paulhastings.com>

Cc: Jung, Soyoung <soyoungjung@paulhastings.com>; Mailing List - Leedy <leedy@bartlit-beck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-

ELM3DS@paulhastings.com>

Subject: RE: Follow-Up Re Samsung Production and Supp Rog Response

I'd rather not wait until Wednesday. Let's talk tomorrow at 6pmET, and continue at 11amET on Wednesday if necessary. If you'd provided times to talk when you sent the data as I'd asked, we wouldn't have this problem.

Please call me on my cell for tomorrow's call, or circulate a dial-in if that works better for your team.

Thanks.

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 |
Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO
80202

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-----Original Message-----

From: Citroen, Phillip W. <phillipcitroen@paulhastings.com>

Sent: Monday, March 18, 2019 7:52 AM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Cc: Jung, Soyoung <soyoungjung@paulhastings.com>; Mailing List - Leedy <leedy@bartlit-beck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Subject: Re: Follow-Up Re Samsung Production and Supp Rog Response

No. How about 11 a.m. ET Wednesday?

Phillip Citroen
Paul Hastings LLP
(202) 551-1991

On Mar 18, 2019, at 9:39 AM, Nosson Knobloch
<nosson.knobloch@bartlitbeck.com<mailto:nosson.knobloch@bartlitbeck.com>>
wrote:

Can you do 5:30pmET tomorrow instead? I have a hard stop at 6:30pmET and am concerned that a 6pm start won't give us enough time.

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122<tel:303.592.3122> | c:
773.301.2851<tel:773.301.2851> |
Nosson.Knobloch@BartlitBeck.com<mailto:Nosson.Knobloch@BartlitBeck.com> |1801
Wewatta Street, 12<x-apple-data-detectors://4>th<x-apple-data-detectors://4> Floor,
Denver, CO 80202<x-apple-data-detectors://4>

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

On Mar 18, 2019, at 7:28 AM, Citroen, Phillip W.
<phillipcitroen@paulhastings.com<mailto:phillipcitroen@paulhastings.com>> wrote:

Nosson,

We are free tomorrow at 6 p.m. ET.

Going forward, please include our alias on all correspondence.

Phillip Citroen
Paul Hastings LLP
(202) 551-1991

On Mar 15, 2019, at 5:15 PM, Nosson Knobloch
<nosson.knobloch@bartlitbeck.com<mailto:nosson.knobloch@bartlitbeck.com><mailto:nosson.knobloch@bartlitbeck.com>> wrote:

Phillip,

As I predicted on Monday, we have some questions about the documents and supplemental interrogatory responses that you sent us last week. Do you have time to discuss on Monday or Tuesday next week?

Among other things, we'd like to understand the following:

1. 

1. Whether "Chip Thick" means chip thickness in microns.

1. How to decipher the “remarks” in the -43 spreadsheet.

1. [REDACTED]

1. [REDACTED]

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 |
Nosson.Knobloch@BartlitBeck.com<mailto:Nosson.Knobloch@BartlitBeck.com><mailto:Nosson.Knobloch@BartlitBeck.com> | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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<mg_info.txt>

Exhibit 6

United States Court of Appeals for the Federal Circuit

SAMSUNG ELECTRONICS CO., LTD., MICRON
TECHNOLOGY, INC., SK HYNIX INC.,
Appellants

v.

ELM 3DS INNOVATIONS, LLC,
Appellee

2017-2474, 2017-2475, 2017-2476, 2017-2478, 2017-2479,
2017-2480, 2017-2482, 2017-2483, 2018-1050, 2018-1079,
2018-1080, 2018-1081, 2018-1082

Appeals from the United States Patent and Trademark
Office, Patent Trial and Appeal Board in Nos. IPR2016-
00386, IPR2016-00387, IPR2016-00388, IPR2016-00390,
IPR2016-00391, IPR2016-00393, IPR2016-00394,
IPR2016-00395, IPR2016-00687, IPR2016-00691,
IPR2016-00708, IPR2016-00770, IPR2016-00786.

Decided: June 12, 2019

RUFFIN B. CORDELL, Fish & Richardson PC, Washing-
ton, DC, argued for all appellants. Appellants Micron
Technology, Inc., SK Hynix Inc. also represented by
CHRISTOPHER DRYER, TIMOTHY W. RIFFE, ROBERT ANDREW
SCHWENTKER, ADAM SHARTZER; CRAIG E. COUNTRYMAN,
RYAN LYNN FREI, OLIVER RICHARDS, San Diego, CA.

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NAVEEN MODI, Paul Hastings LLP, Washington, DC,
for appellant Samsung Electronics Co., Ltd. Also repre-
sented by PHILLIP W. CITROEN, ALLAN SOOBERT.

WILLIAM MEUNIER, Mintz, Levin, Cohn, Ferris, Glovsky
and Popeo, P.C., Boston, MA, argued for appellee. Also rep-
resented by KEVIN AMENDT, SANDRA BADIN, MATTHEW
STEPHEN GALICA, MICHAEL NEWMAN, MICHAEL TIMOTHY
RENAUD, JAMES M. WODARSKI.

Before MOORE, REYNA, and CHEN, *Circuit Judges*.

MOORE, *Circuit Judge*.

Samsung Electronics Co., Ltd., Micron Technology,
Inc., and SK Hynix Inc. (collectively, “Petitioners”) appeal
from the final written decisions of the Patent Trial and Ap-
peal Board in thirteen inter partes reviews holding that
they did not establish the unpatentability of 105 claims
across eleven patents (“Challenged Patents”). Given that
each challenged claim requires a low-tensile-stress dielec-
tric, and substantial evidence supports the Board’s finding
that a person of ordinary skill in the art would not have
reasonably expected success in combining the prior art to
meet this limitation, we affirm.

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BACKGROUND

Appellee Elm 3DS Innovations LLC (“Elm”) is the owner of the Challenged Patents,¹ which share a specification and all relate to “stacked integrated circuit memory.”² ’672 patent at 1:7–8. The Challenged Patents are the subject of co-pending litigation between Elm and Petitioners.

The Board instituted inter partes review based on thirteen petitions filed by Petitioners. Among others not at issue on appeal, the petitions challenged the following claims: claims 17–18, 22, 84, 95, 129–32, 145–46, and 152 of the ’672 patent (IPR2016-00386); claims 1–2, 8, 14, 31–32, 44, 46, and 52–54 of the ’778 patent (IPR2016-00387); claims 10–12, 18–20, 60–63, 67, 70–73, and 77 of the ’239 patent (IPR2016-00388 and IPR2016-00393); claims 1–3, 30–31, 33, 40–41, and 44 of the ’542 patent (IPR2016-00390); claims 30, 34, 36, 135–138, and 147 of the ’862 patent (IPR2016-00391); claims 36 and 51 of the ’617 patent (IPR2016-00394); claims 1, 10–11, and 13–14 of the ’732 patent (IPR2016-00395); claims 1, 7, 17–18, and 33 of the ’119 patent (IPR2016-00687); claims 1 and 20–23 of the ’004 patent (IPR2016-00691); claims 1, 12–13, 24, 36–38, 53, 83, 86–87, and 132 of the ’499 patent (IPR2016-00708 and IPR2016-00770); and claims 58, 60–61, and 67 of the ’570 patent (IPR2016-00786). Each ground challenging the claims was based on obviousness and asserted either U.S. Patent No. 5,202,754 (“Bertin”) or a 1996 article by Kee-Ho Yu, et. al., titled “Real-Time Microvision System with Three-Dimensional Integration Structure” (“Yu”) as the

¹ The patents at issue are U.S. Patent Nos. 8,653,672; 8,841,778; 7,193,239; 8,629,542; 8,796,862; 8,410,617; 7,504,732; 8,928,119; 7,474,004; 8,907,499; and 8,933,570.

² For simplicity, this opinion cites only to the specification of the ’672 patent.

primary reference in combination with, relevant here, U.S. Patent No. 5,354,695 (“Leedy”).³

The Board held that Petitioners had not met their burden of demonstrating that the claims were unpatentable. Specifically, it found that the prior art did not disclose the “substantially flexible” limitation. It also found that Petitioners did not demonstrate a motivation to combine Bertin or Yu with Leedy or a reasonable expectation of success in doing so. Petitioners timely filed notices of appeal, and the appeals were consolidated. We have jurisdiction pursuant to 28 U.S.C. § 1295(a)(4)(A).

DISCUSSION

I. Claim Construction

“We review the Board’s constructions based on intrinsic evidence de novo and its factual findings based on extrinsic evidence for substantial evidence.” *HTC Corp. v. Cellular Commc’ns Equip., LLC*, 877 F.3d 1361, 1367 (Fed. Cir. 2017). The Board construes claims in an unexpired patent according to their broadest reasonable interpretation in light of the specification. 37 C.F.R. § 42.100(b) (2017).⁴ Claims of an expired patent are construed according to the standard applied by district courts. *See In re CSB-Sys. Int’l, Inc.*, 832 F.3d 1335, 1341 (Fed. Cir. 2016) (referencing *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed.

³ Claim 1 of the ’499 patent was challenged based on U.S. Patent No. 5,731,945, which contains the same disclosure as Bertin and adds details not relevant to this appeal.

⁴ The Board’s decisions issued prior to the effective date of the U.S. Patent and Trademark Office’s change to the claim construction standard applied in inter partes review. *See* Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340 (Oct. 11, 2018).

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Cir. 2005) (en banc)). While some patents were expired at the time of the Board's final written decision and others were not, the parties agree that the different claim construction standards do not impact the outcome. Appellants' Br. 44; Appellee's Br. 41. The parties have not contested the Board's application of the *Phillips* claim construction standard.

All challenged claims except for claims 1 and 14 of the '778 patent use "substantially flexible" in at least one of two ways. The first is to modify the term "semiconductor substrate." Claim 129 of the '672 patent illustrates the use in this context (emphasis added):

An integrated circuit structure comprising:

a first substrate comprising a first surface supporting interconnect contacts;

a substantially flexible semiconductor second substrate comprising a first surface and a second surface at least one of which supports interconnect contacts, wherein the second surface is opposite the first surface and wherein the second surface of the second substrate is formed by removal of semiconductor material from the second substrate and is smoothed or polished after removal of the semiconductor material; and

conductive paths between the interconnect contacts supported by the first surface of the first substrate and of the interconnect contacts supported by the second substrate;

wherein the first substrate and the second substrate overlap fully or partially in a stacked relationship; and

wherein the integrated circuit structure further comprises a low-stress silicon-based dielectric material having a stress of 5×10^8 dynes/cm² tensile or less.

“Substantially flexible” is also used to modify “circuit layers,” and other similar terms.⁵ Claim 30 of the ’862 patent illustrates how “substantially flexible” is used in this context (emphasis added):

A stacked circuit structure comprising:

a plurality of stacked, thin, *substantially flexible circuit layers* at least one of which comprises a thinned, substantially flexible monocrystalline semiconductor substrate of one piece;

wherein at least one of the substantially flexible circuit layers comprises at least one memory array comprising memory cells and a low stress silicon-based dielectric material; and

at least one vertical interconnection that passes through at least one of the plurality of stacked, thin, substantially flexible circuit layers.

⁵ See, e.g., ’239 patent at Claim 60 (“substantially flexible” die); ’004 patent at Claim 1 (“substantially flexible integrated circuits”); ’732 patent at Claim 1 (“substantially flexible integrated circuit layer”). The parties do not treat this difference in terminology as affecting the construction of “substantially flexible.” Accordingly, our construction of “substantially flexible” applies across all its uses.

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In each context, the Board relied on a general-purpose dictionary to construe “substantially flexible” to mean “largely able to bend without breaking.” *E.g.*, J.A. 31.

“Claim terms generally are construed in accordance with the ordinary and customary meaning they would have to one of ordinary skill in the art in light of the specification and the prosecution history.” *Aventis Pharma S.A. v. Hospira, Inc.*, 675 F.3d 1324, 1329 (Fed. Cir. 2012) (citing *Phillips*, 415 F.3d at 1312). Extrinsic evidence may also be considered in construing a claim, though “it is less significant than the intrinsic record in determining the legally operative meaning of claim language.” *Phillips*, 415 F.3d at 1317 (internal quotation marks omitted). We will deviate from a claim term’s ordinary meaning “when a patentee sets out a definition and acts as its own lexicographer” or “when the patentee disavows the full scope of a claim term either in the specification or during prosecution.” *Aventis*, 675 F.3d at 1330 (quoting *Thorner v. Sony Computer Entm’t Am. L.L.C.*, 669 F.3d 1362, 1365 (Fed. Cir. 2012)).

The parties dispute the meaning of “substantially flexible.” “Where multiple patents derive from the same parent application and share many common terms, we must interpret the claims consistently across all asserted patents.” *SightSound Techs., LLC v. Apple Inc.*, 809 F.3d 1307, 1316 (Fed. Cir. 2015) (internal quotation marks omitted). The parties do not argue that the definition of “substantially flexible” depends on the patent or claim in which it is used. Because the Challenged Patents derive from the same parent application and use “substantially flexible” throughout, we construe that term the same way for each Challenged Patent.

Petitioners argue the intrinsic record supports a construction of “substantially flexible” substrate as a “substrate that has been thinned to a thickness of less than 50 μm and subsequently polished or smoothed.” Appellants’

Br. 36. Specifically, they rely on the specification's disclosure of step "2A" in a fabrication sequence for a "3DS memory circuit," which states: "Grind the backside or exposed surface of the second circuit substrate to a thickness of less than 50 μm and then polish or smooth the surface. The thinned substrate is now a substantially flexible substrate." '672 patent at 9:3–6; *see also id.* at 2:66–67, 3:5–8 (stating that a feature of the stacked circuit assembly technology includes "[t]hinning of the memory circuit to less than about 50 μm in thickness forming a substantially flexible substrate"). Though these disclosures refer to the substrate being substantially flexible, Petitioners argue they apply with equal force to the claims reciting "substantially flexible" circuit layers, and similar limitations, because the prosecution history requires that a substantially flexible circuit layer includes a substantially flexible substrate.

Elm responds that the Board's construction is consistent with the ordinary meaning of "substantially flexible" and the specification's distinction between flexible and rigid substrates. It criticizes Petitioners' proposed construction as departing from the ordinary meaning, since the flexibility of a material depends on more than how thin and polished it is. Citing the declaration of Petitioners' expert Dr. Paul Franzon, Elm argues the flexibility of a semiconductor substrate depends on the substrate's elastic modulus, crystal orientation, and dimensions. Appellee's Br. 48–49 (citing J.A. 2191–92 ¶ 71).

Neither party's construction is quite right. We begin our analysis with the claim language. The claims indicate that, at least in some situations, thinning and polishing a substrate is one way of forming a substantially flexible substrate. For example, claim 31 of the '778 patent recites "the semiconductor substrate is thinned and polished or smoothed such that the semiconductor substrate is substantially flexible." *See also* '862 patent at Claim 147 (reciting "the polished or smoothed backside [of a thinned, monocrystalline semiconductor substrate] enables the . . .

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substrate to be substantially flexible, and the polished or smoothed backside reduces the vulnerability of the . . . substrate to fracture as a result of flexing”). But that does not mean this is the only way to achieve substantial flexibility. The claim on which claim 31 depends recites “the semiconductor substrate is substantially flexible,” ’778 patent at Claim 2, implying that it covers substantially flexible substrates formed in ways other than the one recited in claim 31, *Clearstream Wastewater Sys., Inc. v. Hydro-Action, Inc.*, 206 F.3d 1440, 1446 (Fed. Cir. 2000) (“Under the doctrine of claim differentiation, it is presumed that different words used in different claims result in a difference in meaning and scope for each of the claims.”). Claim 51 of the ’617 patent recites “the bottomside of the first substrate is polished to make the substrate substantially flexible,” with no specific “thinned” limitation. Conversely, claim 8 of the ’778 patent lacks a polishing limitation, reciting a substrate that “is formed from a semiconductor wafer and is thinned and substantially flexible.” The claims alone do not support limiting “substantially flexible” to Petitioners’ proposed construction.

The prosecution history, on the other hand, shows that “substantially flexible” is narrower than the Board’s construction of “largely able to bend without breaking.” *E.g.*, J.A. 31. During prosecution of the application that led to the ’499 patent, the examiner objected to the use of the term “substantially flexible” because it rendered the claim’s scope unclear. J.A. 10260. Elm responded that “the meaning of [substantially flexible] as used in the claims is clearly explained in the specification,” citing to step 2A in the fabrication sequence. J.A. 10275. “As described in this passage,” Elm continued, “a semiconductor substrate is caused to be substantially flexible by thinning it to 50 microns or less and polishing or smoothing the thinned semiconductor substrate to relieve stress. The phrase ‘substantially flexible’ is used in the claims consistent with this description, which is unambiguous.” *Id.* To overcome

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the examiner's objection, Elm clearly and unambiguously disclaimed claim scope. For a semiconductor substrate to be "substantially flexible" according to the claims, it must be thinned to 50 microns or less and polished or smoothed.

This definition of "substantially flexible" applies to all its uses. In response to a rejection of claims reciting a substantially flexible circuit layer in an application related to the Challenged Patents, Elm stated that "a substantially flexible semiconductor substrate is a *necessary* but not a *sufficient* condition for a substantially flexible circuit layer." J.A. 10316 (emphasis in original). Reinforcing this point, Elm in a response involving another related application explained:

Two features are *required* to achieve substantial flexibility. One is that the semiconductor material must be sufficiently thin, e.g., 50 microns or less. . . . The other is that the dielectric material used in processing the semiconductor material must be sufficiently low stress. Otherwise, substantial flexibility is defeated. As set forth in the present specification, stress of 5×10^8 dynes/cm² or less has been demonstrated to satisfy this requirement.

J.A. 16038 (emphasis added). *See also* J.A. 10314 ("[A] circuit layer requires one or more dielectric layers. . . . For a circuit layer to be substantially flexible, Applicant has found that the dielectric material must have low tensile stress, for example, 5×10^8 dynes/cm² tensile."). Considered in its entirety, the prosecution history clearly and unambiguously demonstrates that a substantially flexible circuit layer, and similar terms, must contain a substantially flexible semiconductor substrate and a sufficiently low tensile stress dielectric material. We see nothing in the specification or prosecution history that limits the dielectric to a particular stress value. Both merely provide as an

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example that a tensile stress of 5×10^8 dynes/cm² is sufficient.

This is not, however, the end of the construction. The prosecution history makes clear that “substantially flexible” cannot be read to cover rigid substrates and circuit layers. See J.A. 15397 (criticizing the prior art substrate because it is “rigid”); J.A. 16039 (stating the prior art “describe[s] a stacked integrated circuit formed on a *rigid* carrier . . . , suggesting that the stacked integrated circuit is in fact *inflexible*” (emphasis in original)). Based on expert testimony from Dr. Franzon, the Board found that “there are a number of factors that, within the context of semiconductor processing, determine the flexibility of a semiconductor substrate,” including the type of semiconductor substrate, the crystal orientation of the material, and the physical dimensions of the substrate. *E.g.*, J.A. 27 (citing J.A. 2191–92 ¶ 71). This suggests thinning the semiconductor substrate to 50 μm and subsequently polishing or smoothing it is necessary but not necessarily sufficient to make the substrate substantially flexible. To ensure that the construction of “substantially flexible” cannot be read to cover a rigid substrate or circuit layer, we interpret a substantially flexible semiconductor substrate as a semiconductor substrate that is thinned to 50 μm and subsequently polished or smoothed such that it is largely able to bend without breaking. Likewise, we interpret a substantially flexible circuit layer as a circuit layer that is largely able to bend without breaking and contains a substantially flexible semiconductor substrate and a sufficiently low tensile stress dielectric material.

II. Obviousness

We review the Board’s legal determinations de novo and its underlying factual findings for substantial evidence. *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2013). Obviousness is a question of law based on underlying facts. *Id.* Whether there was a motivation to

combine references and a reasonable expectation of success in doing so to meet the limitations of the claimed invention are questions of fact. *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1367–68 (Fed. Cir. 2016).

Each ground of unpatentability relied on either Bertin or Yu in combination with Leedy, along with other references not relevant on appeal. Bertin discloses “[a] fabrication method and resultant three-dimensional multichip package having a densely stacked array of semiconductor chips interconnected at least partially by means of a plurality of metallized trenches.” J.A. 1206 at Abstract. “[P]rocessing begins with a semiconductor device 50 (preferably comprising a wafer) having a substrate 52 and an active layer 54, which is typically positioned at least partially therein.” J.A. 1216 at 3:50–53. A dielectric layer is grown over the active layer. *Id.* at 3:60–62.⁶ Yu discloses a fabrication process for a 3D integration structure in which a silicon wafer is glued to quartz glass, thinned and polished, and bonded to a thick wafer. The structure includes a “field oxide,” depicted in two figures as silicon dioxide. J.A. 1350. Leedy discloses a method of fabricating “integrated circuits from flexible membranes formed of very thin low stress dielectric materials, such as silicon dioxide or silicon nitride, and semiconductor layers.” J.A. 1229 at Abstract.

Regarding the Bertin-Leedy combinations, Petitioners proposed depositing a low-stress dielectric material using plasma-enhanced chemical vapor deposition (“PECVD”), as disclosed in Leedy, instead of growing the dielectric layer, as disclosed in Bertin. The Board found that a person of ordinary skill in the art would not have been motivated to make such a combination and would not have had a reasonable expectation of success in doing so. It credited the

⁶ A dielectric is an insulator used in electric circuits. J.A. 2375 ¶ 33.

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testimony of Elm’s expert Dr. Alexander Glew that PECVD was incompatible with Bertin’s integrated circuit. Given the complexity involved in integrated circuit fabrication, it found Dr. Franzon’s testimony that PECVD had certain benefits and that Leedy and Bertin are in the same technological field was insufficient to meet Petitioners’ burden. As a result, it found Petitioners failed to adequately explain “how [Bertin’s] fabrication process would be changed to use [Leedy’s] dielectric material, which is formed in a quite different manner than [Bertin’s] dielectric layer.” J.A. 77. The Board’s finding as to a lack of reasonable expectation of success is supported by substantial evidence.

Bertin discloses that “[a] dielectric layer 60, for example, [silicon dioxide], is grown over active layer 54 of device 50.” J.A. 1216 at 3:60–62. Dr. Glew testified that a silicon dioxide dielectric that is grown directly over circuit components must be high-purity to not damage the circuit components. J.A. 2415 ¶ 128. As a result, one of ordinary skill in the art would have known from Bertin’s description that the dielectric layer 60 “was grown at high temperatures using thermal oxidation.” J.A. 2415–16 ¶ 128; *see also* J.A. 1527 (acknowledging in the Petition that Bertin discloses “thermally grown oxides”). Thermal oxidation is a process in which silicon at the surface of a wafer is converted to high-purity silicon dioxide by exposing it to oxygen at high temperatures, typically between 900 °C and 1200 °C. J.A. 2387–88 ¶¶ 66–67.

Substantial evidence supports the Board’s finding that Petitioners did not adequately explain how Bertin’s fabrication process would be changed to use Leedy’s dielectric material. The Petition asserted that Leedy’s dielectric material could “easily be used in place of” Bertin’s dielectric using PECVD. J.A. 1527. In support of this argument, Dr. Franzon testified that PECVD “was a commonly available deposition technique that could have been used in place of” Bertin’s technique for growing dielectrics. J.A. 2207 ¶ 101. He also testified that Leedy explains that

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“its dielectric deposition processes are compatible with conventional integrated circuit fabrication methods.” J.A. 2206–07 ¶ 101. For example, Leedy states that “[t]he dielectric membrane is compatible with most higher temperature [integrated circuit] processing techniques.” J.A. 1296 at 5:32–33.

Evidence shows that selecting a dielectric and a method of forming that dielectric is more complicated than Petitioners suggest. A specific dielectric, like silicon dioxide, can have “vastly different characteristics and behaviors” depending on how it is made. J.A. 2386 ¶ 63. Dr. Glew identified eighteen factors to be considered when selecting a dielectric and method of formation. Those factors include:

- (1) dielectric constant, (2) breakdown field strength, (3) leakage, (4) surface conductance, (5) moisture absorption or permeability to moisture, (6) stress, (7) adhesion to aluminum, (8) adhesion to dielectric layers above or below, (9) stability, (10) etch rate, (11) permeability to hydrogen, (12) amount of incorporated electrical charge or dipoles, (13) amount of impurities, (14) quality of step coverage, (15) the thickness and uniformity of the film, (16) ability to provide good doped uniformity across a wafer, (17) defect density, [and] (18) amount of residual constituents that outgas during later processing.

J.A. 2421 ¶ 139. Dr. Glew stated that most of these factors are unknown here with respect to Leedy’s dielectric, so a person of ordinary skill in the art could not conclude that it would have been obvious to make the proposed substitution. In light of the complexity of semiconductor fabrication, the Board found Petitioners’ explanation lacking.

The Board’s finding that PECVD is “quite different” from thermal oxidation is supported by substantial evi-

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dence. J.A. 77. As the name suggests, PECVD is a deposition process, unlike thermal oxidation, which is a growth process. PECVD is performed at 400 °C or less and uses plasma to create a reaction between the surface of a wafer and chemical vapors that include the atoms or molecules to be deposited. In contrast to thermal oxidation, which yields a high-purity dielectric, Dr. Glew testified that dielectrics deposited using PECVD “include impurities that make them unusable for a variety of applications requiring higher purity.” J.A. 2392 ¶ 77. According to Dr. Glew, this creates a problem when attempting to implement Leedy’s dielectric into Bertin using PECVD because the dielectric layer of Bertin must be highly pure to not damage the circuit components. J.A. 2415–16 ¶ 128. The dielectric produced using PECVD would not be sufficiently pure. J.A. 2416 ¶ 130. He also testified that PECVD “cannot be used because positive ions present in the plasma can strike and damage the wafer and the exposed active components in and on its surface.” J.A. 2423 ¶ 142.

Petitioners argue the Board erred when it declined to resolve a dispute about front-end-of-line and back-end-of-line processing steps, especially when it relied on Dr. Glew’s testimony that assumed Bertin’s dielectric was grown during the front-end-of-line phase of the fabrication process. Dr. Glew’s testimony was that if Leedy’s dielectric replaced Bertin’s at the same phase in the fabrication process, PECVD could not be used “because the resulting dielectric would not (1) be sufficiently pure; (2) have the ability to adhere sufficiently to the semiconductor wafer; and (3) be able to withstand high temperatures of the remaining [front-end-of-line] steps,” which generally occur at higher temperatures than the back-end-of-line steps, “without changing its form.” J.A. 2422–23 ¶ 142. We see no legal error in the Board’s decision. First, the Board found that even assuming Petitioners’ contentions were accurate, their explanation was lacking. Second, we understand the Board’s opinion as finding it unnecessary to

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decide this issue because, at least as to Dr. Glew’s first two points, the timing would not matter. Though Petitioners disputed these facts in their Reply below, they did so based on attorney argument without premising that argument on the timing of applying PECVD. J.A. 1811–12. Moreover, “[t]he possibility of drawing two inconsistent conclusions from the evidence does not prevent an administrative agency’s finding from being supported by substantial evidence.” *In re Applied Materials, Inc.*, 692 F.3d 1289, 1294 (Fed. Cir. 2012).

Petitioners also argue the Board improperly required proof that unclaimed elements were combinable. “It is well-established that a determination of obviousness based on teachings from multiple references does not require an actual, physical substitution of elements.” *In re Mouttet*, 686 F.3d 1322, 1332 (Fed. Cir. 2012). “What matters in the § 103 nonobviousness determination is whether a person of ordinary skill in the art, having all the teachings of the references before him, is able to produce the structure defined by the claim.” *Orthopedic Equip. Co., Inc. v. United States*, 702 F.2d 1005, 1013 (Fed. Cir. 1983). The Board did not require unclaimed elements be combinable. Rather, it repeatedly stated that integrated-circuit technology is complex and, as such, looked for specific evidence that a person of ordinary skill in the art would have reasonably expected success in combining Bertin’s fabrication process and Leedy’s dielectric material. Petitioners specifically argued in its Petition that “PECVD . . . could have been used in place of the dielectric growing techniques described in Bertin to obtain the predictable result of stacked [integrated circuits] having low tensile stress dielectrics.” J.A. 1528. The Board ultimately determined that Petitioners’ evidence in support of that combination was insufficient. We will not fault the Board for analyzing Petitioners’ obviousness grounds in the way presented in the Petition.

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Finally, Petitioners argue there was a reasonable expectation of success because the Challenged Patents incorporate Leedy by reference. The patents state that “dielectrics in low stress . . . such as low stress silicon dioxide and silicon nitride . . . are discussed at length in [Leedy], incorporated herein by reference.” ’672 patent at 8:46–53. Petitioners argue that the failure to mention any technical problems with using Leedy’s dielectrics indicates that doing so was trivial. The Board considered this argument and rejected it. We find the Petitioners’ argument too speculative to warrant a conclusion that the Board’s factual finding lacked substantial evidence.

The arguments related to the Yu-Leedy combinations were substantially similar to the Bertin-Leedy combinations. According to the Petition, it would have been obvious to replace Yu’s silicon dioxide and processes for forming it with the dielectric and deposition process taught by Leedy. “Using [Leedy’s] dielectric materials and deposition techniques in the manufacture of Yu’s 3D LSI results in” the combination disclosing the low-tensile-stress-dielectric limitation. J.A. 1558. Dr. Franzen’s testimony in support of this combination was identical to the combination in the Bertin-Leedy grounds. *See* J.A. 2206–08 ¶¶ 99–103. The Board found that Petitioners failed to meet their burden for substantially the same reasons.

The evidence discussed as to why a person of ordinary skill in the art would not have reasonably expected success in making the proposed combination applies equally here. Dr. Glew testified that Yu identifies its dielectric as a “field oxide,” which one of ordinary skill in the art would have understood is a highly pure dielectric grown directly on the silicon substrate at high temperatures using thermal oxidation. J.A. 2418–19 ¶¶ 134–35 (citing J.A. 1350). His testimony about why a person of ordinary skill in the art would not have reasonably expected success using PECVD to deposit Leedy’s dielectric was likewise the same. Petitioners raise no argument on appeal that distinguishes the

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Bertin-Leedy grounds from the Yu-Leedy grounds. Substantial evidence supports the Board’s finding of a lack of reasonable expectation of success.

This issue is dispositive as to all challenged claims. All claims except claims 60, 67, 70, and 77 of the ’239 patent; claims 1 and 44 of the ’542 patent; claim 1 of the ’119 patent; and claim 58 of the ’570 patent explicitly require a low tensile stress dielectric. These claims recite either a substantially flexible die or integrated circuit, meaning they too require a low tensile stress dielectric under the proper claim construction. We thus affirm the Board’s finding as to a lack of reasonable expectation of success and need not reach Petitioners’ remaining arguments.

CONCLUSION

Because we hold that substantial evidence supports the Board’s finding of a lack of reasonable expectation of success, we need not address the Board’s separate findings that the prior art does not teach the “substantially flexible” limitation or that a person of ordinary skill in the art would have lacked a motivation to combine. For the foregoing reasons, we affirm.

AFFIRMED

Exhibit 7

Kidokoro, Koichiro

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Thursday, June 20, 2019 1:26 PM
To: Jung, Soyoung; ServicePH Samsung-ELM 3DS
Cc: Mailing List - Leedy
Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

I would like to schedule a meet and confer to discuss next steps regarding the identification of representative products.

In light of the Federal Circuit's recent decision, Elm currently intends to accuse of infringement all Samsung semiconductor products that contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. Elm reserves the right to update its position for any reason, including in the event that this Court (or any court of appeal) adopts a different construction of the "substantially flexible" claim terms.

In order to move forward with the selection of representative products, I would like to discuss the following issues:

1. Whether Samsung has already identified all products sold between 2008 and 2018 that meet the above criteria.
2. How the parties will handle the Samsung semiconductor products for which Samsung has not, to date, supplied complete die thickness data.
3. How the parties will select representative products from the complete set of accused products.

Please let me know if there is a time early next week when you are available to discuss these issues.

In addition, it's been almost a month since I sent the below email, but have not received any meaningful response. Please let us know your thoughts on the below issues this week.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Wednesday, May 22, 2019 9:24 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

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Exhibit 8

Kidokoro, Koichiro

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Tuesday, June 25, 2019 12:52 AM
To: Jung, Soyoung; ServicePH Samsung-ELM 3DS
Cc: Mailing List - Leedy
Subject: [EXT] RE: Elm Discovery Correspondence
Attachments: Samsung relevant product lists 20190624.xlsx

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Exhibit 9



















Exhibit 10

Kidokoro, Koichiro

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To: Nosson Knobloch; ServicePH Samsung-ELM 3DS
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[REDACTED] We believe that this is Elm's burden, not Samsung's. Otherwise, we don't think that we will make much progress on these issues or that a call would be very productive at this point.

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Soyoung,

We will consider your request [REDACTED]

In the meantime, your email fails to address two of the questions that I've raised:

1. When will Samsung provide a complete list of all stacked semiconductor products sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less? If you refuse to commit to a reasonable timeframe to provide this information, we will be forced to raise this issue with the Court.

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Thursday, June 20, 2019 11:26 AM

To: Jung, Soyung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyung,

I would like to schedule a meet and confer to discuss next steps regarding the identification of representative products.

In light of the Federal Circuit's recent decision, Elm currently intends to accuse of infringement all Samsung semiconductor products that contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. Elm reserves the right to update its position for any reason, including in the event that this

Court (or any court of appeal) adopts a different construction of the “substantially flexible” claim terms.

In order to move forward with the selection of representative products, I would like to discuss the following issues:

1. Whether Samsung has already identified all products sold between 2008 and 2018 that meet the above criteria.
2. How the parties will handle the Samsung semiconductor products for which Samsung has not, to date, supplied complete die thickness data.
3. How the parties will select representative products from the complete set of accused products.

Please let me know if there is a time early next week when you are available to discuss these issues.

In addition, it's been almost a month since I sent the below email, but have not received any meaningful response. Please let us know your thoughts on the below issues this week.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Wednesday, May 22, 2019 9:24 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

I am surprised to hear that you believe you've produced your supplier documents. From what I can see, your April 22 production contained no email. For many months, we've been asking for your **communications** with your dielectric suppliers about dielectric stress. Will you be producing those?

Relatedly, your April 22 production is missing the standard metadata. Can you please provide an overlay with that information?

Thanks,

-Nosson

BartlitBeck LLP

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From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Tuesday, May 21, 2019 6:17 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

We produced Samsung's supplier documents on April 22. Samsung may discover additional documents as part of its ongoing discovery efforts based on the list of search terms that the parties agree on.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Tuesday, May 21, 2019 6:44 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: [EXT] RE: Elm Discovery Correspondence

Thanks, Soyoung. Can you please also let me know when we can expect your production of communications with third party dielectric suppliers?

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Monday, May 20, 2019 10:35 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

We identify the following 5 Samsung employees for Elm's custodial discovery requests: Gunho Chang, Jiwoon Im, Ilho Kim, Tae-Young Lee and Jongyoung Park.

We will be sending you our proposed search terms for Elm shortly.

Regards,
Soyoung

From: Jung, Soyoung

Sent: Friday, May 10, 2019 6:39 PM

To: 'Nosson Knobloch' <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

I wanted to give you an update that we have been diligently working with Samsung in Korea this week to identify appropriate custodians, but we will need another week to conclude our investigation. Therefore, we would like to move the date by which Samsung identifies custodians from May 13 to May 20. All the other dates of custodial discovery that we agreed on will stay the same.

We will respond to Matt's email from today separately.

Thanks,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Friday, May 3, 2019 1:46 PM

To: #ELM3DS-MICRON-OMM <ELM3DS-MICRON-OMM@omm.com>; Skhynix-Elm@klgates.com; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: [EXT] Elm Discovery Correspondence

Dear Counsel,

Please see the attached correspondence.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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Exhibit 12

Kidokoro, Koichiro

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Monday, July 15, 2019 12:36 PM
To: Jung, Soyoung; ServicePH Samsung-ELM 3DS
Cc: Mailing List - Leedy
Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

Your email asserts that Samsung has already provided a complete list of all stacked semiconductor products sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less. We fear that this is simply not true and is, instead, another disturbing example of Samsung seeking to gain a litigation advantage through obfuscation and concealment.

One example of the possible gaps in the data Samsung has provided to date relates to Samsung's V-NAND products. According to the following white paper-- https://www.samsung.com/semiconductor/global.semi.static/2bit_V-NAND_technology_White_Paper-1.pdf -- Samsung has been producing V-NAND memory products with 24 layers since 2013, and with 32 layers since 2014. The largest stack that Samsung has identified to us in this case is 16 layers. So it's clear that these V-NAND products have not been identified in discovery. Given the number of layers in these products, we believe it is highly likely that at least one of the layers is 50µm or less.

Another example of a possible gap in the data Samsung has provided relates to camera chips included in Samsung's Galaxy phones. We understand that, at least as of 2016, Samsung's phones have included an image sensor chip stacked, via TSVs, with a DRAM memory chip. None of the products Samsung has identified in the litigation appear to include an image sensor chip stacked with DRAM. Given the nature of the image sensing technology used in Samsung's phones, we believe it is highly likely that at least one of the chips in these products has a thickness of 50µm or less.

Please let us know why these products have not been identified to us in litigation to date.



[REDACTED]

[REDACTED]

Please let us know whether Samsung has any other recommendations for how to move forward with these products.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Wednesday, July 10, 2019 9:29 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

I responded to your first question in my prior email. Samsung has already identified all such products, and you have given us no basis to suspect that Samsung has not done so. We ask that you identify at least one product that you believe is missing from the list, as that may help us understand your question and to further investigate as necessary. Otherwise, we do not see how the Court will entertain your motion.

[REDACTED]

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Monday, July 8, 2019 12:22 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

I hope you had a good Fourth of July holiday. I'm following-up on the below email. We need your answers to these questions ASAP so that we can move forward on discovery and on the selection of representative products.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Monday, June 24, 2019 11:36 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Soyoung,

We will consider your request 


In the meantime, your email fails to address two of the questions that I've raised:

1. When will Samsung provide a complete list of all stacked semiconductor products sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less? If you refuse to commit to a reasonable timeframe to provide this information, we will be forced to raise this issue with the Court.

2. [REDACTED]

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Monday, June 24, 2019 11:19 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

In response to this and your previous email, Samsung has identified all products that you have asked about based on a reasonable search. You have not given any basis for your suspicion that the list of products that Samsung has identified is incomplete. In any event, we will forward this spreadsheet on for Samsung to review.

[REDACTED]

[REDACTED] We believe that this is Elm's burden, not Samsung's. Otherwise, we don't think that we will make much progress on these issues or that a call would be very productive at this point.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Monday, June 24, 2019 9:52 PM


To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

Following-up on the below email, and given your failure to offer any time to talk, we wanted to email you some additional details about the information we're seeking from Samsung. In that vein, I've attached a spreadsheet that contains the following data:

1. Column A: Pre-stay products missing thickness data: This lists the more than 200 Samsung products identified in Elm's June 3, 2016 identification of accused products for which Samsung has not produced die thickness data.
2. Column B: Pre-stay products that contain one die at 50µm or less: This lists the 18 Samsung products included in the pre-stay identification of accused products that Elm provided on June 3, 2016, and that the '43 spreadsheet indicates have at least one die at 50µm or less (note that this list is a subset of the 50 products identified in Column D).
3. 
4. Column D: Post-stay products that contain one die at 50µm or less: This lists the 50 Samsung products identified in the '42 and '43 spreadsheets as including at least one die that is 50µm or less.

We would like Samsung to let us know, **this week**, whether Column D in the attached spreadsheet lists every Samsung semiconductor product sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less. If, as we strongly suspect, this list is incomplete, please also let us know when Samsung will be able to complete this list. If Samsung cannot commit to a reasonable timeframe in which to complete this list, then we intend to raise this issue with the Court.



We look forward to your response.

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Thursday, June 20, 2019 11:26 AM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Soyoung,

I would like to schedule a meet and confer to discuss next steps regarding the identification of representative products.

In light of the Federal Circuit's recent decision, Elm currently intends to accuse of infringement all Samsung semiconductor products that contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. Elm reserves the right to update its position for any reason, including in the event that this Court (or any court of appeal) adopts a different construction of the "substantially flexible" claim terms.

In order to move forward with the selection of representative products, I would like to discuss the following issues:

1. Whether Samsung has already identified all products sold between 2008 and 2018 that meet the above criteria.
2. How the parties will handle the Samsung semiconductor products for which Samsung has not, to date, supplied complete die thickness data.
3. How the parties will select representative products from the complete set of accused products.

Please let me know if there is a time early next week when you are available to discuss these issues.

In addition, it's been almost a month since I sent the below email, but have not received any meaningful response. Please let us know your thoughts on the below issues this week.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Wednesday, May 22, 2019 9:24 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

I am surprised to hear that you believe you've produced your supplier documents. From what I can see, your April 22 production contained no email. For many months, we've been asking for your **communications** with your dielectric suppliers about dielectric stress. Will you be producing those?

Relatedly, your April 22 production is missing the standard metadata. Can you please provide an overlay with that information?

Thanks,

-Nosson

BartlitBeck LLP

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From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Tuesday, May 21, 2019 6:17 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

We produced Samsung's supplier documents on April 22. Samsung may discover additional documents as part of its ongoing discovery efforts based on the list of search terms that the parties agree on.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Tuesday, May 21, 2019 6:44 AM
To: Jung, Soyung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Thanks, Soyung. Can you please also let me know when we can expect your production of communications with third party dielectric suppliers?

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyung <soyoungjung@paulhastings.com>
Sent: Monday, May 20, 2019 10:35 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

We identify the following 5 Samsung employees for Elm's custodial discovery requests: Gunho Chang, Jiwoon Im, Ilho Kim, Tae-Young Lee and Jongyoung Park.

We will be sending you our proposed search terms for Elm shortly.

Regards,
Soyung

From: Jung, Soyung
Sent: Friday, May 10, 2019 6:39 PM
To: 'Nosson Knobloch' <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

I wanted to give you an update that we have been diligently working with Samsung in Korea this week to identify appropriate custodians, but we will need another week to conclude our investigation. Therefore, we would like to move the date by which Samsung identifies custodians from May 13 to May 20. All the other dates of custodial discovery that we agreed on will stay the same.

We will respond to Matt's email from today separately.

Thanks,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Friday, May 3, 2019 1:46 PM
To: #ELM3DS-MICRON-OMM <ELM3DS-MICRON-OMM@omm.com>; Skhynix-Elm@klgates.com; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] Elm Discovery Correspondence

Dear Counsel,

Please see the attached correspondence.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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Exhibit 13

Kidokoro, Koichiro

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Tuesday, July 30, 2019 6:34 PM
To: Jung, Soyoung
Cc: Farnan, Brian; Farnan, Michael; Mailing List - Leedy; ServicePH Samsung-ELM 3DS; Poff, Adam
Subject: [EXT] Elm/Samsung Sales Data Meet and Confer
Attachments: Samsung relevant product lists 20190624.xlsx

Soyoung,

As Phillip requested, I am sending you a written description of the middle-ground I proposed on today's call. By the end of this week, Samsung will commit to providing US sales data for products in columns B or D in the attached spreadsheet. Samsung will produce that data within two weeks. When Samsung produces that data, it will clearly explain how it defined "US Sales" for purposes of the data it collected, and will also identify any other geographic data it has tracked for those products.

At the same time, Samsung will continue to investigate the die thickness issues. Samsung expects to provide to Elm a complete list of all multi-layer semiconductor products that contain a layer that is 50 microns or less within the next two to three weeks. Once that list is completed, Elm will promptly produce US sales data for any such products that are not listed in columns B or D in the attached spreadsheet.

At the same time, the parties will continue to meet and confer in good faith to try and reach an agreement on the scope of what constitutes a US sale, and the extent to which sales outside that scope are properly within the scope of discovery in this case.

Your agreement to the above will by no means fully satisfy Samsung's responsibilities in response to our recent discovery requests. But, we believe your agreement may demonstrate that the parties have a path forward that does not involve seeking the Court's assistance. If Samsung fails to confirm its agreement to this proposal by the end of this week, then Elm intends to move to compel on its recent discovery requests.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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Exhibit 14

Kidokoro, Koichiro

From: Jung, Soyoung
Sent: Wednesday, August 14, 2019 3:02 PM
To: Nosson Knobloch; ServicePH Samsung-ELM 3DS
Cc: Mailing List - Leedy
Subject: RE: Elm Discovery Correspondence

Nosson,

We provide some comments to your email below.

For the first category of V-NAND products that you have raised below, the examples you provided do not persuade us that Samsung's list of stacked die products is incomplete.

You refer to V-NAND products with multiple "layers," but we are not convinced that "layers" mean "stacks" of chips, as you seem to be reading this term. For example, page 3 of the white paper that you cited states in part: "NAND flash capacity is determined by the number of memory *cells* that can populate *a NAND chip*" and "The *32-layer stacks of cells* are connected to over 2 billion channel holes that have been etched from the top layer of the NAND to the bottom." The following webpage also explains that stacked "chips" is entirely distinguishable from NAND "layers," such that one single chip can contain multiple such layers: <https://thememoryguy.com/nand-flashes-layers-of-layers-of-layers/>. In contrast, we have identified products with stacked chips. Thus, we don't agree that a publication paper describing V-NAND products with 24 or 32 *layers* suggests that Samsung has failed to disclose additional stacked products with more than 16 stacked *chips*.

As for your second example below, we are surprised that Elm is raising image sensor products for the first time at this late stage, when the parties have been treating this case as directed to stacked memory products for several years now. Given that, we do not believe that your suggestion that Samsung has been misleading or not diligent in providing a complete list of stacked die products is justified. If Elm believes now that image sensor products should be added to the case, we would appreciate more reasonable time for investigation than the very short notice that you have given us to identify an entirely new category of products.

Given the seriousness of Elm's apparent attempt to substantially expand the scope of this case, we believe it would only be fair if, in the meantime, Elm amends its infringement contentions so that they provide Samsung more meaningful notice of Elm's theory of infringement with respect to the new image sensor products. We believe that amended infringement contentions would be especially instructive here given the issue above with respect to multiple layers or chips, and Elm's confusing use of terms recently, e.g., semiconductor "layer" instead of "substrate," or stacked "semiconductor product" instead of "memory product" (see Elm's Common Interrogatory Nos. 4-5). At the very least, Samsung is entitled to a full understanding of Elm's bases for why it believes that image sensor products are reasonably similar to the stacked memory products accused to date.

Therefore, please confirm that if it is Elm's intention to add image sensor products to the case Elm will amend its infringement contentions accordingly.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Friday, August 9, 2019 12:08 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-

ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

It's been nearly three weeks since we sent you the below email, raising serious concerns about the data Samsung has (and has not) produced, and the representations you've made about its completeness.

Please let us know where these issues stand so that we can decide how to proceed.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Monday, July 15, 2019 10:36 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

Your email asserts that Samsung has already provided a complete list of all stacked semiconductor products sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less. We fear that this is simply not true and is, instead, another disturbing example of Samsung seeking to gain a litigation advantage through obfuscation and concealment.

One example of the possible gaps in the data Samsung has provided to date relates to Samsung's V-NAND products. According to the following white paper-- https://www.samsung.com/semiconductor/global.semi.static/2bit_V-NAND_technology_White_Paper-1.pdf -- Samsung has been producing V-NAND memory products with 24 layers since 2013, and with 32 layers since 2014. The largest stack that Samsung has identified to us in this case is 16 layers. So it's clear that these V-NAND products have not been identified in discovery. Given the number

of layers in these products, we believe it is highly likely that at least one of the layers is 50µm or less.

Another example of a possible gap in the data Samsung has provided relates to camera chips included in Samsung's Galaxy phones. We understand that, at least as of 2016, Samsung's phones have included an image sensor chip stacked, via TSVs, with a DRAM memory chip. None of the products Samsung has identified in the litigation appear to include an image sensor chip stacked with DRAM. Given the nature of the image sensing technology used in Samsung's phones, we believe it is highly likely that at least one of the chips in these products has a thickness of 50µm or less.

Please let us know why these products have not been identified to us in litigation to date.

[REDACTED]

[REDACTED]

Please let us know whether Samsung has any other recommendations for how to move forward with these products.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Wednesday, July 10, 2019 9:29 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

I responded to your first question in my prior email. Samsung has already identified all such products, and you have given us no basis to suspect that Samsung has not done so. We ask that you identify at least one product that you believe is missing from the list, as that may help us understand your question and to further investigate as necessary. Otherwise, we do not see how the Court will entertain your motion.

[REDACTED]

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Monday, July 8, 2019 12:22 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

I hope you had a good Fourth of July holiday. I'm following-up on the below email. We need your answers to these questions ASAP so that we can move forward on discovery and on the selection of representative products.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Monday, June 24, 2019 11:36 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

We will consider your request [REDACTED]

In the meantime, your email fails to address two of the questions that I've raised:

1. When will Samsung provide a complete list of all stacked semiconductor products sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less? If you refuse to commit to a reasonable timeframe to provide this information, we will be forced to raise this issue with the Court.
2. [REDACTED]

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Monday, June 24, 2019 11:19 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

In response to this and your previous email, Samsung has identified all products that you have asked about based on a reasonable search. You have not given any basis for your suspicion that the list of products that Samsung has identified is incomplete. In any event, we will forward this spreadsheet on for Samsung to review.

[REDACTED]

[REDACTED] We believe that this is Elm's burden, not Samsung's. Otherwise, we don't think that we will make much progress on these issues or that a call would be very productive at this point.

Regards,
Soyoung

From: Nossou Knobloch <nossou.knobloch@bartlitbeck.com>
Sent: Monday, June 24, 2019 9:52 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

Following-up on the below email, and given your failure to offer any time to talk, we wanted to email you some additional details about the information we're seeking from Samsung. In that vein, I've attached a spreadsheet that contains the following data:

1. Column A: Pre-stay products missing thickness data: This lists the more than 200 Samsung products identified in Elm's June 3, 2016 identification of accused products for which Samsung has not produced die thickness data.
2. Column B: Pre-stay products that contain one die at 50µm or less: This lists the 18 Samsung products included in the pre-stay identification of accused products that Elm provided on June 3, 2016, and that the '43 spreadsheet indicates have at least one die at 50µm or less (note that this list is a subset of the 50 products identified in Column D).
3. [REDACTED]
4. Column D: Post-stay products that contain one die at 50µm or less: This lists the 50 Samsung products identified in the '42 and '43 spreadsheets as including at least one die that is 50µm or less.

We would like Samsung to let us know, **this week**, whether Column D in the attached spreadsheet lists every Samsung semiconductor product sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the

layers has a thickness of 50µm or less. If, as we strongly suspect, this list is incomplete, please also let us know when Samsung will be able to complete this list. If Samsung cannot commit to a reasonable timeframe in which to complete this list, then we intend to raise this issue with the Court.



We look forward to your response.

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Thursday, June 20, 2019 11:26 AM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Soyoung,

I would like to schedule a meet and confer to discuss next steps regarding the identification of representative products.

In light of the Federal Circuit’s recent decision, Elm currently intends to accuse of infringement all Samsung semiconductor products that contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. Elm reserves the right to update its position for any reason, including in the event that this Court (or any court of appeal) adopts a different construction of the “substantially flexible” claim terms.

In order to move forward with the selection of representative products, I would like to discuss the following issues:

1. Whether Samsung has already identified all products sold between 2008 and 2018 that meet the above criteria.
2. How the parties will handle the Samsung semiconductor products for which Samsung has not, to date, supplied complete die thickness data.
3. How the parties will select representative products from the complete set of accused products.

Please let me know if there is a time early next week when you are available to discuss these issues.

In addition, it's been almost a month since I sent the below email, but have not received any meaningful response. Please let us know your thoughts on the below issues this week.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Wednesday, May 22, 2019 9:24 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

I am surprised to hear that you believe you've produced your supplier documents. From what I can see, your April 22 production contained no email. For many months, we've been asking for your **communications** with your dielectric suppliers about dielectric stress. Will you be producing those?

Relatedly, your April 22 production is missing the standard metadata. Can you please provide an overlay with that information?

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Tuesday, May 21, 2019 6:17 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

We produced Samsung's supplier documents on April 22. Samsung may discover additional documents as part of its ongoing discovery efforts based on the list of search terms that the parties agree on.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Tuesday, May 21, 2019 6:44 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: [EXT] RE: Elm Discovery Correspondence

Thanks, Soyoung. Can you please also let me know when we can expect your production of communications with third party dielectric suppliers?

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Monday, May 20, 2019 10:35 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

We identify the following 5 Samsung employees for Elm's custodial discovery requests: Gunho Chang, Jiwoon Im, Ilho Kim, Tae-Young Lee and Jongyoung Park.

We will be sending you our proposed search terms for Elm shortly.

Regards,
Soyoung

From: Jung, Soyoung
Sent: Friday, May 10, 2019 6:39 PM
To: 'Nosson Knobloch' <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

I wanted to give you an update that we have been diligently working with Samsung in Korea this week to identify appropriate custodians, but we will need another week to conclude our investigation. Therefore, we would like to move the date by which Samsung identifies custodians from May 13 to May 20. All the other dates of custodial discovery that we agreed on will stay the same.

We will respond to Matt's email from today separately.

Thanks,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Friday, May 3, 2019 1:46 PM
To: #ELM3DS-MICRON-OMM <ELM3DS-MICRON-OMM@omm.com>; Skhynix-Elm@klgates.com; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] Elm Discovery Correspondence

Dear Counsel,

Please see the attached correspondence.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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Exhibit 15

Kidokoro, Koichiro

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Friday, August 16, 2019 1:02 PM
To: Jung, Soyoung; ServicePH Samsung-ELM 3DS
Cc: Mailing List - Leedy
Subject: [EXT] RE: Elm/Samsung Accused Products

Soyoung,

There are two significant problems with your response:

1. It confirms that the representations in your June 24 email were untrue, and in fact sought to conceal whole categories of potential accused products.
2. Despite taking a month to provide this response, it contains no additional information about Samsung's products (beyond a reference to a third-party website that can be found with a simple google search).

Samsung's pattern of obfuscation and concealment must end. In order to move forward, **Elm requests that Samsung provide the following information:**

1. Within two weeks, Samsung provide a complete list of every Samsung semiconductor products that contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. This list must include every product that meets the above definition regardless of whether Samsung believes it is within the scope of this case, and must be signed by a Samsung employee under penalties of perjury.
2. Within one month, Samsung provides all US sales data concerning the products listed in response to paragraph 1. This data must include every sale that Samsung knows to have a connection to the US based on any geographic data that Samsung tracks for its product sales. This sales data must be accompanied by a declaration certifying the completeness of the information signed by a Samsung employee under penalties of perjury.

Please let me know no later than **Wednesday, August 21st**, whether Samsung will agree to provide the above information. If Samsung refuses, we intend to immediately raise this issue with the Court.

With regards to Elm's infringement contentions, my June 20 email made it clear that Elm currently intends to accuse of infringement every Samsung semiconductor product

that contains more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. Once Samsung identifies all such products, Elm will update its infringement contentions in accordance with the schedule set-forth by the Court.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Wednesday, August 14, 2019 1:02 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

We provide some comments to your email below.

For the first category of V-NAND products that you have raised below, the examples you provided do not persuade us that Samsung's list of stacked die products is incomplete.

You refer to V-NAND products with multiple "layers," but we are not convinced that "layers" mean "stacks" of chips, as you seem to be reading this term. For example, page 3 of the white paper that you cited states in part: "NAND flash capacity is determined by the number of memory *cells* that can populate *a NAND chip*" and "The *32-layer stacks of cells* are connected to over 2 billion channel holes that have been etched from the top layer of the NAND to the bottom." The following webpage also explains that stacked "chips" is entirely distinguishable from NAND "layers," such that one single chip can contain multiple such layers: <https://thememoryguy.com/nand-flashes-layers-of-layers-of-layers/>. In contrast, we have identified products with stacked chips. Thus, we don't agree that a publication paper describing V-NAND products with 24 or 32 *layers* suggests that Samsung has failed to disclose additional stacked products with more than 16 stacked *chips*.

As for your second example below, we are surprised that Elm is raising image sensor products for the first time at this late stage, when the parties have been treating this case as directed to stacked memory products for several years now. Given that, we do not believe that your suggestion that Samsung has been misleading or not diligent in providing a complete list of stacked die products is justified. If Elm believes now that image sensor products should be added to the case, we would appreciate more reasonable time for investigation than the very short notice that you have given us to identify an entirely new category of products.

Given the seriousness of Elm's apparent attempt to substantially expand the scope of this case, we believe it would only be fair if, in the meantime, Elm amends its infringement contentions so that they provide Samsung more meaningful notice of Elm's theory of infringement with respect to the new image sensor products. We believe that amended

infringement contentions would be especially instructive here given the issue above with respect to multiple layers or chips, and Elm's confusing use of terms recently, e.g., semiconductor "layer" instead of "substrate," or stacked "semiconductor product" instead of "memory product" (see Elm's Common Interrogatory Nos. 4-5). At the very least, Samsung is entitled to a full understanding of Elm's bases for why it believes that image sensor products are reasonably similar to the stacked memory products accused to date.

Therefore, please confirm that if it is Elm's intention to add image sensor products to the case Elm will amend its infringement contentions accordingly.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Friday, August 9, 2019 12:08 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

It's been nearly three weeks since we sent you the below email, raising serious concerns about the data Samsung has (and has not) produced, and the representations you've made about its completeness.

Please let us know where these issues stand so that we can decide how to proceed.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Monday, July 15, 2019 10:36 AM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Soyoung,

Your email asserts that Samsung has already provided a complete list of all stacked semiconductor products sold from 2008 to the present that Samsung knows to contain

more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less. We fear that this is simply not true and is, instead, another disturbing example of Samsung seeking to gain a litigation advantage through obfuscation and concealment.

One example of the possible gaps in the data Samsung has provided to date relates to Samsung's V-NAND products. According to the following white paper-- https://www.samsung.com/semiconductor/global.semi.static/2bit_V-NAND_technology_White_Paper-1.pdf -- Samsung has been producing V-NAND memory products with 24 layers since 2013, and with 32 layers since 2014. The largest stack that Samsung has identified to us in this case is 16 layers. So it's clear that these V-NAND products have not been identified in discovery. Given the number of layers in these products, we believe it is highly likely that at least one of the layers is 50µm or less.

Another example of a possible gap in the data Samsung has provided relates to camera chips included in Samsung's Galaxy phones. We understand that, at least as of 2016, Samsung's phones have included an image sensor chip stacked, via TSVs, with a DRAM memory chip. None of the products Samsung has identified in the litigation appear to include an image sensor chip stacked with DRAM. Given the nature of the image sensing technology used in Samsung's phones, we believe it is highly likely that at least one of the chips in these products has a thickness of 50µm or less.

Please let us know why these products have not been identified to us in litigation to date.

[REDACTED]

[REDACTED]

[REDACTED] Please let us know whether Samsung has any other recommendations for how to move forward with these products.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Wednesday, July 10, 2019 9:29 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

I responded to your first question in my prior email. Samsung has already identified all such products, and you have given us no basis to suspect that Samsung has not done so. We ask that you identify at least one product that you believe is missing from the list, as that may help us understand your question and to further investigate as necessary. Otherwise, we do not see how the Court will entertain your motion.

[REDACTED]

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Monday, July 8, 2019 12:22 PM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

I hope you had a good Fourth of July holiday. I'm following-up on the below email. We need your answers to these questions ASAP so that we can move forward on discovery and on the selection of representative products.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Monday, June 24, 2019 11:36 PM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

We will consider your request 



In the meantime, your email fails to address two of the questions that I've raised:

1. When will Samsung provide a complete list of all stacked semiconductor products sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less? If you refuse to commit to a reasonable timeframe to provide this information, we will be forced to raise this issue with the Court.

2. 

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Monday, June 24, 2019 11:19 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

In response to this and your previous email, Samsung has identified all products that you have asked about based on a reasonable search. You have not given any basis for your suspicion that the list of products that Samsung has identified is incomplete. In any event, we will forward this spreadsheet on for Samsung to review.

[REDACTED]

[REDACTED] We believe that this is Elm's burden, not Samsung's. Otherwise, we don't think that we will make much progress on these issues or that a call would be very productive at this point.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Monday, June 24, 2019 9:52 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

Following-up on the below email, and given your failure to offer any time to talk, we wanted to email you some additional details about the information we're seeking from Samsung. In that vein, I've attached a spreadsheet that contains the following data:

1. Column A: Pre-stay products missing thickness data: This lists the more than 200 Samsung products identified in Elm's June 3, 2016 identification of accused products for which Samsung has not produced die thickness data.
2. Column B: Pre-stay products that contain one die at 50µm or less: This lists the 18 Samsung products included in the pre-stay identification of accused products that Elm provided on June 3, 2016, and that the '43 spreadsheet indicates have at least one die at 50µm or less (note that this list is a subset of the 50 products identified in Column D).

3.

[REDACTED]

4. Column D: Post-stay products that contain one die at 50µm or less: This lists the 50 Samsung products identified in the '42 and '43 spreadsheets as including at least one die that is 50µm or less.

We would like Samsung to let us know, **this week**, whether Column D in the attached spreadsheet lists every Samsung semiconductor product sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less. If, as we strongly suspect, this list is incomplete, please also let us know when Samsung will be able to complete this list. If Samsung cannot commit to a reasonable timeframe in which to complete this list, then we intend to raise this issue with the Court.

[REDACTED]

We look forward to your response.

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Thursday, June 20, 2019 11:26 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

I would like to schedule a meet and confer to discuss next steps regarding the identification of representative products.

In light of the Federal Circuit's recent decision, Elm currently intends to accuse of infringement all Samsung semiconductor products that contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. Elm reserves the right to update its position for any reason, including in the event that this Court (or any court of appeal) adopts a different construction of the "substantially flexible" claim terms.

In order to move forward with the selection of representative products, I would like to discuss the following issues:

1. Whether Samsung has already identified all products sold between 2008 and 2018 that meet the above criteria.
2. How the parties will handle the Samsung semiconductor products for which Samsung has not, to date, supplied complete die thickness data.
3. How the parties will select representative products from the complete set of accused products.

Please let me know if there is a time early next week when you are available to discuss these issues.

In addition, it's been almost a month since I sent the below email, but have not received any meaningful response. Please let us know your thoughts on the below issues this week.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Wednesday, May 22, 2019 9:24 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

I am surprised to hear that you believe you've produced your supplier documents. From what I can see, your April 22 production contained no email. For many months, we've been asking for your **communications** with your dielectric suppliers about dielectric stress. Will you be producing those?

Relatedly, your April 22 production is missing the standard metadata. Can you please provide an overlay with that information?

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Tuesday, May 21, 2019 6:17 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

We produced Samsung's supplier documents on April 22. Samsung may discover additional documents as part of its ongoing discovery efforts based on the list of search terms that the parties agree on.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Tuesday, May 21, 2019 6:44 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: [EXT] RE: Elm Discovery Correspondence

Thanks, Soyoung. Can you please also let me know when we can expect your production of communications with third party dielectric suppliers?

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Monday, May 20, 2019 10:35 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

We identify the following 5 Samsung employees for Elm's custodial discovery requests: Gunho Chang, Jiwoon Im, Ilho Kim, Tae-Young Lee and Jongyoung Park.

We will be sending you our proposed search terms for Elm shortly.

Regards,
Soyoung

From: Jung, Soyoung
Sent: Friday, May 10, 2019 6:39 PM
To: 'Nosson Knobloch' <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

I wanted to give you an update that we have been diligently working with Samsung in Korea this week to identify appropriate custodians, but we will need another week to conclude our investigation. Therefore, we would like to move the date by which Samsung identifies custodians from May 13 to May 20. All the other dates of custodial discovery that we agreed on will stay the same.

We will respond to Matt's email from today separately.

Thanks,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Friday, May 3, 2019 1:46 PM
To: #ELM3DS-MICRON-OMM <ELM3DS-MICRON-OMM@omm.com>; Skhynix-Elm@klgates.com; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] Elm Discovery Correspondence

Dear Counsel,

Please see the attached correspondence.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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Exhibit 16

Kidokoro, Koichiro

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Friday, August 23, 2019 12:15 AM
To: Jung, Soyoung; ServicePH Samsung-ELM 3DS
Cc: Mailing List - Leedy
Subject: [EXT] RE: Elm/Samsung Accused Products

Soyoung,

Thank you for your email. We are considering the issues you've raised with regards to the image sensor products. In the meantime, it appears that we all agree that stacked memory products have been at issue in this case from the very start. But, for reasons I simply do not understand, we still do not have a complete list of Samsung stacked memory products that include a layer that is 50 microns or less. Let alone basic sales or technical data for such products.

Instead of providing that information, it appears that you are continuing to try and conceal information about Samsung's products. [REDACTED]

[REDACTED] the following press release, published earlier this month on Samsung's own website: <https://news.samsung.com/global/samsung-electronics-takes-3d-memory-to-new-heights-with-sixth-generation-v-nand-ssds-for-client-computing>. In that press release, Samsung includes a "mass production timeline" of V-NAND products, showing that it began mass-production of 24-layer V-NAND products in 2013, and 32-layer V-NAND products in 2014. [REDACTED]

This must end now.

In order to avoid an immediate motion to compel on these issues, **Samsung must commit to provide the following:**

1. **By August 30, Samsung provide a complete list of every Samsung semiconductor memory product that contains more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. This list must include every product that meets the above definition regardless of whether Samsung believes it is within the scope of this case (including, without limitation, all V-NAND products that include a layer that is less than 50 microns thick), and must be signed by a Samsung employee under penalties of perjury.**

2. By **September 13**, Samsung provides all US sales data concerning the products listed in response to paragraph 1. This data must include every sale that Samsung knows to have a connection to the US based on any geographic data that Samsung tracks for its product sales. This sales data must be accompanied by a declaration certifying the completeness of the information signed by a Samsung employee under penalties of perjury.

3. By **September 20**, Samsung provides core technical data for all products listed in response to paragraph 1. This data must be accompanied by a chart that correlates any relevant documents to the specific products listed in response to paragraph 1 and must include, at a minimum, the following core technical information:
 - a. Stress data for every dielectric used in the product
 - b. Physical dimensions of every part of the product, including but not limited to the height, width, and length of every semiconductor layer, every dielectric layer, and every metal layer in the product
 - c. Process flow documents listing, in order, every process to which the product is subjected during manufacturing;
 - d. Process parameters for all package processing, including wafer thinning/back grind, wafer polish, saw/clean, die-attach, and wire bond;
 - e. Wafer process parameters for deposition of dielectric layers, including without limitation inter-layer dielectric, inter-metal dielectric, and passivation layers, beginning with deposition of the first inter-layer dielectric;
 - f. Process parameters for deposition of metal layers; CMP of dielectric or metal layers; and annealing steps occurring after deposition of the first inter-layer dielectric; and
 - g. Warpage measurements performed during wafer and/or package processing, including without limitation upper and lower control limits in warpage specifications.

To be clear, your agreement to the above will not fully satisfy Samsung's discovery obligations. And, by offering the above compromise, Elm does not mean to suggest in any way that it intends not to pursue discovery on any other issues we've been discussing. The **ONLY** thing I'm saying is that, if Samsung agrees to the above, Elm will not immediately raise these issues with the Court.

Please let me know **by Monday, August 26**, whether Samsung agrees to the above, or has an alternative, concrete formulation it would like to propose. Absent that, we intend to file a motion to compel immediately.

I'm available to discuss these issues tomorrow or Monday.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Thursday, August 22, 2019 6:46 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm/Samsung Accused Products

Nosson,

The accusations in your email that Samsung has intentionally concealed information from Elm are baseless and disconnected from our response. We clearly explained that the white paper you cite does not suggest, as you claimed, that Samsung has omitted other V-NAND products from its list of products. You have given no response to this except to merely reiterate your accusation that the information Samsung has given is incomplete. [REDACTED]

We also made clear that Samsung was surprised that Elm is now introducing image sensor products to the case. You refer to your June 20 email as stating Elm's intent to accuse "semiconductor products," but you do not deny that Elm is only now adding image sensor products for the first time, when Elm has for years since the outset of this litigation only sought discovery on memory products. Given this history, we don't see how you can claim in good faith that Samsung "sought to conceal whole categories of potential accused products."

Given your unjustified accusations, we see no basis for your demand for a complete list of products by the arbitrary deadline of 2 weeks. To be clear, you have not given any legitimate basis to suspect that Samsung's list of memory products is incomplete. [REDACTED]

[REDACTED] In fact, it is Elm's own apparent refusal to amend its infringement contentions, or otherwise provide further details regarding its infringement theory, that will undoubtedly complicate and hinder Samsung's efforts to produce this list of products.

We disagree that Elm's obligations to update its contentions are limited to the schedule set forth in the Court's order. Samsung is entitled to know at least why Elm believes that image sensor products are reasonably similar to the accused memory products, and how Elm reads the claims onto these products, such as how Elm identifies the chip or "semiconductor layer" with 50 microns or less in the stack, with respect to the DRAM component and/or the image sensor component. The fact that Elm is apparently unable to even articulate a theory of infringement confirms that Elm has only very recently attempted to expand the scope of this case to an open-ended universe of "semiconductor products," while giving virtually no notice to Samsung of what it accuses and how. This approach is not supported by any authority that we are aware of. Without such notice, discovery will inevitably be inaccurate or incomplete, and Samsung should not be required to singlehandedly bear the burden of this production, when Elm's theory of infringement is still incoherent. We believe it is in Elm's interest to update its infringement contentions to assist Samsung in a more productive investigation of these new products, in the timeframes you desire. Please let us know if Elm will do so.

And, we previously agreed that Samsung will produce US sales data for all relevant memory products. Barring unforeseen circumstances, we do not anticipate any issues extending that agreement to the new image sensor products. Our main concerns are set forth above with respect to timing and Elm's refusal to provide any more notice or detail in support of its attempt to add new products to the case.

Should Elm wish to raise this issue with the Court, we do not see Elm gaining much traction where Samsung does not disagree to disclosing a list of new products, but Elm refuses to even put in the effort to explain why image sensor products are reasonably similar to memory products and how it interprets critical claim elements in these products.

Regards,
Soyoung

From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Wednesday, August 21, 2019 8:42 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm/Samsung Accused Products

Nosson,

We will respond to your email below tomorrow.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Friday, August 16, 2019 10:02 AM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm/Samsung Accused Products

Soyoung,

There are two significant problems with your response:

1. It confirms that the representations in your June 24 email were untrue, and in fact sought to conceal whole categories of potential accused products.
2. Despite taking a month to provide this response, it contains no additional information about Samsung's products (beyond a reference to a third-party website that can be found with a simple google search).

Samsung's pattern of obfuscation and concealment must end. In order to move forward, Elm requests that Samsung provide the following information:

1. Within two weeks, Samsung provide a complete list of every Samsung semiconductor products that contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. This list must include every product that meets the above definition regardless of whether Samsung believes it is within the scope of this case, and must be signed by a Samsung employee under penalties of perjury.
2. Within one month, Samsung provides all US sales data concerning the products listed in response to paragraph 1. This data must include every sale that Samsung knows to have a connection to the US based on any geographic data that Samsung tracks for its product sales. This sales data must be accompanied by a declaration certifying the completeness of the information signed by a Samsung employee under penalties of perjury.

Please let me know no later than **Wednesday, August 21st**, whether Samsung will agree to provide the above information. If Samsung refuses, we intend to immediately raise this issue with the Court.

With regards to Elm's infringement contentions, my June 20 email made it clear that Elm currently intends to accuse of infringement every Samsung semiconductor product that contains more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. Once Samsung identifies all such products, Elm will update its infringement contentions in accordance with the schedule set-forth by the Court.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Wednesday, August 14, 2019 1:02 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

We provide some comments to your email below.

For the first category of V-NAND products that you have raised below, the examples you provided do not persuade us that Samsung's list of stacked die products is incomplete.

You refer to V-NAND products with multiple "layers," but we are not convinced that "layers" mean "stacks" of chips, as you seem to be reading this term. For example, page 3 of the white paper that you cited states in part: "NAND flash capacity is determined by the number of memory *cells* that can populate *a NAND chip*" and "The *32-layer stacks of cells* are connected to over 2 billion channel holes that have been etched from the top layer of the NAND to the bottom." The following webpage also explains that stacked "chips" is entirely distinguishable from NAND "layers," such that one single chip can contain multiple such layers: <https://thememoryguy.com/nand-flashes-layers-of-layers-of-layers/>. In contrast, we have identified products with stacked chips. Thus, we don't agree that a publication paper describing V-NAND products with 24 or 32 *layers* suggests that Samsung has failed to disclose additional stacked products with more than 16 stacked *chips*.

As for your second example below, we are surprised that Elm is raising image sensor products for the first time at this late stage, when the parties have been treating this case as directed to stacked memory products for several years now. Given that, we do not believe that your suggestion that Samsung has been misleading or not diligent in providing a complete list of stacked die products is justified. If Elm believes now that image sensor products should be added to the case, we would appreciate more reasonable time for investigation than the very short notice that you have given us to identify an entirely new category of products.

Given the seriousness of Elm's apparent attempt to substantially expand the scope of this case, we believe it would only be fair if, in the meantime, Elm amends its infringement contentions so that they provide Samsung more meaningful notice of Elm's theory of infringement with respect to the new image sensor products. We believe that amended infringement contentions would be especially instructive here given the issue above with respect to multiple layers or chips, and Elm's confusing use of terms recently, e.g., semiconductor "layer" instead of "substrate," or stacked "semiconductor product" instead of "memory product" (see Elm's Common Interrogatory Nos. 4-5). At the very least, Samsung is entitled to a full understanding of Elm's bases for why it believes that image sensor products are reasonably similar to the stacked memory products accused to date.

Therefore, please confirm that if it is Elm's intention to add image sensor products to the case Elm will amend its infringement contentions accordingly.

Regards,
Soyoung

From: Nossong Knobloch <nossong.knobloch@bartlitbeck.com>

Sent: Friday, August 9, 2019 12:08 PM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

It's been nearly three weeks since we sent you the below email, raising serious concerns about the data Samsung has (and has not) produced, and the representations you've made about its completeness.

Please let us know where these issues stand so that we can decide how to proceed.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Monday, July 15, 2019 10:36 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

Your email asserts that Samsung has already provided a complete list of all stacked semiconductor products sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less. We fear that this is simply not true and is, instead, another disturbing example of Samsung seeking to gain a litigation advantage through obfuscation and concealment.

One example of the possible gaps in the data Samsung has provided to date relates to Samsung's V-NAND products. According to the following white paper-- https://www.samsung.com/semiconductor/global.semi.static/2bit_V-NAND_technology_White_Paper-1.pdf-- Samsung has been producing V-NAND memory products with 24 layers since 2013, and with 32 layers since 2014. The largest stack that Samsung has identified to us in this case is 16 layers. So it's clear that these V-NAND products have not been identified in discovery. Given the number of layers in these products, we believe it is highly likely that at least one of the layers is 50µm or less.

Another example of a possible gap in the data Samsung has provided relates to camera chips included in Samsung's Galaxy phones. We understand that, at least as of 2016, Samsung's phones have included an image sensor chip stacked, via TSVs, with a DRAM memory chip. None of the products Samsung has identified in the litigation appear to include an image sensor chip stacked with DRAM. Given the nature of the image sensing technology used in Samsung's phones, we believe it is

highly likely that at least one of the chips in these products has a thickness of 50µm or less.

Please let us know why these products have not been identified to us in litigation to date.

[REDACTED]

[REDACTED]

Please let us know whether Samsung has any other recommendations for how to move forward with these products.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Wednesday, July 10, 2019 9:29 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

I responded to your first question in my prior email. Samsung has already identified all such products, and you have given us no basis to suspect that Samsung has not done so. We ask that you identify at least one product that you believe is missing from the list, as that may help us understand your question and to further investigate as necessary. Otherwise, we do not see how the Court will entertain your motion.

[REDACTED]

Regards,
Soyoung

From: Nossou Knobloch <nossou.knobloch@bartlitbeck.com>
Sent: Monday, July 8, 2019 12:22 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

I hope you had a good Fourth of July holiday. I'm following-up on the below email. We need your answers to these questions ASAP so that we can move forward on discovery and on the selection of representative products.

Thanks,

-Nossou

BartlitBeck LLP

Nossou D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nossou.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Nossou Knobloch <nossou.knobloch@bartlitbeck.com>
Sent: Monday, June 24, 2019 11:36 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Soyoung,

We will consider your request [REDACTED]

[REDACTED]

In the meantime, your email fails to address two of the questions that I've raised:

1. When will Samsung provide a complete list of all stacked semiconductor products sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less? If you refuse to commit to a reasonable timeframe to provide this information, we will be forced to raise this issue with the Court.

2. [REDACTED]

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Monday, June 24, 2019 11:19 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

In response to this and your previous email, Samsung has identified all products that you have asked about based on a reasonable search. You have not given any basis for your suspicion that the list of products that Samsung has identified is incomplete. In any event, we will forward this spreadsheet on for Samsung to review.

[REDACTED]


[REDACTED] We believe that this is Elm's burden, not Samsung's. Otherwise, we don't think that we will make much progress on these issues or that a call would be very productive at this point.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Monday, June 24, 2019 9:52 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

Following-up on the below email, and given your failure to offer any time to talk, we wanted to email you some additional details about the information we're seeking from Samsung. In that vein, I've attached a spreadsheet that contains the following data:

1. Column A: Pre-stay products missing thickness data: This lists the more than 200 Samsung products identified in Elm's June 3, 2016 identification of accused products for which Samsung has not produced die thickness data.
2. Column B: Pre-stay products that contain one die at 50µm or less: This lists the 18 Samsung products included in the pre-stay identification of accused products that Elm provided on June 3, 2016, and that the '43 spreadsheet indicates have at least one die at 50µm or less (note that this list is a subset of the 50 products identified in Column D).
3. 
4. Column D: Post-stay products that contain one die at 50µm or less: This lists the 50 Samsung products identified in the '42 and '43 spreadsheets as including at least one die that is 50µm or less.

We would like Samsung to let us know, **this week**, whether Column D in the attached spreadsheet lists every Samsung semiconductor product sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less. If, as we strongly suspect, this list is incomplete, please also let us know when Samsung will be able to complete this list. If Samsung cannot commit to a reasonable timeframe in which to complete this list, then we intend to raise this issue with the Court.





We look forward to your response.

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Thursday, June 20, 2019 11:26 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

I would like to schedule a meet and confer to discuss next steps regarding the identification of representative products.

In light of the Federal Circuit's recent decision, Elm currently intends to accuse of infringement all Samsung semiconductor products that contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. Elm reserves the right to update its position for any reason, including in the event that this Court (or any court of appeal) adopts a different construction of the "substantially flexible" claim terms.

In order to move forward with the selection of representative products, I would like to discuss the following issues:

1. Whether Samsung has already identified all products sold between 2008 and 2018 that meet the above criteria.
2. How the parties will handle the Samsung semiconductor products for which Samsung has not, to date, supplied complete die thickness data.

3. How the parties will select representative products from the complete set of accused products.

Please let me know if there is a time early next week when you are available to discuss these issues.

In addition, it's been almost a month since I sent the below email, but have not received any meaningful response. Please let us know your thoughts on the below issues this week.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Wednesday, May 22, 2019 9:24 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

I am surprised to hear that you believe you've produced your supplier documents. From what I can see, your April 22 production contained no email. For many months, we've been asking for your **communications** with your dielectric suppliers about dielectric stress. Will you be producing those?

Relatedly, your April 22 production is missing the standard metadata. Can you please provide an overlay with that information?

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Tuesday, May 21, 2019 6:17 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

We produced Samsung's supplier documents on April 22. Samsung may discover additional documents as part of its ongoing discovery efforts based on the list of search terms that the parties agree on.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Tuesday, May 21, 2019 6:44 AM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Thanks, Soyoung. Can you please also let me know when we can expect your production of communications with third party dielectric suppliers?

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Monday, May 20, 2019 10:35 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

We identify the following 5 Samsung employees for Elm's custodial discovery requests: Gunho Chang, Jiwoon Im, Ilho Kim, Tae-Young Lee and Jongyoung Park.

We will be sending you our proposed search terms for Elm shortly.

Regards,
Soyoung

From: Jung, Soyoung
Sent: Friday, May 10, 2019 6:39 PM
To: 'Nosson Knobloch' <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

I wanted to give you an update that we have been diligently working with Samsung in Korea this week to identify appropriate custodians, but we will need another week to conclude our investigation. Therefore, we would like to move the date by which Samsung identifies custodians from May 13 to May 20. All the other dates of custodial discovery that we agreed on will stay the same.

We will respond to Matt's email from today separately.

Thanks,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Friday, May 3, 2019 1:46 PM
To: #ELM3DS-MICRON-OMM <ELM3DS-MICRON-OMM@omm.com>; Skhynix-Elm@klgates.com; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] Elm Discovery Correspondence

Dear Counsel,

Please see the attached correspondence.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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Exhibit 17

Kidokoro, Koichiro

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Monday, August 26, 2019 10:39 AM
To: Jung, Soyoun; ServicePH Samsung-ELM 3DS
Cc: Mailing List - Leedy
Subject: [EXT] RE: Elm/Samsung Accused Products
Attachments: 20190826 DRAFT Letter to Court.docx

Soyoun,

I've attached a draft letter to the Court seeking a discovery conference on the issues outlined in my Thursday email. Please let us know, **by tomorrow**, whether Samsung has a concrete proposal responsive to that email or, if not, whether Samsung has any edits it would like to propose to the attached letter.

With regards to your comments about Samsung's V-NAND products, perhaps the following summary will help you understand some of the reasons why we are so disappointed with Samsung's conduct in discovery in this case:

- On June 24, I asked you when Samsung will “provide a complete list of all stacked semiconductor products sold from 2008 to the present that Samsung knows to contain more than one **circuit layer**, where at least one **circuit layer** is stacked above or below another **circuit layer**, and where at least one of the **layers** has a thickness of 50µm or less.” (emphasis added)
- On July 10, you stated that “Samsung has already identified **all such products**” (emphasis added)
- On July 15, I pointed out that there were at least two categories of products covered by my June 24 email that Samsung appeared not to have identified to us in this case: Samsung V-NAND products and Samsung image sensor products with stacked memory chips.
- On August 14, you conceded that Samsung's V-NAND products have multiple “layers” but suggested that those layers are not “stacks” of dies or chips. But this distinction misses the point because my June 24 email referred to circuit layers, not to stacks of die or chips. Your email also raised some concerns about Elm adding a new type of product to the case (i.e., image sensor chips stacked with memory chips). But you have never denied that Samsung is indeed selling such products, that they meet the definition set-forth in my June 24 email, and that Samsung has never identified them to us in discovery in this case.

I am available to discuss these issues today or tomorrow.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Friday, August 23, 2019 5:07 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm/Samsung Accused Products

Nosson,

As a preliminary matter, we will not be able to get a response to you from Samsung by Monday, August 26. It is already the weekend in Korea, and we will not be able to discuss these issues with Samsung by Monday. We can give you a response later in the week.

However, we do not believe there is a legitimate dispute here as to the completeness of the list of relevant memory products that Samsung has identified to date—with the exception of [REDACTED]

[REDACTED] That is a separate issue not subject to dispute, as Samsung is resolving the issue and has already agreed to provide all the relevant discovery to Elm.

Aside from that issue, your allegations of our intentional concealment are completely inappropriate and unwarranted. You seem to have misapprehended the technology at issue here, as there is a difference between layers and stacks. Thus, before firing off further accusations, please carefully reread my email of August 14, which attempted to highlight for you the distinction you have missed between (1) multiple “layers” of memory cells and (2) “stacks” of dies/chips. Your lack of any meaningful response to this email confirms that your accusations are still based on a critical error in your understanding.

Just like the white paper you cited earlier, the press release you now refer to below merely addresses products with 24 and 32 “layers” of memory cells—not “stacks” of semiconductor dies. For example, this press release describes “The Only Single-stack 3D Memory Die With a 100+ Layer Design” (emphasis added). It also states that “the new V-NAND adds around 40-percent more cells to the previous 9x-layer single-stack structure” (emphasis added). It also characterizes the 24-layer and 32-layer products that you have raised as earlier 1st and 2nd generation V-NAND products, and the 9x-layer (single-stack) products as 5th generation V-NAND products. Thus, just because a single die or chip can have dozens of layers (if not more) of cells, that does not make the die or chip amount to more than a single stack; the third party website I previously directed you to also explains why. We suggest that you study these technical details further or have someone on your team explain them to you, before making additional baseless allegations.

Until then, I can assure you that Samsung has identified the relevant memory products with “stacks” of semiconductor dies and, in response to your questions, [REDACTED]

Regards,
Soyoung

From: Nossou Knobloch <nossou.knobloch@bartlitbeck.com>
Sent: Thursday, August 22, 2019 9:15 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm/Samsung Accused Products

Soyoung,

Thank you for your email. We are considering the issues you've raised with regards to the image sensor products. In the meantime, it appears that we all agree that stacked memory products have been at issue in this case from the very start. But, for reasons I simply do not understand, we still do not have a complete list of Samsung stacked memory products that include a layer that is 50 microns or less. Let alone basic sales or technical data for such products.

Instead of providing that information, it appears that you are continuing to try and conceal information about Samsung's products. [REDACTED]

[REDACTED] the following press release, published earlier this month on Samsung's own website: <https://news.samsung.com/global/samsung-electronics-takes-3d-memory-to-new-heights-with-sixth-generation-v-nand-ssds-for-client-computing>. In that press release, Samsung includes a "mass production timeline" of V-NAND products, showing that it began mass-production of 24-layer V-NAND products in 2013, and 32-layer V-NAND products in 2014. [REDACTED]

This must end now.

In order to avoid an immediate motion to compel on these issues, Samsung must commit to provide the following:

1. By **August 30**, Samsung provide a complete list of every Samsung semiconductor memory product that contains more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. This list must include every product that meets the above definition regardless of whether Samsung believes it is within the scope of this case (including, without limitation, all V-NAND products that include a layer that is less than 50 microns thick), and must be signed by a Samsung employee under penalties of perjury.

2. By **September 13**, Samsung provides all US sales data concerning the products listed in response to paragraph 1. This data must include every sale that Samsung knows to have a connection to the US based on any geographic data that Samsung tracks for its product sales. This sales data must be accompanied by a declaration certifying the completeness of the information signed by a Samsung employee under penalties of perjury.

3. By **September 20**, Samsung provides core technical data for all products listed in response to paragraph 1. This data must be accompanied by a chart that correlates any relevant documents to the specific products listed in response to paragraph 1 and must include, at a minimum, the following core technical information:
 - a. Stress data for every dielectric used in the product
 - b. Physical dimensions of every part of the product, including but not limited to the height, width, and length of every semiconductor layer, every dielectric layer, and every metal layer in the product
 - c. Process flow documents listing, in order, every process to which the product is subjected during manufacturing;
 - d. Process parameters for all package processing, including wafer thinning/back grind, wafer polish, saw/clean, die-attach, and wire bond;
 - e. Wafer process parameters for deposition of dielectric layers, including without limitation inter-layer dielectric, inter-metal dielectric, and passivation layers, beginning with deposition of the first inter-layer dielectric;
 - f. Process parameters for deposition of metal layers; CMP of dielectric or metal layers; and annealing steps occurring after deposition of the first inter-layer dielectric; and
 - g. Warpage measurements performed during wafer and/or package processing, including without limitation upper and lower control limits in warpage specifications.

To be clear, your agreement to the above will not fully satisfy Samsung's discovery obligations. And, by offering the above compromise, Elm does not mean to suggest in any way that it intends not to pursue discovery on any other issues we've been discussing. The **ONLY** thing I'm saying is that, if Samsung agrees to the above, Elm will not immediately raise these issues with the Court.

Please let me know **by Monday, August 26**, whether Samsung agrees to the above, or has an alternative, concrete formulation it would like to propose. Absent that, we intend to file a motion to compel immediately.

I'm available to discuss these issues tomorrow or Monday.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Thursday, August 22, 2019 6:46 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm/Samsung Accused Products

Nosson,

The accusations in your email that Samsung has intentionally concealed information from Elm are baseless and disconnected from our response. We clearly explained that the white paper you cite does not suggest, as you claimed, that Samsung has omitted other V-NAND products from its list of products. You have given no response to this except to merely reiterate your accusation that the information Samsung has given is incomplete. [REDACTED]

We also made clear that Samsung was surprised that Elm is now introducing image sensor products to the case. You refer to your June 20 email as stating Elm's intent to accuse "semiconductor products," but you do not deny that Elm is only now adding image sensor products for the first time, when Elm has for years since the outset of this litigation only sought discovery on memory products. Given this history, we don't see how you can claim in good faith that Samsung "sought to conceal whole categories of potential accused products."

Given your unjustified accusations, we see no basis for your demand for a complete list of products by the arbitrary deadline of 2 weeks. To be clear, you have not given any legitimate basis to suspect that Samsung's list of memory products is incomplete. [REDACTED]

[REDACTED] In fact, it is Elm's own apparent refusal to amend its infringement contentions, or otherwise provide further details regarding its infringement theory, that will undoubtedly complicate and hinder Samsung's efforts to produce this list of products.

We disagree that Elm's obligations to update its contentions are limited to the schedule set forth in the Court's order. Samsung is entitled to know at least why Elm believes that image sensor products are reasonably similar to the accused memory products, and how Elm reads the claims onto these products, such as how Elm identifies the chip or "semiconductor layer" with 50 microns or less in the stack, with respect to the DRAM component and/or the image sensor component. The fact that Elm is apparently unable to even articulate a theory of infringement confirms that Elm has only very recently attempted to expand the scope of this case to an open-ended universe of "semiconductor products," while giving virtually no notice to Samsung of what it accuses and how. This approach is not supported by any authority that we are aware of. Without such notice, discovery will inevitably be inaccurate or incomplete, and Samsung should not be required to singlehandedly bear the burden of this production, when Elm's theory of infringement is still incoherent. We believe it is in Elm's interest to update its infringement contentions to assist Samsung in a more productive investigation of these new products, in the timeframes you desire. Please let us know if Elm will do so.

And, we previously agreed that Samsung will produce US sales data for all relevant memory products. Barring unforeseen circumstances, we do not anticipate any issues extending that agreement to the new image sensor products. Our main concerns are set forth above with respect to timing and Elm's refusal to provide any more notice or detail in support of its attempt to add new products to the case.

Should Elm wish to raise this issue with the Court, we do not see Elm gaining much traction where Samsung does not disagree to disclosing a list of new products, but Elm refuses to even put in the effort to explain why image sensor products are reasonably similar to memory products and how it interprets critical claim elements in these products.

Regards,
Soyoung

From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Wednesday, August 21, 2019 8:42 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm/Samsung Accused Products

Nosson,

We will respond to your email below tomorrow.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Friday, August 16, 2019 10:02 AM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm/Samsung Accused Products

Soyoung,

There are two significant problems with your response:

1. It confirms that the representations in your June 24 email were untrue, and in fact sought to conceal whole categories of potential accused products.
2. Despite taking a month to provide this response, it contains no additional information about Samsung's products (beyond a reference to a third-party website that can be found with a simple google search).

Samsung's pattern of obfuscation and concealment must end. In order to move forward, Elm requests that Samsung provide the following information:

1. Within two weeks, Samsung provide a complete list of every Samsung semiconductor products that contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. This list must include every product that meets the above definition regardless of whether Samsung believes it is within the scope of this case, and must be signed by a Samsung employee under penalties of perjury.
2. Within one month, Samsung provides all US sales data concerning the products listed in response to paragraph 1. This data must include every sale that Samsung knows to have a connection to the US based on any geographic data that Samsung tracks for its product sales. This sales data must be accompanied by a declaration certifying the completeness of the information signed by a Samsung employee under penalties of perjury.

Please let me know no later than **Wednesday, August 21st**, whether Samsung will agree to provide the above information. If Samsung refuses, we intend to immediately raise this issue with the Court.

With regards to Elm's infringement contentions, my June 20 email made it clear that Elm currently intends to accuse of infringement every Samsung semiconductor product that contains more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. Once Samsung identifies all such products, Elm will update its infringement contentions in accordance with the schedule set-forth by the Court.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Wednesday, August 14, 2019 1:02 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

We provide some comments to your email below.

For the first category of V-NAND products that you have raised below, the examples you provided do not persuade us that Samsung's list of stacked die products is incomplete.

You refer to V-NAND products with multiple "layers," but we are not convinced that "layers" mean "stacks" of chips, as you seem to be reading this term. For example, page 3 of the white paper that you cited states in part: "NAND flash capacity is determined by the number of memory *cells* that can populate *a NAND chip*" and "The *32-layer stacks of cells* are connected to over 2 billion channel holes that have been etched from the top layer of the NAND to the bottom." The following webpage also explains that stacked "chips" is entirely distinguishable from NAND "layers," such that one single chip can contain multiple such layers: <https://thememoryguy.com/nand-flashes-layers-of-layers-of-layers/>. In contrast, we have identified products with stacked chips. Thus, we don't agree that a publication paper describing V-NAND products with 24 or 32 *layers* suggests that Samsung has failed to disclose additional stacked products with more than 16 stacked *chips*.

As for your second example below, we are surprised that Elm is raising image sensor products for the first time at this late stage, when the parties have been treating this case as directed to stacked memory products for several years now. Given that, we do not believe that your suggestion that Samsung has been misleading or not diligent in providing a complete list of stacked die products is justified. If Elm believes now that image sensor products should be added to the case, we would appreciate more reasonable time for investigation than the very short notice that you have given us to identify an entirely new category of products.

Given the seriousness of Elm's apparent attempt to substantially expand the scope of this case, we believe it would only be fair if, in the meantime, Elm amends its infringement contentions so that they provide Samsung more meaningful notice of Elm's theory of infringement with respect to the new image sensor products. We believe that amended infringement contentions would be especially instructive here given the issue above with respect to multiple layers or chips, and Elm's confusing use of terms recently, e.g., semiconductor "layer" instead of "substrate," or stacked "semiconductor product" instead of "memory product" (see Elm's Common Interrogatory Nos. 4-5). At the very least, Samsung is entitled to a full understanding of Elm's bases for why it believes that image sensor products are reasonably similar to the stacked memory products accused to date.

Therefore, please confirm that if it is Elm's intention to add image sensor products to the case Elm will amend its infringement contentions accordingly.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Friday, August 9, 2019 12:08 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

It's been nearly three weeks since we sent you the below email, raising serious concerns about the data Samsung has (and has not) produced, and the representations you've made about its completeness.

Please let us know where these issues stand so that we can decide how to proceed.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Monday, July 15, 2019 10:36 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

Your email asserts that Samsung has already provided a complete list of all stacked semiconductor products sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less. We fear that this is simply not true and is, instead, another disturbing example of Samsung seeking to gain a litigation advantage through obfuscation and concealment.

One example of the possible gaps in the data Samsung has provided to date relates to Samsung's V-NAND products. According to the following white paper-- https://www.samsung.com/semiconductor/global.semi.static/2bit_V-NAND_technology_White_Paper-1.pdf-- Samsung has been producing V-NAND memory products with 24 layers since 2013, and with 32 layers since 2014. The largest stack that Samsung has identified to us in this case is 16 layers. So it's clear that these V-NAND products have not been identified in discovery. Given the number of layers in these products, we believe it is highly likely that at least one of the layers is 50µm or less.

Another example of a possible gap in the data Samsung has provided relates to camera chips included in Samsung's Galaxy phones. We understand that, at least as of 2016, Samsung's phones have included an image sensor chip stacked, via TSVs, with a DRAM memory chip. None of the products Samsung has identified in the litigation appear to include an image sensor chip stacked with DRAM. Given the nature of the image sensing technology used in Samsung's phones, we believe it is

highly likely that at least one of the chips in these products has a thickness of 50µm or less.

Please let us know why these products have not been identified to us in litigation to date.

[REDACTED]

[REDACTED]

Please let us know whether Samsung has any other recommendations for how to move forward with these products.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Wednesday, July 10, 2019 9:29 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

I responded to your first question in my prior email. Samsung has already identified all such products, and you have given us no basis to suspect that Samsung has not done so. We ask that you identify at least one product that you believe is missing from the list, as that may help us understand your question and to further investigate as necessary. Otherwise, we do not see how the Court will entertain your motion.

[REDACTED]

Regards,
Soyoung

From: Nossou Knobloch <nossou.knobloch@bartlitbeck.com>
Sent: Monday, July 8, 2019 12:22 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

I hope you had a good Fourth of July holiday. I'm following-up on the below email. We need your answers to these questions ASAP so that we can move forward on discovery and on the selection of representative products.

Thanks,

-Nossou

BartlitBeck LLP

Nossou D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nossou.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nossou Knobloch <nossou.knobloch@bartlitbeck.com>
Sent: Monday, June 24, 2019 11:36 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Soyoung,

We will consider your request [REDACTED]

[REDACTED]

In the meantime, your email fails to address two of the questions that I've raised:

1. When will Samsung provide a complete list of all stacked semiconductor products sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less? If you refuse to commit to a reasonable timeframe to provide this information, we will be forced to raise this issue with the Court.

2. [REDACTED]

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Monday, June 24, 2019 11:19 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

In response to this and your previous email, Samsung has identified all products that you have asked about based on a reasonable search. You have not given any basis for your suspicion that the list of products that Samsung has identified is incomplete. In any event, we will forward this spreadsheet on for Samsung to review.

[REDACTED]


[REDACTED] We believe that this is Elm's burden, not Samsung's. Otherwise, we don't think that we will make much progress on these issues or that a call would be very productive at this point.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Monday, June 24, 2019 9:52 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

Following-up on the below email, and given your failure to offer any time to talk, we wanted to email you some additional details about the information we're seeking from Samsung. In that vein, I've attached a spreadsheet that contains the following data:

1. Column A: Pre-stay products missing thickness data: This lists the more than 200 Samsung products identified in Elm's June 3, 2016 identification of accused products for which Samsung has not produced die thickness data.
2. Column B: Pre-stay products that contain one die at 50µm or less: This lists the 18 Samsung products included in the pre-stay identification of accused products that Elm provided on June 3, 2016, and that the '43 spreadsheet indicates have at least one die at 50µm or less (note that this list is a subset of the 50 products identified in Column D).
3. 
4. Column D: Post-stay products that contain one die at 50µm or less: This lists the 50 Samsung products identified in the '42 and '43 spreadsheets as including at least one die that is 50µm or less.

We would like Samsung to let us know, **this week**, whether Column D in the attached spreadsheet lists every Samsung semiconductor product sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less. If, as we strongly suspect, this list is incomplete, please also let us know when Samsung will be able to complete this list. If Samsung cannot commit to a reasonable timeframe in which to complete this list, then we intend to raise this issue with the Court.



[REDACTED]

We look forward to your response.

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Thursday, June 20, 2019 11:26 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

I would like to schedule a meet and confer to discuss next steps regarding the identification of representative products.

In light of the Federal Circuit's recent decision, Elm currently intends to accuse of infringement all Samsung semiconductor products that contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. Elm reserves the right to update its position for any reason, including in the event that this Court (or any court of appeal) adopts a different construction of the "substantially flexible" claim terms.

In order to move forward with the selection of representative products, I would like to discuss the following issues:

1. Whether Samsung has already identified all products sold between 2008 and 2018 that meet the above criteria.
2. How the parties will handle the Samsung semiconductor products for which Samsung has not, to date, supplied complete die thickness data.

3. How the parties will select representative products from the complete set of accused products.

Please let me know if there is a time early next week when you are available to discuss these issues.

In addition, it's been almost a month since I sent the below email, but have not received any meaningful response. Please let us know your thoughts on the below issues this week.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Wednesday, May 22, 2019 9:24 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

I am surprised to hear that you believe you've produced your supplier documents. From what I can see, your April 22 production contained no email. For many months, we've been asking for your **communications** with your dielectric suppliers about dielectric stress. Will you be producing those?

Relatedly, your April 22 production is missing the standard metadata. Can you please provide an overlay with that information?

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Tuesday, May 21, 2019 6:17 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

We produced Samsung's supplier documents on April 22. Samsung may discover additional documents as part of its ongoing discovery efforts based on the list of search terms that the parties agree on.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Tuesday, May 21, 2019 6:44 AM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Thanks, Soyoung. Can you please also let me know when we can expect your production of communications with third party dielectric suppliers?

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Monday, May 20, 2019 10:35 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

We identify the following 5 Samsung employees for Elm's custodial discovery requests: Gunho Chang, Jiwoon Im, Ilho Kim, Tae-Young Lee and Jongyoung Park.

We will be sending you our proposed search terms for Elm shortly.

Regards,
Soyoung

From: Jung, Soyoung
Sent: Friday, May 10, 2019 6:39 PM
To: 'Nosson Knobloch' <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

I wanted to give you an update that we have been diligently working with Samsung in Korea this week to identify appropriate custodians, but we will need another week to conclude our investigation. Therefore, we would like to move the date by which Samsung identifies custodians from May 13 to May 20. All the other dates of custodial discovery that we agreed on will stay the same.

We will respond to Matt's email from today separately.

Thanks,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Friday, May 3, 2019 1:46 PM
To: #ELM3DS-MICRON-OMM <ELM3DS-MICRON-OMM@omm.com>; Skhynix-Elm@klgates.com; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] Elm Discovery Correspondence

Dear Counsel,

Please see the attached correspondence.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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Exhibit 18

BartlitBeck_{LLP}

November 23, 2020

Via E-Filing

The Honorable Leonard P. Stark
J. Caleb Boggs Federal Building
844 N. King Street
Room 6124, Unit 26
Wilmington, DE 19801-3556

Re: *Elm 3DS Innovations, LLC v. Samsung Elecs. Co., Ltd., et al.*, C.A. No. 14-01430-LPS-CJB

Dear Chief Judge Stark,

The parties in the above-referenced matters write to request the scheduling of a discovery teleconference.

The following attorneys, including at least one Delaware Counsel and at least one Lead Counsel per party, participated in a verbal meet-and-confer by telephone on July 30, 2019:

Delaware Counsel for Elm: Brian Farnan

Lead Counsel for Elm: Nosson Knobloch

Delaware Counsel for Samsung: Adam Poff

Lead Counsel for Samsung: Soyoung Jung and Phillip Citroen

The disputes requiring judicial attention relate to Elm's request that Samsung provide a complete list of every Samsung semiconductor product that contains more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less, and Elm's request for technical and sales data about each such semiconductor product.

Sincerely,

Nosson Knobloch

DENVER OFFICE
1801 WEWATTA STREET
SUITE 1200
DENVER, CO 80202
TELEPHONE: (303) 592-3100
FACSIMILE: (303) 592-3140

CHICAGO OFFICE
COURTHOUSE PLACE
54 WEST HUBBARD STREET
CHICAGO, IL 60654
TELEPHONE: (312) 494-4400
FACSIMILE: (312) 494-4440

WRITER'S DIRECT DIAL:
(303) 592-3122
nosson.knobloch@BartlitBeck.com

Exhibit 19

Kidokoro, Koichiro

From: Jung, Soyoung
Sent: Tuesday, August 27, 2019 7:52 PM
To: Nosson Knobloch; ServicePH Samsung-ELM 3DS
Cc: Mailing List - Leedy
Subject: RE: Elm/Samsung Accused Products

Nosson,

We believe that you are still mistaken in your understanding of “circuit layer,” which we note is not mentioned anywhere in the Samsung publications that you cited. Those publications only describe layers of memory cells (not **circuit layers**) in V-NAND products, which have a fundamentally different structure than the other products at issue to date. We are frustrated and confused about what could be perpetuating such a difference in understanding, so I believe that a phone call to discuss this issue would be best.

We are unfortunately tied up until end of this week. Phillip is available this Friday around noon ET and I’m generally free for the rest of that day. Please let us know when you are available.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Monday, August 26, 2019 7:39 AM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm/Samsung Accused Products

Soyoung,

I’ve attached a draft letter to the Court seeking a discovery conference on the issues outlined in my Thursday email. Please let us know, **by tomorrow**, whether Samsung has a concrete proposal responsive to that email or, if not, whether Samsung has any edits it would like to propose to the attached letter.

With regards to your comments about Samsung’s V-NAND products, perhaps the following summary will help you understand some of the reasons why we are so disappointed with Samsung’s conduct in discovery in this case:

- On June 24, I asked you when Samsung will “provide a complete list of all stacked semiconductor products sold from 2008 to the present that Samsung knows to contain more than one **circuit layer**, where at least one **circuit layer** is stacked above or below another **circuit layer**, and where at least one of the **layers** has a thickness of 50µm or less.” (emphasis added)

- On July 10, you stated that “Samsung has already identified ***all such products***” (emphasis added)
- On July 15, I pointed out that there were at least two categories of products covered by my June 24 email that Samsung appeared not to have identified to us in this case: Samsung V-NAND products and Samsung image sensor products with stacked memory chips.
- On August 14, you conceded that Samsung’s V-NAND products have multiple “layers” but suggested that those layers are not “stacks” of dies or chips. But this distinction misses the point because my June 24 email referred to circuit layers, not to stacks of die or chips. Your email also raised some concerns about Elm adding a new type of product to the case (i.e., image sensor chips stacked with memory chips). But you have never denied that Samsung is indeed selling such products, that they meet the definition set-forth in my June 24 email, and that Samsung has never identified them to us in discovery in this case.

I am available to discuss these issues today or tomorrow.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Friday, August 23, 2019 5:07 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm/Samsung Accused Products

Nosson,

As a preliminary matter, we will not be able to get a response to you from Samsung by Monday, August 26. It is already the weekend in Korea, and we will not be able to discuss these issues with Samsung by Monday. We can give you a response later in the week.

However, we do not believe there is a legitimate dispute here as to the completeness of the list of relevant memory products that Samsung has identified to date—with the exception of [REDACTED]

[REDACTED] That is a separate issue not subject to dispute, as Samsung is resolving the issue and has already agreed to provide all the relevant discovery to Elm.

Aside from that issue, your allegations of our intentional concealment are completely inappropriate and unwarranted. You seem to have misapprehended the technology at issue here, as there is a difference between layers and stacks. Thus, before firing off further accusations, please carefully reread my email of August 14, which attempted to highlight for you the distinction you have missed between (1) multiple “layers” of memory cells and (2) “stacks” of dies/chips. Your lack of any meaningful response to this email confirms that your accusations are still based on a critical error in your understanding.

Just like the white paper you cited earlier, the press release you now refer to below merely addresses products with 24 and 32 “layers” of memory cells—not “stacks” of semiconductor dies. For example, this press release describes “The Only **Single-stack** 3D Memory **Die** With a **100+ Layer** Design” (emphasis added). It also states that “the new V-NAND adds around 40-percent more cells to the previous **9x-layer single-stack** structure” (emphasis added). It also characterizes the 24-layer and 32-layer products that you have raised as earlier 1st and 2nd generation V-NAND products, and the 9x-layer (single-stack) products as 5th generation V-NAND products. Thus, just because a single die or chip can have dozens of layers (if not more) of cells, that does not make the die or chip amount to more than a single stack; the third party website I previously directed you to also explains why. We suggest that you study these technical details further or have someone on your team explain them to you, before making additional baseless allegations.

Until then, I can assure you that Samsung has identified the relevant memory products with “stacks” of semiconductor dies and, in response to your questions, [REDACTED]

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Thursday, August 22, 2019 9:15 PM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: [EXT] RE: Elm/Samsung Accused Products

Soyoung,

Thank you for your email. We are considering the issues you’ve raised with regards to the image sensor products. In the meantime, it appears that we all agree that stacked memory products have been at issue in this case from the very start. But, for reasons I simply do not understand, we still do not have a complete list of Samsung stacked memory products that include a layer that is 50 microns or less. Let alone basic sales or technical data for such products.

Instead of providing that information, it appears that you are continuing to try and conceal information about Samsung’s products. [REDACTED]

[REDACTED] the following press release, published earlier this month on Samsung’s own website: <https://news.samsung.com/global/samsung-electronics-takes-3d-memory-to-new-heights-with-sixth-generation-v-nand-ssds-for-client-computing>. In that press release, Samsung includes a “mass production timeline” of V-NAND products, showing that it began mass-production of 24-layer V-NAND products in 2013, and 32-

layer V-NAND products in 2014. [REDACTED]

This must end now.

In order to avoid an immediate motion to compel on these issues, Samsung must commit to provide the following:

1. By **August 30**, Samsung provide a complete list of every Samsung semiconductor memory product that contains more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. This list must include every product that meets the above definition regardless of whether Samsung believes it is within the scope of this case (including, without limitation, all V-NAND products that include a layer that is less than 50 microns thick), and must be signed by a Samsung employee under penalties of perjury.
2. By **September 13**, Samsung provides all US sales data concerning the products listed in response to paragraph 1. This data must include every sale that Samsung knows to have a connection to the US based on any geographic data that Samsung tracks for its product sales. This sales data must be accompanied by a declaration certifying the completeness of the information signed by a Samsung employee under penalties of perjury.
3. By **September 20**, Samsung provides core technical data for all products listed in response to paragraph 1. This data must be accompanied by a chart that correlates any relevant documents to the specific products listed in response to paragraph 1 and must include, at a minimum, the following core technical information:
 - a. Stress data for every dielectric used in the product
 - b. Physical dimensions of every part of the product, including but not limited to the height, width, and length of every semiconductor layer, every dielectric layer, and every metal layer in the product
 - c. Process flow documents listing, in order, every process to which the product is subjected during manufacturing;
 - d. Process parameters for all package processing, including wafer thinning/back grind, wafer polish, saw/clean, die-attach, and wire bond;
 - e. Wafer process parameters for deposition of dielectric layers, including without limitation inter-layer dielectric, inter-metal dielectric, and passivation layers, beginning with deposition of the first inter-layer dielectric;
 - f. Process parameters for deposition of metal layers; CMP of dielectric or metal layers; and annealing steps occurring after deposition of the first inter-layer dielectric; and

- g. Warpage measurements performed during wafer and/or package processing, including without limitation upper and lower control limits in warpage specifications.

To be clear, your agreement to the above will not fully satisfy Samsung's discovery obligations. And, by offering the above compromise, Elm does not mean to suggest in any way that it intends not to pursue discovery on any other issues we've been discussing. The ONLY thing I'm saying is that, if Samsung agrees to the above, Elm will not immediately raise these issues with the Court.

Please let me know **by Monday, August 26**, whether Samsung agrees to the above, or has an alternative, concrete formulation it would like to propose. Absent that, we intend to file a motion to compel immediately.

I'm available to discuss these issues tomorrow or Monday.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Thursday, August 22, 2019 6:46 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm/Samsung Accused Products

Nosson,

The accusations in your email that Samsung has intentionally concealed information from Elm are baseless and disconnected from our response. We clearly explained that the white paper you cite does not suggest, as you claimed, that Samsung has omitted other V-NAND products from its list of products. You have given no response to this except to merely reiterate your accusation that the information Samsung has given is incomplete. [REDACTED]

We also made clear that Samsung was surprised that Elm is now introducing image sensor products to the case. You refer to your June 20 email as stating Elm's intent to accuse "semiconductor products," but you do not deny that Elm is only now adding image sensor products for the first time, when Elm has for years since the outset of this litigation only sought discovery on memory products. Given this history, we don't see how you can claim in good faith that Samsung "sought to conceal whole categories of potential accused products."

Given your unjustified accusations, we see no basis for your demand for a complete list of products by the arbitrary deadline of 2 weeks. To be clear, you have not given any legitimate basis to suspect that Samsung's list of memory products is incomplete. [REDACTED]

[REDACTED] In fact, it is Elm's own apparent refusal to amend its infringement contentions, or otherwise provide further details regarding its infringement theory, that will undoubtedly complicate and hinder Samsung's efforts to produce this list of products.

We disagree that Elm's obligations to update its contentions are limited to the schedule set forth in the Court's order. Samsung is entitled to know at least why Elm believes that image sensor products are reasonably similar to the accused memory products, and how Elm reads the claims onto these products, such as how Elm identifies the chip or "semiconductor layer" with 50 microns or less in the stack, with respect to the DRAM component and/or the image sensor component. The fact that Elm is apparently unable to even articulate a theory of infringement confirms that Elm has only very recently attempted to expand the scope of this case to an open-ended universe of "semiconductor products," while giving virtually no notice to Samsung of what it accuses and how. This approach is not supported by any authority that we are aware of. Without such notice, discovery will inevitably be inaccurate or incomplete, and Samsung should not be required to singlehandedly bear the burden of this production, when Elm's theory of infringement is still incoherent. We believe it is in Elm's interest to update its infringement contentions to assist Samsung in a more productive investigation of these new products, in the timeframes you desire. Please let us know if Elm will do so.

And, we previously agreed that Samsung will produce US sales data for all relevant memory products. Barring unforeseen circumstances, we do not anticipate any issues extending that agreement to the new image sensor products. Our main concerns are set forth above with respect to timing and Elm's refusal to provide any more notice or detail in support of its attempt to add new products to the case.

Should Elm wish to raise this issue with the Court, we do not see Elm gaining much traction where Samsung does not disagree to disclosing a list of new products, but Elm refuses to even put in the effort to explain why image sensor products are reasonably similar to memory products and how it interprets critical claim elements in these products.

Regards,
Soyoung

From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Wednesday, August 21, 2019 8:42 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm/Samsung Accused Products

Nosson,

We will respond to your email below tomorrow.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Friday, August 16, 2019 10:02 AM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: [EXT] RE: Elm/Samsung Accused Products

Soyoung,

There are two significant problems with your response:

1. It confirms that the representations in your June 24 email were untrue, and in fact sought to conceal whole categories of potential accused products.
2. Despite taking a month to provide this response, it contains no additional information about Samsung's products (beyond a reference to a third-party website that can be found with a simple google search).

Samsung's pattern of obfuscation and concealment must end. In order to move forward, Elm requests that Samsung provide the following information:

1. Within two weeks, Samsung provide a complete list of every Samsung semiconductor products that contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. This list must include every product that meets the above definition regardless of whether Samsung believes it is within the scope of this case, and must be signed by a Samsung employee under penalties of perjury.
2. Within one month, Samsung provides all US sales data concerning the products listed in response to paragraph 1. This data must include every sale that Samsung knows to have a connection to the US based on any geographic data that Samsung tracks for its product sales. This sales data must be accompanied by a declaration certifying the completeness of the information signed by a Samsung employee under penalties of perjury.

Please let me know no later than **Wednesday, August 21st**, whether Samsung will agree to provide the above information. If Samsung refuses, we intend to immediately raise this issue with the Court.

With regards to Elm's infringement contentions, my June 20 email made it clear that Elm currently intends to accuse of infringement every Samsung semiconductor product that contains more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. Once Samsung identifies all such products, Elm will update its infringement contentions in accordance with the schedule set-forth by the Court.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Wednesday, August 14, 2019 1:02 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

We provide some comments to your email below.

For the first category of V-NAND products that you have raised below, the examples you provided do not persuade us that Samsung's list of stacked die products is incomplete.

You refer to V-NAND products with multiple "layers," but we are not convinced that "layers" mean "stacks" of chips, as you seem to be reading this term. For example, page 3 of the white paper that you cited states in part: "NAND flash capacity is determined by the number of memory *cells* that can populate *a NAND chip*" and "The *32-layer stacks of cells* are connected to over 2 billion channel holes that have been etched from the top layer of the NAND to the bottom." The following webpage also explains that stacked "chips" is entirely distinguishable from NAND "layers," such that one single chip can contain multiple such layers: <https://themoryguy.com/nand-flashes-layers-of-layers-of-layers/>. In contrast, we have identified products with stacked chips. Thus, we don't agree that a publication paper describing V-NAND products with 24 or 32 *layers* suggests that Samsung has failed to disclose additional stacked products with more than 16 stacked *chips*.

As for your second example below, we are surprised that Elm is raising image sensor products for the first time at this late stage, when the parties have been treating this case as directed to stacked memory products for several years now. Given that, we do not believe that your suggestion that Samsung has been misleading or not diligent in providing a complete list of stacked die products is justified. If Elm believes now that image sensor products should be added to the case, we would appreciate more reasonable time for investigation than the very short notice that you have given us to identify an entirely new category of products.

Given the seriousness of Elm's apparent attempt to substantially expand the scope of this case, we believe it would only be fair if, in the meantime, Elm amends its infringement contentions so that they provide Samsung more meaningful notice of Elm's theory of infringement with respect to the new image sensor products. We believe that amended infringement contentions would be especially instructive here given the issue above with respect to multiple layers or chips, and Elm's confusing use of terms recently, e.g., semiconductor "layer" instead of "substrate," or stacked "semiconductor product" instead of "memory product" (see Elm's Common Interrogatory Nos. 4-5). At the very least, Samsung is entitled to a full understanding of Elm's bases for why it believes that image sensor products are reasonably similar to the stacked memory products accused to date.

Therefore, please confirm that if it is Elm's intention to add image sensor products to the case Elm will amend its infringement contentions accordingly.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Friday, August 9, 2019 12:08 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

It's been nearly three weeks since we sent you the below email, raising serious concerns about the data Samsung has (and has not) produced, and the representations you've made about its completeness.

Please let us know where these issues stand so that we can decide how to proceed.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Monday, July 15, 2019 10:36 AM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Soyoung,

Your email asserts that Samsung has already provided a complete list of all stacked semiconductor products sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less. We fear that this is simply not true and is, instead, another disturbing example of Samsung seeking to gain a litigation advantage through obfuscation and concealment.

One example of the possible gaps in the data Samsung has provided to date relates to Samsung's V-NAND products. According to the following white paper-- https://www.samsung.com/semiconductor/global.semi.static/2bit_V-NAND_technology_White_Paper-1.pdf -- Samsung has been producing V-NAND memory products with 24 layers since 2013, and with 32 layers since 2014. The largest stack that Samsung has identified to us in this case is 16 layers. So it's clear that these V-NAND products have not been identified in discovery. Given the number of layers in these products, we believe it is highly likely that at least one of the layers is 50µm or less.

Another example of a possible gap in the data Samsung has provided relates to camera chips included in Samsung's Galaxy phones. We understand that, at least as of 2016, Samsung's phones have included an image sensor chip stacked, via TSVs, with a DRAM memory chip. None of the products Samsung has identified in the litigation appear to include an image sensor chip stacked with DRAM. Given the nature of the image sensing technology used in Samsung's phones, we believe it is highly likely that at least one of the chips in these products has a thickness of 50µm or less.

Please let us know why these products have not been identified to us in litigation to date.

[REDACTED]

[REDACTED]

Please let us know whether Samsung has any other recommendations for how to move forward with these products.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Wednesday, July 10, 2019 9:29 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

I responded to your first question in my prior email. Samsung has already identified all such products, and you have given us no basis to suspect that Samsung has not done so. We ask that you identify at least one product that you believe is missing from the list, as that may help us understand your question and to further investigate as necessary. Otherwise, we do not see how the Court will entertain your motion.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Monday, July 8, 2019 12:22 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

I hope you had a good Fourth of July holiday. I'm following-up on the below email. We need your answers to these questions ASAP so that we can move forward on discovery and on the selection of representative products.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Monday, June 24, 2019 11:36 PM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

We will consider your request [REDACTED]

In the meantime, your email fails to address two of the questions that I've raised:

1. When will Samsung provide a complete list of all stacked semiconductor products sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less? If you refuse to commit to a reasonable timeframe to provide this information, we will be forced to raise this issue with the Court.

2. [REDACTED]

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Monday, June 24, 2019 11:19 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

In response to this and your previous email, Samsung has identified all products that you have asked about based on a reasonable search. You have not given any basis for your suspicion that the list of products that Samsung has identified is incomplete. In any event, we will forward this spreadsheet on for Samsung to review.

[REDACTED]

[REDACTED] We believe that this is Elm's burden, not Samsung's. Otherwise, we don't think that we will make much progress on these issues or that a call would be very productive at this point.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Monday, June 24, 2019 9:52 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

Following-up on the below email, and given your failure to offer any time to talk, we wanted to email you some additional details about the information we're seeking from Samsung. In that vein, I've attached a spreadsheet that contains the following data:

1. Column A: Pre-stay products missing thickness data: This lists the more than 200 Samsung products identified in Elm's June 3, 2016 identification of accused products for which Samsung has not produced die thickness data.
2. Column B: Pre-stay products that contain one die at 50µm or less: This lists the 18 Samsung products included in the pre-stay identification of accused products that Elm provided on June 3, 2016, and that the '43 spreadsheet indicates have at least one die at 50µm or less (note that this list is a subset of the 50 products identified in Column D).

3. [REDACTED]

4. Column D: Post-stay products that contain one die at 50µm or less: This lists the 50 Samsung products identified in the '42 and '43 spreadsheets as including at least one die that is 50µm or less.

We would like Samsung to let us know, **this week**, whether Column D in the attached spreadsheet lists every Samsung semiconductor product sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less. If, as we strongly suspect, this list is incomplete, please also let us know when Samsung will be able to complete this list. If Samsung cannot commit to a reasonable timeframe in which to complete this list, then we intend to raise this issue with the Court.



We look forward to your response.

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Thursday, June 20, 2019 11:26 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

I would like to schedule a meet and confer to discuss next steps regarding the identification of representative products.

In light of the Federal Circuit's recent decision, Elm currently intends to accuse of infringement all Samsung semiconductor products that contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. Elm reserves the right to update its position for any reason, including in the event that this Court (or any court of appeal) adopts a different construction of the "substantially flexible" claim terms.

In order to move forward with the selection of representative products, I would like to discuss the following issues:

1. Whether Samsung has already identified all products sold between 2008 and 2018 that meet the above criteria.
2. How the parties will handle the Samsung semiconductor products for which Samsung has not, to date, supplied complete die thickness data.
3. How the parties will select representative products from the complete set of accused products.

Please let me know if there is a time early next week when you are available to discuss these issues.

In addition, it's been almost a month since I sent the below email, but have not received any meaningful response. Please let us know your thoughts on the below issues this week.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Wednesday, May 22, 2019 9:24 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

I am surprised to hear that you believe you've produced your supplier documents. From what I can see, your April 22 production contained no email. For many months, we've been asking for your **communications** with your dielectric suppliers about dielectric stress. Will you be producing those?

Relatedly, your April 22 production is missing the standard metadata. Can you please provide an overlay with that information?

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Tuesday, May 21, 2019 6:17 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

We produced Samsung's supplier documents on April 22. Samsung may discover additional documents as part of its ongoing discovery efforts based on the list of search terms that the parties agree on.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Tuesday, May 21, 2019 6:44 AM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Thanks, Soyoung. Can you please also let me know when we can expect your production of communications with third party dielectric suppliers?

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Monday, May 20, 2019 10:35 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

We identify the following 5 Samsung employees for Elm's custodial discovery requests: Gunho Chang, Jiwoon Im, Ilho Kim, Tae-Young Lee and Jongyoung Park.

We will be sending you our proposed search terms for Elm shortly.

Regards,
Soyoung

From: Jung, Soyoung
Sent: Friday, May 10, 2019 6:39 PM
To: 'Nosson Knobloch' <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

I wanted to give you an update that we have been diligently working with Samsung in Korea this week to identify appropriate custodians, but we will need another week to conclude our investigation. Therefore, we would like to move the date by which Samsung identifies custodians from May 13 to May 20. All the other dates of custodial discovery that we agreed on will stay the same.

We will respond to Matt's email from today separately.

Thanks,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Friday, May 3, 2019 1:46 PM
To: #ELM3DS-MICRON-OMM <ELM3DS-MICRON-OMM@omm.com>; Skhynix-Elm@klgates.com; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] Elm Discovery Correspondence

Dear Counsel,

Please see the attached correspondence.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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Exhibit 20

BartlitBeck_{LLP}

August 30, 2019

Via email

Soyoung Jung
Phillip Citroen
ServicePHSamsung-ELM3DS@paulhastings.com

Re: *Elm 3DS Innovations, LLC v. Samsung Elecs. Co. Ltd., et al.*,
C.A. No. 14-cv-1430-LPS-CJB, D. Del.

Dear Counsel,

In the hopes of ensuring a productive conversation on Tuesday, this letter provides a more detailed description of the minimal discovery commitments that Elm expects Samsung to make during that conversation. Nothing in this letter is intended to limit the scope of any pending discovery requests. Nor should this letter be construed as a commitment from Elm not to pursue additional discovery on any issue. Instead, this letter is intended to help guide the conversation and to put Samsung on notice that, if it refuses to commit to provide discovery substantially along the lines outlined in this letter, Elm intends to immediately move to compel.

Samsung must immediately provide the information it committed to provide on August 1. After our July 30 meet and confer, I sent you an email outlining the middle ground approach I proposed in order to avoid immediately filing a motion to compel. You agreed to that approach but, since then, have failed to hold up your end of the deal. In particular, you agreed to “investigate the die thickness issue,” said that you expected to “provide to Elm a complete list of all multi-layer semiconductor products that contain a layer that is 50 microns or less within the next two to three weeks,” and agreed to “promptly produce US sales data for any such products” that were not listed in the spreadsheet I had sent you.

Although a month has passed, you have not provided us a complete list of all such products, or sales data for them. **Samsung must commit to provide that list** no later than **Friday, Sept. 6**, and provide US sales data for any such products that were not included in the Samsung-Elm-000062354 spreadsheet no later than **Friday, Sept. 13**.

In order to avoid any disagreements about the propriety or scope of these updates, Elm provides the following notes explaining what the September 6 and 13 updates must entail:

- These updates will include every Samsung memory product that contains more than one die, where at least one die is stacked above or below another die, and where at least one of the die has a thickness of 50 microns or less.

DENVER OFFICE
1801 WEWATTA STREET
SUITE 1200
DENVER, CO 80202
TELEPHONE: (303) 592-3100
FACSIMILE: (303) 592-3140

CHICAGO OFFICE
COURTHOUSE PLACE
54 WEST HUBBARD STREET
CHICAGO, IL 60654
TELEPHONE: (312) 494-4400
FACSIMILE: (312) 494-4440

WRITER'S DIRECT DIAL:
(303) 592-3122
nosson.knobloch@BartlitBeck.com

Soyoung Jung
Phillip Citroen
August 30, 2019
Page 2

- The September 13 update must be accompanied with an updated interrogatory response, signed by a Samsung employee, that attests to the completeness of the information Samsung is providing.

Samsung must identify all other stacked semiconductor products sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. Samsung must identify all such products by September 27 and produce US sales data for any such products by October 11. Elm asked Samsung to provide this list almost immediately after the Federal Circuit's decision on your appeal of the PTAB's IPR rulings. You responded that Samsung has already identified all such products, but it has become increasingly clear that Samsung indeed has not. You have since stated various reasons for not providing that information, but none of those reasons justify Samsung's misstatements. More importantly, it should be beyond dispute that, in the course of discovery in a case like this, Elm is entitled to seek information about potential additional accused products. Nonetheless, although we've exchanged numerous emails on this issue, two months have passed and Samsung has not provided any new information.

To be clear, Elm is using the term "circuit layer" as a broad term covering any semiconductor layer on which circuits are formed. For avoidance of doubt, this includes the layers of memory cells (as you've described them) deposited on V-NAND memory products. This also includes image sensor chips which comprise circuits formed on a semiconductor. This also includes any other semiconductor product that meets the above definition, regardless of whether that product has been identified in Elm's infringement contentions.

Samsung's October 11 update must be accompanied with an updated interrogatory response, signed by a Samsung employee, that attests to the completeness of the information Samsung is providing.

Technical data. As you know, Elm has been seeking technical data for the accused products for a very long time. Samsung has resisted providing comprehensive technical data for all the accused products, instead asserting that the parties must first reach an agreement on representative products. While Elm has agreed in principle to focus discovery on the representative products, Elm has been deeply frustrated by Samsung's inability (or unwillingness) to provide even basic information on the accused products, thereby hindering the parties' ability to reach a representative products agreement and delaying the production of comprehensive technical data.

[REDACTED]

[REDACTED] Elm requests that Samsung immediately provide core technical data for these products. This data must be accompanied by a chart that

Soyoung Jung
Phillip Citroen
August 30, 2019
Page 3

correlates any relevant documents to the relevant products and must include, at a minimum, the following core technical information:

- Stress data for every dielectric used in the product.
- Physical dimensions of every part of the product, including but not limited to the height, width, and length of every semiconductor layer, every dielectric layer, and every metal layer in the product.
- Process flow documents listing, in order, every process to which the product is subjected during manufacturing.
- Process parameters for all package processing, including wafer thinning/back grind, wafer polish, saw/clean, die-attach, and wire bond.
- Wafer process parameters for deposition of dielectric layers, including without limitation inter-layer dielectric, inter-metal dielectric, and passivation layers, beginning with deposition of the first inter-layer dielectric.
- Process parameters for deposition of metal layers; CMP of dielectric or metal layers; and annealing steps occurring after deposition of the first inter-layer dielectric.
- Warpage measurements performed during wafer and/or package processing, including without limitation upper and lower control limits in warpage specifications.

Samsung must provide this information no later than **September 27**. In addition, Elm expects that Samsung will commit to move expeditiously to reach a representative products agreement that will cover all the relevant product lines, and provide comprehensive technical data for all such representative products as efficiently as possible after reaching that agreement.

In addition, it appears that Samsung has not supplied any physical samples of these products to Elm. Elm requests that, no later than **September 27**, Samsung supply ten samples of each of these products. Assuming the per-product cost is roughly in line with the costs of previous product samples, Elm will promptly pay Samsung the reasonable cost of the products.

We look forward to discussing these issues further on Tuesday.

Sincerely,



Nosson Knobloch

Exhibit 21

PAUL HASTINGS

1(213) 683-6211
soyoungjung@paulhastings.com

September 4, 2019

VIA E-MAIL

Nosson Knobloch
Bartlit Beck Herman Palenchar & Scott LLP
1801 Wewatta, Suite 1200
Denver, CO 80202

Re: *Elm 3DS Innovations, LLC v. Samsung Elecs. Co. Ltd., et al.*, CA. No. 14-cv-1430-LPS-CJB

Dear Nosson:

This letter presents Samsung's counter-proposal on the discovery issues we have been addressing in our on-going correspondence and our meet-and-confer yesterday.

For the most part, Samsung does not disagree with your proposal for discovery except to address the issues we discussed on our call, your proposed dates, and the omission of Elm's corresponding obligations. For example, we note that Samsung has been extremely diligent on numerous issues relating to thousands of products, has produced thousands of pages of documents, and has complied with its agreements with Elm. In contrast, Elm has still not produced documents responsive to Defendants' numerous RFPs that it agreed to supplement several months ago. We have, therefore, included this in our counter-proposal as well.

As we also explained on our call, September 13 lands on a major Korean Thanksgiving holiday and Samsung employees will have several days of the week off. This will impact the schedule you have proposed. [REDACTED]

With these practical realities and internal considerations in mind, Samsung counter-proposes the following schedule:

By September 13, 2019:

- Elm produces detailed explanations as to how it reads the claims onto (1) image sensor products, and (2) V-NAND products, including a sufficient technical basis that demonstrates how Elm contends these products are reasonably similar to the stacked die memory products charted in its infringement contentions and accused to date.

PAUL
HASTINGS

Nosson Knobloch
September 4, 2019
Page 2

By September 20, 2019:

- Samsung produces a final list of the remaining stacked memory products, and an attestation that the list is complete.
- Samsung provides a chart correlating its production to date of technical documents with the 6 products that Elm has identified to Samsung.

By October 4, 2019:

- Samsung produces U.S. sales data for the remaining stacked memory products.
- Samsung provides a list of semiconductor products, and an attestation that the list is complete [or within 3 weeks from Elm's showing of reasonable similarity of new semiconductor products, whichever is later].
- Elm identifies to Samsung specific categories of technical documents it believes are missing from Samsung's production to date of technical documents on stacked memory products, and that it would like Samsung to focus its search on.

By October 11, 2019:

- Elm identifies any additional stacked memory products for which it seeks technical data.

By October 25, 2019:

- Samsung produces U.S. sales data for the remaining semiconductor products [or within 3 weeks from Samsung's disclosure of semiconductor products, whichever is later].

By end of October:

- Samsung reports on the availability of physical samples, if Elm has issued a proper RFP for them and has given Samsung the necessary time to investigate.
- Samsung starts rolling production of additional technical documents, and the parties continue to meet and confer about the scope of documents that Elm still seeks.
- Elm starts rolling production of additional documents responsive to Defendants' RFP Nos. 14-16, 19-21, 23-26, 28-32, 34-36, 39, 41-70, 72, 74-76, and the parties continue to meet and confer about the scope of documents that Samsung still seeks.

PAUL

HASTINGS

Nosson Knobloch
September 4, 2019
Page 3

If you have any questions or would like to further discuss the above, please let us know.

Sincerely,

/s/ Soyoung Jung

Soyoung Jung
of PAUL HASTINGS LLP

Exhibit 22

Kidokoro, Koichiro

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Friday, September 13, 2019 9:06 AM
To: Jung, Soyoung; ServicePH Samsung-ELM 3DS
Cc: Mailing List - Leedy; Poff, Adam; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com
Subject: [EXT] RE: Elm/Samsung Accused Products

Soyoung,

This email responds to some of the issues raised in your September 4th letter.

1. Please confirm that the September 20 and October 4 updates you've promised to give us with regards to the "remaining stacked memory products" will include every Samsung memory product that contains more than one die, where at least one die is stacked above or below another die, and where at least one of the die has a thickness of 50 microns or less (other than those products identified in columns B or D in the spreadsheet I sent you on July 30).
2. Elm will provide an additional explanation concerning the image sensor and V-NAND products as soon as possible. Please confirm that, within three weeks of receiving that explanation, Samsung will provide a complete list of **all** stacked V-NAND and image sensor products that include more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. Please also confirm that, no more than three weeks after that, Samsung will produce US sales data for all such products.
3. Your offer with regards to physical samples is unacceptable. Your proposal would give Samsung two full months to investigate the availability of samples for just 6 products. Elm cannot agree to such a long timeframe for Samsung's investigation. Nor can Elm agree to your proposal because it omits any commitment, by Samsung, to produce the physical samples it has. Samsung must report on the availability of physical samples of the 6 [REDACTED] accused products that we've identified to you by the end of this month. In addition, Samsung must agree to move expeditiously to report on the availability of additional physical samples as additional products are identified, and to produce the physical samples it is able to locate.

We believe these issues must be resolved before Elm can meaningfully respond to the remaining issues addressed in your letter. We are available to discuss these or any of the other issues raised in your letter if you have any question or concerns.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Wednesday, September 4, 2019 9:43 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>; Poff, Adam <APOFF@ycst.com>; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com
Subject: RE: Elm/Samsung Accused Products

Nosson,

Per our discussion yesterday, please find attached Samsung's counter proposal to Elm's proposed schedule of discovery.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Friday, August 30, 2019 1:55 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>; Poff, Adam <APOFF@ycst.com>; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com
Subject: [EXT] RE: Elm/Samsung Accused Products

Soyoung,

Since I sent the below email, I've had to book another meeting for 10:30 to 11:30amMT on Tuesday. My morning is still otherwise open, but please let me know what time works for you ASAP so that we can be sure to secure a time to talk then.

Please also see the attached letter concerning the discovery issues we would like to discuss on Tuesday.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Thursday, August 29, 2019 11:58 AM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>; Poff, Adam <APOFF@ycst.com>; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com
Subject: RE: Elm/Samsung Accused Products

Soyoung,

We believe that the issues we've raised are ripe for raising with the Court. All of these are issues we've been discussing for months, if not years, and Samsung's refusal to comply with its most basic discovery obligations must end immediately.

Nonetheless, we are willing to hold off on filing our motion to give Samsung one more opportunity to comply with its discovery obligations.

We are available Tuesday morning after 9amMT. Please let me know what time works for you. Let's reserve a full hour, as there is a lot to discuss.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Wednesday, August 28, 2019 10:38 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>; Poff, Adam <APOFF@ycst.com>; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com
Subject: RE: Elm/Samsung Accused Products

Nosson,

We have asked you to participate on one more call so that we can understand the exact scope of your concerns. From our perspective, the issues you have raised have shifted from image sensor products, to V-NAND products, and now to US sales and newly-requested technical data.

While we are willing to work with you to resolve any legitimate issues, we cannot offer a concrete proposal without knowing exactly what the issues are and against this moving target. We thus, again, propose one more call to discuss your specific concerns, so that we can get clarity as to the issues actually in dispute and be able to meaningfully consider whether there is a proposal that can be made to resolve any dispute.

We are generally available from Tuesday on next week. Please let us know which days and times work for you. If the parties cannot reach agreement on the call, we will promptly provide any proposed edits that we have to the joint letter to seek the Court's assistance in moving forward.

In the meantime, we disagree with the additional assertions in your email of today. For example, you state that Samsung has failed to produce US sales data, but Samsung produced that data on August 21, 2019. While you likewise suggest (incorrectly) that Samsung has failed to produce technical data, you only raised that issue for the first time in an email on August 22, 2019, and your to attempt to raise that with the Court merely a few days later does not give Samsung reasonable time to investigate and respond, let alone meet and confer about your concerns. This is not consistent with your obligation to first attempt to resolve the issue in good faith without burdening the Court. We would like to discuss these issues before doing so.

Regards,
Soyoung

From: Nossong Knobloch <nossong.knobloch@bartlitbeck.com>

Sent: Wednesday, August 28, 2019 8:34 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>; Poff, Adam <APOFF@ycst.com>; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com

Subject: [EXT] RE: Elm/Samsung Accused Products

Soyoung,

At a bare minimum, Samsung's failure to provide US sales data and technical data for Samsung's stacked memory products is an issue that is ripe for judicial intervention. We have discussed that issue numerous times, but you have failed to provide that data, and have repeatedly blown past the dates by which you said you would provide such information.

Our draft letter does not explicitly call-out the V-NAND or image sensor products. We are happy to meet and confer about those further, but also reserve the right to address those products in a letter brief to the Court, either in connection with this motion or a later motion. I'm not available on Friday. I am available today and tomorrow. I'm also available Monday or Tuesday next week.

Samsung can avoid this motion practice if it provides fulsome disclosures on the issues that are indisputably subject to disclosure in this case, and engages in good faith in resolving our differences on the remaining issues. To date, you have done neither.

Accordingly please send us edits to the draft letter **today**. We will also entertain any concrete proposal you provide on how to move forward. But you cannot refuse to propose any path forward and then tell us that any motion to compel is premature.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Tuesday, August 27, 2019 9:13 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>; Poff, Adam <APOFF@ycst.com>

Subject: RE: Elm/Samsung Accused Products

Nosson,

The letter is not ready to be sent to the Court, and you have failed to meet and confer in good faith. We repeatedly informed you that Samsung has identified all relevant memory products to date, and repeatedly pointed to the errors in your assumption that Samsung has not done so. You continue to misapprehend the meaning of “layers” referenced in the publications you have cited; these are not stacked circuit layers, as we have tried to explain to you. Until you address these issues, our meet and confer obligation has not been satisfied and there is nothing to be decided by the Court. The call that we proposed is necessary at least to understand why the parties are at impasse. If we cannot resolve these issues on our call, we will review the draft letter and respond with any edits.

As for the newly-raised image sensor products, we informed you that Samsung is willing to disclose a list of products. [REDACTED]

[REDACTED] However, we also informed you that the accuracy and completeness of such a list will be limited by Elm’s lack of any notice to Samsung on how these new products are reasonably similar to the accused memory products and how the claims should be read onto these products. You informed us that you will look into these concerns, and we have not yet received your response. The meet and confer process on these issues is not complete and they are clearly not ripe for the Court.

In fact, your draft letter indicates that the parties met and conferred about these issues on July 30. That is not true. We never discussed any of this on the phone; you have only tried to accelerate this dispute without responding to our questions. If you continue to push forward on this path while repeatedly refusing to engage us on the legitimate points we have raised, we reserve the right to seek costs and fees incurred from this point forward in resolving these issues.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Tuesday, August 27, 2019 5:00 PM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-

ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: [EXT] RE: Elm/Samsung Accused Products

Soyoung,

You have failed to provide a concrete proposal in response to my email. I'm happy to discuss the V-NAND products in greater detail when our schedules align, but you haven't even provided a concrete proposal for when Samsung will provide the requested information for the other products. Accordingly, I intend to file a motion to compel. Please let me know if you have any edits to the letter I sent you on August 26th, or if that letter is ready to be sent to the Court.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Tuesday, August 27, 2019 5:52 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm/Samsung Accused Products

Nosson,

We believe that you are still mistaken in your understanding of "circuit layer," which we note is not mentioned anywhere in the Samsung publications that you cited. Those publications only describe layers of memory cells (not **circuit layers**) in V-NAND products, which have a fundamentally different structure than the other products at issue to date. We are frustrated and confused about what could be perpetuating such a difference in understanding, so I believe that a phone call to discuss this issue would be best.

We are unfortunately tied up until end of this week. Phillip is available this Friday around noon ET and I'm generally free for the rest of that day. Please let us know when you are available.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Monday, August 26, 2019 7:39 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: [EXT] RE: Elm/Samsung Accused Products

Soyoung,

I've attached a draft letter to the Court seeking a discovery conference on the issues outlined in my Thursday email. Please let us know, **by tomorrow**, whether Samsung has a concrete proposal responsive to that email or, if not, whether Samsung has any edits it would like to propose to the attached letter.

With regards to your comments about Samsung's V-NAND products, perhaps the following summary will help you understand some of the reasons why we are so disappointed with Samsung's conduct in discovery in this case:

- On June 24, I asked you when Samsung will "provide a complete list of all stacked semiconductor products sold from 2008 to the present that Samsung knows to contain more than one **circuit layer**, where at least one **circuit layer** is stacked above or below another **circuit layer**, and where at least one of the **layers** has a thickness of 50µm or less." (emphasis added)
- On July 10, you stated that "Samsung has already identified **all such products**" (emphasis added)
- On July 15, I pointed out that there were at least two categories of products covered by my June 24 email that Samsung appeared not to have identified to us in this case: Samsung V-NAND products and Samsung image sensor products with stacked memory chips.
- On August 14, you conceded that Samsung's V-NAND products have multiple "layers" but suggested that those layers are not "stacks" of dies or chips. But this distinction misses the point because my June 24 email referred to circuit layers, not to stacks of die or chips. Your email also raised some concerns about Elm adding a new type of product to the case (i.e., image sensor chips stacked with memory chips). But you have never denied that Samsung is indeed selling such products, that they meet the definition set-forth in my June 24 email, and that Samsung has never identified them to us in discovery in this case.

I am available to discuss these issues today or tomorrow.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Friday, August 23, 2019 5:07 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm/Samsung Accused Products

Nosson,

As a preliminary matter, we will not be able to get a response to you from Samsung by Monday, August 26. It is already the weekend in Korea, and we will not be able to discuss these issues with Samsung by Monday. We can give you a response later in the week.

However, we do not believe there is a legitimate dispute here as to the completeness of the list of relevant memory products that Samsung has identified to date—with the exception of [REDACTED]. That is a separate issue not subject to dispute, as Samsung is resolving the issue and has already agreed to provide all the relevant discovery to Elm.

Aside from that issue, your allegations of our intentional concealment are completely inappropriate and unwarranted. You seem to have misapprehended the technology at issue here, as there is a difference between layers and stacks. Thus, before firing off further accusations, please carefully reread my email of August 14, which attempted to highlight for you the distinction you have missed between (1) multiple “layers” of memory cells and (2) “stacks” of dies/chips. Your lack of any meaningful response to this email confirms that your accusations are still based on a critical error in your understanding.

Just like the white paper you cited earlier, the press release you now refer to below merely addresses products with 24 and 32 “layers” of memory cells—not “stacks” of semiconductor dies. For example, this press release describes “The Only **Single-stack** 3D Memory **Die** With a **100+ Layer** Design” (emphasis added). It also states that “the new V-NAND adds around 40-percent more cells to the previous **9x-layer single-stack** structure” (emphasis added). It also characterizes the 24-layer and 32-layer products that you have raised as earlier 1st and 2nd generation V-NAND products, and the 9x-layer (single-stack) products as 5th generation V-NAND products. Thus, just because a single die or chip can have dozens of layers (if not more) of cells, that does not make the die or chip amount to more than a single stack; the third party website I previously directed you to also explains why. We suggest that you study these technical details further or have someone on your team explain them to you, before making additional baseless allegations.

Until then, I can assure you that Samsung has identified the relevant memory products with “stacks” of semiconductor dies and, in response to your questions, [REDACTED]

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Thursday, August 22, 2019 9:15 PM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: [EXT] RE: Elm/Samsung Accused Products

Soyoung,

Thank you for your email. We are considering the issues you've raised with regards to the image sensor products. In the meantime, it appears that we all agree that stacked memory products have been at issue in this case from the very start. But, for reasons I simply do not understand, we still do not have a complete list of Samsung stacked memory products that include a layer that is 50 microns or less. Let alone basic sales or technical data for such products.

Instead of providing that information, it appears that you are continuing to try and conceal information about Samsung's products. [REDACTED]

[REDACTED] the following press release, published earlier this month on Samsung's own website: <https://news.samsung.com/global/samsung-electronics-takes-3d-memory-to-new-heights-with-sixth-generation-v-nand-ssds-for-client-computing>. In that press release, Samsung includes a "mass production timeline" of V-NAND products, showing that it began mass-production of 24-layer V-NAND products in 2013, and 32-layer V-NAND products in 2014. [REDACTED]

This must end now.

In order to avoid an immediate motion to compel on these issues, Samsung must commit to provide the following:

1. By **August 30**, Samsung provide a complete list of every Samsung semiconductor memory product that contains more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. This list must include every product that meets the above definition regardless of whether Samsung believes it is within the scope of this case (including, without limitation, all V-NAND products that include a layer that is less than 50 microns thick), and must be signed by a Samsung employee under penalties of perjury.
2. By **September 13**, Samsung provides all US sales data concerning the products listed in response to paragraph 1. This data must include every sale that Samsung knows to have a connection to the US based on any geographic data that Samsung tracks for its product sales. This sales data must be accompanied by a declaration certifying the completeness of the information signed by a Samsung employee under penalties of perjury.

3. By **September 20**, Samsung provides core technical data for all products listed in response to paragraph 1. This data must be accompanied by a chart that correlates any relevant documents to the specific products listed in response to paragraph 1 and must include, at a minimum, the following core technical information:
- a. Stress data for every dielectric used in the product
 - b. Physical dimensions of every part of the product, including but not limited to the height, width, and length of every semiconductor layer, every dielectric layer, and every metal layer in the product
 - c. Process flow documents listing, in order, every process to which the product is subjected during manufacturing;
 - d. Process parameters for all package processing, including wafer thinning/back grind, wafer polish, saw/clean, die-attach, and wire bond;
 - e. Wafer process parameters for deposition of dielectric layers, including without limitation inter-layer dielectric, inter-metal dielectric, and passivation layers, beginning with deposition of the first inter-layer dielectric;
 - f. Process parameters for deposition of metal layers; CMP of dielectric or metal layers; and annealing steps occurring after deposition of the first inter-layer dielectric; and
 - g. Warpage measurements performed during wafer and/or package processing, including without limitation upper and lower control limits in warpage specifications.

To be clear, your agreement to the above will not fully satisfy Samsung's discovery obligations. And, by offering the above compromise, Elm does not mean to suggest in any way that it intends not to pursue discovery on any other issues we've been discussing. The **ONLY** thing I'm saying is that, if Samsung agrees to the above, Elm will not immediately raise these issues with the Court.

Please let me know **by Monday, August 26**, whether Samsung agrees to the above, or has an alternative, concrete formulation it would like to propose. Absent that, we intend to file a motion to compel immediately.

I'm available to discuss these issues tomorrow or Monday.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Thursday, August 22, 2019 6:46 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm/Samsung Accused Products

Nosson,

The accusations in your email that Samsung has intentionally concealed information from Elm are baseless and disconnected from our response. We clearly explained that the white paper you cite does not suggest, as you claimed, that Samsung has omitted other V-NAND products from its list of products. You have given no response to this except to merely reiterate your accusation that the information Samsung has given is incomplete. [REDACTED]

We also made clear that Samsung was surprised that Elm is now introducing image sensor products to the case. You refer to your June 20 email as stating Elm's intent to accuse "semiconductor products," but you do not deny that Elm is only now adding image sensor products for the first time, when Elm has for years since the outset of this litigation only sought discovery on memory products. Given this history, we don't see how you can claim in good faith that Samsung "sought to conceal whole categories of potential accused products."

Given your unjustified accusations, we see no basis for your demand for a complete list of products by the arbitrary deadline of 2 weeks. To be clear, you have not given any legitimate basis to suspect that Samsung's list of memory products is incomplete. [REDACTED]

[REDACTED] In fact, it is Elm's own apparent refusal to amend its infringement contentions, or otherwise provide further details regarding its infringement theory, that will undoubtedly complicate and hinder Samsung's efforts to produce this list of products.

We disagree that Elm's obligations to update its contentions are limited to the schedule set forth in the Court's order. Samsung is entitled to know at least why Elm believes that image sensor products are reasonably similar to the accused memory products, and how Elm reads the claims onto these products, such as how Elm identifies the chip or "semiconductor layer" with 50 microns or less in the stack, with respect to the DRAM component and/or the image sensor component. The fact that Elm is apparently unable to even articulate a theory of infringement confirms that Elm has only very recently attempted to expand the scope of this case to an open-ended universe of "semiconductor products," while giving virtually no notice to Samsung of what it accuses and how. This approach is not supported by any authority that we are aware of. Without such notice, discovery will inevitably be inaccurate or incomplete, and Samsung should not be required to singlehandedly bear the burden of this production, when Elm's theory of infringement is still incoherent. We believe it is in Elm's interest to update its infringement contentions to assist Samsung in a more productive investigation of these new products, in the timeframes you desire. Please let us know if Elm will do so.

And, we previously agreed that Samsung will produce US sales data for all relevant memory products. Barring unforeseen circumstances, we do not anticipate any issues extending that agreement to the new image sensor products. Our main concerns are set forth above with respect to timing and Elm's refusal to provide any more notice or detail in support of its attempt to add new products to the case.

Should Elm wish to raise this issue with the Court, we do not see Elm gaining much traction where Samsung does not disagree to disclosing a list of new products, but Elm refuses to even put in the effort to explain why image sensor products are reasonably similar to memory products and how it interprets critical claim elements in these products.

Regards,
Soyoung

From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Wednesday, August 21, 2019 8:42 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm/Samsung Accused Products

Nosson,

We will respond to your email below tomorrow.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Friday, August 16, 2019 10:02 AM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm/Samsung Accused Products

Soyoung,

There are two significant problems with your response:

1. It confirms that the representations in your June 24 email were untrue, and in fact sought to conceal whole categories of potential accused products.
2. Despite taking a month to provide this response, it contains no additional information about Samsung's products (beyond a reference to a third-party website that can be found with a simple google search).

Samsung's pattern of obfuscation and concealment must end. In order to move forward, Elm requests that Samsung provide the following information:

1. Within two weeks, Samsung provide a complete list of every Samsung semiconductor products that contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. This list must include every product that meets the above definition regardless of whether

Samsung believes it is within the scope of this case, and must be signed by a Samsung employee under penalties of perjury.

2. Within one month, Samsung provides all US sales data concerning the products listed in response to paragraph 1. This data must include every sale that Samsung knows to have a connection to the US based on any geographic data that Samsung tracks for its product sales. This sales data must be accompanied by a declaration certifying the completeness of the information signed by a Samsung employee under penalties of perjury.

Please let me know no later than **Wednesday, August 21st**, whether Samsung will agree to provide the above information. If Samsung refuses, we intend to immediately raise this issue with the Court.

With regards to Elm's infringement contentions, my June 20 email made it clear that Elm currently intends to accuse of infringement every Samsung semiconductor product that contains more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. Once Samsung identifies all such products, Elm will update its infringement contentions in accordance with the schedule set-forth by the Court.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Wednesday, August 14, 2019 1:02 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

We provide some comments to your email below.

For the first category of V-NAND products that you have raised below, the examples you provided do not persuade us that Samsung's list of stacked die products is incomplete.

You refer to V-NAND products with multiple “layers,” but we are not convinced that “layers” mean “stacks” of chips, as you seem to be reading this term. For example, page 3 of the white paper that you cited states in part: “NAND flash capacity is determined by the number of memory *cells* that can populate *a NAND chip*” and “The *32-layer stacks of cells* are connected to over 2 billion channel holes that have been etched from the top layer of the NAND to the bottom.” The following webpage also explains that stacked “chips” is entirely distinguishable from NAND “layers,” such that one single chip can contain multiple such layers: <https://themoryguy.com/nand-flashes-layers-of-layers-of-layers/>. In contrast, we have identified products with stacked chips. Thus, we don’t agree that a publication paper describing V-NAND products with 24 or 32 *layers* suggests that Samsung has failed to disclose additional stacked products with more than 16 stacked *chips*.

As for your second example below, we are surprised that Elm is raising image sensor products for the first time at this late stage, when the parties have been treating this case as directed to stacked memory products for several years now. Given that, we do not believe that your suggestion that Samsung has been misleading or not diligent in providing a complete list of stacked die products is justified. If Elm believes now that image sensor products should be added to the case, we would appreciate more reasonable time for investigation than the very short notice that you have given us to identify an entirely new category of products.

Given the seriousness of Elm’s apparent attempt to substantially expand the scope of this case, we believe it would only be fair if, in the meantime, Elm amends its infringement contentions so that they provide Samsung more meaningful notice of Elm’s theory of infringement with respect to the new image sensor products. We believe that amended infringement contentions would be especially instructive here given the issue above with respect to multiple layers or chips, and Elm’s confusing use of terms recently, e.g., semiconductor “layer” instead of “substrate,” or stacked “semiconductor product” instead of “memory product” (see Elm’s Common Interrogatory Nos. 4-5). At the very least, Samsung is entitled to a full understanding of Elm’s bases for why it believes that image sensor products are reasonably similar to the stacked memory products accused to date.

Therefore, please confirm that if it is Elm’s intention to add image sensor products to the case Elm will amend its infringement contentions accordingly.

Regards,
Soyoung

From: Nossou Knobloch <nossou.knobloch@bartlitbeck.com>
Sent: Friday, August 9, 2019 12:08 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

It’s been nearly three weeks since we sent you the below email, raising serious concerns about the data Samsung has (and has not) produced, and the representations you’ve made about its completeness.

Please let us know where these issues stand so that we can decide how to proceed.

Thanks,

-Nossou

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Monday, July 15, 2019 10:36 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

Your email asserts that Samsung has already provided a complete list of all stacked semiconductor products sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less. We fear that this is simply not true and is, instead, another disturbing example of Samsung seeking to gain a litigation advantage through obfuscation and concealment.

One example of the possible gaps in the data Samsung has provided to date relates to Samsung's V-NAND products. According to the following white paper-- https://www.samsung.com/semiconductor/global.semi.static/2bit_V-NAND_technology_White_Paper-1.pdf -- Samsung has been producing V-NAND memory products with 24 layers since 2013, and with 32 layers since 2014. The largest stack that Samsung has identified to us in this case is 16 layers. So it's clear that these V-NAND products have not been identified in discovery. Given the number of layers in these products, we believe it is highly likely that at least one of the layers is 50µm or less.

Another example of a possible gap in the data Samsung has provided relates to camera chips included in Samsung's Galaxy phones. We understand that, at least as of 2016, Samsung's phones have included an image sensor chip stacked, via TSVs, with a DRAM memory chip. None of the products Samsung has identified in the litigation appear to include an image sensor chip stacked with DRAM. Given the nature of the image sensing technology used in Samsung's phones, we believe it is highly likely that at least one of the chips in these products has a thickness of 50µm or less.

Please let us know why these products have not been identified to us in litigation to date.

[REDACTED]

[REDACTED]

Please let us know whether Samsung has any other recommendations for how to move forward with these products.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Wednesday, July 10, 2019 9:29 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

I responded to your first question in my prior email. Samsung has already identified all such products, and you have given us no basis to suspect that Samsung has not done so. We ask that you identify at least one product that you believe is missing from the list, as that may help us understand your question and to further investigate as necessary. Otherwise, we do not see how the Court will entertain your motion.

[REDACTED]

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Monday, July 8, 2019 12:22 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

I hope you had a good Fourth of July holiday. I'm following-up on the below email. We need your answers to these questions ASAP so that we can move forward on discovery and on the selection of representative products.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Monday, June 24, 2019 11:36 PM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Soyoung,

We will consider your request

In the meantime, your email fails to address two of the questions that I've raised:

1. When will Samsung provide a complete list of all stacked semiconductor products sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below

another circuit layer, and where at least one of the layers has a thickness of 50µm or less? If you refuse to commit to a reasonable timeframe to provide this information, we will be forced to raise this issue with the Court.

2. [REDACTED]

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Monday, June 24, 2019 11:19 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

In response to this and your previous email, Samsung has identified all products that you have asked about based on a reasonable search. You have not given any basis for your suspicion that the list of products that Samsung has identified is incomplete. In any event, we will forward this spreadsheet on for Samsung to review.

Further, we have repeatedly informed you that Samsung does not have the requested thickness information. Whether that is difficult for you to believe is irrelevant to the fact that this information has not turned up after months of Samsung's diligent searches.

Finally, we ask that you propose preliminary suggestions for addressing products for which no thickness information exists and arriving at a list of representative products. We believe that this is Elm's burden, not Samsung's. Otherwise, we don't think that we will make much progress on these issues or that a call would be very productive at this point.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Monday, June 24, 2019 9:52 PM


To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: [EXT] RE: Elm Discovery Correspondence

Soyoung,

Following-up on the below email, and given your failure to offer any time to talk, we wanted to email you some additional details about the information we're seeking from Samsung. In that vein, I've attached a spreadsheet that contains the following data:

1. Column A: Pre-stay products missing thickness data: This lists the more than 200 Samsung products identified in Elm's June 3, 2016 identification of accused products for which Samsung has not produced die thickness data.
2. Column B: Pre-stay products that contain one die at 50µm or less: This lists the 18 Samsung products included in the pre-stay identification of accused products that Elm provided on June 3, 2016, and that the '43 spreadsheet indicates have at least one die at 50µm or less (note that this list is a subset of the 50 products identified in Column D).
3. 
4. Column D: Post-stay products that contain one die at 50µm or less: This lists the 50 Samsung products identified in the '42 and '43 spreadsheets as including at least one die that is 50µm or less.

We would like Samsung to let us know, **this week**, whether Column D in the attached spreadsheet lists every Samsung semiconductor product sold from 2008 to the present that Samsung knows to contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50µm or less. If, as we strongly suspect, this list is incomplete, please also let us know when Samsung will be able to complete this list. If Samsung cannot commit to a reasonable timeframe in which to complete this list, then we intend to raise this issue with the Court.



We look forward to your response.

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Thursday, June 20, 2019 11:26 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

I would like to schedule a meet and confer to discuss next steps regarding the identification of representative products.

In light of the Federal Circuit's recent decision, Elm currently intends to accuse of infringement all Samsung semiconductor products that contain more than one circuit layer, where at least one circuit layer is stacked above or below another circuit layer, and where at least one of the layers has a thickness of 50 microns or less. Elm reserves the right to update its position for any reason, including in the event that this Court (or any court of appeal) adopts a different construction of the "substantially flexible" claim terms.

In order to move forward with the selection of representative products, I would like to discuss the following issues:

1. Whether Samsung has already identified all products sold between 2008 and 2018 that meet the above criteria.
2. How the parties will handle the Samsung semiconductor products for which Samsung has not, to date, supplied complete die thickness data.
3. How the parties will select representative products from the complete set of accused products.

Please let me know if there is a time early next week when you are available to discuss these issues.

In addition, it's been almost a month since I sent the below email, but have not received any meaningful response. Please let us know your thoughts on the below issues this week.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Wednesday, May 22, 2019 9:24 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Soyoung,

I am surprised to hear that you believe you've produced your supplier documents. From what I can see, your April 22 production contained no email. For many months, we've been asking for your **communications** with your dielectric suppliers about dielectric stress. Will you be producing those?

Relatedly, your April 22 production is missing the standard metadata. Can you please provide an overlay with that information?

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Tuesday, May 21, 2019 6:17 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>

Subject: RE: Elm Discovery Correspondence

Nosson,

We produced Samsung's supplier documents on April 22. Samsung may discover additional documents as part of its ongoing discovery efforts based on the list of search terms that the parties agree on.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Tuesday, May 21, 2019 6:44 AM
To: Jung, Soyoung <soyoungjung@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Elm Discovery Correspondence

Thanks, Soyoung. Can you please also let me know when we can expect your production of communications with third party dielectric suppliers?

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>
Sent: Monday, May 20, 2019 10:35 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

We identify the following 5 Samsung employees for Elm's custodial discovery requests: Gunho Chang, Jiwoon Im, Ilho Kim, Tae-Young Lee and Jongyoung Park.

We will be sending you our proposed search terms for Elm shortly.

Regards,
Soyoung

From: Jung, Soyoung
Sent: Friday, May 10, 2019 6:39 PM
To: 'Nosson Knobloch' <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; apoff@ycst.com; Kraman, Pilar <PKraman@ycst.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Elm Discovery Correspondence

Nosson,

I wanted to give you an update that we have been diligently working with Samsung in Korea this week to identify appropriate custodians, but we will need another week to conclude our investigation. Therefore, we would like to move

the date by which Samsung identifies custodians from May 13 to May 20. All the other dates of custodial discovery that we agreed on will stay the same.

We will respond to Matt's email from today separately.

Thanks,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Friday, May 3, 2019 1:46 PM
To: #ELM3DS-MICRON-OMM <ELM3DS-MICRON-OMM@omm.com>; Skhynix-Elm@klgates.com; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] Elm Discovery Correspondence

Dear Counsel,

Please see the attached correspondence.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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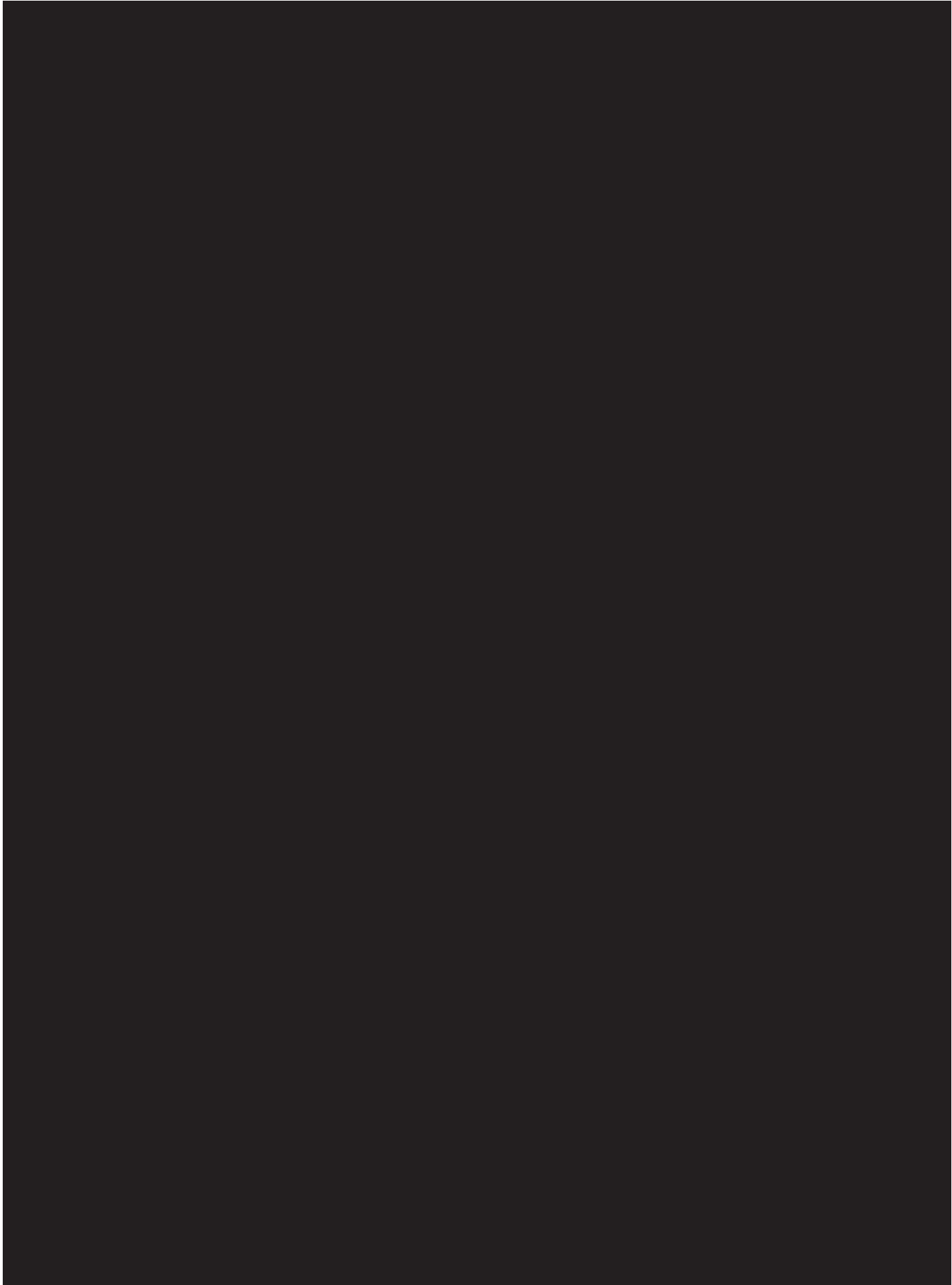
Exhibit 23



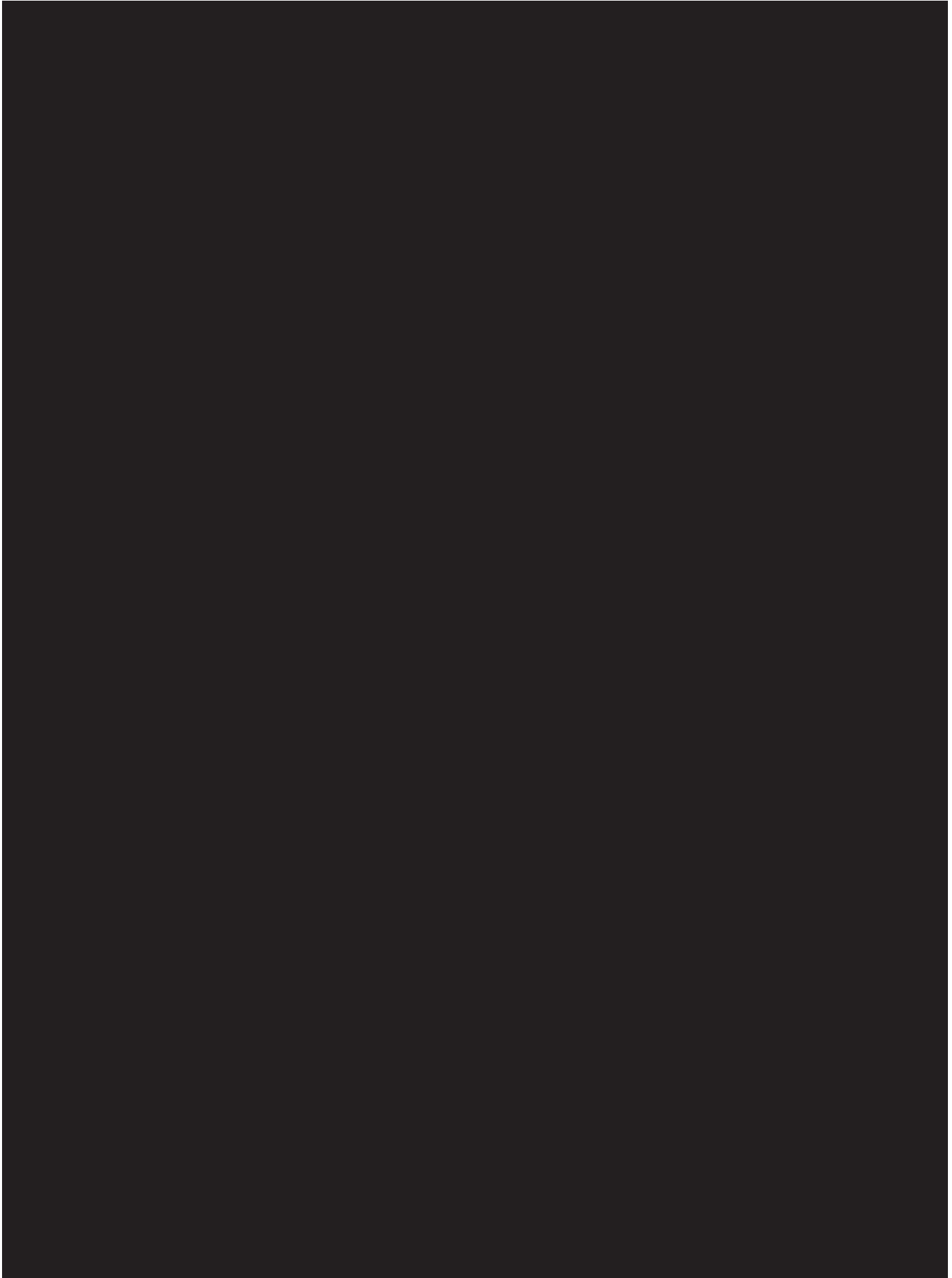




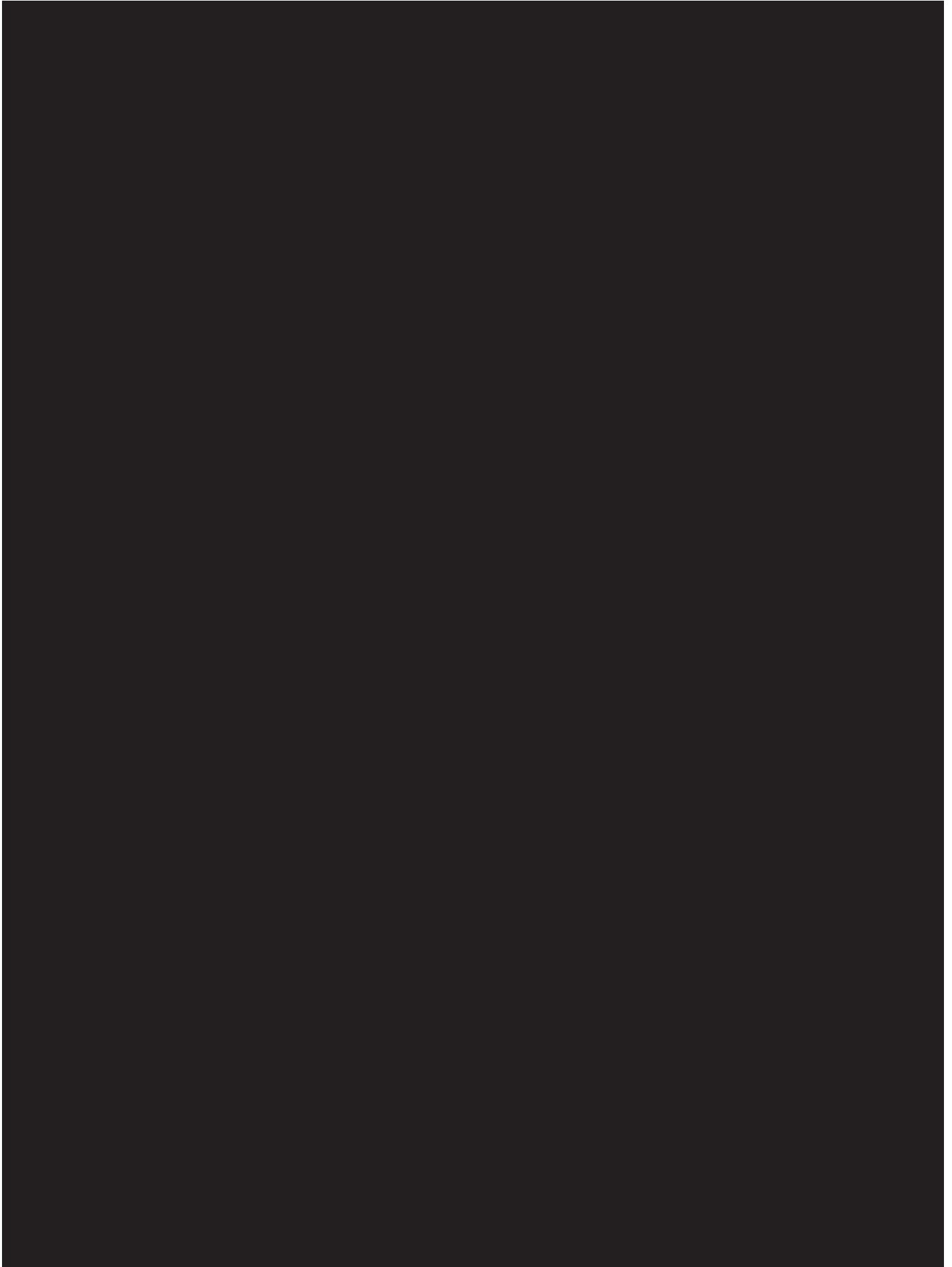


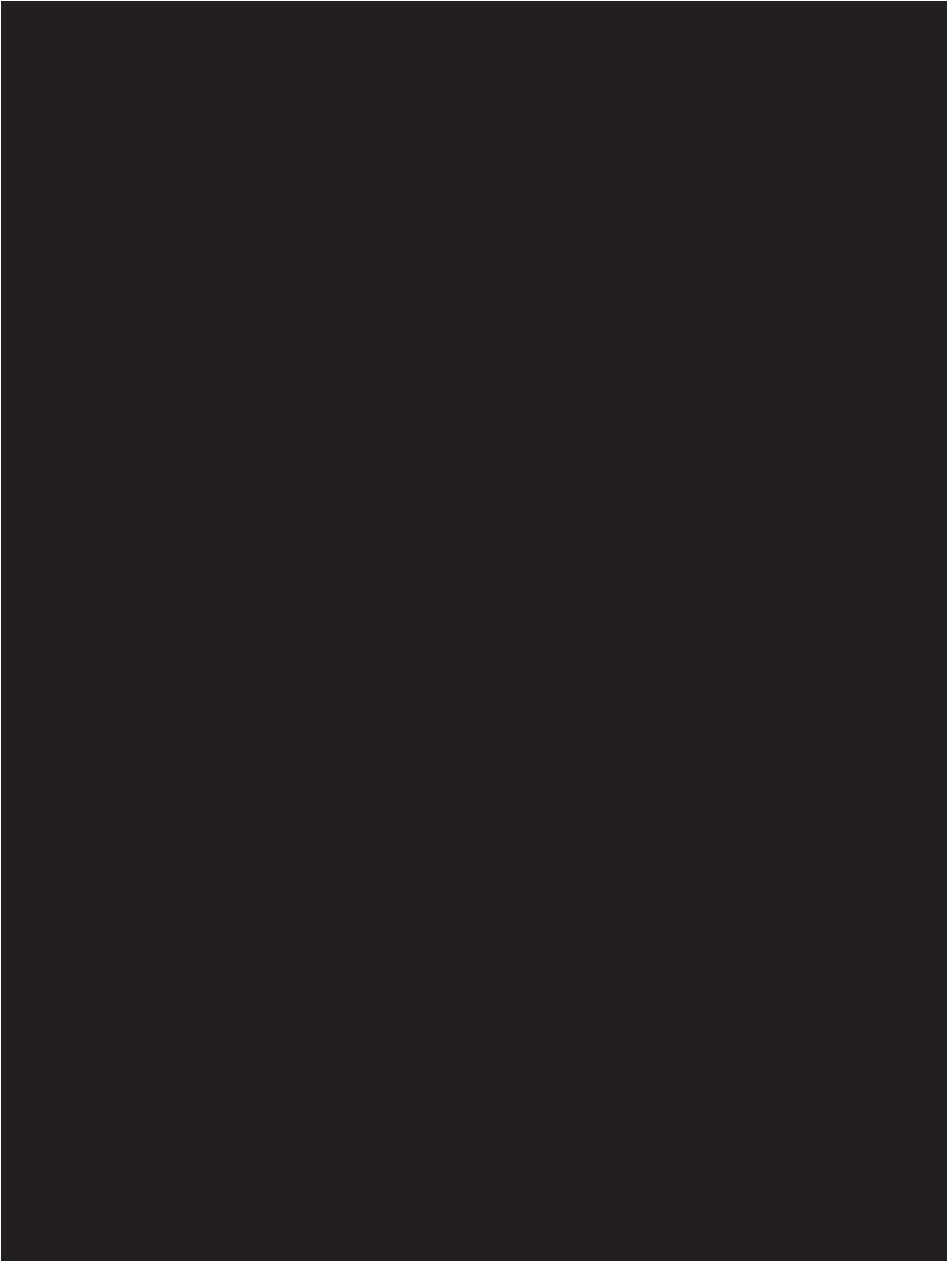


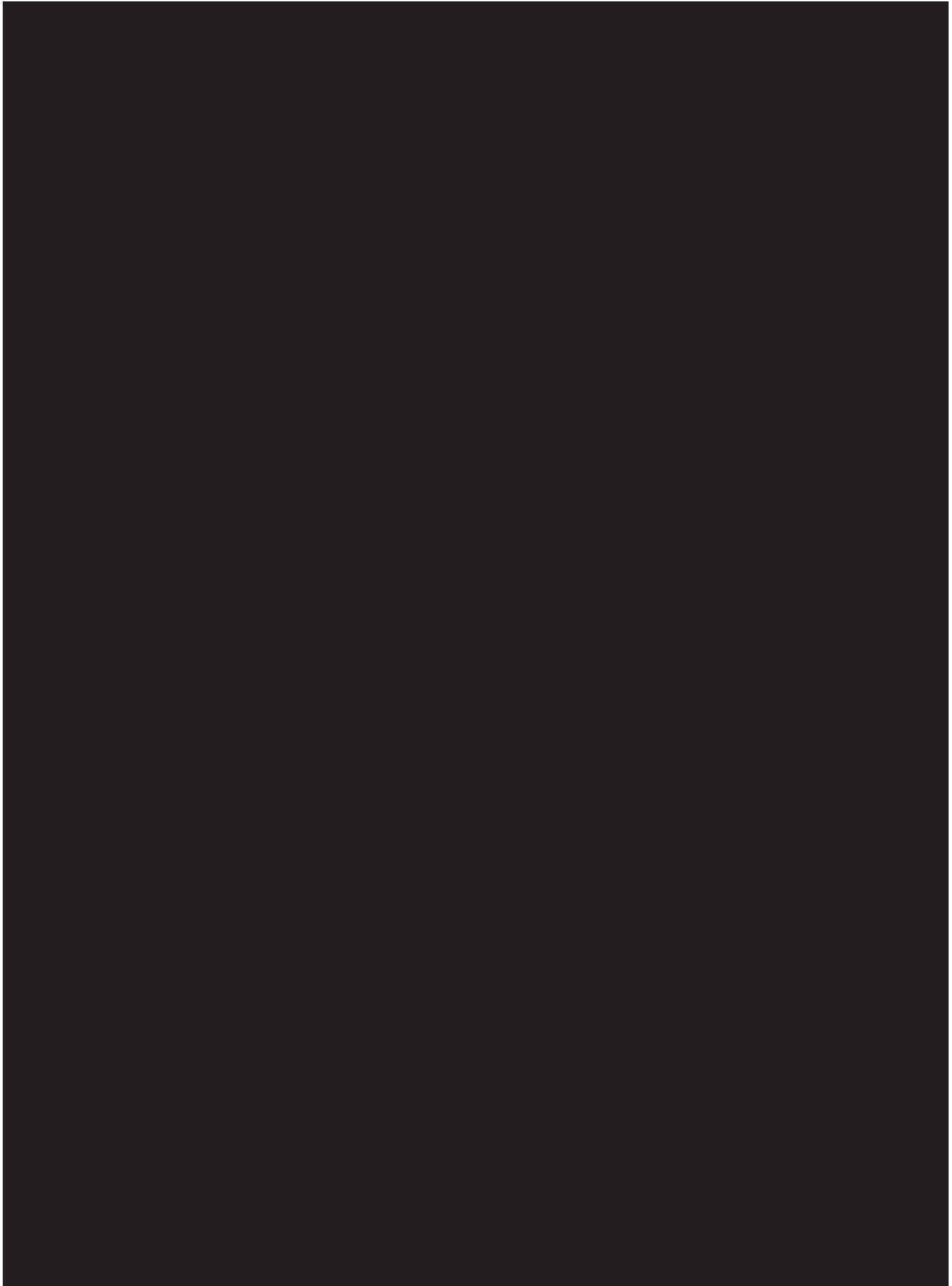














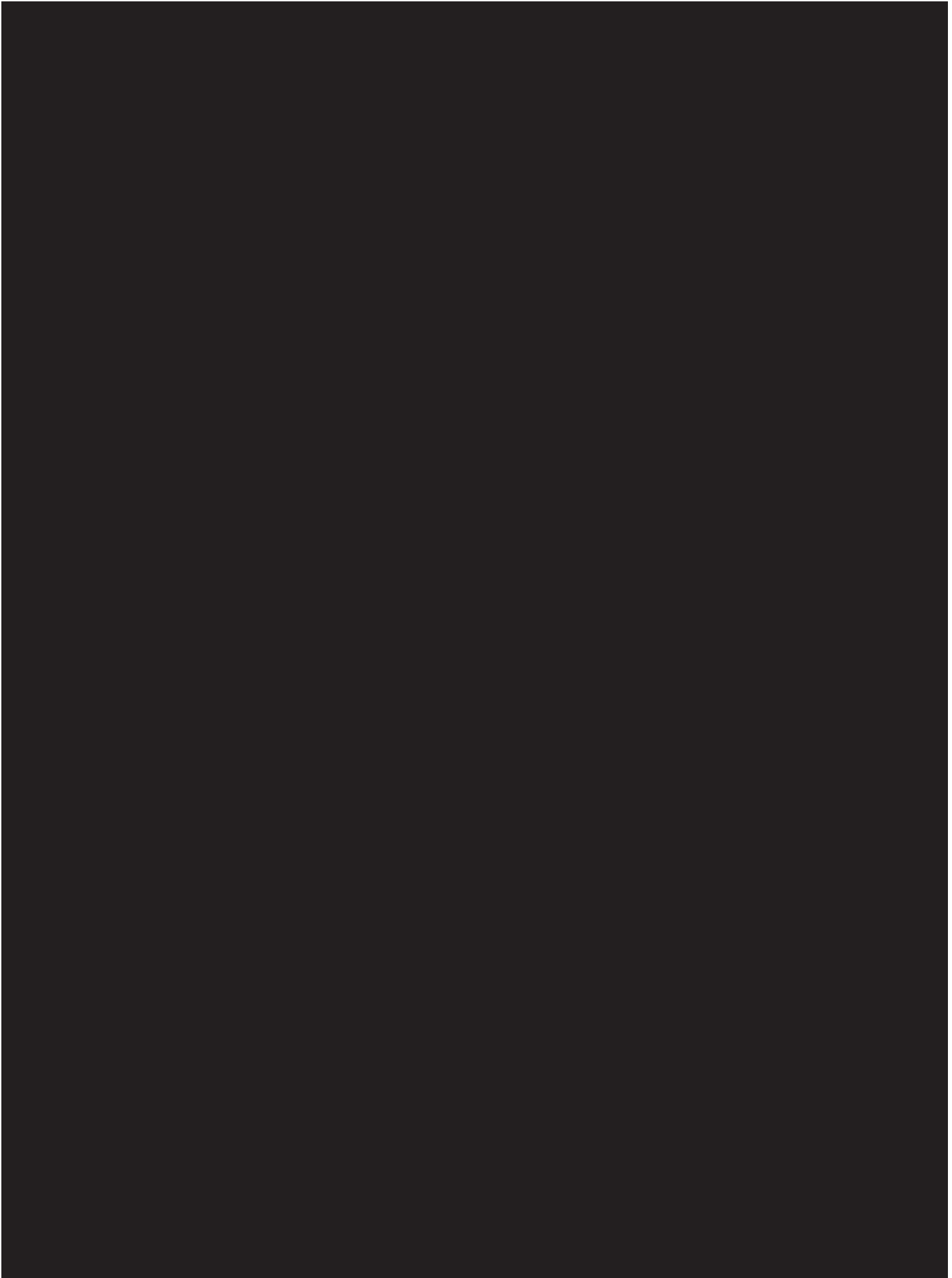


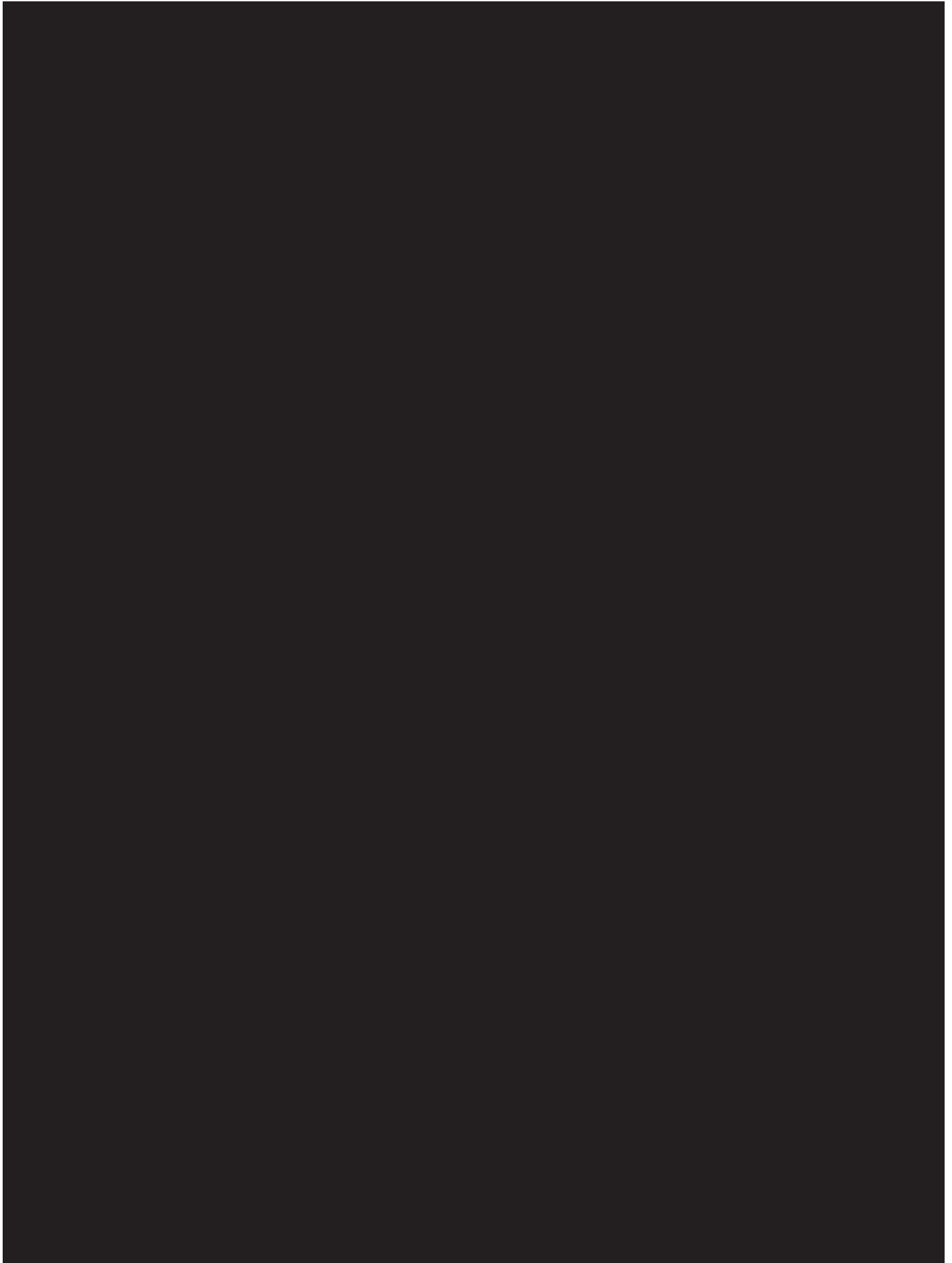




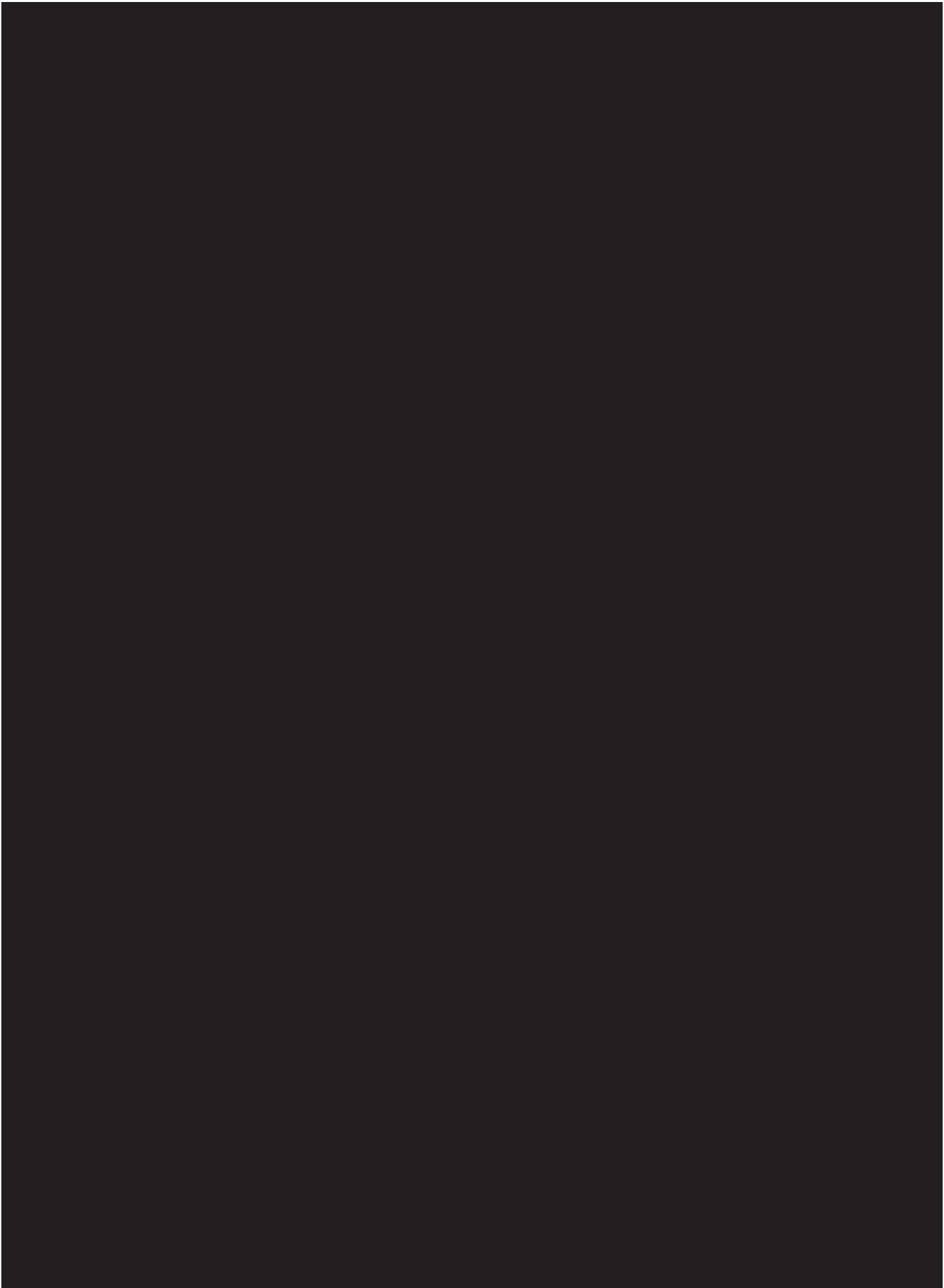


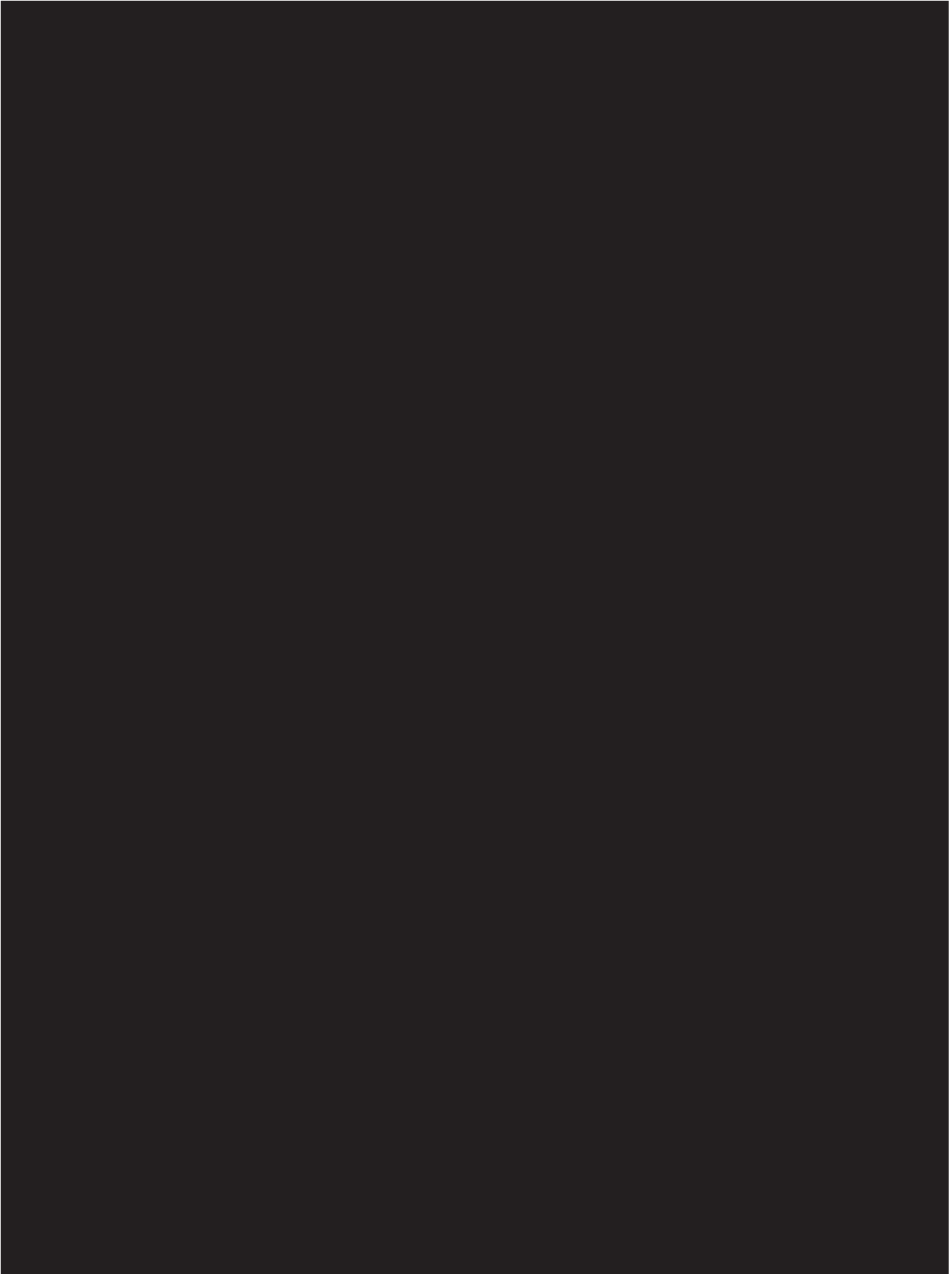


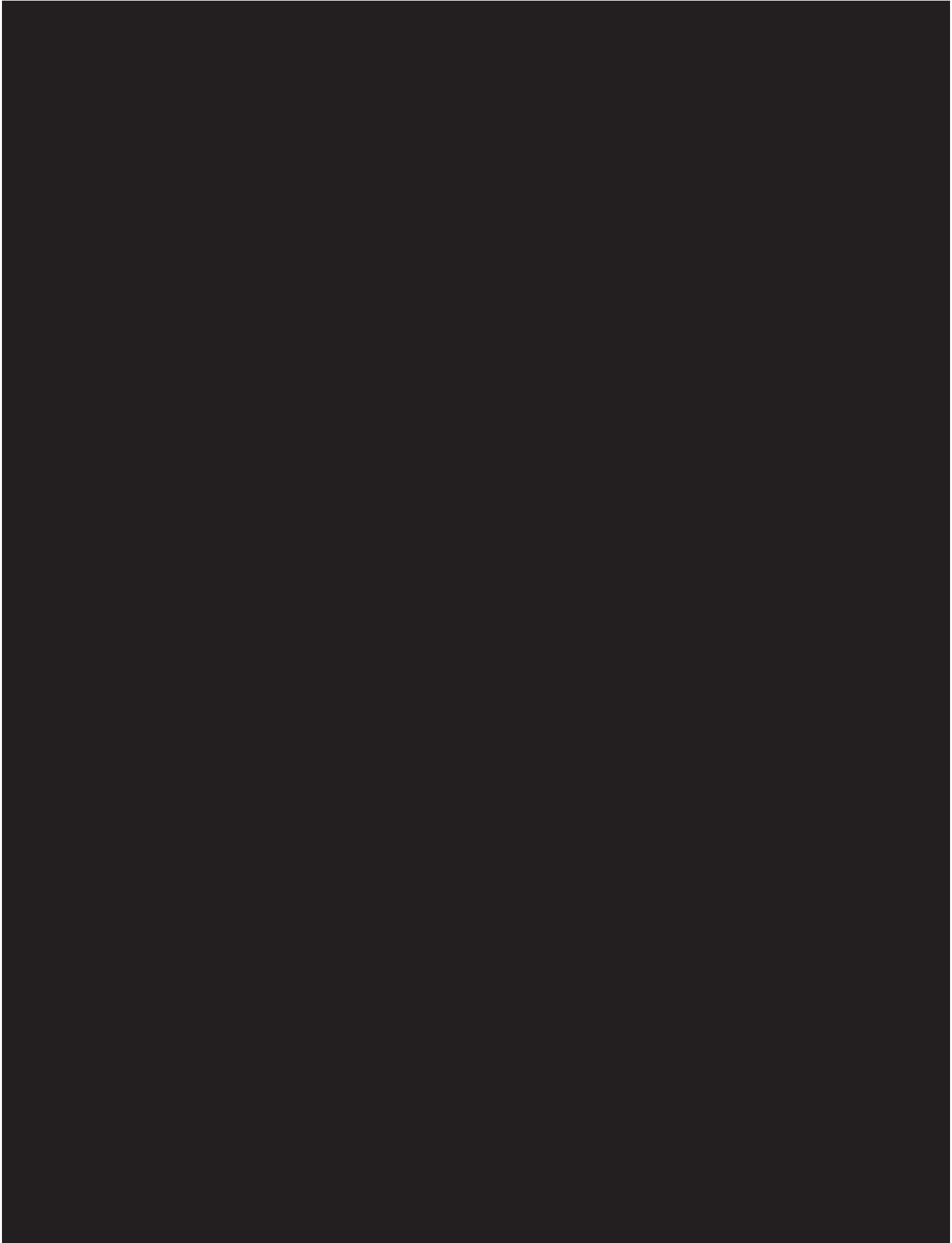






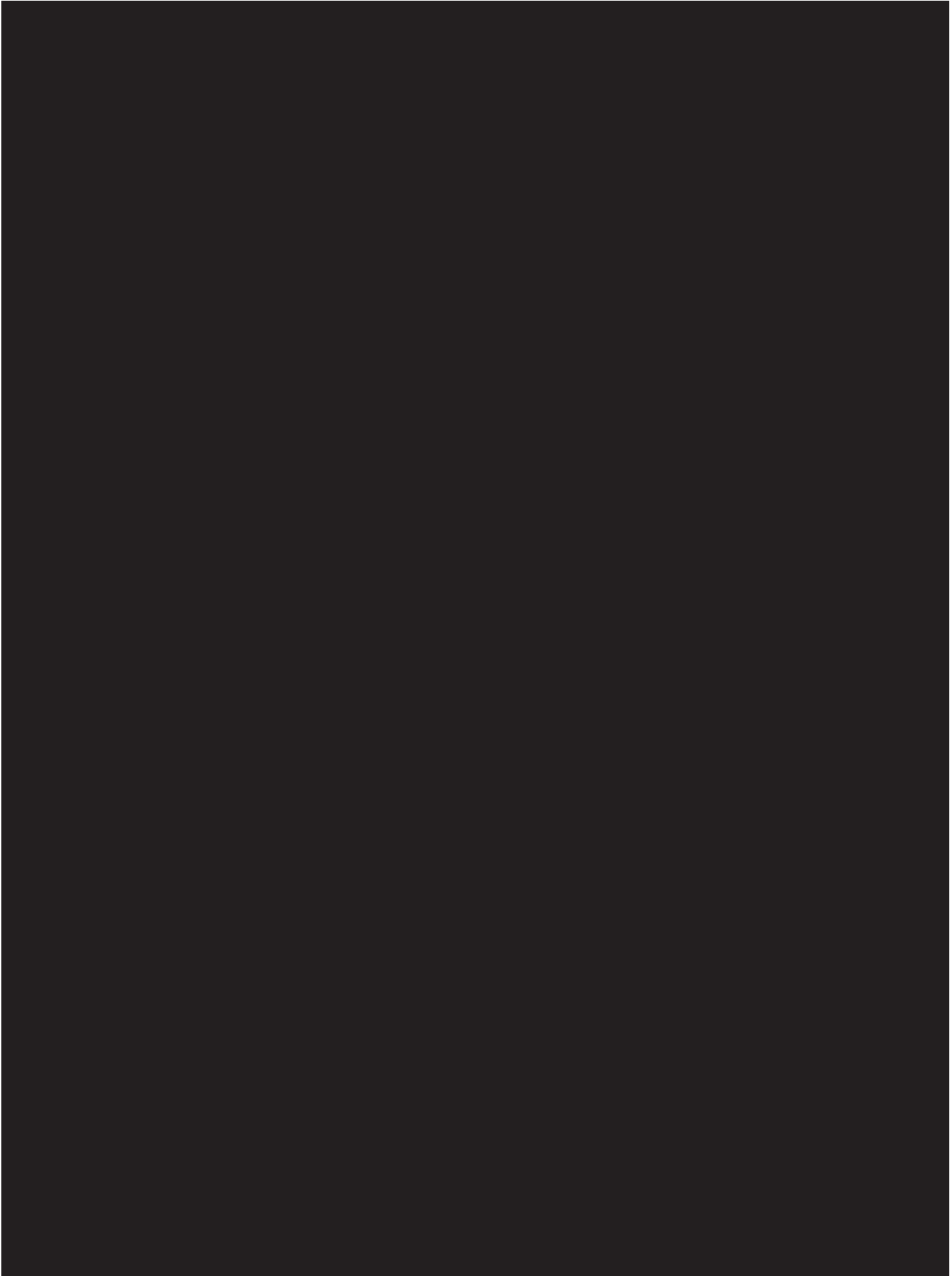




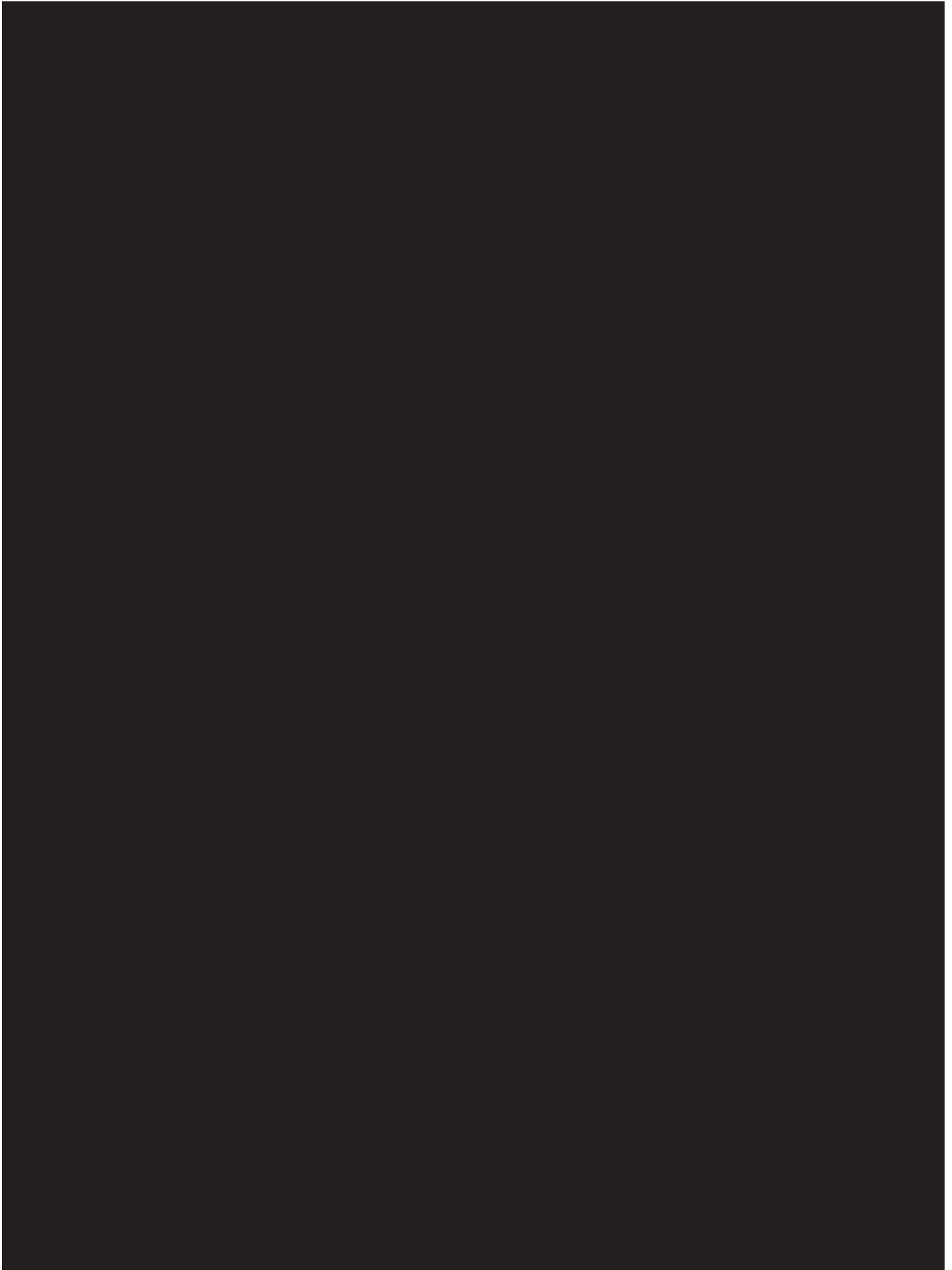










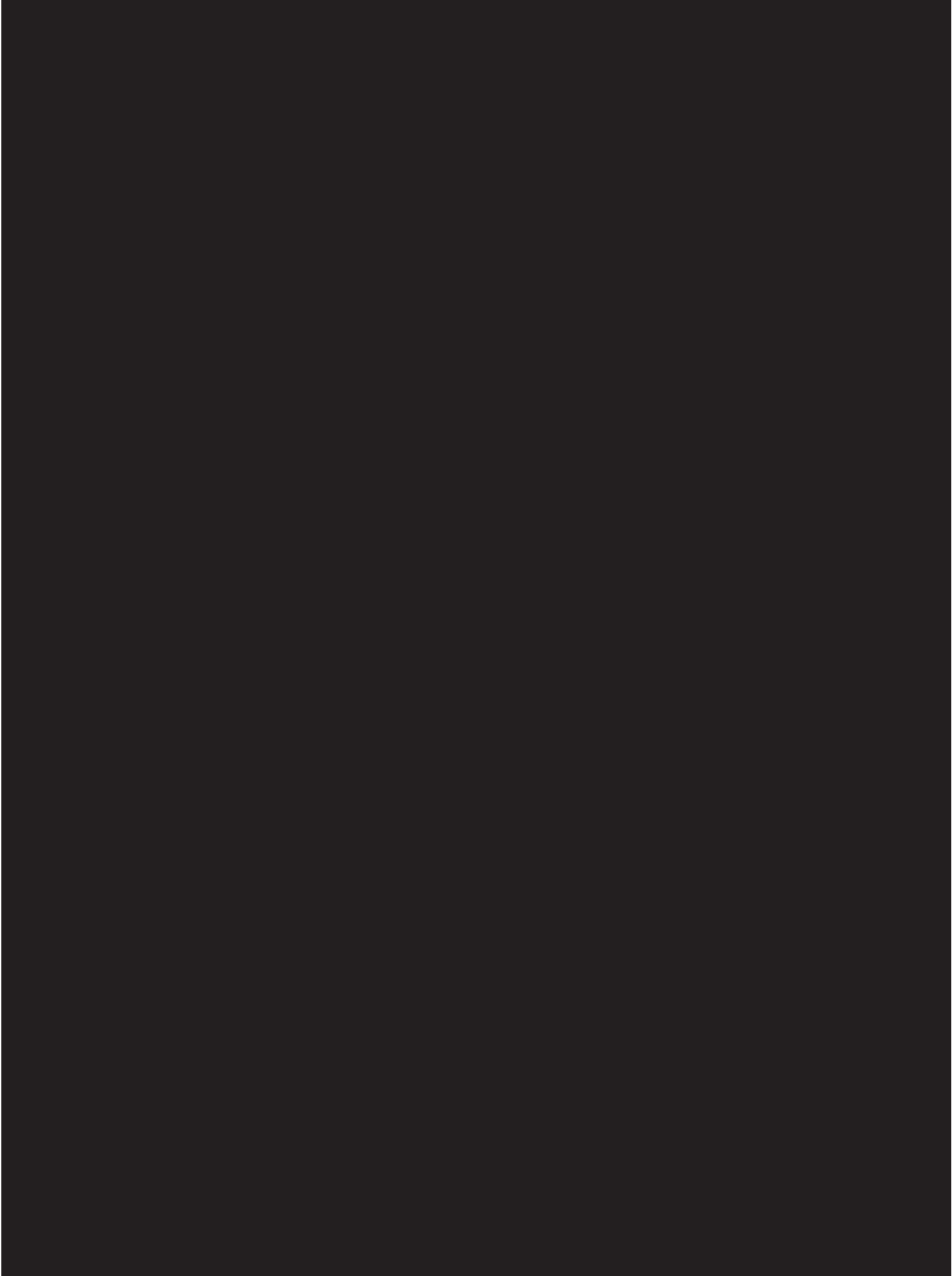


























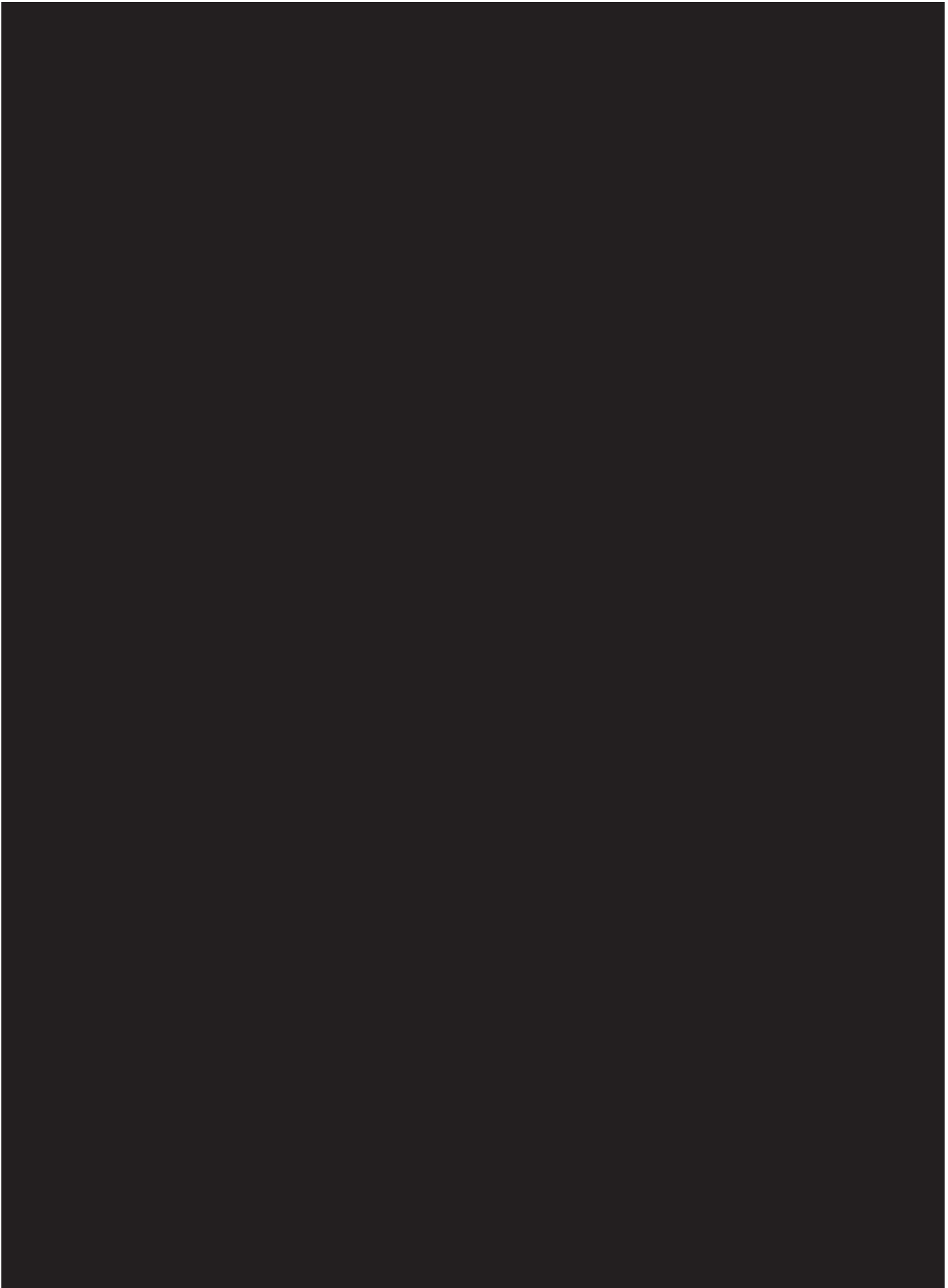




Exhibit 24

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

ELM 3DS INNOVATIONS, LLC, a Delaware limited liability company,)	
)	
Plaintiff,	)	C.A. No. 14-cv-1430-LPS
)	
v.	)	JURY TRIAL DEMANDED
SAMSUNG ELECTRONICS CO., LTD., a Korean business entity,)	
SAMSUNG SEMICONDUCTOR, INC., a California Corporation,)	
SAMSUNG ELECTRONICS AMERICA, INC., a New York corporation, and)	
SAMSUNG AUSTIN SEMICONDUCTOR, LLC, a Delaware limited liability company,)	
Defendants.)	

**SAMSUNG’S THIRD SUPPLEMENTAL OBJECTIONS AND RESPONSES TO
ELM’S THIRD SET OF INTERROGATORIES**

Pursuant to Rules 26 and 33 of the Federal Rules of Civil Procedure, defendants Samsung Electronics Co., Ltd., Samsung Semiconductor, Inc., Samsung Electronics America, Inc., and Samsung Austin Semiconductor, LLC (collectively “Samsung”) hereby object and respond to Plaintiff ELM 3DS Innovations, LLC’s (“Elm”) Third Set of Interrogatories, dated June 3, 2016.

GENERAL OBJECTIONS

Samsung makes the following general responses and objections (“General Objections”) to each “Definition,” “Instruction,” and “Interrogatory” propounded in Elm’s Third Set of

Interrogatories. These General Objections are hereby incorporated into each specific response. The assertion of the same, similar or additional objections or partial responses to individual interrogatories does not waive any of Samsung's General Objections.

1. Samsung objects to Elm's definition of "Elm" and "Elm 3DS" as vague, ambiguous, overbroad, and unduly burdensome to the extent that they include "all parents, subsidiaries, affiliates, assignees, predecessors, employees, and agents thereof." Samsung further objects to the definition as not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to the extent that these terms may include persons or entities that are not parties to this action.

2. Samsung objects to Elm's definitions of "you" and "your" as overbroad, unduly burdensome, and oppressive to the extent that they include Samsung "and their parents, subsidiaries, divisions, affiliates, predecessors, assigns, successors, and acquired assets of business units, and any of their present or former officers, directors, trustees, employees, agents, representatives, attorneys, patent agents, and all other persons acting on their behalf." Samsung will respond, subject to and without waiving all other objections, only as to the named Samsung Defendants: Samsung Electronics Co., Ltd., Samsung Semiconductor, Inc., Samsung Electronics America, Inc., and Samsung Austin Semiconductor, LLC.

3. Samsung objects to Elm's Instruction No. 1 because it purports to impose requirements and obligations on Samsung other than as set forth in the Federal Rules of Civil Procedure.

4. Samsung provides these objections and responses to the best of its current knowledge. Discovery or further investigation may reveal additional or different information warranting amendment of these objections and responses. Samsung reserves the right to produce at trial and make reference to any evidence, facts, documents, or information not discovered at

this time, omitted through good-faith error, mistake, or oversight, or the relevance of which Samsung has not presently identified.

5. By responding to these interrogatories, Samsung does not concede the relevance or materiality of any of the interrogatories or of the subjects to which it refers. Samsung's responses are made subject to, and without waiving any objections as to the competency, relevancy, materiality, privilege, or admissibility of any of the responses, or of the subject matter to which they concern, in any proceeding in this action or in any other proceeding.

6. Samsung objects to any interrogatory to the extent that it seeks information that is protected from disclosure by the attorney-client privilege, the attorney work product doctrine, the joint defense or common interest privilege, or any other applicable privilege, doctrine, or discovery immunity. The inadvertent production by Samsung of information protected from disclosure by any such privilege, doctrine, or immunity shall not be deemed a waiver by Samsung of such privileges or protections.

7. Samsung objects generally to the interrogatories to the extent they seek confidential, proprietary, or trade secret information of third parties. Samsung will endeavor to work with third parties in order to obtain their consent, if necessary, before providing such information. To the extent an interrogatory seeks information of a confidential or proprietary nature to Samsung, or to others to whom Samsung is under an obligation of confidentiality, Samsung will respond pursuant to the terms of the protective order entered in this case and subject to notice to third parties, as necessary.

8. Samsung objects to each interrogatory and to Elm's "Definitions" and "Instructions" to the extent they are vague, ambiguous, overbroad, unduly burdensome, are not proportional to the needs of this case, or purport to impose upon Samsung any duty or obligation that is inconsistent with or in excess of those obligations that are imposed by the Federal Rules of Civil Procedure, the Civil Local Rules and/or the Patent Local Rules of this Court, or any other applicable rule.

9. Samsung objects to any interrogatory to the extent it seeks irrelevant information about Samsung's products or business operations, or is not otherwise proportional to the needs of this case. Such requests are overbroad and unduly burdensome. Samsung will only produce information that is relevant to the patents-in-suit, or that is otherwise related to the claims or defenses asserted by the parties in this litigation.

10. Samsung objects to each interrogatory to the extent that it would impose a duty on Samsung to undertake a search for or an evaluation of information, documents, or things for which Elm is equally able to search for and evaluate and/or is not proportional to the needs of this case. In particular, Samsung objects to each interrogatory to the extent that it seeks information or documents that are publicly available.

11. Samsung objects to each interrogatory to the extent that it seeks information that can be derived or ascertained from documents that will be produced in discovery, is not otherwise proportional to the needs of this case, or that is uniquely in Elm's possession, custody, and control.

12. Samsung objects to each interrogatory to the extent it would require Samsung to draw a legal conclusion or contention to make a proper response.

13. Samsung objects to each interrogatory to the extent that it purports to define words or phrases to have a meaning different from their commonly understood meaning, or to include more than their commonly understood definitions.

14. In Samsung's objections, the terms "and" and "or" are intended to be construed conjunctively or disjunctively as necessary to make the objections inclusive rather than exclusive.

15. Samsung objects to each interrogatory to the extent it purports to require Samsung to identify or describe or identify "every," "each," "any," or other similarly expansive, infinite, or all-inclusive terms as overbroad and unduly burdensome.

16. Samsung objects to Elm's "Instructions" and the interrogatories to the extent they seek information that is not in the possession, custody, or control of Samsung, purport to require Samsung to speculate about the identity of persons who might have responsive documents, and/or purport to call for any description of documents that Samsung no longer possesses and/or was under no obligation to maintain.

17. Samsung objects to each interrogatory to the extent it is not limited in time and seeks information for periods of time that are not relevant to any claim or defense and is not otherwise proportional to the needs of this case.

18. Samsung objects to the interrogatories as a whole, and to each interrogatory contained therein, to the extent they are overbroad, unreasonably burdensome, and/or not proportional to the needs of this case. In particular, Samsung objects to the interrogatories as a whole, and to each interrogatory contained therein, to the extent they seek irrelevant information about accused products. By answering, objecting, and otherwise responding to the interrogatories, Samsung does not concede relevance or admissibility, both of which Samsung reserves the right to challenge.

19. Samsung objects to the interrogatories as a whole, and to each interrogatory contained therein, to the extent they are premature and/or to the extent they: (a) conflict with any schedule entered by the Court; (b) seek information that is the subject of expert testimony; (c) seek information and/or responses that are dependent on the Court's construction of the asserted claims of the patents-in-suit; or (d) are dependent on depositions and documents that have not been taken or produced.

20. Samsung's objections as set forth herein are made without prejudice to Samsung's right to assert any additional or supplemental objections pursuant to Rule 26(e).

21. Samsung will make, and has made, reasonable efforts to respond to Elm's Third Set of Interrogatories, to the extent that no objection is made, as Samsung reasonably understands and interprets each Interrogatory. If Elm subsequently asserts any interpretation of

any interrogatory that differs from the interpretation of Samsung, then Samsung reserves the right to supplement and amend its objections and responses.

OBJECTIONS AND RESPONSES TO INTERROGATORIES

Subject to the foregoing qualifications and General Objections and the specific objections made below, Samsung objects and responds to Elm's Third Set of Interrogatories as follows:

INTERROGATORY NO. 4:

Identify by part number all Stacked Integrated Circuit Products that (A) are not included in the Second Amended Accused Product List served on June 3, 2016, and (B) that you (1) sell directly to an affiliate or third party, and/or (2) incorporate in products that you subsequently sell to an affiliate or a third party.

OBJECTIONS AND RESPONSE TO INTERROGATORY NO. 4:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this interrogatory to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this interrogatory to the extent that it seeks private, privileged, and confidential commercial, financial, and/or proprietary business information. Samsung further objects to this interrogatory as overbroad, unduly burdensome, and not proportional to the needs of this case, particularly to the extent that it may include products that are not manufactured by Samsung and/or products that are not imported, sold, or offered for sale in the United States by Samsung. Samsung further objects to this interrogatory to the extent that it is duplicative and seeks information that can be derived or ascertained from documents that were produced in discovery and that is uniquely in Elm's possession, custody and control. Samsung further objects to this interrogatory on the grounds that it is vague, ambiguous, and overbroad as to "affiliate," "third party," and "incorporate in

products.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this interrogatory as overbroad to the extent it is unlimited with respect to time or geography.

Subject to and without in any way waiving the foregoing objections, and to the extent it understands this interrogatory, Samsung responds as follows: pursuant to Federal Rule of Civil Procedure 33(d), Samsung refers Elm to the documents bearing bates numbers SAMSUNG-ELM-000025176 – SAMSUNG-ELM-000050134, wherein information responsive to this interrogatory may be found. Samsung expressly reserves the right to supplement this response following further investigation and/or discovery.

FIRST SUPPLEMENTAL OBJECTIONS AND RESPONSE TO INTERROGATORY NO. 4:

Samsung further objects to this interrogatory as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired or will expire soon, Samsung objects to this interrogatory to the extent it seeks post-patent expiration data.

Subject to and without waiving the foregoing general and specific objections, and to the extent it understands this interrogatory, Samsung further responds as follows:

Appendix A, attached hereto, lists all stacked silicon die packages having two or more vertically stacked die that have been sold in the United States in the period between 2007 to present and that are not included in the Second Amended Accused Product List served on June 3, 2016.

Samsung expressly reserves the right to amend or supplement this response following further investigation and/or discovery.

SECOND SUPPLEMENTAL OBJECTIONS AND RESPONSE TO INTERROGATORY NO. 4:

Subject to and without waiving the foregoing general and specific objections, and to the extent it understands this interrogatory, Samsung further responds as follows: pursuant to Federal Rule of Civil Procedure 33(d), Samsung refers Elm to the documents bearing bates numbers SAMSUNG-ELM-000058542 – SAMSUNG-ELM-000058543, wherein information responsive to this interrogatory may be found.

These documents provide a revised list of all stacked silicon die packages having two or more vertically stacked die that have been sold in the United States in the period between 2007 to present and that are not included in the Second Amended Accused Product List served on June 3, 2016, and replaces the list in Appendix A to Samsung’s First Supplemental Objections and Responses to Elm’s Third Set of Interrogatories served on August 9, 2018. These documents include certain information regarding the identified packages, including the number of stacked chips, process node, product type, whether the stacked die are interconnected by wiring or through-silicon vias, and die thickness, to the extent known after a reasonable search.

[REDACTED]

Die thickness is provided separately for each die in SAMSUNG-ELM-000058543 except where otherwise indicated. In particular, where indicated, a provided die thickness may apply to multiple stacked die in a package.

Samsung expressly reserves the right to amend or supplement this response following further investigation and/or discovery.

THIRD SUPPLEMENTAL OBJECTIONS AND RESPONSE TO INTERROGATORY NO. 4:

Subject to and without waiving the foregoing general and specific objections, and to the extent it understands this interrogatory, Samsung further responds as follows: pursuant to Federal Rule of Civil Procedure 33(d), Samsung refers Elm to the document bearing bates number SAMSUNG-ELM-000062355, wherein information responsive to this interrogatory may be found.

This document provides a revised list of all stacked silicon die memory packages having two or more vertically stacked die that have been sold in the United States in the period between 2007 to present and replaces the list of products provided in document SAMSUNG-ELM-000058543, as referred to in Samsung's Second Supplemental Objections and Responses to Elm's Third Set of Interrogatories served on March 14, 2019.

This document includes certain information regarding the identified packages, including the number of stacked dies and the minimum thickness of at least one stacked die in each product, to the extent known after a reasonable search.

Samsung expressly reserves the right to amend or supplement this response following further investigation and/or discovery.

DATED: September 20, 2019

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Samsung Electronics America, Inc., and
Samsung Austin Semiconductor, LLC*

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/s/ Adam W. Poff

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Samsung Austin Semiconductor, LLC*

CERTIFICATE OF SERVICE

I, Adam W. Poff, hereby certify that on September 20, 2019, I caused a true and correct copy of the foregoing document to be served on the following counsel of record in the manner indicated:

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Exhibit 25

BartlitBeck_{LLP}

November 5, 2019

Via email

Soyoung Jung
Phillip Citroen
ServicePHSamsung-ELM3DS@paulhastings.com

Re: *Elm 3DS Innovations, LLC v. Samsung Elecs. Co. Ltd., et al.*,
C.A. No. 14-cv-1430-LPS-CJB, D. Del.

Dear Counsel,

This letter follows-up on your September 4, 2019 proposal regarding discovery, and on our recent call concerning Samsung sales data.

As contemplated in your September 4 proposal, Elm provides the attached explanation for why it believes Samsung's stacked image-sensor products practice Claims 58 and 60 of U.S. Patent No. 8,933,570 (the '570 patent). This is not intended as a substitute for infringement contentions, which will be provided as appropriate after Samsung produces technical data for the relevant products. Nor should you misconstrue this letter to suggest in any way that Elm intends to accuse these products only of infringing the '570 patent. These are intended merely to explain Elm's request that Samsung produce detailed revenue and technical data for its stacked image sensor products.

In accordance with your September 4 letter, we expect that Samsung will produce US revenue data for its stacked image sensor products within three weeks of receiving this letter, and begin rolling productions of technical data for these products within a week or two thereafter.

In addition, during our recent call, we discussed three categories of sales that have not been included in the data you've produced to date, and that Elm requests you produce as soon as possible:

- ***Downstream product revenue:*** Samsung informed us that the revenue data produced to date does not include revenue associated with accused products that Samsung has incorporated as components in a product that Samsung subsequently shipped to or sold in the United States. Samsung acknowledged that Elm is entitled to this information, and committed to produce it as soon as possible.
- ***Components supplied from the United States:*** As the Court ruled in connection with Elm's recent motion to compel against Micron, D.I. 204, Elm is entitled to discovery into revenue generated from components that Samsung supplies from the United States which are subsequently used, outside the United States, to make an infringing product. [REDACTED]

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Soyoung Jung
Phillip Citroen
November 5, 2019
Page 2

[REDACTED] Elm is serving an interrogatory seeking revenue information associated with sales of such products. Elm expects that, in light of the Court's ruling and the advance notice provided to Samsung on this issue, that Samsung's response to this interrogatory will include the complete data requested.

- **Worldwide sales data:** [REDACTED]
[REDACTED] given the Court's recent ruling in connection with Elm's recent motion to compel against Micron, D.I. 204, Elm requests that Samsung produce worldwide sales data for all stacked semiconductor products that include at least one die that is 50 microns or less.

Please let us know when we can expect Samsung to produce this information. As always, we are available to discuss if you have any questions or concerns.

Sincerely,



Nossong Knobloch



1
CONFIDENTIAL



2
CONFIDENTIAL



3
CONFIDENTIAL



4
CONFIDENTIAL



5
CONFIDENTIAL



6
CONFIDENTIAL



7
CONFIDENTIAL



8
CONFIDENTIAL

Exhibit 26

PAUL HASTINGS

1(202) 551-1991
phillipcitroen@paulhastings.com

November 15, 2019

VIA E-MAIL

Nosson D. Knobloch
BartlitBeck LLP
1801 Wewatta, 12th Floor
Denver, CO 80202

Re: *Elm 3DS Innovations, LLC v. Samsung Elecs. Co. Ltd., et al.*, CA. No. 14-cv-1430-LPS-CJB

Nosson:

We are sending you instructions on how to download our production bearing Bates numbers SAMSUNG-ELM-000062356-SAMSUNG-ELM-000062358. These documents are highly confidential and designated "CONFIDENTIAL OUTSIDE COUNSEL ONLY, HIGHLY CONFIDENTIAL" and should be treated accordingly as provided in the Protective Order entered by the Court.

The document Bates-stamped SAMSUNG-ELM-000062356 is an updated list of memory products that removes from the previous list 19 products that Samsung has since discovered were not stacked, as we informed you in our correspondence of October 4, 2019. The document Bates-stamped SAMSUNG-ELM-000062357 is identical to the spreadsheet of U.S. sales data that we produced to you on October 11, 2019. The document Bates-stamped SAMSUNG-ELM-000062358 provides additional COGS data corresponding to the data in SAMSUNG-ELM-000062357.

We are concurrently serving Samsung's supplemental responses to Elm's interrogatories, which provide further information about these documents.

Sincerely,

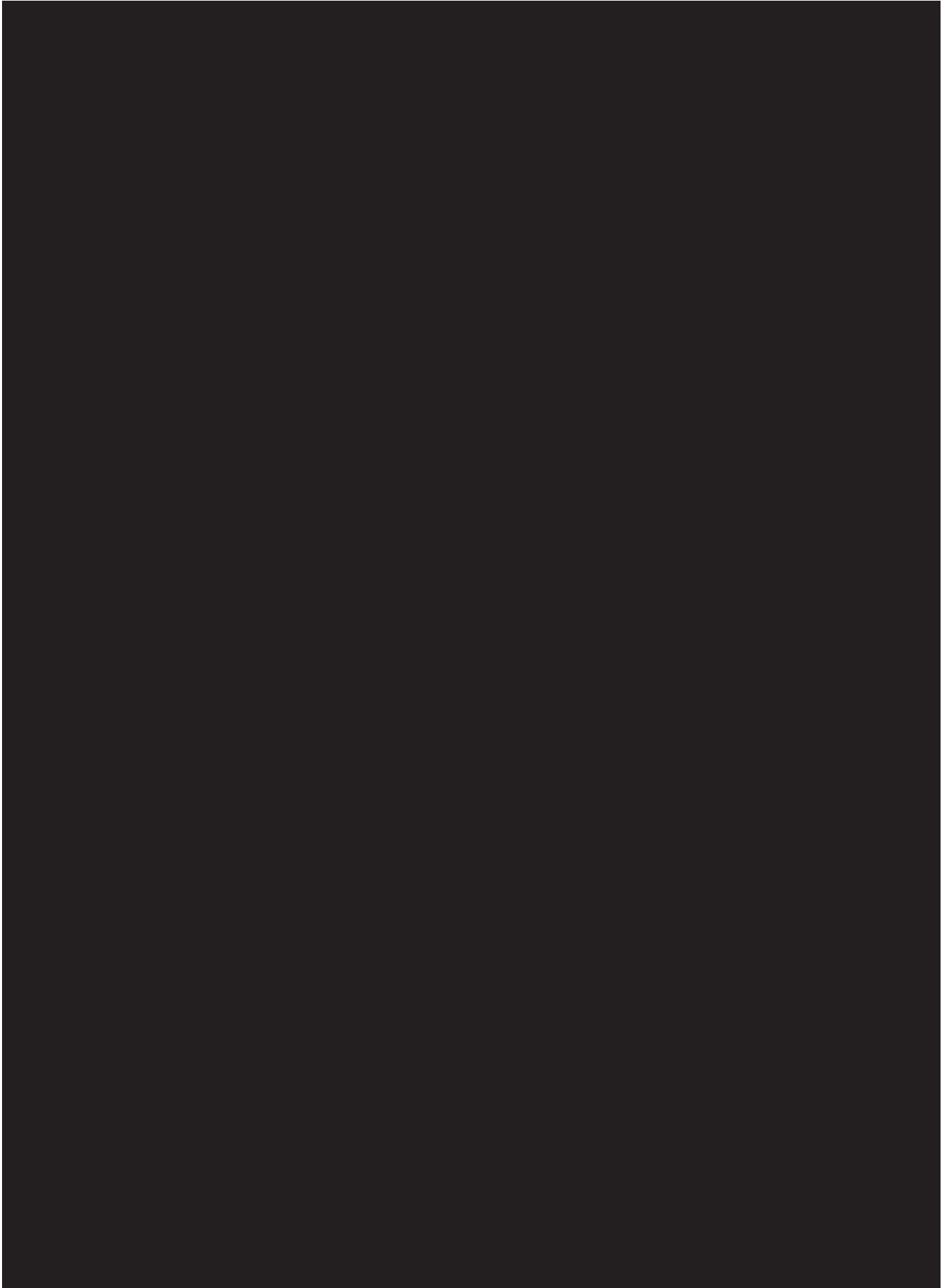
/s/ Philip W. Citroen

Phillip W. Citroen
for PAUL HASTINGS LLP

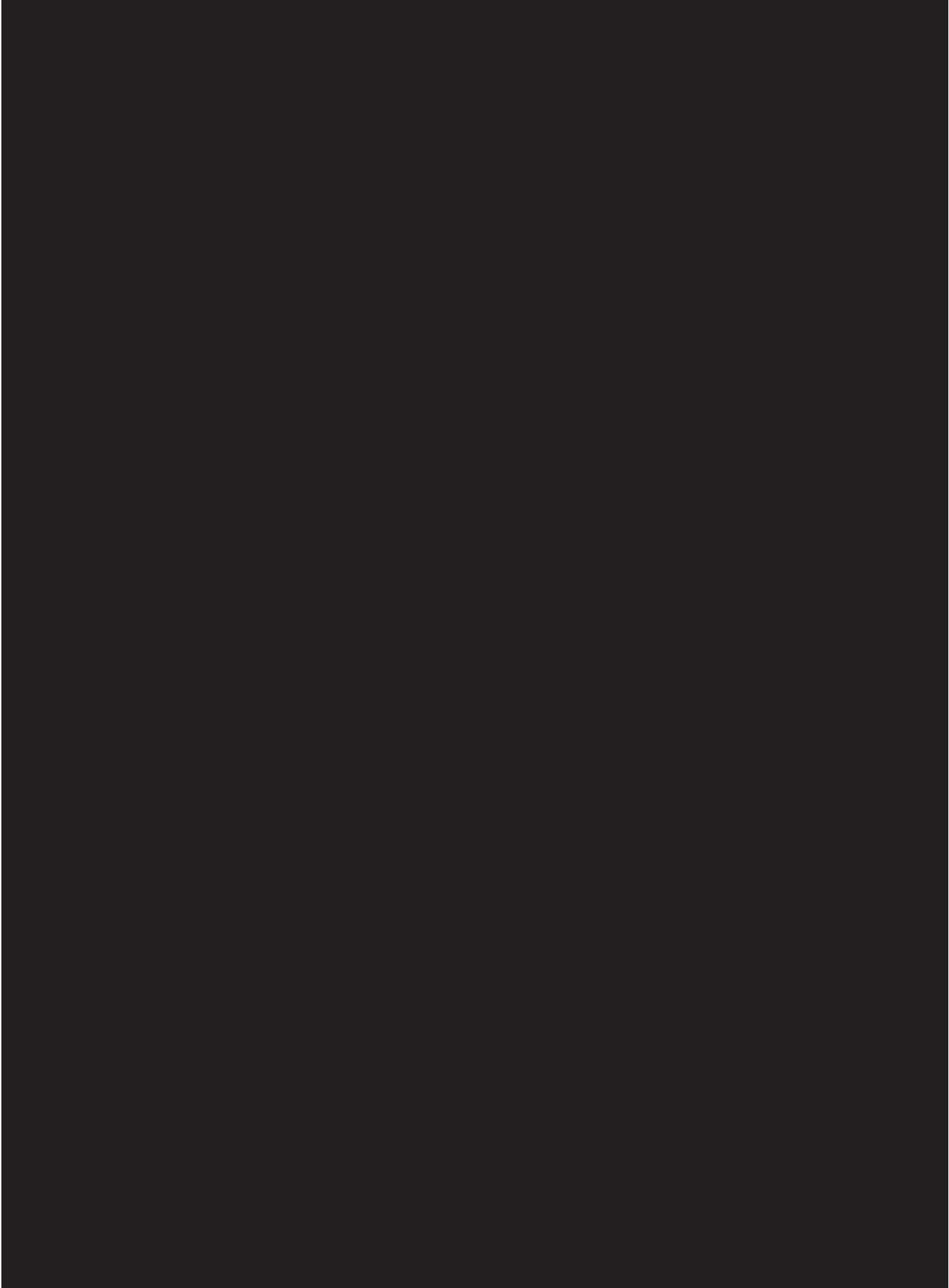
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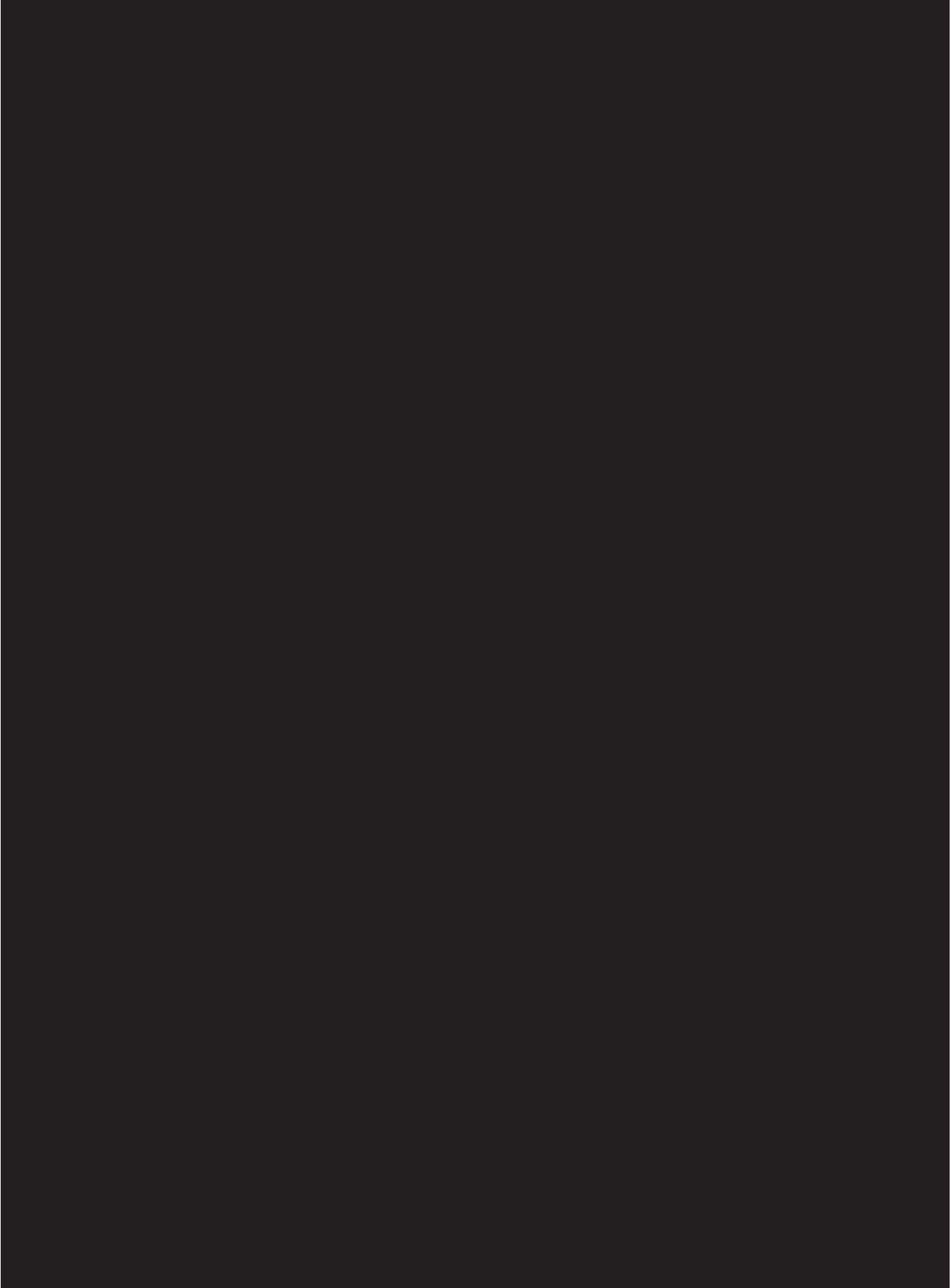
cc: Counsel of Record (*via email*)

Exhibit 27





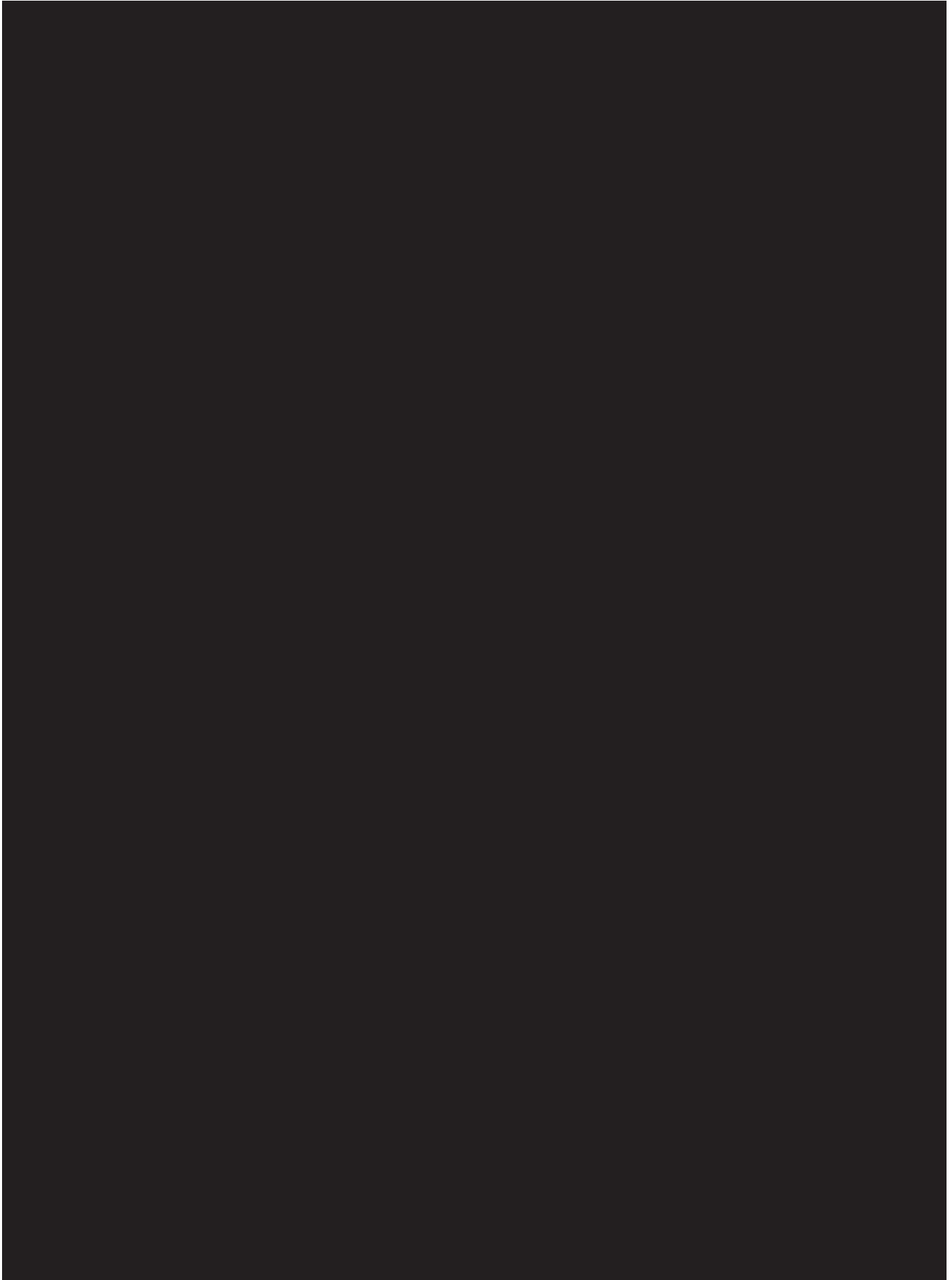






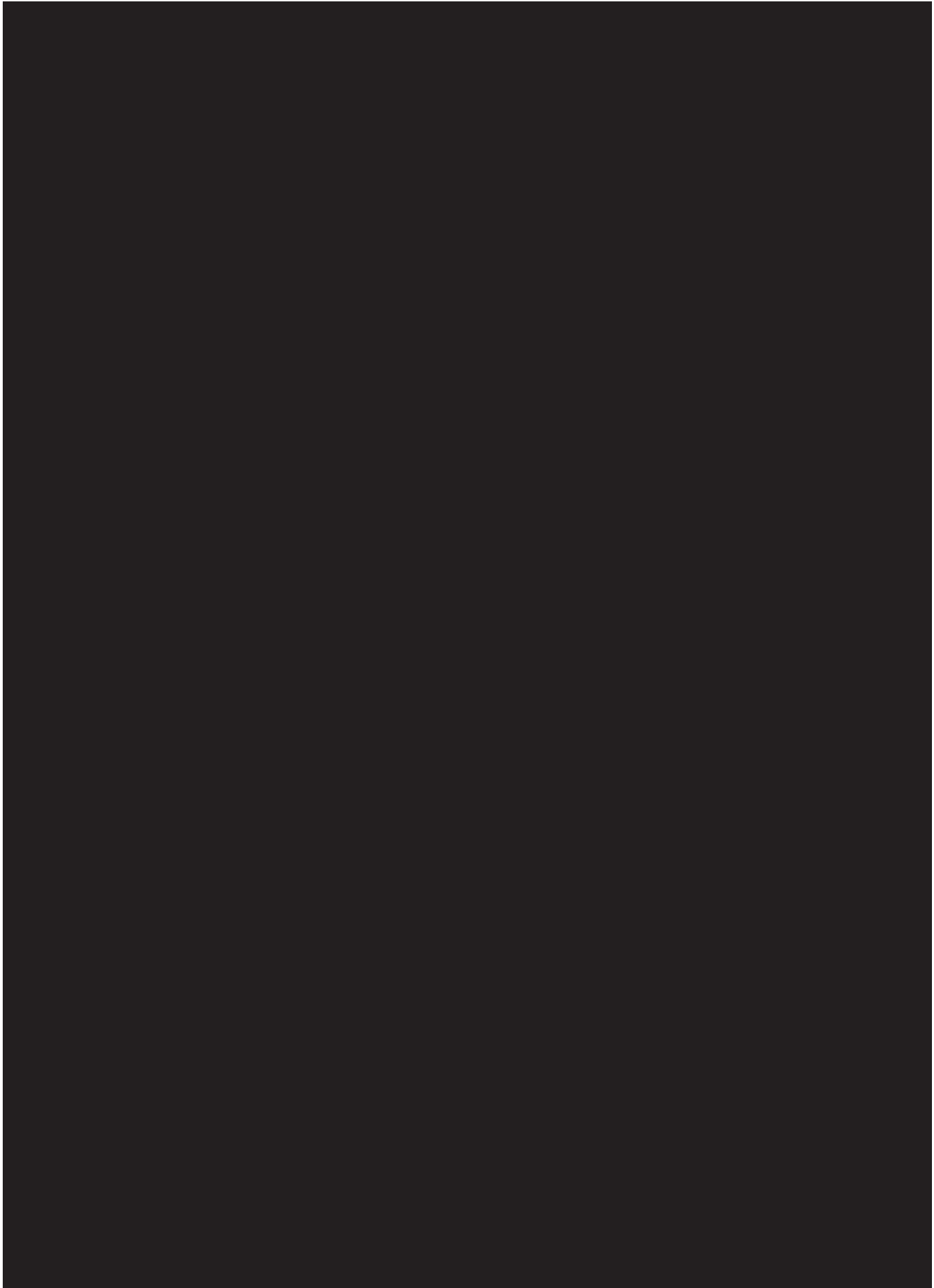


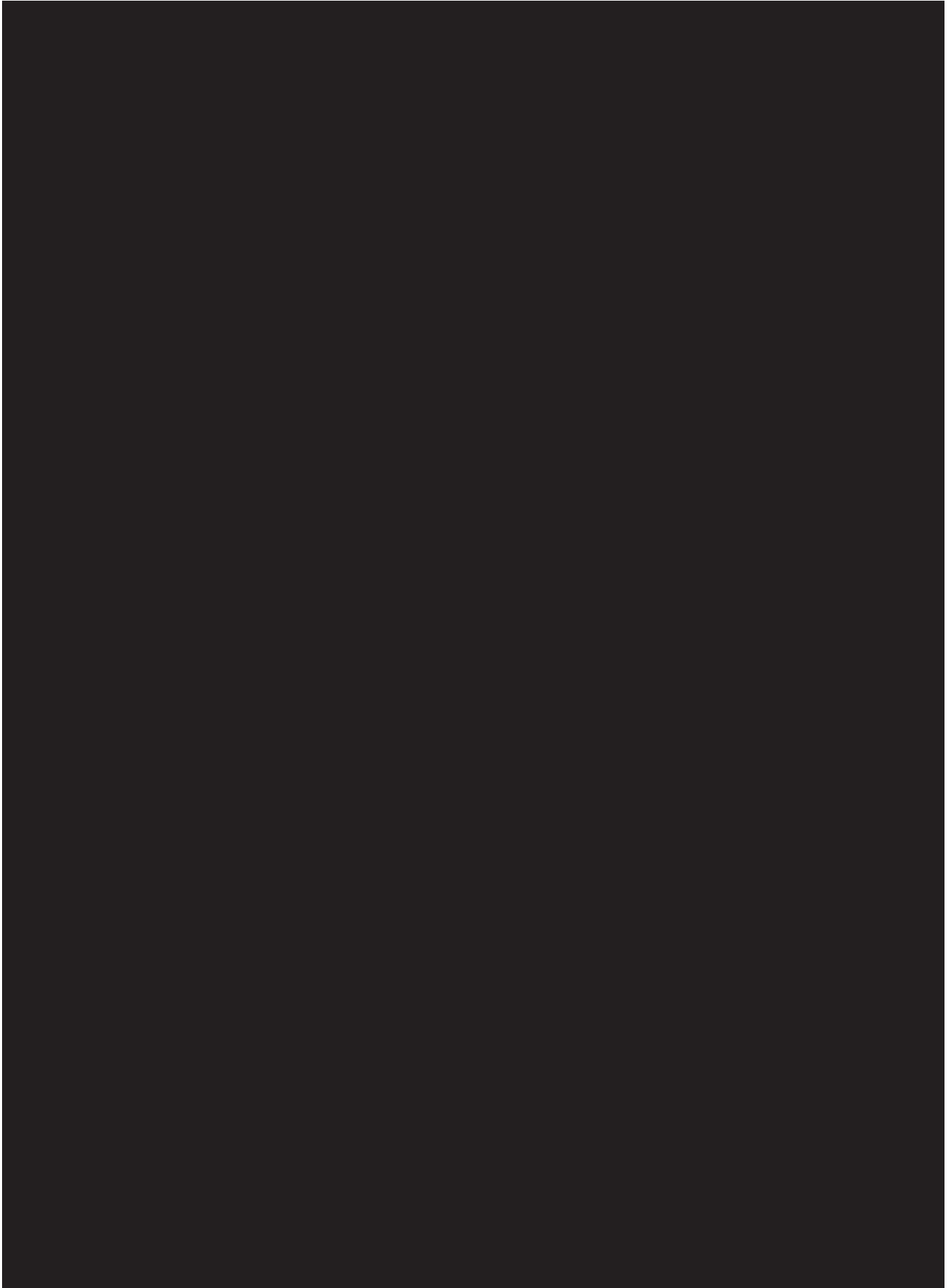


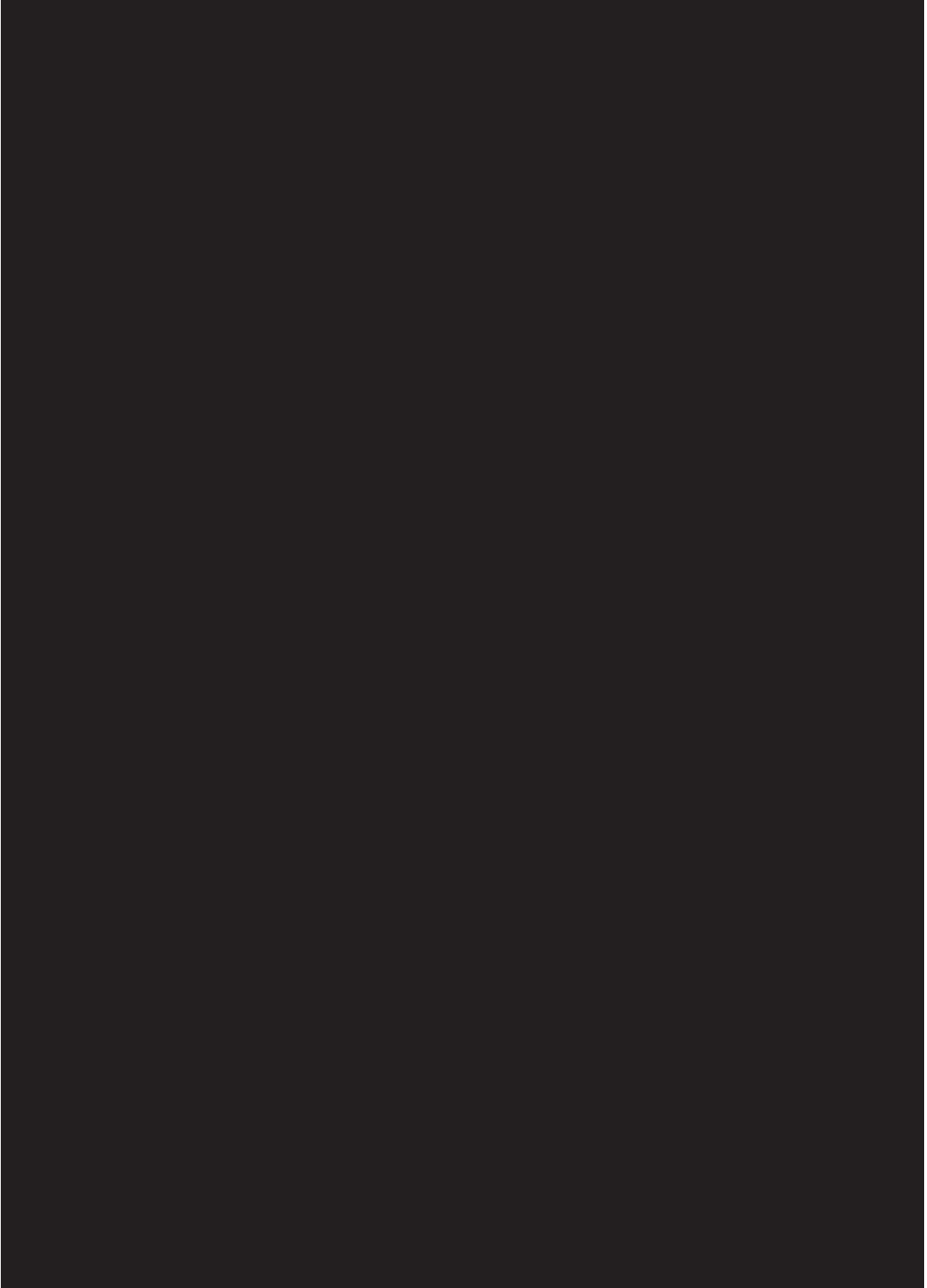


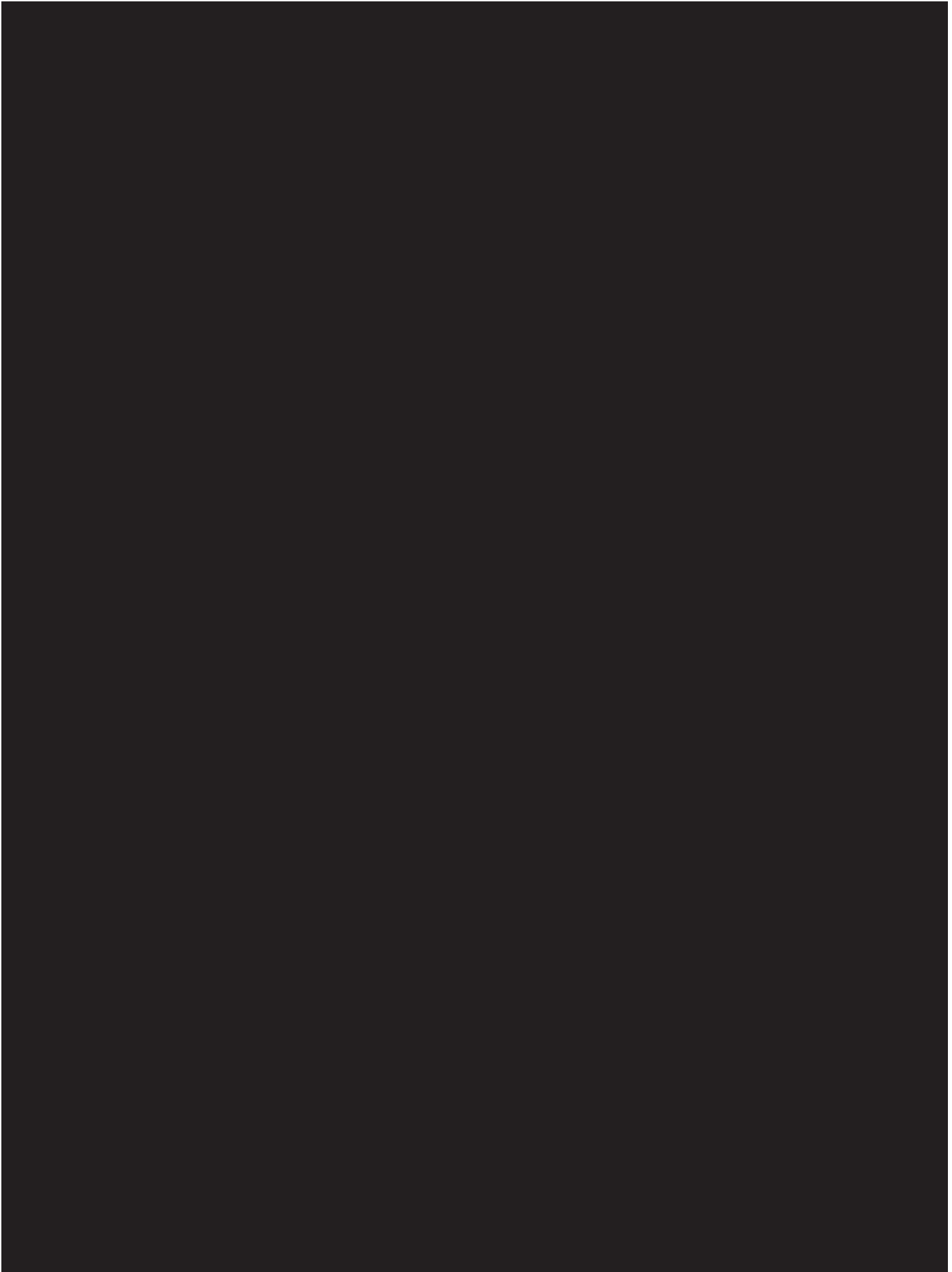




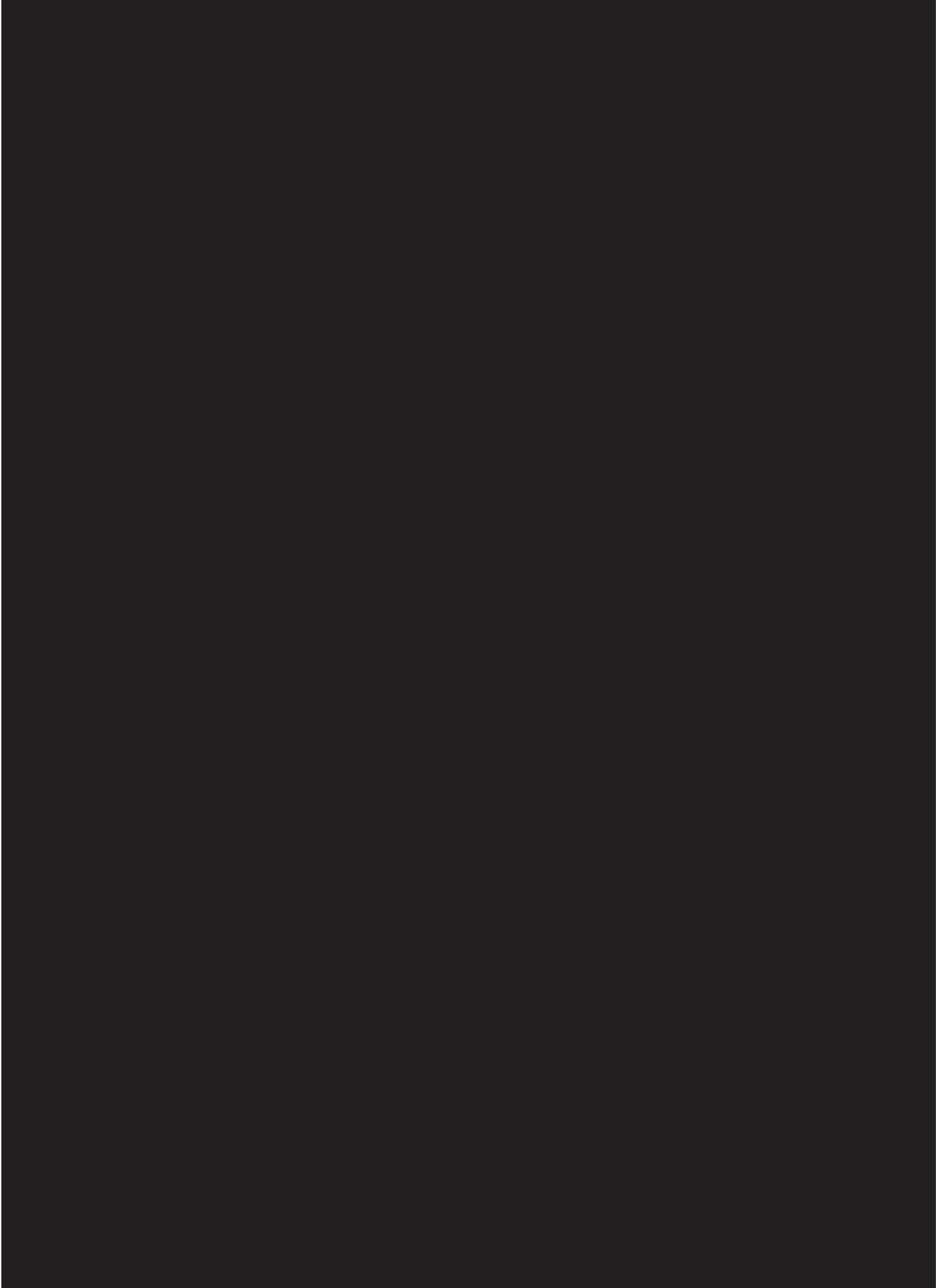


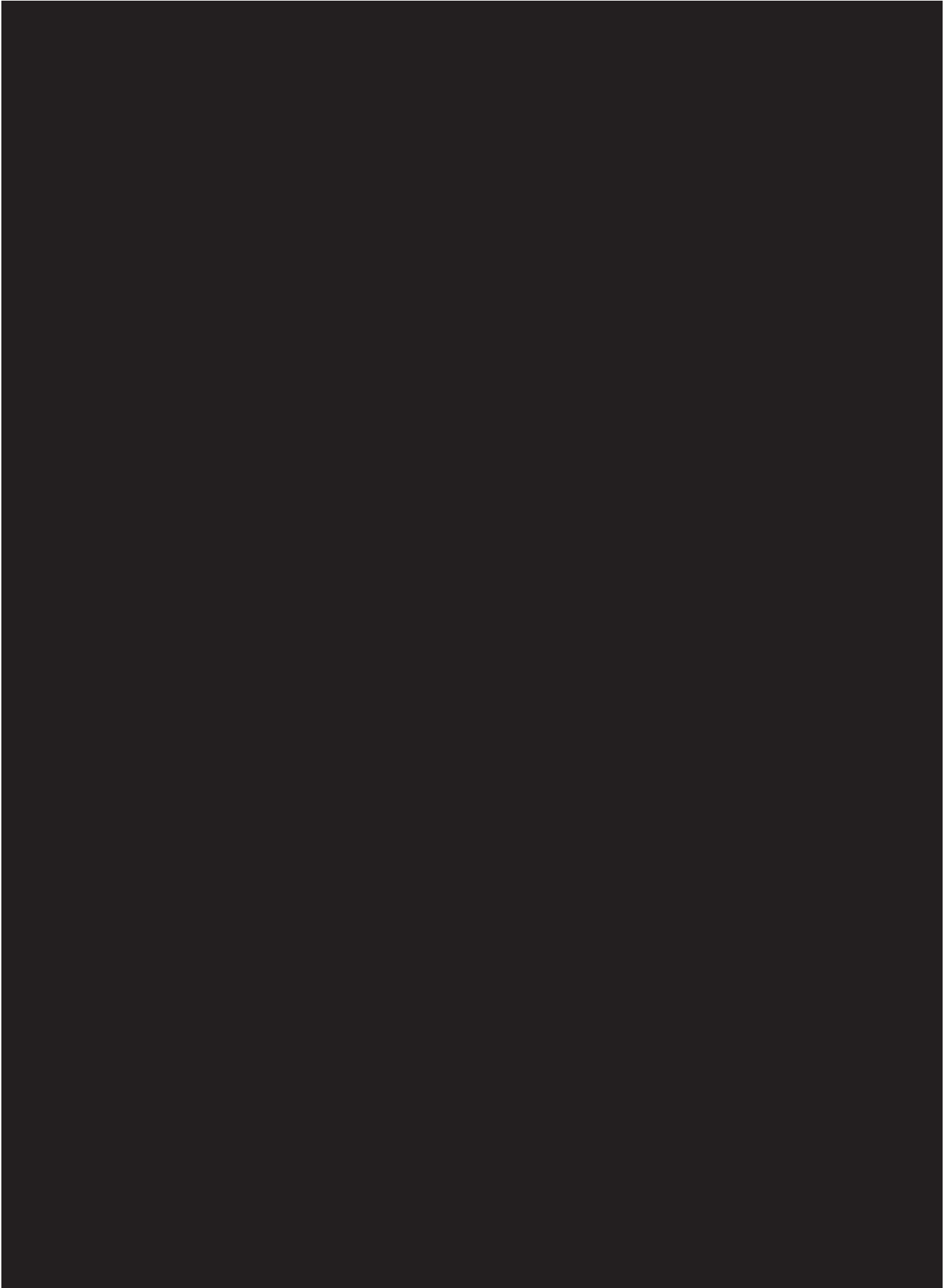


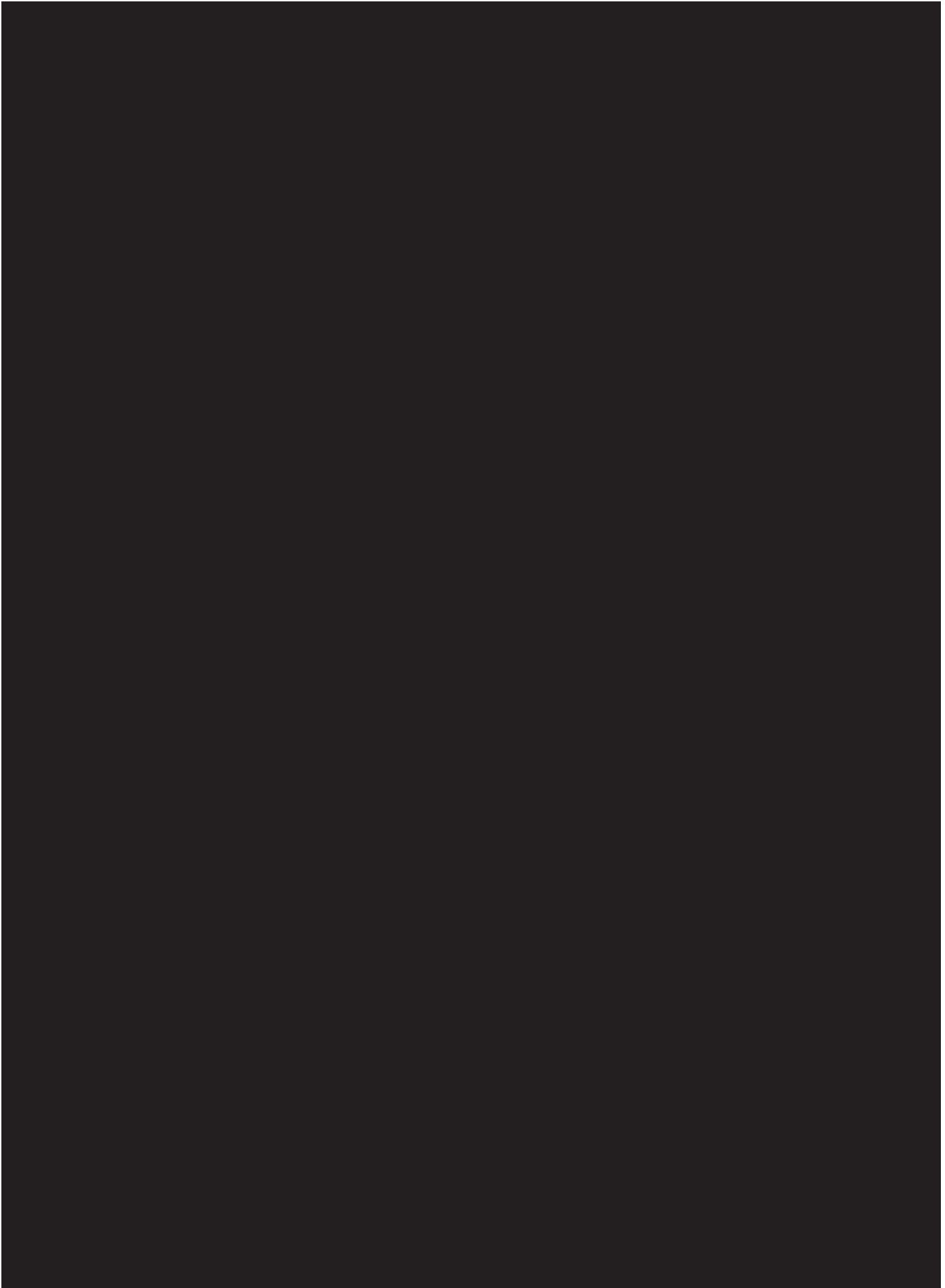


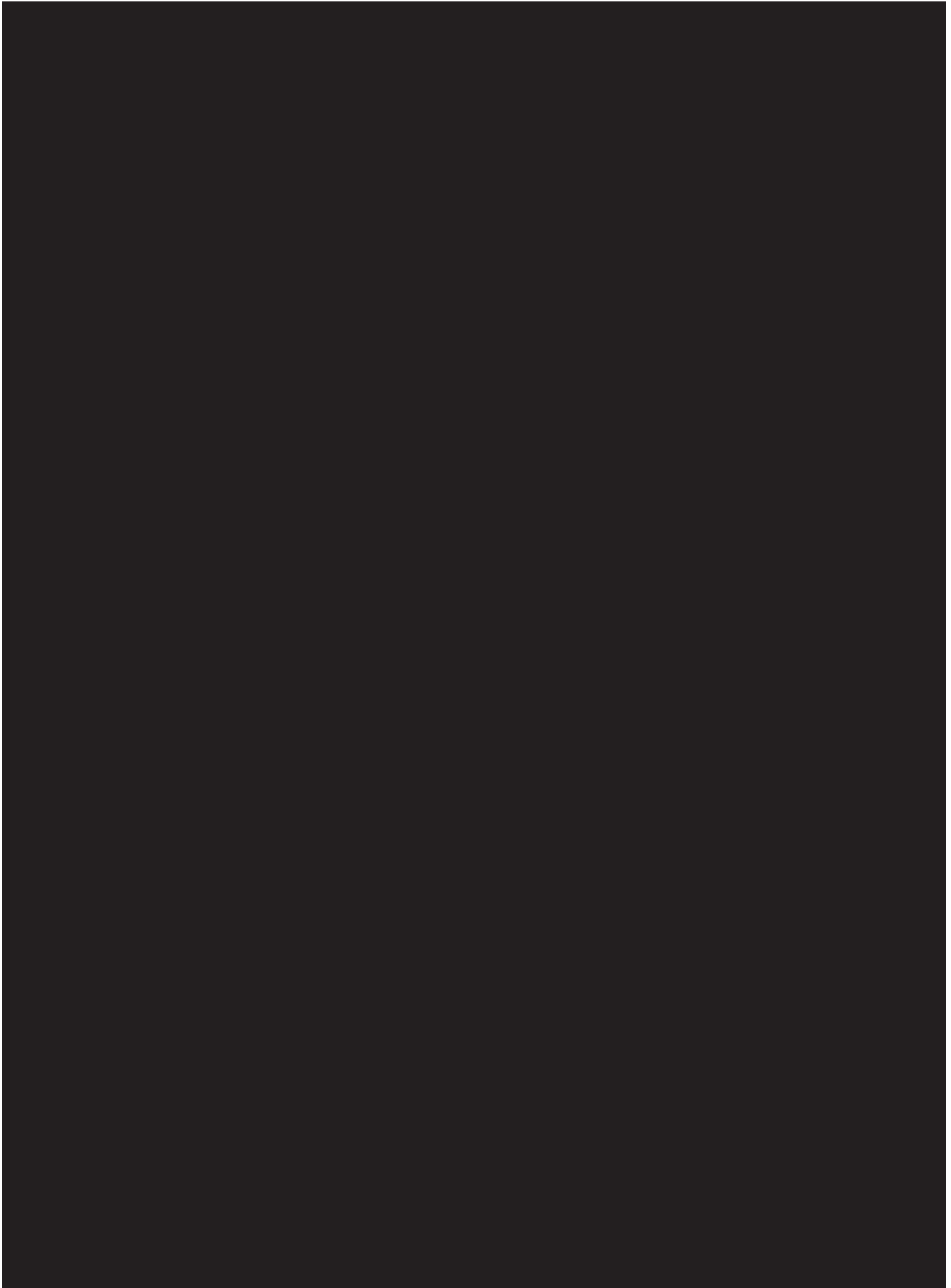


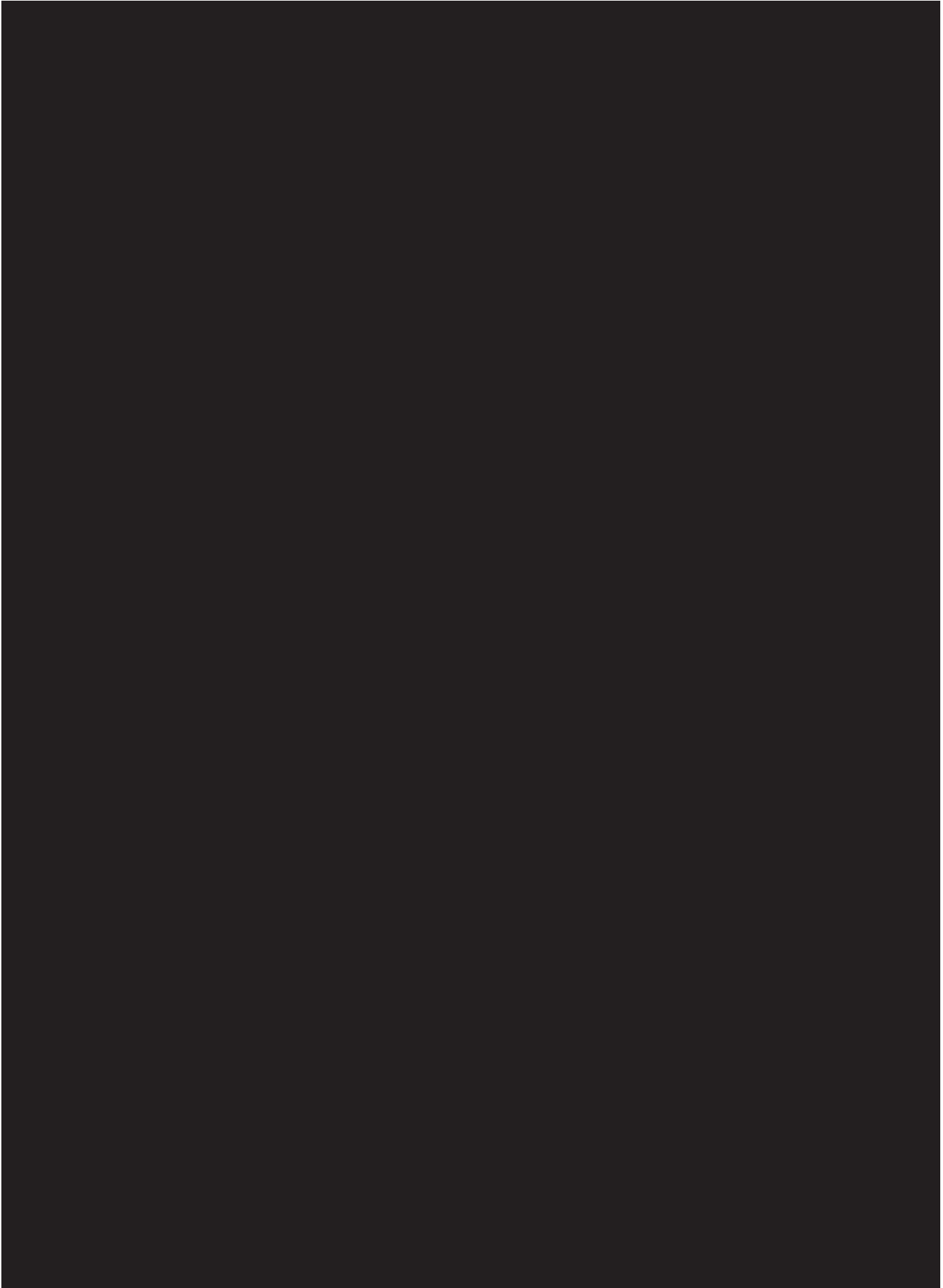


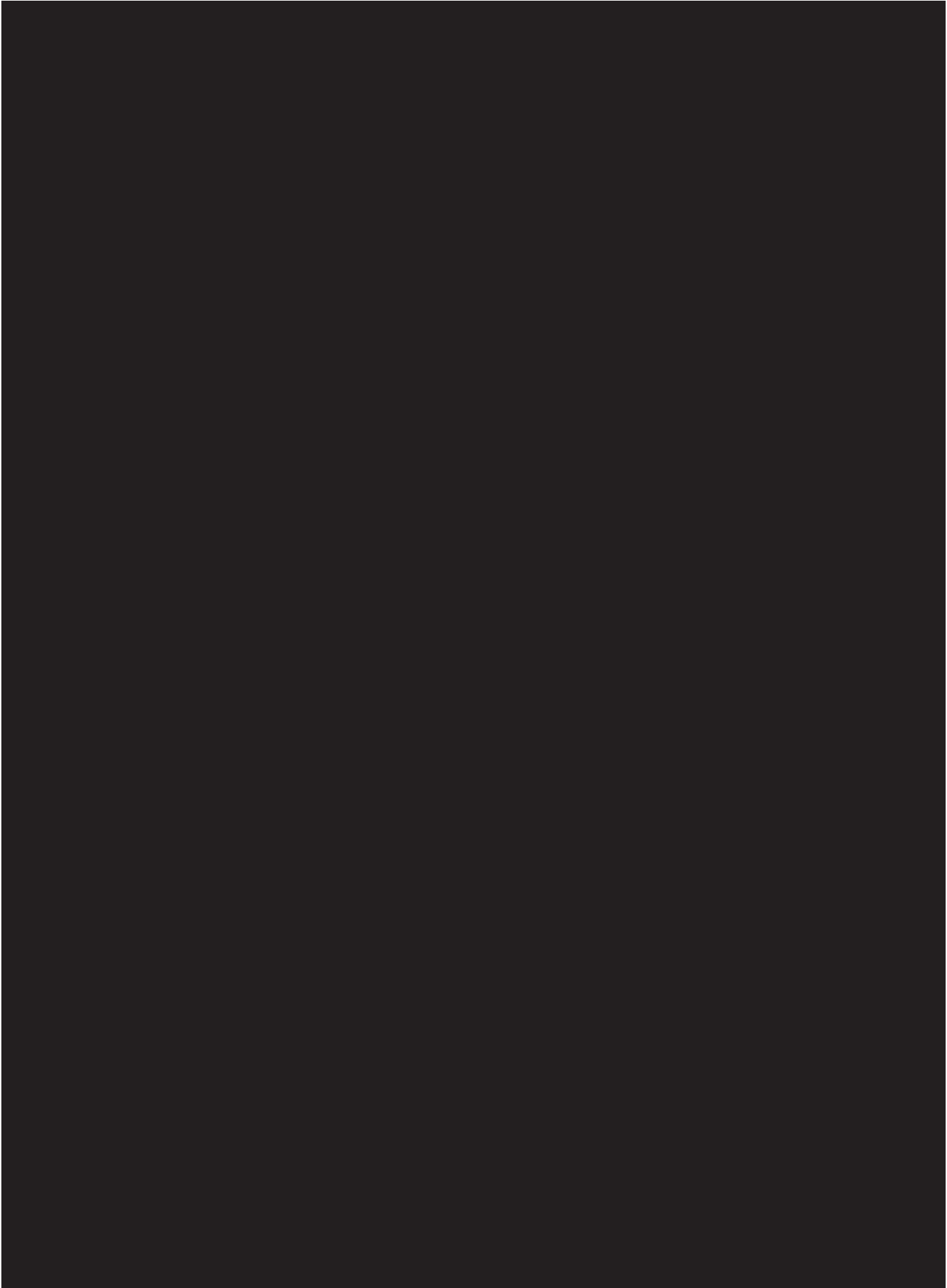








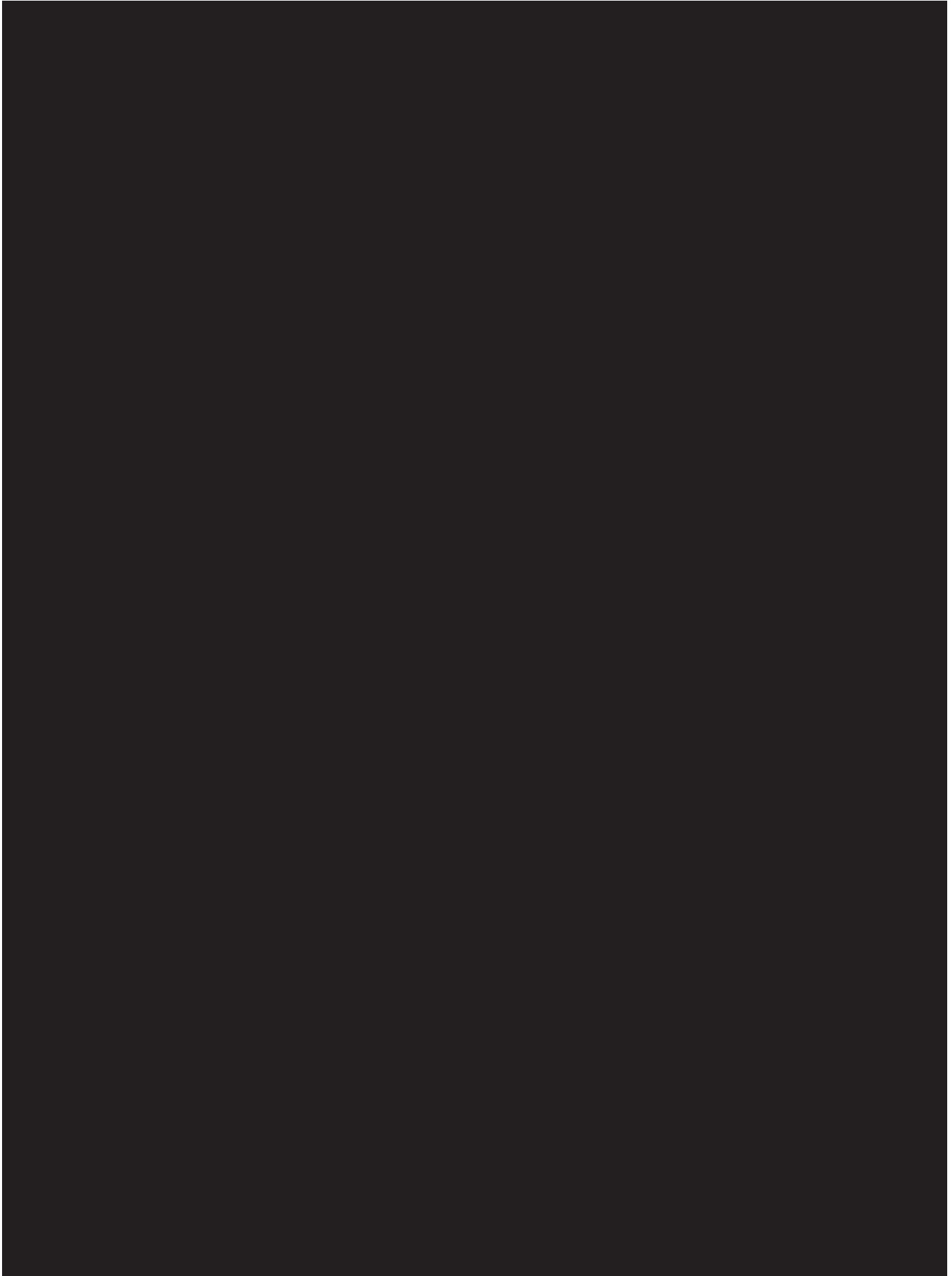


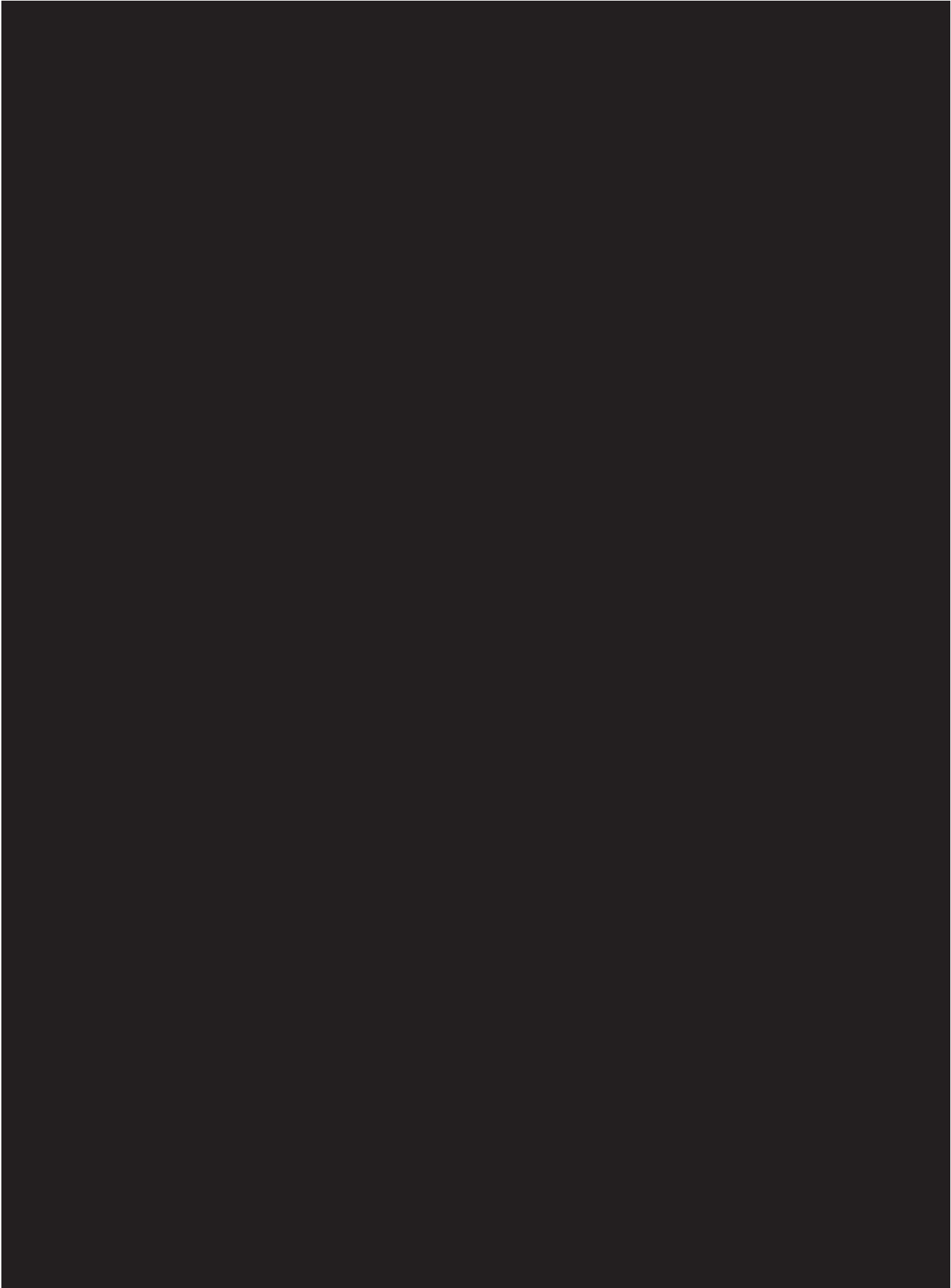


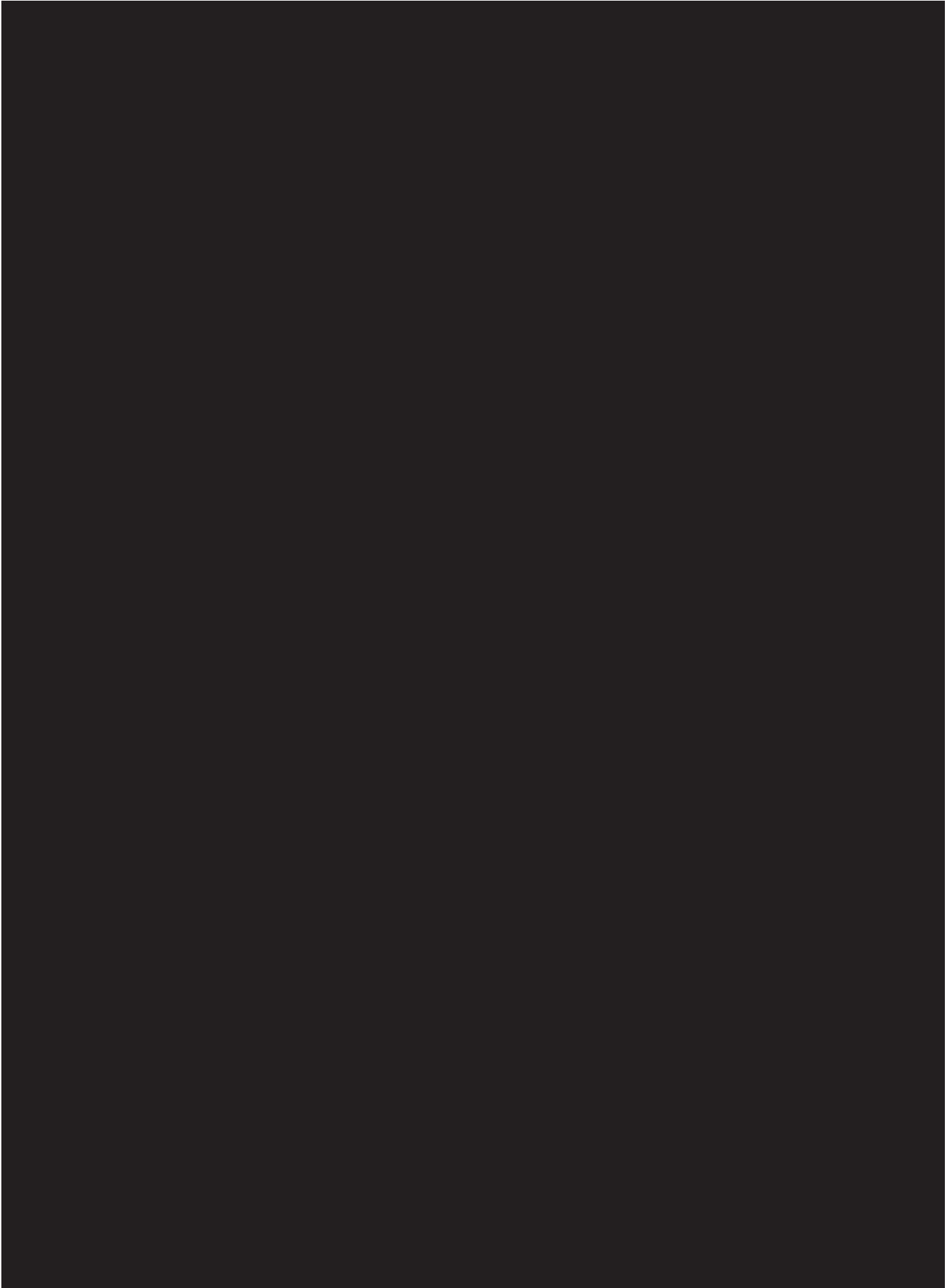


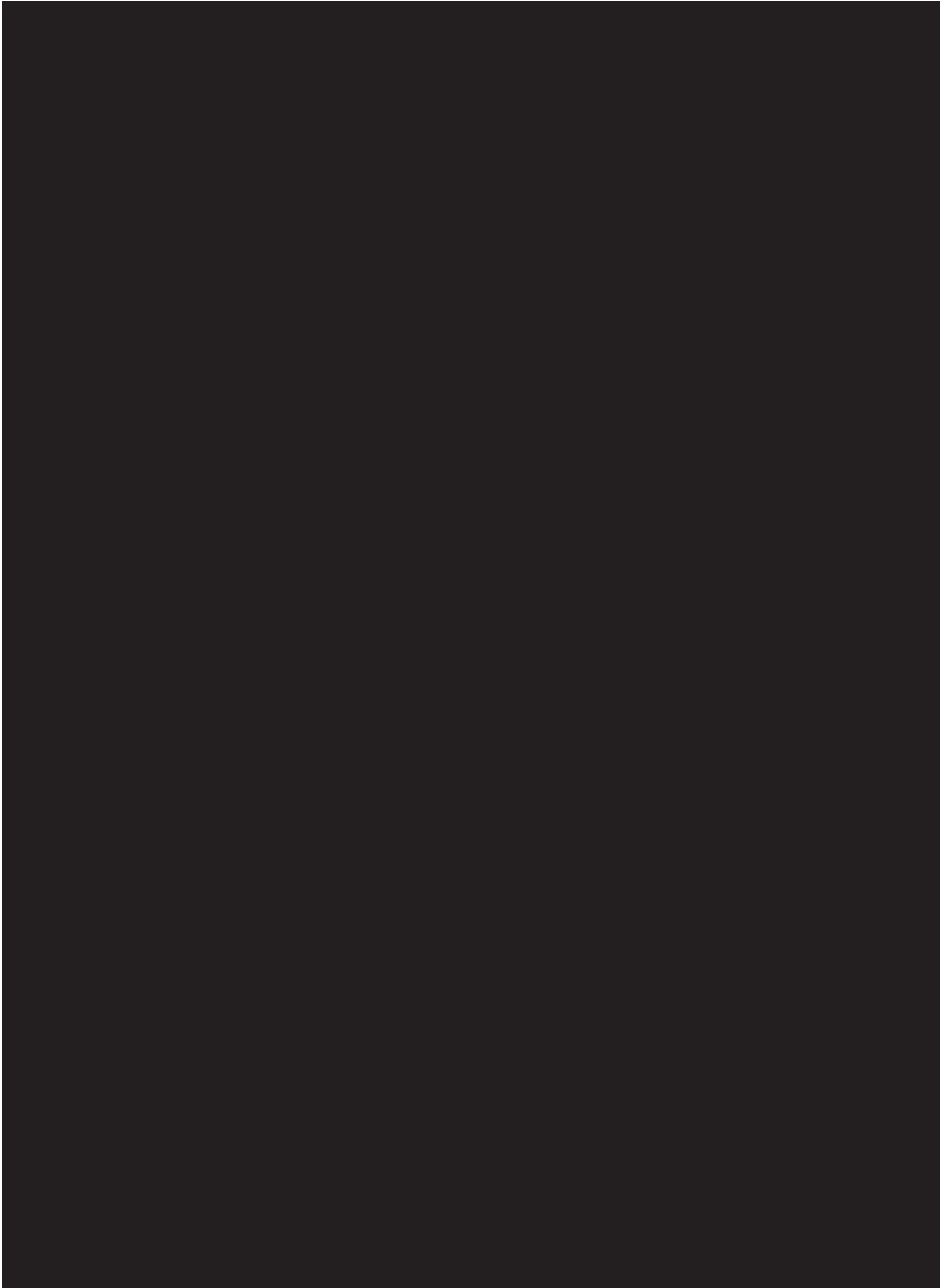


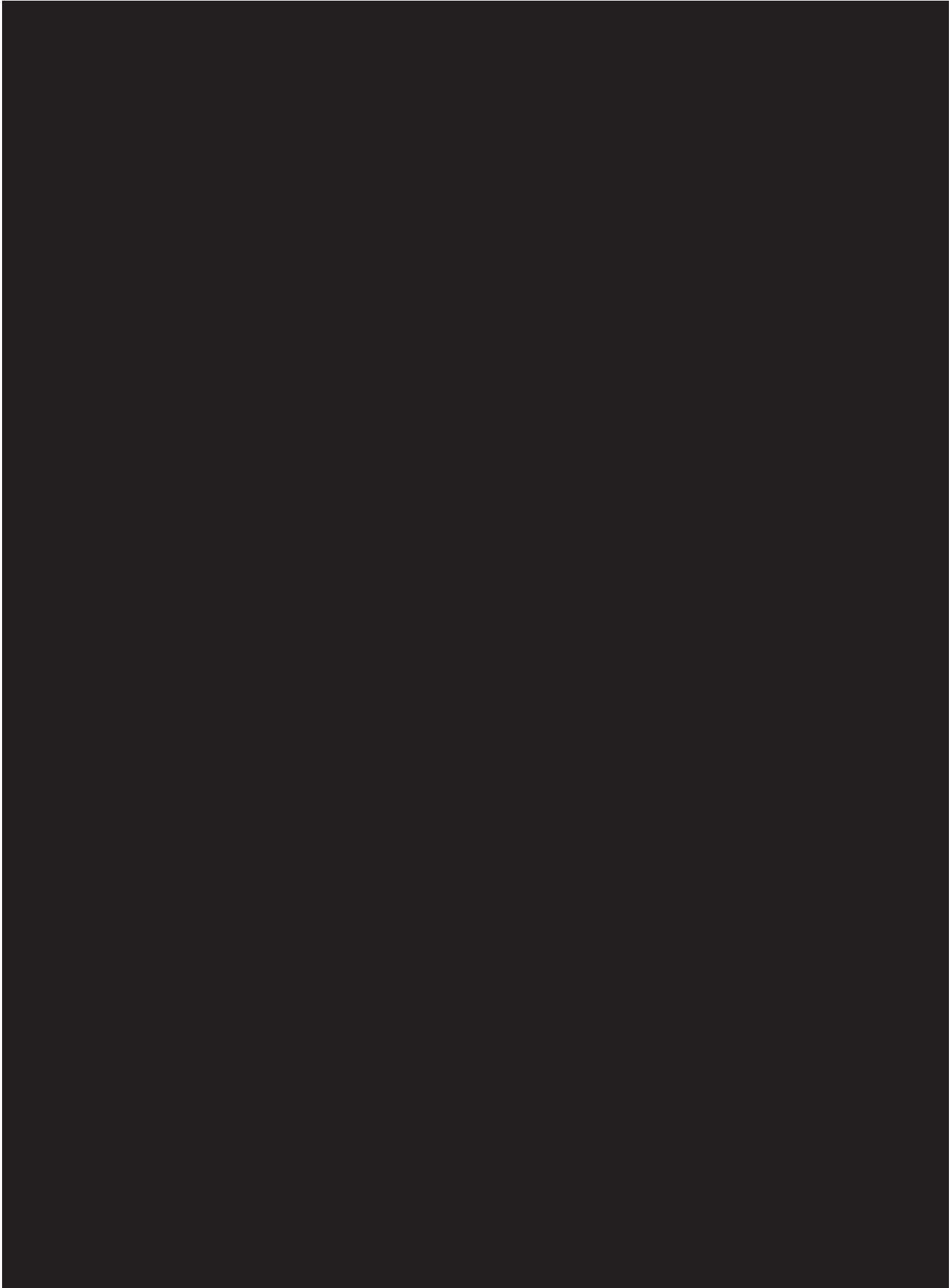






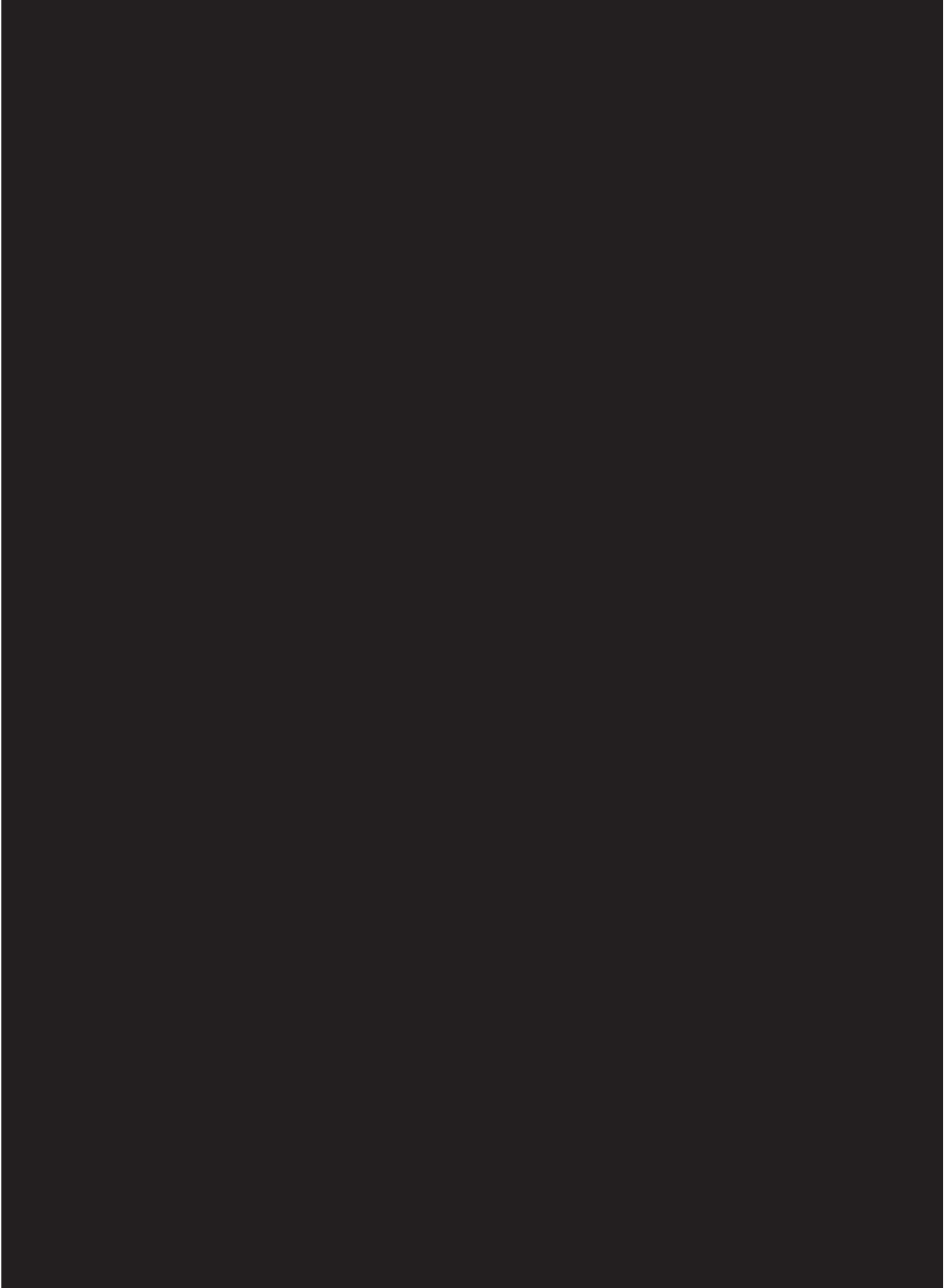


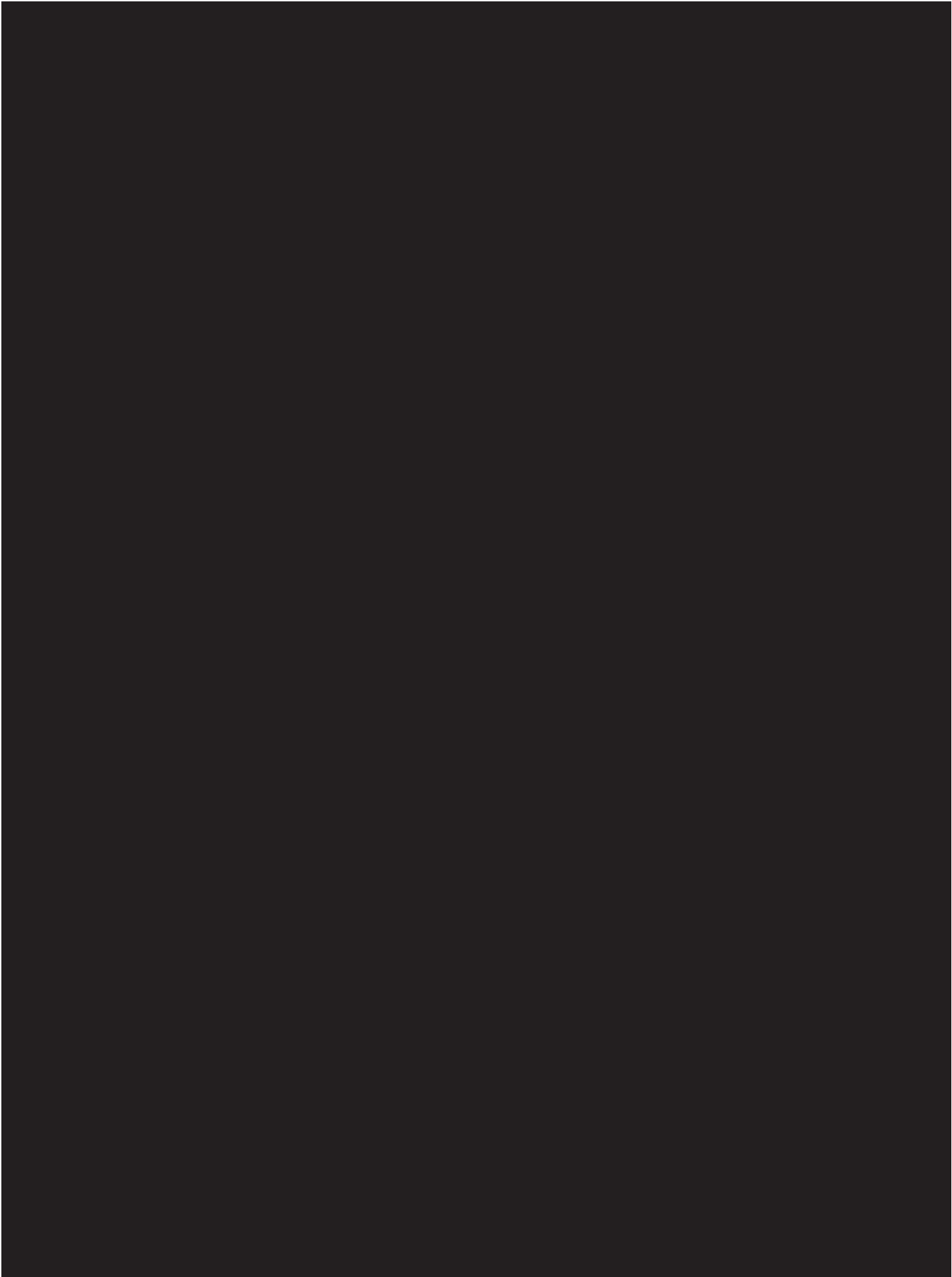


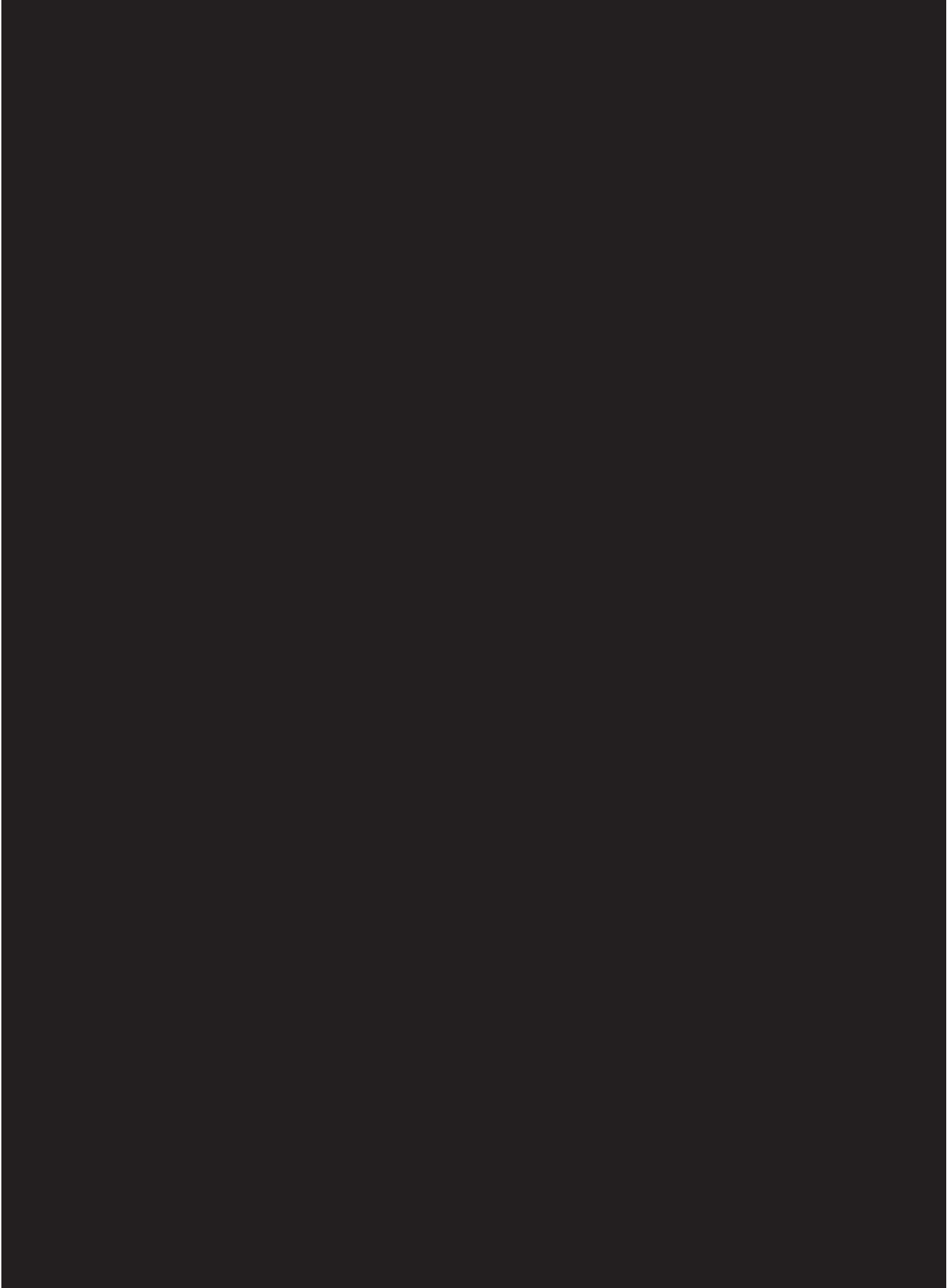






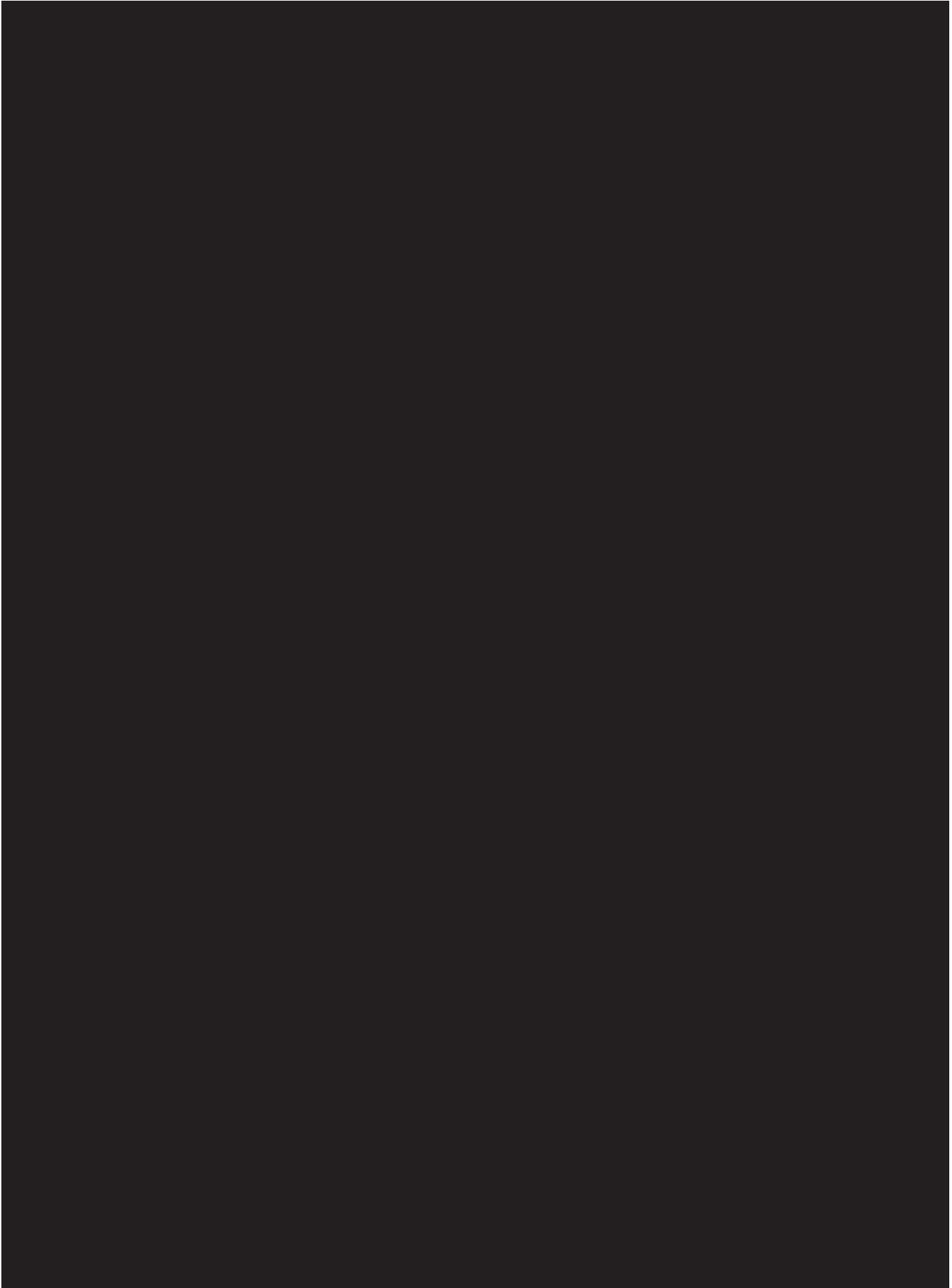




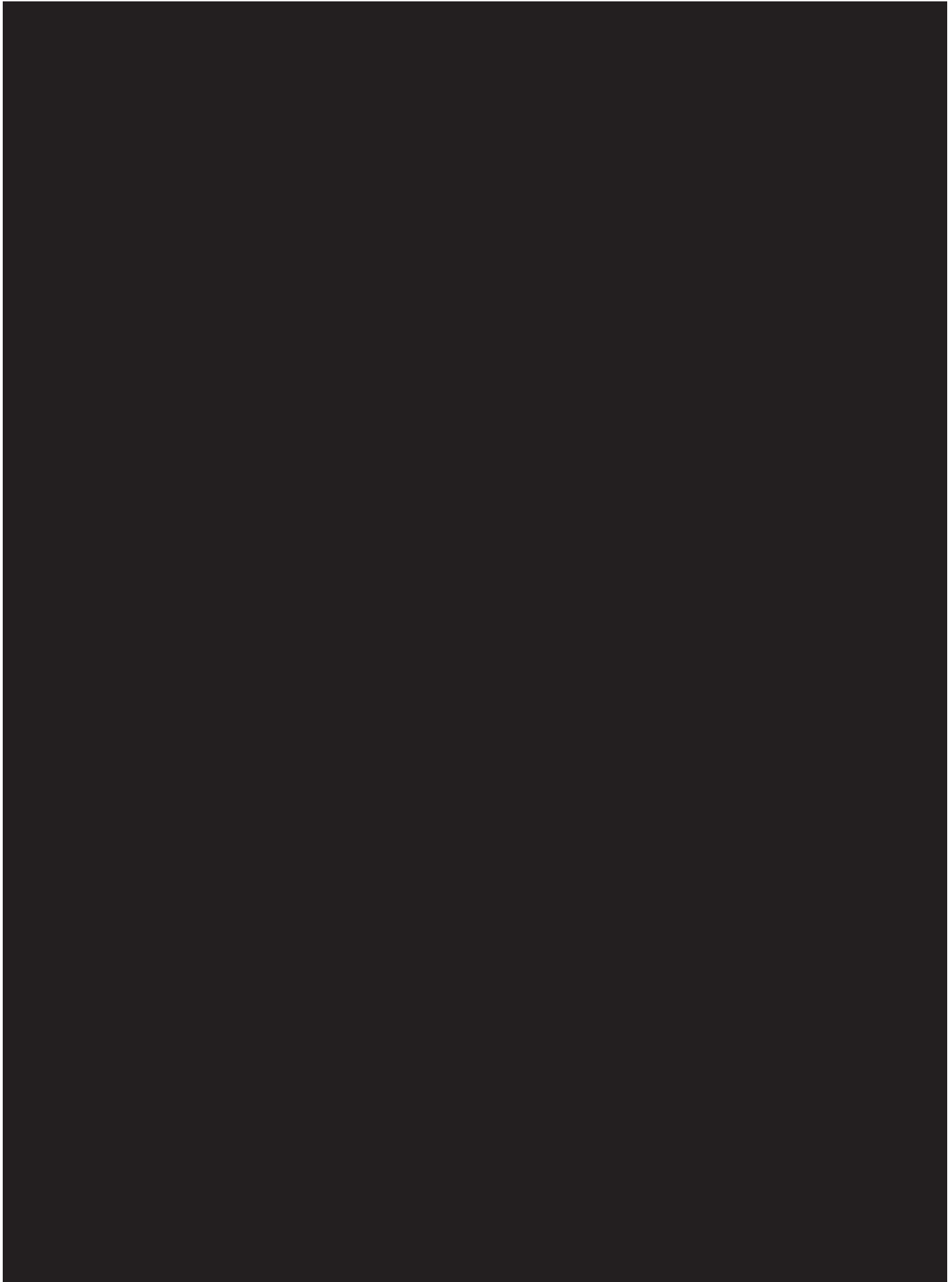












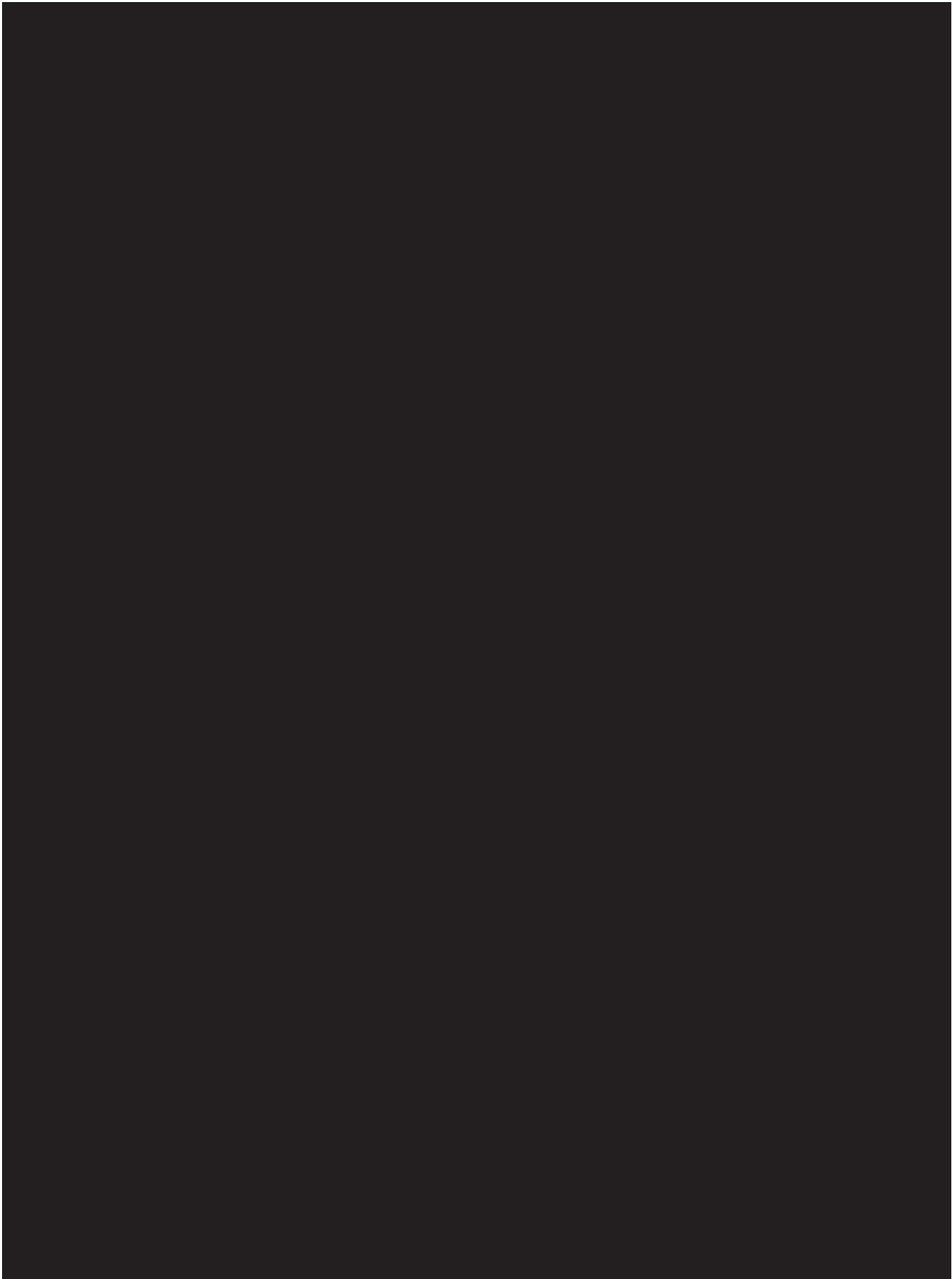




Exhibit 28

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

ELM 3DS INNOVATIONS, LLC, a Delaware limited liability company,)	
)	
Plaintiff,	)	C.A. No. 14-cv-1430-LPS-CJB
)	
v.	)	JURY TRIAL DEMANDED
)	
SAMSUNG ELECTRONICS CO., LTD., a Korean business entity,)	
SAMSUNG SEMICONDUCTOR, INC., a California Corporation,)	
SAMSUNG ELECTRONICS AMERICA, INC., a New York corporation, and)	
SAMSUNG AUSTIN SEMICONDUCTOR, LLC, a Delaware limited liability company,)	
Defendants.)	

**SAMSUNG’S FOURTH SUPPLEMENTAL OBJECTIONS AND RESPONSES TO
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Samsung makes the following general responses and objections (“General Objections”) to each “Definition,” “Instruction,” and “Interrogatory” propounded in Elm’s Third Set of

Interrogatories. These General Objections are hereby incorporated into each specific response. The assertion of the same, similar or additional objections or partial responses to individual interrogatories does not waive any of Samsung's General Objections.

1. Samsung objects to Elm's definition of "Elm" and "Elm 3DS" as vague, ambiguous, overbroad, and unduly burdensome to the extent that they include "all parents, subsidiaries, affiliates, assignees, predecessors, employees, and agents thereof." Samsung further objects to the definition as not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to the extent that these terms may include persons or entities that are not parties to this action.

2. Samsung objects to Elm's definitions of "you" and "your" as overbroad, unduly burdensome, and oppressive to the extent that they include Samsung "and their parents, subsidiaries, divisions, affiliates, predecessors, assigns, successors, and acquired assets of business units, and any of their present or former officers, directors, trustees, employees, agents, representatives, attorneys, patent agents, and all other persons acting on their behalf." Samsung will respond, subject to and without waiving all other objections, only as to the named Samsung Defendants: Samsung Electronics Co., Ltd., Samsung Semiconductor, Inc., Samsung Electronics America, Inc., and Samsung Austin Semiconductor, LLC.

3. Samsung objects to Elm's Instruction No. 1 because it purports to impose requirements and obligations on Samsung other than as set forth in the Federal Rules of Civil Procedure.

4. Samsung provides these objections and responses to the best of its current knowledge. Discovery or further investigation may reveal additional or different information warranting amendment of these objections and responses. Samsung reserves the right to produce at trial and make reference to any evidence, facts, documents, or information not discovered at

this time, omitted through good-faith error, mistake, or oversight, or the relevance of which Samsung has not presently identified.

5. By responding to these interrogatories, Samsung does not concede the relevance or materiality of any of the interrogatories or of the subjects to which it refers. Samsung's responses are made subject to, and without waiving any objections as to the competency, relevancy, materiality, privilege, or admissibility of any of the responses, or of the subject matter to which they concern, in any proceeding in this action or in any other proceeding.

6. Samsung objects to any interrogatory to the extent that it seeks information that is protected from disclosure by the attorney-client privilege, the attorney work product doctrine, the joint defense or common interest privilege, or any other applicable privilege, doctrine, or discovery immunity. The inadvertent production by Samsung of information protected from disclosure by any such privilege, doctrine, or immunity shall not be deemed a waiver by Samsung of such privileges or protections.

7. Samsung objects generally to the interrogatories to the extent they seek confidential, proprietary, or trade secret information of third parties. Samsung will endeavor to work with third parties in order to obtain their consent, if necessary, before providing such information. To the extent an interrogatory seeks information of a confidential or proprietary nature to Samsung, or to others to whom Samsung is under an obligation of confidentiality, Samsung will respond pursuant to the terms of the protective order entered in this case and subject to notice to third parties, as necessary.

8. Samsung objects to each interrogatory and to Elm's "Definitions" and "Instructions" to the extent they are vague, ambiguous, overbroad, unduly burdensome, are not proportional to the needs of this case, or purport to impose upon Samsung any duty or obligation that is inconsistent with or in excess of those obligations that are imposed by the Federal Rules of Civil Procedure, the Civil Local Rules and/or the Patent Local Rules of this Court, or any other applicable rule.

9. Samsung objects to any interrogatory to the extent it seeks irrelevant information about Samsung's products or business operations, or is not otherwise proportional to the needs of this case. Such requests are overbroad and unduly burdensome. Samsung will only produce information that is relevant to the patents-in-suit, or that is otherwise related to the claims or defenses asserted by the parties in this litigation.

10. Samsung objects to each interrogatory to the extent that it would impose a duty on Samsung to undertake a search for or an evaluation of information, documents, or things for which Elm is equally able to search for and evaluate and/or is not proportional to the needs of this case. In particular, Samsung objects to each interrogatory to the extent that it seeks information or documents that are publicly available.

11. Samsung objects to each interrogatory to the extent that it seeks information that can be derived or ascertained from documents that will be produced in discovery, is not otherwise proportional to the needs of this case, or that is uniquely in Elm's possession, custody, and control.

12. Samsung objects to each interrogatory to the extent it would require Samsung to draw a legal conclusion or contention to make a proper response.

13. Samsung objects to each interrogatory to the extent that it purports to define words or phrases to have a meaning different from their commonly understood meaning, or to include more than their commonly understood definitions.

14. In Samsung's objections, the terms "and" and "or" are intended to be construed conjunctively or disjunctively as necessary to make the objections inclusive rather than exclusive.

15. Samsung objects to each interrogatory to the extent it purports to require Samsung to identify or describe or identify "every," "each," "any," or other similarly expansive, infinite, or all-inclusive terms as overbroad and unduly burdensome.

16. Samsung objects to Elm's "Instructions" and the interrogatories to the extent they seek information that is not in the possession, custody, or control of Samsung, purport to require Samsung to speculate about the identity of persons who might have responsive documents, and/or purport to call for any description of documents that Samsung no longer possesses and/or was under no obligation to maintain.

17. Samsung objects to each interrogatory to the extent it is not limited in time and seeks information for periods of time that are not relevant to any claim or defense and is not otherwise proportional to the needs of this case.

18. Samsung objects to the interrogatories as a whole, and to each interrogatory contained therein, to the extent they are overbroad, unreasonably burdensome, and/or not proportional to the needs of this case. In particular, Samsung objects to the interrogatories as a whole, and to each interrogatory contained therein, to the extent they seek irrelevant information about accused products. By answering, objecting, and otherwise responding to the interrogatories, Samsung does not concede relevance or admissibility, both of which Samsung reserves the right to challenge.

19. Samsung objects to the interrogatories as a whole, and to each interrogatory contained therein, to the extent they are premature and/or to the extent they: (a) conflict with any schedule entered by the Court; (b) seek information that is the subject of expert testimony; (c) seek information and/or responses that are dependent on the Court's construction of the asserted claims of the patents-in-suit; or (d) are dependent on depositions and documents that have not been taken or produced.

20. Samsung's objections as set forth herein are made without prejudice to Samsung's right to assert any additional or supplemental objections pursuant to Rule 26(e).

21. Samsung will make, and has made, reasonable efforts to respond to Elm's Third Set of Interrogatories, to the extent that no objection is made, as Samsung reasonably understands and interprets each Interrogatory. If Elm subsequently asserts any interpretation of

any interrogatory that differs from the interpretation of Samsung, then Samsung reserves the right to supplement and amend its objections and responses.

OBJECTIONS AND RESPONSES TO INTERROGATORIES

Subject to the foregoing qualifications and General Objections and the specific objections made below, Samsung objects and responds to Elm's Third Set of Interrogatories as follows:

INTERROGATORY NO. 4:

Identify by part number all Stacked Integrated Circuit Products that (A) are not included in the Second Amended Accused Product List served on June 3, 2016, and (B) that you (1) sell directly to an affiliate or third party, and/or (2) incorporate in products that you subsequently sell to an affiliate or a third party.

OBJECTIONS AND RESPONSE TO INTERROGATORY NO. 4:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this interrogatory to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this interrogatory to the extent that it seeks private, privileged, and confidential commercial, financial, and/or proprietary business information. Samsung further objects to this interrogatory as overbroad, unduly burdensome, and not proportional to the needs of this case, particularly to the extent that it may include products that are not manufactured by Samsung and/or products that are not imported, sold, or offered for sale in the United States by Samsung. Samsung further objects to this interrogatory to the extent that it is duplicative and seeks information that can be derived or ascertained from documents that were produced in discovery and that is uniquely in Elm's possession, custody and control. Samsung further objects to this interrogatory on the grounds that it is vague, ambiguous, and overbroad as to "affiliate," "third party," and "incorporate in

products.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this interrogatory as overbroad to the extent it is unlimited with respect to time or geography.

Subject to and without in any way waiving the foregoing objections, and to the extent it understands this interrogatory, Samsung responds as follows: pursuant to Federal Rule of Civil Procedure 33(d), Samsung refers Elm to the documents bearing bates numbers SAMSUNG-ELM-000025176 – SAMSUNG-ELM-000050134, wherein information responsive to this interrogatory may be found. Samsung expressly reserves the right to supplement this response following further investigation and/or discovery.

FIRST SUPPLEMENTAL OBJECTIONS AND RESPONSE TO INTERROGATORY NO. 4:

Samsung further objects to this interrogatory as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired or will expire soon, Samsung objects to this interrogatory to the extent it seeks post-patent expiration data.

Subject to and without waiving the foregoing general and specific objections, and to the extent it understands this interrogatory, Samsung further responds as follows:

Appendix A, attached hereto, lists all stacked silicon die packages having two or more vertically stacked die that have been sold in the United States in the period between 2007 to present and that are not included in the Second Amended Accused Product List served on June 3, 2016.

Samsung expressly reserves the right to amend or supplement this response following further investigation and/or discovery.

SECOND SUPPLEMENTAL OBJECTIONS AND RESPONSE TO INTERROGATORY NO. 4:

Subject to and without waiving the foregoing general and specific objections, and to the extent it understands this interrogatory, Samsung further responds as follows: pursuant to Federal Rule of Civil Procedure 33(d), Samsung refers Elm to the documents bearing bates numbers SAMSUNG-ELM-000058542 – SAMSUNG-ELM-000058543, wherein information responsive to this interrogatory may be found.

These documents provide a revised list of all stacked silicon die packages having two or more vertically stacked die that have been sold in the United States in the period between 2007 to present and that are not included in the Second Amended Accused Product List served on June 3, 2016, and replaces the list in Appendix A to Samsung’s First Supplemental Objections and Responses to Elm’s Third Set of Interrogatories served on August 9, 2018. These documents include certain information regarding the identified packages, including the number of stacked chips, process node, product type, whether the stacked die are interconnected by wiring or through-silicon vias, and die thickness, to the extent known after a reasonable search.

[REDACTED]

Die thickness is provided separately for each die in SAMSUNG-ELM-000058543 except where otherwise indicated. In particular, where indicated, a provided die thickness may apply to multiple stacked die in a package.

Samsung expressly reserves the right to amend or supplement this response following further investigation and/or discovery.

THIRD SUPPLEMENTAL OBJECTIONS AND RESPONSE TO INTERROGATORY NO. 4:

Subject to and without waiving the foregoing general and specific objections, and to the extent it understands this interrogatory, Samsung further responds as follows: pursuant to Federal Rule of Civil Procedure 33(d), Samsung refers Elm to the document bearing bates number SAMSUNG-ELM-000062355, wherein information responsive to this interrogatory may be found.

This document provides a revised list of all stacked silicon die memory packages having two or more vertically stacked die that have been sold in the United States in the period between 2007 to present and replaces the list of products provided in document SAMSUNG-ELM-000058543, as referred to in Samsung's Second Supplemental Objections and Responses to Elm's Third Set of Interrogatories served on September 20, 2019.

This document includes certain information regarding the identified packages, including the number of stacked dies and the minimum thickness of at least one stacked die in each product, to the extent known after a reasonable search.

Samsung expressly reserves the right to amend or supplement this response following further investigation and/or discovery.

FOURTH SUPPLEMENTAL OBJECTIONS AND RESPONSE TO INTERROGATORY NO. 4:

Subject to and without waiving the foregoing general and specific objections, and to the extent it understands this interrogatory, Samsung further responds as follows: pursuant to Federal Rule of Civil Procedure 33(d), Samsung refers Elm to the document bearing bates number

SAMSUNG-ELM-000062356, wherein information responsive to this interrogatory may be found.

This document provides a revised list of all stacked silicon die memory packages having two or more vertically stacked die that have been sold in the United States in the period between 2007 to present and replaces the list of products provided in document SAMSUNG-ELM-000062355, as referred to in Samsung's Third Supplemental Objections and Responses to Elm's Third Set of Interrogatories served on September 20, 2019.

This document includes certain information regarding the identified packages, including the number of stacked dies and the minimum die thickness for each product, to the extent known after a reasonable search.

Samsung expressly reserves the right to amend or supplement this response following further investigation and/or discovery.

DATED: November 15, 2019

OF COUNSEL:

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YOUNG CONAWAY STARGATT &
TAYLOR, LLP

/s/ Adam W. Poff

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Samsung Electronics America, Inc., and
Samsung Austin Semiconductor, LLC*

VERIFICATION

I,  declare:

I am a Director of the Licensing Team at Samsung Electronics Co., Ltd., defendant in the above-titled action, and I have been authorized to make this verification on its behalf.

I have read the foregoing SAMSUNG's FOURTH SUPPLEMENTAL OBJECTIONS AND RESPONSES TO ELM'S THIRD SET OF INTERROGATORIES, and know the contents thereof. I am informed and believe that the factual statements stated therein are true and on that ground declare under penalty of perjury under the laws of the United States of America that the same are true and correct.

Executed at Seoul, South Korea on this 17th day of November, 2019.



CERTIFICATE OF SERVICE

I, Adam W. Poff, hereby certify that on November 15, 2019, I caused a true and correct copy of the foregoing document to be served on the following counsel of record in the manner indicated:

BY E-MAIL

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Attorneys for Defendants

Exhibit 29

Kidokoro, Koichiro

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Sunday, December 15, 2019 12:12 PM
To: Mariano, Andrea
Cc: Mailing List - Leedy; 'Bfarnan@farnanlaw.com'; 'Mfarnan@farnanlaw.com'; ServicePH
Samsung-ELM 3DS; apoff@ycst.com
Subject: [EXT] Samsung Sales Data Discovery Plan

Soyoung and Phillip,

This email memorializes the agreements we reached over the past week regarding the sales data discovery that Samsung has agreed to provide in order to avoid motion practice this week. Please let me know right away if you believe I've missed or misstated anything.

1. By January 10, Samsung will produce all U.S. sales data for all downstream products that include a relevant memory component or a relevant image sensor component made by Samsung.
2. By January 24, Samsung will produce worldwide sales data for all relevant products (including all stacked semiconductor products that include at least one die that is 50 microns or less) regarding which Samsung has conducted sales-related activities in the U.S. Samsung has represented that it is currently investigating the various types of activities that it conducts in the U.S., and has agreed to raise any questions about the specific activities that Elm believes should be included in this inquiry in advance of the January 24 deadline. In addition, Samsung has agreed to the following guidelines:
 - a. This production will include all worldwide sales of relevant products to any customer who has ever met with any representative of any Samsung entity in the United States, and all worldwide sales of relevant products to any affiliates of such customers.
 - b. This production will include all worldwide sales of relevant products to any customer who has ever received, in the United States, an email, call, or other communication from any Samsung entity.
 - c. This production will include all worldwide sales of relevant products where Samsung knows or has reason to believe that the product will be imported into the United States, or incorporated into a product that will later be imported into the United States.

3. By January 10, Samsung will produce worldwide sales data for all relevant image sensor products (and the downstream products incorporating such products) that incorporate die made from wafers that Samsung made in or supplied from the U.S.
4. Samsung indicated that it needed a few more days to investigate what sorts of data it can provide regarding worldwide sales of relevant memory products that incorporate die made from wafers that Samsung made in or supplied from the U.S. The parties will meet and confer again on Wednesday, December 18, to further discuss this issue. To the extent that Samsung determines it is able to provide a reliable estimate of such sales, it has agreed to do so by January 31. The parties agreed that an estimate is “reliable” if it meets at least the following two criteria:
 - a. It represents an honest effort to estimate the relevant information as accurately as reasonably possible; and
 - b. Samsung will not, in any later phase of the case, challenge the reliability of the estimate.
5. On Wednesday, December 18, Samsung will provide an update regarding sales data relating to relevant products (including all stacked semiconductor products that include at least one die that is 50 microns or less) that Samsung acquires from third parties, and then imports, sells, or offers for sale in the United States. Elm explained that it believes this information is covered by numerous prior discovery requests, including Interrogatory No. 4. Elm further notes that this information is covered by Common Interrogatory Nos. 2, 4, and 5. Samsung reiterated its objection that this had not previously been the subject of the parties’ meet and confers. Elm stressed that it expects Samsung to work expeditiously to supplement its productions with this information.
6. Samsung agreed to investigate its ability to provide information concerning the prices that Samsung entities pay for relevant components incorporated into final downstream products.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Mariano, Andrea <andreamariano@paulhastings.com>

Sent: Thursday, December 12, 2019 9:58 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>; 'Bfarnan@farnanlaw.com' <Bfarnan@farnanlaw.com>; 'Mfarnan@farnanlaw.com' <Mfarnan@farnanlaw.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Subject: Elm 3DS Innovations LLC v. Samsung Electronics Co. Ltd. et al., Case No. 14-cv-1430- LPS-CJB

Counsel,

Attached please find correspondence from Samsung regarding discovery matters.

Thank you,
Andrea



Andrea Mariano | Senior Litigation Paralegal
Paul Hastings LLP | 515 South Flower Street, Twenty-Fifth Floor, Los Angeles, CA 90071 | Direct: +1.213.683.6224 | Main: +1.213.683.6000 | Fax: +1.213.996.3224 | andreamariano@paulhastings.com | www.paulhastings.com

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Exhibit 30

Kidokoro, Koichiro

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Saturday, March 14, 2020 10:01 PM
To: Citroen, Phillip W.
Cc: ServicePH Samsung-ELM 3DS; apoff@ycst.com; Brian Farnan; Mailing List - Leedy
Subject: [EXT] March 13 Elm/Samsung Meet and Confer

Phillip and Anand,

Thank you for taking the time to talk yesterday. Below is my summary of the items we discussed. Please confirm that I've accurately summarized our discussion.

Thanks,

-Nosson

Summary of March 13 Meet and Confer

1. Attendees: Adam Poff; Nosson Knobloch; Brian Farnan; Phillip Citroen; Anand Patel
2. Sales data issues:
 - a. [REDACTED] (“relevant components” are semiconductor products with more than one die in a vertical stack, where at least one die in the stack is 50 microns or less in thickness).
 - b. [REDACTED]
 - c. [REDACTED]
 - d. Samsung explained that SAMSUNG-ELM-000062360 and SAMSUNG-ELM-000062361 together identify Samsung’s US sales of stacked memory products. Samsung further explained that the sales in these spreadsheets are not duplicative, they are additive, even though in some cases the same product codes appear in both spreadsheets.

e. Samsung stated that it believes its production of SELA-MIAMI's sales of downstream products containing memory products, which currently ends in 2017, is incomplete. Samsung is working to update that data.


f. 


g. The following items from our March 3 meet and confer remain open:

- i. Samsung is still checking to be sure it has produced all non-US sales of accused memory and image sensor components, including all intra-company transfers of those component.
- ii. Samsung is still checking to be sure that its non-US sales data is comprehensive, and is not limited to the relevant products that happened to have US sales.
- iii. Samsung is still investigating Elm's questions concerning the relationship between SAMSUNG-ELM-000062366 and SAMSUNG-ELM-000062370. In particular, Samsung has previously stated that SAMSUNG-ELM-000062366 lists SEC's worldwide sales of image sensor products incorporating an SAS wafer, and SAMSUNG-ELM-000062370 lists SEC's worldwide sales of image sensor products. Elm noted that, if those identifications are correct, 62366 should be a subset of 62370. But 62366 shows more sales than 62370. Samsung did not provide any updates on this issue during the March 13 call.
- iv. Samsung did not provide any further updates regarding the product codes in SAMSUNG-ELM-000062374, which differ from all the other product codes Samsung has identified. Samsung agreed to investigate this issue during our March 3 meet and confer.
- v. Samsung did not provide any further updates regarding its commitment to updates its sales data for stacked memory products (SAMSUNG-ELM-000062357 and SAMSUNG-ELM-000062367) to include units.

3. Representative Products Issues:

- a. Substantially flexible: Samsung indicated that it currently intends to agree to a representative products agreement that applies to all the asserted claim limitations, including the “substantially flexible” limitations. Elm reiterated that, if Samsung cannot agree to include that limitation, the parties need to raise this issue with the Court as soon as possible.
 - b. Packaging type:
 - i. Samsung explained that the “packaging type” criteria it has proposed to include in the representative products agreement is not the same as the “product type” data it has previously produced.
 - ii. Samsung confirmed that it has not produced “packaging type” data for any of the accused products. Samsung stated that it is not sure how many different packaging types would need to be included in the representative products agreement.
 - iii. Samsung stated that it is working on collecting “packaging type” data for all the relevant products, but could not state when that data will be produced. Elm stressed the importance of providing this data quickly so that Elm can evaluate Samsung’s proposal regarding representative products.
 - iv. Elm asked Samsung to explain why “packaging type” is relevant to the asserted claims. Samsung explained that it is primarily relevant to the stress and flexibility limitations. Elm requested that Samsung explain why it believes that packaging is relevant to the stress and flexibility limitations, because this explanation may reveal an underlying dispute about the meaning of the terms that needs to be raised with the Court. Samsung agreed to consider this request and get back to Elm.
 - c. Die in the stack: Elm reiterated its request that Samsung explain why the number of die in the stack (beyond 2) is relevant to the elements of the asserted claims. Samsung asserted that it believed it was relevant to the flexibility limitations. Elm requested that Samsung provide a more detailed explanation for this position, as this may be an issue the parties need to raise with the Court.
4. Additional technical data needed to evaluate Samsung’s representative products proposal:
- a. Samsung agreed to produce process node and interconnect type data for the 69 products identified in Elm’s email from yesterday. Samsung asserted that Samsung-Elm-000062356 identifies the number of die and the minimum thickness of the die for those products.
 - b. Samsung stated its belief that, for the 93 products Elm had identified with inconsistent die numbers in Samsung’s productions, that the more recently-produced data in Samsung-Elm-000062356 was correct. Samsung agreed to confirm this as soon as possible.

5. Product samples: Elm reiterated its request that Samsung disclose whether it has samples available for each of the accused products. Samsung agreed to investigate this issue.
6. Technical data for image sensor products: Samsung agreed to investigate and let Elm know when this data will be produced.
7. Missing core technical data for process nodes 


8. Case schedule: Samsung stated that it cannot meet the March 31 deadline for substantial completion of document production. Elm urged Samsung to come up with a reasonable proposal for amending the case schedule. Samsung indicated that it was working with the other Defendants to formulate a case schedule proposal.

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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Exhibit 31

Kidokoro, Koichiro

From: Citroen, Phillip W.
Sent: Thursday, April 30, 2020 11:13 PM
To: Nosson Knobloch
Cc: Mailing List - Leedy; apoff@ycst.com; Michael J. Farnan; Brian Farnan; ServicePH Samsung-ELM 3DS
Subject: RE: Elm/Samsung Meet and Confer Issues

Nosson,

As you know, Samsung has produced a substantial number of documents over the past few weeks, which are relevant to our discussions in March.

Regarding technical documents, Samsung has produced documents relevant to the process of selecting representative products as well as other technical documents for the accused stacked memory products that Elm has requested. We have also received additional information from Samsung regarding node type, chip thickness, number of stacked die, etc., for these products, which we are reviewing and discussing with Samsung before producing. On top of that, Samsung expects to produce additional technical documents by May 15, including documents relating to the accused image sensor products. Given the large amount of data Samsung is collecting, the number of people involved, the ongoing pandemic, and the present holiday in Korea, these additional documents have taken longer to collect than originally anticipated.

We have also made progress in obtaining updated financials and tracking down answers to the remaining outstanding questions we discussed previously regarding financials. As you know, all of the Samsung subsidiaries are working remotely and collecting financial data requires individual employees to physically go to the relevant offices. That makes this process exceedingly difficult. In spite of that, Samsung is taking steps to provide Elm with updated financial data and resolve the outstanding discrepancies.

Specifically, we received updated financial data from SEA and SELA-Miami, which we plan to produce next week. We also received updated financials from SSI, but are awaiting confirmation of a couple of items before production—again, likely in the next week or two. SEC provided updated transfer prices for internal sales between Samsung entities, which we are reviewing with the goal of producing in the next week or two. SEC also is currently collecting updated financials for other sales of the accused products, in an effort to resolve several of the issues Elm raised (e.g., discrepancies between image sensor products data and missing sales quantities). We were hoping to receive that new information this week, but those collections were more involved than we originally anticipated. We continue to actively coordinate with SEC on these remaining tasks, and anticipate that we will finish productions in the coming weeks.

Regards,
Phillip

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Thursday, April 30, 2020 7:35 PM
To: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>; apoff@ycst.com; Michael J. Farnan <mfarnan@farnanlaw.com>; Brian Farnan <bfarnan@farnanlaw.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Subject: [EXT] RE: Elm/Samsung Meet and Confer Issues

Phillip and Anand,

Please provide an update on the various outstanding issues in the below email string, most of which you'd agreed to address by the end of April. Please also let me know whether, now that I expect you've produced all the outstanding sales and technical data we'd discussed, Samsung is in a position to provide a concrete proposal regarding representative products. Finally, please let me know when you are available to meet and confer about these issues.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Sent: Tuesday, March 31, 2020 8:04 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>; apoff@ycst.com; Michael J. Farnan <mfarnan@farnanlaw.com>; Brian Farnan <bfarnan@farnanlaw.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Subject: RE: Elm/Samsung Meet and Confer Issues

Correct. Thanks.

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Tuesday, March 31, 2020 4:44 PM
To: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>; apoff@ycst.com; Michael J. Farnan <mfarnan@farnanlaw.com>; Brian Farnan <bfarnan@farnanlaw.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Subject: [EXT] RE: Elm/Samsung Meet and Confer Issues

Thanks, Phillip. To ensure we are on the same page, I understood from yesterday's conversation that where Samsung says it plans to produce something in a matter of "weeks," that means no later than the end of April. Please confirm.

Also, please let me know in the next day or two what (if anything) you will produce from the *Uniloc* case.

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Sent: Tuesday, March 31, 2020 1:59 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>; apoff@ycst.com; Michael J. Farnan <mfarnan@farnanlaw.com>; Brian Farnan <bfarnan@farnanlaw.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Subject: RE: Elm/Samsung Meet and Confer Issues

Nosson,

We confirm Samsung is investigating the issue you raised regarding cost data in the Uniloc case.

Also, as discussed yesterday, "months" in 2b is a typo and should be "weeks."

Regards,
Phillip

From: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Sent: Monday, March 30, 2020 3:34 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>; apoff@ycst.com; Michael J. Farnan <mfarnan@farnanlaw.com>; Brian Farnan <bfarnan@farnanlaw.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Subject: RE: Elm/Samsung Meet and Confer Issues

Nosson,

See below.

Thanks,
Phillip

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Thursday, March 26, 2020 7:57 PM
To: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>; apoff@ycst.com; Michael J. Farnan <mfarnan@farnanlaw.com>; Brian Farnan <bfarnan@farnanlaw.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Subject: [EXT] RE: Elm/Samsung Meet and Confer Issues

Phillip,

Here is my summary of today's meet and confer. Please confirm, before Monday's meet and confer, that this accurately summarizes our discussion. And please let me know as soon as possible what time you are available to talk on Monday. I want to be sure to secure that time.

Thanks,

-Nosson

1. Cost of Goods: Samsung stated that it did not believe this data was relevant because the accused products here are the stacked memory or image sensor components, not the downstream products. Elm responded that it believed this data was relevant for all the reasons laid out in Judge Gilstrap's decision earlier this week. The parties agreed to discuss again on Monday after Samsung has a chance to discuss this issue with its client. Elm explained that, if Samsung still refuses to produce this data on Monday's call, Elm plans to move to compel.
 - a. Samsung requested that Elm provide additional caselaw supporting the relevance of this data. Elm stated that the decision in the *Uniloc v. Samsung* case that Elm sent this morning provided ample authority for the relevance of this data.

[PH] Elm raised this issue for the first time in an email sent a few hours before our meet and confer last Thursday (3/26). Elm's email did not specifically identify the COGs data it believes is missing, but instead cited a court order to produce COGs in a different case before a different venue involving different technology and accused products, followed by a general statement that "Elm's discovery requests have also sought this information." The timing and substance of the email made it impossible for Samsung to consult with its client before the meet and confer.

Additionally, despite Samsung's request, Elm refused to provide any further specificity during the meet and confer beyond generic references to "downstream products" or any additional case law supporting its request relevant to the products at issue in this case. Elm seemed more interested in filing a motion to compel than engaging in a good faith meet and confer. Nevertheless, Samsung agreed to investigate and consult with its client with the limited information Elm was willing to provide. Samsung is still unclear what information, precisely, Elm is requesting beyond what Samsung has already produced or the basis for Elm's request. Any motion to compel at this stage would be premature and improper.

2. Representative products:

- a. Samsung reiterated that it would not provide any further explanation for why it believed the package type and number of die in the stack were relevant to the flexibility and/or stress claim terms. Samsung further noted that it might be willing to drop these criteria from the representative products agreement after the Court issued its claim construction ruling.

[PH] Samsung has sufficiently explained that these criteria are based on Samsung's non-infringement positions with respect to the "substantially flexible" and "stress" terms. While Elm seeks more details regarding Samsung's non-infringement positions, Samsung is not required to provide further specificity at this time, beyond what it has already provided (i.e., that its non-infringement positions are based on these criteria).

The claim construction order will address both of these claim terms, so it clearly may impact whether these criteria are needed. Samsung is willing to reevaluate the criteria in view of the Court's order and will drop any criteria that are no longer necessary.

- b. Samsung stated that it did not know how many different package types may be implicated by its proposal. Elm stressed the importance of tracking down this

information quickly, as it could obviate the need to raise this issue with the Court. Samsung agreed to produce this data sometime next month.

[PH] Samsung is investigating the different packaging types based on the most recent list of products accused by Elm. Samsung estimates that it will be able to provide this information in the coming months.

- c. Elm explained that, given the discovery that has been deferred until after the parties reach a representative products agreement, the data that Samsung now contends is necessary to properly categorize the accused products must be produced right away. Samsung stated that it expected to finish producing that data “sometime next month.” Elm stated that, if Samsung cannot commit to a more expedited timeline for producing this data before or during the meet and confer this coming Monday, Elm would likely move to compel.

[PH] Elm did not state that Samsung needed to commit to a more expedited schedule than that discussed during the call. Elm stated that it wanted to avoid additional incremental delays. Elm seemed to accept Samsung’s estimate of producing needed information and documents in the coming weeks. Samsung estimates that it can provide any remaining data regarding at least the node type, number of chips in the stack, and interconnect type by April 10, if not sooner.

3. Sales data:

- a. SELA-MIAMI image sensor transfer prices: Samsung stated that it is investigating the transfer prices for 10 of the 11 products identified in Elm’s email earlier today. Samsung stated that the 11th product turns out not to be stacked. Samsung did not state when it would produce transfer prices for these products.
 - i. I don’t recall making this request on the call, but now request that Samsung let us now when it will produce this data on Monday’s call.

[PH] We are currently investigating this issue with Samsung and estimate providing any missing data in the coming weeks.

- b. Samsung stated that it has confirmed that its production of sales data for stacked memory products was complete. Elm understood this to include, where applicable, downstream sales for products that include stacked memory products. Please let me know if we misunderstood.

[PH] Samsung has produced the full set of financial data for the memory products.

- c. Samsung stated that its production of sales data for stacked image sensor products was, in fact, incomplete. Samsung said it would complete this production within the next two weeks.

[PH] As mentioned on our meet and confer, Samsung continues to investigate this issue and estimates that it will produce the missing information in the coming weeks.

- d. The parties discussed the issue Elm had previously identified with regards to SAMSUNG-ELM-000062370. As a reminder, Elm had previously noted that Samsung has stated that SAMSUNG-ELM-000062366 lists SEC's worldwide sales of image sensor products incorporating an SAS wafer, and SAMSUNG-ELM-000062370 lists SEC's worldwide sales of image sensor products. Elm noted that, if those identifications are correct, 62366 should be a subset of 62370. But 62366 shows more sales than 62370.
- i. On today's call, Samsung explained that it turns out that SAMSUNG-ELM-000062370 is incomplete. Samsung stated that it would supplement its production to include the data missing from SAMSUNG-ELM-000062370 within the next two weeks.

[PH] As mentioned on our meet and confer, Samsung believes that the data used to prepare the 62370 spreadsheet was incomplete and therefore is working to understand why that was the case. Samsung believes it will be able to produce any missing information in the coming weeks.

e.

[REDACTED]

Elm noted its disbelief and stated that, if Samsung cannot provide a credible explanation for this gap in its data, Elm will move to compel.

[PH] Elm's articulation of this issue differs from our understanding of its request. We understand Elm to be requesting information about how the products identified in the 62374 spreadsheet can be correlated to specific SEC end products. In other words, Elm is requesting correlation data for SAS components and downstream products. As mentioned on our meet and confer,

[REDACTED]

[REDACTED] Elm has not explained how filing a motion to compel can be successful, besides harassing Samsung and burdening the Court.

- f. The parties discussed Elm's request for sales units (as opposed to just revenue) for the stacked memory product sales currently disclosed in SAMSUNG-ELM-000062357 and SAMSUNG-ELM-000062367. Samsung stated that it is working to collect and produce unit data for SAMSUNG-ELM-000062357. For SAMSUNG-ELM-000062367, Samsung stated that it thought the unit data for SAMSUNG-ELM-000062357 would suffice. Elm explained that it did not believe it would without some additional data from Samsung. Samsung agreed to investigate and produce data sufficient to identify the relevant units represented by the sales in both of these documents.

[PH] As mentioned on our meet and confer, Samsung currently is working with the relevant Samsung entity (SSI) to collect unit data for the 62357 spreadsheet. But because SSI's home state of California is under a shelter-in-place order and the company's entire finance team is out of the office, collecting such information is difficult and slow. Samsung is endeavoring to press forward with this collection, consistent with work restrictions imposed by the government and corporate management.

Elm misstates Samsung's position with respect to the 62367 spreadsheet. Samsung believes, and stated during the meet and confer, that the 62370 spreadsheet, which contains worldwide sales data with units, should be sufficient. After considering this information, if Elm believes that unit data still is required for the 62367 spreadsheet, Samsung will consider that new request.

4. Product samples: Samsung stated that it had recently received some data from its Korean affiliates concerning the availability of product samples, and would endeavor to produce that data soon. Samsung stated that its US entity, SSI, has been unable to collect this data so far, and it's not sure when they will be able to in light of work restrictions in California. Elm requested that Samsung endeavor to produce this information as soon as possible. I cannot recall if I reiterated this point on today's call, but not here that this data is particularly critical as Elm believes it is an important factor in finalizing a representative products agreement.

[PH] We are working with Samsung to understand the data received so far regarding product samples. We are so far unable to collect similar data from SSI at this time given California's shelter-in-place order and the restrictions in place, but we continue to work with SSI to the best of our ability to determine if and how this data can be collected in the near future.

5. Technical data for image sensor products: Samsung stated that it expected to produce core technical data for stacked image sensor products within the next two weeks.

[PH] Samsung is collecting the documents and estimates producing them in the coming weeks.

6. Core technical data for memory process nodes: Samsung stated that it is currently working to identify what data is missing, and to supplement its production accordingly. For "new" process nodes (i.e., process nodes that came online after Samsung produced its initial core technical documents), Samsung expects to produce the core technical documents within a couple weeks. [REDACTED]

[PH] For products recently added to the case by Elm, Samsung is collecting the data and documents and estimates producing them in the coming weeks. [REDACTED]

7. Categorical privilege logging: Elm asked that Samsung respond to its email inquiring into the possibility of categorical privilege logging. After our call ended, Elm received the Defendants' response from Micron's counsel.

[PH] Correct.

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Tuesday, March 24, 2020 10:53 PM
To: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>; apoff@ycst.com; Michael J. Farnan <mfarnan@farnanlaw.com>; Brian Farnan <bfarnan@farnanlaw.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Subject: Elm/Samsung Meet and Confer Issues

Phillip,

Here is a non-exhaustive list of the issues we may raise with the Court if you are unable to provide a meaningful update on them before or during our meet and confer on Thursday:

- Samsung’s failure to explain why “package type” and number of die in the stack are necessary criteria for grouping representative products.
- Samsung’s failure to produce basic technical data for stacked memory products that have been part of this case for years.
- Samsung’s refusal to produce many categories of responsive documents until after a representative products agreement is reached, while simultaneously indefinitely delaying production of data it claims is necessary to reach that agreement (which data should have been produced months, if not years, ago).
- Samsung’s failure to supplement its sales data productions after Elm identified deficiencies pursuant to the Court’s directives following our prior motion to compel. These failures are particularly egregious because they reveal inaccuracies in representations that Samsung made to the Court when responding to Elm’s motion to compel.

I look forward to what I hope will be a productive conversation on Thursday.

Best,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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Exhibit 32

Kidokoro, Koichiro

From: Citroen, Phillip W.
Sent: Monday, May 11, 2020 10:03 PM
To: Nosson Knobloch; Soobert, Allan M.; Patel, Anand; ServicePH Samsung-ELM 3DS
Cc: Mailing List - Leedy; mfarnan@farnanlaw.com; Poff, Adam; Kraman, Pilar
Subject: RE: Representative Products Plan

Nosson,

During the process of collecting data for this case, Samsung just discovered that there are additional stacked memory products with a minimum die thickness of 50 microns or less that have been inadvertently overlooked. We are investigating this issue with Samsung but, in the meantime, wanted to alert Elm of this issue immediately. We have a call scheduled with Samsung to get more information. We will provide an update ASAP.

We will respond to the issues raised in your email below tomorrow, after we discuss them with Samsung.

Thanks,
Phillip

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Monday, May 11, 2020 12:08 AM
To: Citroen, Phillip W. <phillipcitroen@paulhastings.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Patel, Anand <anandpatel@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>; mfarnan@farnanlaw.com; Poff, Adam <APOFF@ycst.com>; Kraman, Pilar <PKraman@ycst.com>
Subject: [EXT] RE: Representative Products Plan

Phillip,

Your recriminations cannot undo the unambiguous record of delays in Samsung's discovery in this case. It is simply false for you to assert that Samsung met the April 30 deadline it had committed to. Indeed, your earlier emails admitted the opposite. We are working diligently to review what you have produced, and I am confident we will find numerous gaps in your productions, in addition to the ones you've already admitted to.

In order for us to further assess whether to seek the Court's assistance, please respond to each of the following items before 5pmET tomorrow:

1. Representative products: More than two months ago, I proposed that we group representative products by process node. You rejected that approach—for reasons that Samsung still hasn't explained—and insisted that the representative product groups be further broken-down based on the interconnect type, packaging type, and number of chips in the stack. Given that **Samsung** is insisting on these additional categories, and **Samsung** is the party with greater access to the relevant data, I propose that **Samsung**

take the lead on grouping the relevant products into those additional sub-categories. Accordingly, please let me know if you agree to proceed as follows:

- a. Elm provide to Samsung a list of the accused products it is aware of, grouped by process node, to the extent we know the process node. Of course, as we've already indicated to you, there are products for which we've been unable to identify the process node to date. Those will all be grouped into one category. I need to check with my team, but I believe we can provide this to you by Wednesday, at least for the products you identified to us before your most recent productions.
 - b. Within 2 business days after receiving Elm's list as indicated in item (a), above, Samsung will provide the following:
 - i. An identification of the process nodes for each product for which Elm has not been able to locate the process node.
 - ii. A chart further sub-dividing the accused products into the various categories that Samsung is proposing for purposes of selecting representative products.
 - c. Samsung will work expeditiously with Elm to update the products groups as additional sales data is produced (including the sales data produced just last week, which we are still working to analyze).
2. I understand that you now contend that Samsung has produced all available dielectric stress data for the relevant process nodes. As I'm sure you will recall, Samsung previously provided a correlation chart to enable Elm to identify which stress data related to which node. I'd expected to receive—no later than April 30—an update of that chart or something similar to enable us to correlate stress data to the relevant process nodes. Indeed, I specifically identified the missing stress data in my March 13 email, and you responded, on March 26, that you expected to produce it “in the coming weeks.” I understood that to mean you would provide at least the same specificity as you'd previously provided and cannot imagine why you'd have a different understanding. In any case, when will you provide an updated correlation chart so we can match the stress data to the relevant nodes?
 3. You've said that you plan to produce technical documents for the image sensor products by May 15. Are those documents organized/identified in a way that will enable us to correlate product numbers to specific documents? If not, will you also produce, on May 15, a chart or other decoder to enable us to correlate your documents to your products?
 4. Your emails regarding sales data have been frustratingly vague. You've indicated that you're still tracking down some relevant sales data, but you haven't explained what that is. Can you please clearly explain what data you believe is still missing and when it will be produced?

5. Your email productions appear to be missing communications with dielectric suppliers. We've been asking for those communications for more than a year. Your February 19 letter said that such communications would be included in custodial productions "in the upcoming weeks." Why haven't those communications been produced to date, and when will they be produced?
6. Have you now produced process flow documents (or something equivalent) for every relevant process node? This is another category I specifically called-out in my March 13 email, and you responded, on March 26, that you expected to produce it "in the coming weeks." You later said that meant no later than the end of April and have never indicated that those were among the documents you were still working to collect. While we haven't finished reviewing your productions yet, we've searched and have not found all the missing process flow documents. Please explain.

The above list is by no means an exhaustive account of the deficiencies in Samsung's productions. But your last email exhorted us to try to work with you, and not against you, on these discovery matters. We've been trying to work with you all along and would view timely, comprehensive, and cooperative answers to the above questions as an indication that you actually intend to reciprocate.

Regards,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Citroen, Phillip W. <phillipcitroen@paulhastings.com>

Sent: Friday, May 8, 2020 9:05 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Patel, Anand <anandpatel@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>; mfarnan@farnanlaw.com

Subject: RE: Representative Products Plan

Nosson,

We write to follow up on our May 6th meet and confer and to respond to your May 7th email. During our call, you requested that—to avoid a motion to compel on the representative products issue—Samsung must (i) provide a date by when it promises to complete its productions of documents relating to representative products, (ii) provide a "consequence" should it fail to meet that date, (iii) explain its recently produced sales spreadsheets, (iv) identify where in each document in its productions information relevant to the parties' representative productions discussion might be

located, and (v) provide an inventory of all physical samples of accused products, including image sensor products. I will address each of those items below.

As I stated in my May 6th email and on our meet and confer, your entire argument is premised on a fallacy that Samsung somehow has not complied with its discovery obligations, nor in a timely fashion. Samsung has complied, and will continue to comply, with its discovery obligations, in good faith. We have been addressing Elm's serial requests as best we can. It is simply incorrect to say that Samsung has repeatedly missed deadlines, in light of our recent productions that specifically address many of the points you raise ("document dumps," as you referred to them).

The following table summarizes Samsung's recent productions through the month of April and into early May.

Date	# Docs	# Pages	Description
April 11th	2104	64900	Email discovery and technical documents
April 24th	3529	71671	Email discovery and technical documents with information relating to process nodes, interconnect types, packaging types, and number of stacked chips
April 30th	32	4577	Technical documents with information relating to packaging and number of stacked chips
May 5th	57	2506	Technical documents with information relating to packaging and number of stacked chips; updated sales spreadsheets


As you can see, and contrary to your incorrect allegations, Samsung has made substantial productions of responsive documents, and in particular, documents necessary to categorize the hundreds of accused products. As noted in my prior email and on our meet and confer, Samsung intends to produce the remaining documents necessary for the parties to continue their representative products discussions by May 15th. We want to continue working with Elm to reach a representative products agreement, as we believe such an agreement would benefit the parties and lessen the burden on the Court.

In any event, you admitted on the call that you did not fully understand or appreciate the contents of these productions. We are happy to provide answers to discrete questions regarding Samsung's productions, as I said. But, it is not our burden to provide page and line citations for each piece of technical information related to our representative products discussion for all of the accused products, as Elm demanded for the first time on our meet and confer. We are willing to work jointly toward preparing a categorization of accused products based on the relevant technical factors. But it is neither fair nor efficient for Elm to push all the work onto Samsung.

To demonstrate our good faith and cooperation, I tried to explain on our call the answer to item iii above, i.e., to describe the recently produced spreadsheets. While you were unwilling to accept our brief explanation, I will repeat that response here: All of the sales spreadsheets we produced on May 5th update prior spreadsheets. For five of the six, the old and new spreadsheets utilize identical formats and listings of accused products, and substantially overlap in their sales figures. We did not realize that that information would not be sufficient for someone familiar with our productions to "decode" the sales spreadsheets.

To provide further clarity, please see the below correlation:





Regarding product samples, I provided a list of the accused memory products Samsung has in inventory in my May 6th email. During our meet and confer, you for the first time demanded an inventory of product samples for the accused image sensor products as well, even though our prior correspondence relating to product samples has been in the context of determining representative products for the accused memory products—not image sensor products. Nevertheless, we agreed to try to provide an inventory of the accused image sensor products by May 15th as well.

You also requested that Samsung provide a “consequence” for what would happen if it fails to meet its May 15th expected production date. That, again, is based on a false premise, and it is entirely inappropriate to suggest that Samsung should somehow be punished for diligently working through these discovery issues and its continued efforts in identifying, collecting, reviewing, and producing documents, all in response to your serial requests.

Samsung has gone to great lengths to not only comply with its discovery obligations, but also attempt to respond to your every demand, even during a global pandemic. Occasional hiccups will happen, but there is no need to regularly threaten unnecessary motion practice.

Based on prior experience in this case, we do not think it is advisable to raise issues with the Court prematurely. While we cannot stop you from doing that and unnecessarily burdening the Court, we would ask again that you work with us, not against us, on these issues, as the Court expects. Otherwise, we will be left without an agreement on representative products as a consequence.

To the extent Elm decides to involve the Court anyway, we are currently available on May 20th, 21st, and 28th.

Thanks,
Phillip

From: Nossou Knobloch <nossou.knobloch@bartlitbeck.com>
Sent: Thursday, May 7, 2020 6:33 PM
To: Soobert, Allan M. <allansoobert@paulhastings.com>; Citroen, Phillip W. <phillipcitroen@paulhastings.com>; Patel, Anand <anandpatel@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Cc: Mailing List - Leedy <leedy@bartlit-beck.com>; mfarnan@farnanlaw.com
Subject: [EXT] RE: Representative Products Plan

Phillip, Anand, and Allan,

As a reminder, please also let us know what days you’re available for a teleconference with Judge Hall on May 15 and the week of May 18.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch

Sent: Thursday, May 7, 2020 1:19 PM

To: Soobert, Allan M. <allansoobert@paulhastings.com>; Citroen, Phillip W. <phillipcitroen@paulhastings.com>; anandpatel@paulhastings.com; Samsung Paul Hastings <ServicePHSamsung-ELM3DS@paulhastings.com>

Cc: Mailing List - Leedy <leedy@bartlit-beck.com>; mfarnan@farnanlaw.com

Subject: Representative Products Plan

Phillip, Anand, and Allan,

As discussed yesterday, Elm is deeply disappointed by the slow progress towards finalizing a representative products agreement. Samsung has delayed discovery on numerous issues pending that agreement, but is simultaneously holding up the progress of the case by failing to provide the data needed to even begin negotiations over the representative products. As I reiterated yesterday, and as you undoubtedly already understood, the data needed to finalize a representative products agreement includes, at a minimum, the following:

1. Sales data for all the relevant products, including guidance sufficient for Elm to decode that data. For example, earlier this week Samsung produced a number of spreadsheets containing sales data, but has not provided an explanation for what those spreadsheets contain. Without that explanation, it is simply impossible for Elm to decode these documents.
2. Core technical data for all the relevant products. As discussed yesterday, Samsung must also provide guidance sufficient for Elm to understand where to locate—for each relevant product—all of the information that Samsung has indicated it believes is necessary for establishing the various representative product groups.
3. A complete list of all relevant products for which Samsung has samples available.

You committed on our call yesterday to let us know, no later than tomorrow, when you will provide this information. I look forward to receiving that information from you.

In addition, as we discussed yesterday, we expect Samsung to explain what the consequence would be for Samsung's failure to meet the deadline you propose for providing the information needed to begin our negotiations over representative products. I have never in my career worked opposite a party who has so often missed the deadlines by which it had committed to produce data. Your latest missed deadline of April 30 is only the most recent example in what

has been, in my experience, an unprecedented string of missed deadlines that stretches way before the start of the coronavirus pandemic. Accordingly, we cannot take your word for it that data will be forthcoming in the timeline you agree to. We need firm commitments, with clear consequences.

Regards,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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Exhibit 33

Kidokoro, Koichiro

From: Citroen, Phillip W.
Sent: Friday, June 19, 2020 6:20 PM
To: Mailing List - Leedy; mfarnan@farnanlaw.com; bfarnan@farnanlaw.com
Cc: ServicePH Samsung-ELM 3DS; Poff, Adam; Kraman, Pilar
Subject: Elm 3DS Innovations, LLC v. Samsung Electronics Co., Ltd., C.A. No. 14-1430-LPS
Attachments: Elm v. Samsung - Representative Products Spreadsheet.pdf

Counsel,

Pursuant the Court's May 27 Oral Order, please see the attached spreadsheet, which mirrors the columns in Ex. 30 to Elm's May 19 letter to the Court with the modifications proposed in Samsung's May 22 letter and approved by the Court's Oral Order.

Although not required by the Court's Oral Order, the spreadsheet also includes similar information for the accused image sensor products to assist the parties in reaching a representative products agreement for those products.

The following notes apply to the memory products:

1. The list of memory products includes:
 - a. all stacked memory products sold in the relevant time period with at least one die having a minimum thickness of 50 microns, and
 - b. [REDACTED]
2. [REDACTED]
3. [REDACTED]
4. For certain inventory, a minimum numbers of products must be purchased. Also, some inventory may currently be allocated to customers.

Please note the information in the spreadsheet was collected from numerous divisions, groups, engineers, and resources for a large number of products and in a short period of time, so Samsung reserves the right to revise the information in the spreadsheet should the need arise.

We look forward to working with you to address any questions you may have and select representative products.

Regards,
Phillip



Phillip Citroen | Of Counsel, Litigation Department
Paul Hastings LLP | 875 15th Street, N.W., Washington, DC 20005 | Direct: +1.202.551.1700
| Main: +1.202.551.1700 | Fax: +1.202.551.0491 | phillipcitroen@paulhastings.com | www.paulhastings.com

Exhibit 34











































































Exhibit 35

Kidokoro, Koichiro

From: Citroen, Phillip W.
Sent: Monday, July 6, 2020 8:55 PM
To: Mailing List - Leedy; mfarnan@farnanlaw.com; bfarnan@farnanlaw.com
Cc: ServicePH Samsung-ELM 3DS; Poff, Adam; Kraman, Pilar
Subject: RE: Elm 3DS Innovations, LLC v. Samsung Electronics Co., Ltd., C.A. No. 14-1430-LPS
Attachments: Elm v. Samsung - Amended Representative Products Spreadsheet (Served 07.06.2020).pdf

Counsel,

We have updated the spreadsheet served on June 19 to bold nodes that correspond to a die that has a thickness of 50 microns or less, to the extent Samsung was able to find this information after a reasonable search. [REDACTED]

[REDACTED] The spreadsheet also includes updated financial data.

Additionally, regarding image sensor products, Samsung proposes that we group these products using the following criteria:

1. Process node with the same node size, trench isolation fabrication process, and number of metal layers; and
2. Number of stacked chips.

We aim to provide the information corresponding to No. 1 this week, to the extent not already provided.

Thanks,
Phillip

From: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Sent: Friday, June 19, 2020 6:20 PM
To: Mailing List - Leedy <leedy@bartlit-beck.com>; mfarnan@farnanlaw.com; bfarnan@farnanlaw.com
Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Poff, Adam <APOFF@ycst.com>; Kraman, Pilar <PKraman@ycst.com>
Subject: Elm 3DS Innovations, LLC v. Samsung Electronics Co., Ltd., C.A. No. 14-1430-LPS

Counsel,

Pursuant the Court's May 27 Oral Order, please see the attached spreadsheet, which mirrors the columns in Ex. 30 to Elm's May 19 letter to the Court with the modifications proposed in Samsung's May 22 letter and approved by the Court's Oral Order.

Although not required by the Court's Oral Order, the spreadsheet also includes similar information for the accused image sensor products to assist the parties in reaching a representative products agreement for those products.

The following notes apply to the memory products:

1. The list of memory products includes:
 - a. all stacked memory products sold in the relevant time period with at least one die having a minimum thickness of 50 microns, and

- b. [REDACTED]
- 2. [REDACTED]
- 3. [REDACTED]
- 4. For certain inventory, a minimum numbers of products must be purchased. Also, some inventory may currently be allocated to customers.

Please note the information in the spreadsheet was collected from numerous divisions, groups, engineers, and resources for a large number of products and in a short period of time, so Samsung reserves the right to revise the information in the spreadsheet should the need arise.

We look forward to working with you to address any questions you may have and select representative products.

Regards,
Phillip



Phillip Citroen | Of Counsel, Litigation Department

Paul Hastings LLP | 875 15th Street, N.W., Washington, DC 20005 | Direct: +1.202.551.1700 | Main: +1.202.551.1700 | Fax: +1.202.551.0491 | phillipcitroen@paulhastings.com | www.paulhastings.com

Exhibit 36

Kidokoro, Koichiro

From: Citroen, Phillip W.
Sent: Friday, July 10, 2020 8:26 PM
To: Nosson Knobloch; Mailing List - Leedy; mfarnan@farnanlaw.com; bfarnan@farnanlaw.com
Cc: ServicePH Samsung-ELM 3DS; Poff, Adam; Kraman, Pilar
Subject: Elm v. Samsung
Attachments: Elm v. Samsung - Amended Representative Products Spreadsheet (Served 07.10.2020).pdf

Counsel,

We have attached a revised version of the spreadsheet served on June 19 and July 6 to include trench isolation and number of metal layers information for the image sensor products. After further investigation, we have also bolded the node that corresponds to the die that has a thickness of 50 microns or less for these products. No other changes were made in this version compared to the version provided on July 6.

Thanks,
Phillip

**PAUL
HASTINGS**

Phillip Citroen | Of Counsel, Litigation Department

Paul Hastings LLP | 2050 M Street NW, Washington, DC 20036 | Direct: +1.202.551.199

Main: +1.202.551.1700 | Fax: +1.202.551.0491 | phillipcitroen@paulhastings.com |

www.paulhastings.com

Exhibit 37

Kidokoro, Koichiro

From: Citroen, Phillip W.
Sent: Friday, July 17, 2020 7:28 PM
To: Nosson Knobloch; Mailing List - Leedy; mfarnan@farnanlaw.com; bfarnan@farnanlaw.com
Cc: ServicePH Samsung-ELM 3DS; Poff, Adam; Kraman, Pilar
Subject: RE: Elm v. Samsung
Attachments: Elm v. Samsung - Amended Representative Products Spreadsheet (Served 07.17.2020).pdf

Counsel,

We have attached an updated spreadsheet, which corrects the revenue error with respect to the TSV products.

Also, for the image sensor products, we added additional detail for the number of metal layers. [REDACTED]

[REDACTED] This information, along with the node size and trench isolation process, is needed to group products based on node fabrication process.

Thanks,
Phillip

From: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Sent: Friday, July 10, 2020 8:26 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; Mailing List - Leedy <leedy@bartlit-beck.com>; mfarnan@farnanlaw.com; bfarnan@farnanlaw.com
Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Poff, Adam <APOFF@ycst.com>; Kraman, Pilar <PKraman@ycst.com>
Subject: Elm v. Samsung

Counsel,

We have attached a revised version of the spreadsheet served on June 19 and July 6 to include trench isolation and number of metal layers information for the image sensor products. After further investigation, we have also bolded the node that corresponds to the die that has a thickness of 50 microns or less for these products. No other changes were made in this version compared to the version provided on July 6.

Thanks,
Phillip



Phillip Citroen | Of Counsel, Litigation Department

Paul Hastings LLP | 2050 M Street NW, Washington, DC 20036 | Direct: +1.202.551.1990
Main: +1.202.551.1700 | Fax: +1.202.551.0491 | phillipcitroen@paulhastings.com | www.paulhastings.com

Exhibit 38

Kidokoro, Koichiro

From: Jung, Soyoung
Sent: Saturday, September 5, 2020 12:15 AM
To: Nossou Knobloch; Citroen, Phillip W.
Cc: ServicePH Samsung-ELM 3DS; Soobert, Allan M.; apoff@ycst.com; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com; pkraman@ycst.com; Mailing List - Leedy
Subject: RE: Discovery Update
Attachments: Elm v. Samsung - Amended Representative Products Spreadsheet (Served 09.04.2020).pdf

Nossou,

Please find attached an updated Representative Products Spreadsheet that adds the sales data from SAMSUNG-ELM-000206023.

We also corrected the typos mentioned in our email of August 28 relating to [REDACTED]

Best,
Soyoung

From: Nossou Knobloch <nossou.knobloch@bartlitbeck.com>
Sent: Sunday, August 30, 2020 1:11 PM
To: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Jung, Soyoung <soyoungjung@paulhastings.com>; apoff@ycst.com; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com; pkraman@ycst.com; Mailing List - Leedy <leedy@bartlitbeck.com>
Subject: [EXT] RE: Discovery Update

Phillip,

I appreciate your sending the updates in your below email in advance of our Friday call. Here are some thoughts on each of the 10 updates in your email:

1. We agree to drop packaging type as a criterion for grouping memory products.
2. We look forward to receiving your updated interrogatory responses on September 18. We understand you will update, at a minimum, your responses to Interrogatory Nos. 3, 4, and 5, and Common Interrogatory Nos. 2, 4, 5, as laid out in my August 21 letter.
3. We appreciate your acknowledgement of the omission—from the Representative Products Spreadsheet—of the sales data in SAMSUNG-ELM-000206023. We note that this is a significant omission, involving [REDACTED] in downstream product sales. We look forward to receiving an update to this spreadsheet that corrects this error as soon as possible.

4. We look forward to receiving more detailed image sensor sales data this week.
5. With regards to Samsung's knowledge of third-party downstream products, we are working on drafting a list of the products in groups for which Samsung does not have any samples and has not identified any downstream Samsung products. With regards to that subset of products, it is absolutely critical that Samsung provide all information in its possession, custody, or control concerning where Elm may be locate samples of those products. As discussed, this includes data regarding which customers purchased the products from Samsung, when those products were purchased, and any information Samsung has about which downstream products the third parties included those components in. We understand that Samsung has agreed to work to provide that information. Please confirm.
6. Thank you for noting the typo in the spreadsheet that resolves one of Elm's concerns about the image sensor products. We expect that Samsung will correct this error in future versions of this spreadsheet (including the one Samsung has agreed to provide to remedy the omission of the downstream image sensor product sales).
7. With regards to core technical data, can you please confirm whether or not Samsung will provide an updated stress data correlation chart for the memory products? Also, as discussed on Friday, please let us know whether Samsung will agree to update its chart to identify and correlate the technical documents relating to the image sensor dielectrics.
8. We look forward to receiving Samsung's additional custodial productions, though we are frustrated that Samsung waited until the very end of discovery to provide documents from custodians it identified years ago.
9. Regarding the PRP document review, we are still waiting for Samsung's written description of the procedures that will govern that review. Given Samsung's disclosure—on Friday's call—that [REDACTED] it is especially important for us to get that review started as soon as possible. As discussed, whatever procedures Samsung proposes must include some mechanism by which Elm's expert can identify portions of those PRP documents to be printed or otherwise reproduced so that we can use them in depositions, expert reports, trial exhibits, etc.
10. Regarding image sensor samples, please send us 12 samples of each of the products we'd requested for which Samsung is able to provide just 12 samples.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Sent: Friday, August 28, 2020 2:48 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Jung, Soyoun <soyoungjung@paulhastings.com>; apoff@ycst.com; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com; pkraman@ycst.com; Mailing List - Leedy <leedy@bartlitbeck.com>
Subject: RE: Discovery Update

Nosson,

I want to first address the points in your latest email.

1. The threshold issue should be resolved before the “numerous other issues” you vaguely reference in your email. For example, the thresholds may result in the exclusion of older, low revenue products [REDACTED]
2. You broadly state without more specificity that there are “significant discrepancies” between the representative products spreadsheet and the previously produced sales spreadsheets. If you are referring to the one or two issues you identified for the image sensor products, that should not prevent the parties from reaching an agreement with respect to the memory products. You have since identified a potential discrepancy with [REDACTED]. We are looking into this.
3. The proposal to focus on product groups rather than components is not what we discussed before, so we will need to consult with our client and get back to you.

Beyond your email, we have a few other updates, including in response to your August 21 email.

1. After further consideration, and as another example of Samsung’s willingness to reach a workable compromise on a representative products agreement, Samsung agrees to drop packaging type as a criterion for grouping the memory products.
2. Samsung agrees to update its interrogatory responses with the identifying information that you requested by September 18.
3. We agree that the Representative Products Spreadsheet is missing the sales data in SAMSUNG-ELM-000206023. We have not yet discovered the source of that error, but it appears to be inadvertent error, and we will provide an updated spreadsheet with this sales data incorporated.
4. Regarding your request for more detailed information using the full-length product codes for the image sensor products, Samsung has agreed to provide this information. We plan to produce this information early next week. This information will also address your questions about [REDACTED], which you should be able to map between the Representative Products Spreadsheet and the underlying sales data.
5. Samsung has been investigating what information it has regarding the identification of third-party downstream products that include an accused product. This is an extremely burdensome process and so is taking time to complete. That said, Samsung has found some information, but it is not detailed and Samsung cannot confirm the accuracy of the information.
6. [REDACTED]
7. Samsung has produced core technical data for the image sensor products and the recently identified memory products, and additional documents are currently being processed for production.

8. Regarding your question about Samsung's witnesses, we are rolling out additional productions today, which will go into early next week, that will contain documents in the possession, custody or control of these individuals.
9. Regarding the standalone computer, we were able to lower some of the costs since our last communication on this issue. The costs are outlined below:
 - a. Setup for Laptop and Virtual Machine: \$10,000/Flat Fee
 - b. Monthly Hardware Rental Fee and Hosting (Includes 5 monthly hours of technical support): \$5,000/Month
 - c. Technical Support (after first 5 hours per month): \$150/Hour
 - d. Facilitation and Monitoring of Expert Review Process: \$150/Hour
 - e. Shipping Fees: At Cost
10. Regarding your second request for samples of image sensor products, please see the table below. Samsung is still collecting information for 

 Samsung is collecting the price information for these wafers.

Thanks,
Phillip

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Friday, August 28, 2020 1:29 AM

To: Citroen, Phillip W. <phillipcitroen@paulhastings.com>

Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Jung, Soyoun <soyoungjung@paulhastings.com>; apoff@ycst.com; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com; pkraman@ycst.com; Mailing List - Leedy <leedy@bartlitbeck.com>

Subject: [EXT] RE: Discovery Update

Phillip,

I believe my characterization of past events actually understates the egregiousness of Samsung's discovery conduct.

Moving beyond our disputes over the past, I do not understand your present obsession over finalizing the one aspect of the representative products agreement addressed in your August 10

email. While that is an important aspect of any such agreement, there are numerous other issues that need to be ironed-out, including how the parties will handle the products for which Samsung purports not to have key technical information. But you haven't said a word about those issues for quite some time. Elm is working on a proposal to address these other issues as well, and I hope to have that for you next week.

Moreover, we cannot possibly agree to a specific threshold—like the [REDACTED] threshold you proposed in your August 10 email—before we address the issues raised in my letter. For example, there are significant discrepancies between the downstream sales reported in the representative products spreadsheet you compiled pursuant to the Court's order and the sales spreadsheets you've previously produced. In order for us to understand the implications of choosing a particular threshold for purposes of this case, we need to be sure we're working off the correct data.

That said, there is one specific aspect of your August 10 proposal that I'm prepared to address, and that I'd like to discuss tomorrow: I take your proposal to mean that any component that has less than [REDACTED] in sales would be eliminated from the case. Rather than thinking about this in terms of components, however, I think we should be considering this issue of thresholds in terms of representative product groups. If a given product has relatively minimal sales, but is included in a group that has a lot of sales, that product should remain in the case because its inclusion should have little impact on the discovery to be conducted or the work to be done to prove infringement. On the other hand, there appear to be entire product groups that have relatively minimal sales which we could eliminate from the case.

For example, the memory product group with [REDACTED]

[REDACTED] Assuming these numbers are correct, then all the products in the group could be eliminated under our agreement. On the other hand, [REDACTED]

[REDACTED] I see no reason to eliminate such a product from the case (indeed, it may end up being the representative product for its group, given that many of the others in the group are not in inventory).

I look forward to discussing these issues tomorrow.

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Sent: Thursday, August 27, 2020 1:45 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Jung, Soyoung <soyoungjung@paulhastings.com>; apoff@ycst.com; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com; pkraman@ycst.com; Mailing List - Leedy <leedy@bartlitbeck.com>
Subject: RE: Discovery Update

Nosson,

We are free at 5 p.m. ET. Please circulate a meeting invite.

Your characterization of the representative products process is exaggerated and ignores Elm's own conduct. We have asked multiple times for Elm's position on Samsung's modified proposal to only be met with a letter raising entirely unrelated issues. Does Elm still not have a position on Samsung's modified proposal, and, if not, why?

Thanks,
Phillip

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Thursday, August 27, 2020 10:16 AM
To: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Jung, Soyoung <soyoungjung@paulhastings.com>; apoff@ycst.com; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com; pkraman@ycst.com; Mailing List - Leedy <leedy@bartlitbeck.com>
Subject: [EXT] RE: Discovery Update

Phillip,

I am not available at 4pmET tomorrow. Could we talk, instead, at 3pmET or 5pmET?

Your assertions that Elm has caused some sort of unreasonable delay in the process of reaching a representative products agreement are truly shocking. At every turn, Elm has been forced to push Samsung to provide the most basic discovery, only to find—time and again—that Samsung's disclosures have been incomplete and inaccurate. Samsung's apparent failure to meet its obligation to substantially complete its document production this week is a problem entirely of its own making.

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Sent: Wednesday, August 26, 2020 9:29 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Jung, Soyoung <soyoungjung@paulhastings.com>; apoff@ycst.com; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com; pkraman@ycst.com; Mailing List - Leedy <leedy@bartlitbeck.com>
Subject: RE: Discovery Update

Nosson,

Although we are still looking into a number of the issues that you raised for the first time this past Friday—many of which relate to the representative products spreadsheet provided to Elm back on July 10—we are willing to meet and confer this week in hopes of moving things forward. We are currently available on Friday at 4 p.m. ET. Please confirm this time works for Elm.

In particular, we don't understand why Elm has not responded to Samsung's proposed thresholds and modifications to the representative products proposal in our August 10 email. None of the issues raised in your letter should prevent the parties from finalizing an agreement now. As previously noted, the lack of an agreement has made it impossible for Samsung to complete substantial production. Please be prepared to explain Elm's current position during our call.

Regarding RFP No. 68, I believe we already explained that [REDACTED] but we will check again with Samsung and circle back.

Thanks,
Phillip

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Wednesday, August 26, 2020 11:34 AM
To: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Jung, Soyoung <soyoungjung@paulhastings.com>; apoff@ycst.com; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com; pkraman@ycst.com; Mailing List - Leedy <leedy@bartlitbeck.com>
Subject: [EXT] RE: Discovery Update

Phillip,

Are you available to meet and confer on the issues raised in my August 21 letter tomorrow or Friday?

In addition, I would like to meet and confer with you about Samsung's response to RFP No. 68, which sought sample of wafers used to make the relevant products. Samsung has refused to produce such wafers. We believe we are entitled to this discovery and would like to discuss whether there is room for compromise on this issue or if we need to raise it with the Court.

In particular, we would like to know whether Samsung would agree to produce 1-3 wafers from each of its relevant process nodes which are currently active or from which Samsung has fully processed wafers in inventory.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Friday, August 21, 2020 4:10 PM

To: Citroen, Phillip W. <phillipcitroen@paulhastings.com>

Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Jung, Soyoun <soyoungjung@paulhastings.com>; apoff@ycst.com; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com; pkraman@ycst.com; Mailing List - Leedy <leedy@bartlitbeck.com>

Subject: RE: Discovery Update

Phillip,

Please see the attached letter which responds to your email, below, and addresses a number of other discovery-related issues. Please also let me know when you are available to meet and confer to discuss the issues raised in the attached letter.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Citroen, Phillip W. <phillipcitroen@paulhastings.com>

Sent: Thursday, August 20, 2020 3:55 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Jung, Soyoun <soyoungjung@paulhastings.com>; apoff@ycst.com; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com; pkraman@ycst.com; Mailing List - Leedy <leedy@bartlitbeck.com>

Subject: RE: Discovery Update

Nosson,

To follow up on my email from August 14, we still have not received a response on our representative products proposal. Can you please provide an update? Specifically, does Elm agree to the modifications and threshold proposed in our email sent to you on August 10?

With the substantial completion deadline quickly approaching, we would like to finalize the agreement as soon as possible. The lack of agreement is delaying Samsung's ability to complete substantial production.

On your last point, you should have by now all license agreements that Samsung has identified except for the one with [REDACTED], which you referred to in your letter to Judge Hall. As you know, we do not have consent to produce that agreement yet, even though we provided [REDACTED] a letter to try to resolve the issue.

Thanks,
Phillip

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Friday, August 14, 2020 4:11 PM

To: Citroen, Phillip W. <phillipcitroen@paulhastings.com>

Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Jung, Soyoung <soyoungjung@paulhastings.com>; apoff@ycst.com; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com; pkraman@ycst.com; Mailing List - Leedy <leedy@bartlitbeck.com>

Subject: [EXT] RE: Discovery Update

Phillip,

I expect to have an update for you on the representative products issues next week.

With regard to our expert's access to the PRP documents, we continue to believe that Samsung's insistence on such a restrictive review process is unreasonable. Nonetheless, to avoid further delays in our review of those materials, we are open to shouldering 1/3 of the cost, as you've requested. Before we finalize that commitment, however, we need the following:

1. A written estimate of the costs, and how they break down. We've asked for this a few times and have yet to receive it.
2. A detailed description of the protocols that will govern this review. We've requested this a number of times already, and you haven't provided it. We cannot possibly commit to a review process that has only been described to us in broad strokes.
3. A commitment from you that the computer contains all relevant PRPs. To the extent we discover there are missing PRPs, and the process for loading them for review prolongs the time that we need to maintain this system, we propose that Samsung shoulder 100% of the costs associated with such delays. With the substantial completion deadline coming up in a matter of weeks, there is simply no excuse for an incomplete production of these materials.

With regard to product samples allegedly subject to NDA, the only reason we're even aware of the issue is because *we did request* samples that you now say are subject to NDA. So I don't understand how you could say this issue is premature.

In addition, we are still waiting for Samsung to produce licenses that it has identified as relevant to this case. While we have worked with you over the past months to resolve concerns about those licenses, we still haven't received them. We think the time has come to produce those materials.

Regards,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Citroen, Phillip W. <phillipcitroen@paulhastings.com>

Sent: Friday, August 14, 2020 1:18 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Jung, Soyoun <soyoungjung@paulhastings.com>; apoff@ycst.com; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com; pkraman@ycst.com; Mailing List - Leedy <leedy@bartlitbeck.com>

Subject: RE: Discovery Update

Nosson,

Do you have an update on the representative products issues (including the proposed thresholds) and the standalone computer issue? We would like to reach agreement on these issues.

Also, during the meet and confer this past Monday, you stated that Elm will move to compel samples of memory products subject to NDAs—even though Elm never requested samples of those products. This is yet another example of Elm prematurely running to the Court instead of making an attempt to work things out. If Elm would have simply requested samples of those products (like it did for certain image sensor products), Samsung could have taken the appropriate steps to notify relevant third parties and produce the requested samples, subject to any objections by third parties.

Your response during the meet and confer was that Elm should not have to request samples of those products, but that if a request is necessary, you were orally making the request for relevant samples during the call (albeit without specifying which ones). That is an unreasonable position. Samsung should not have to guess which products Elm may request and preemptively contact all relevant third parties. It is likewise inappropriate for Elm to vaguely request—for the first time during the meet and confer—samples of all products subject to NDAs, and then attempt to use that request as a basis to move to compel.

If Elm wants samples of any of those products, it must specifically request those products in writing by product number so that Samsung can move the process forward on its end. If Samsung is not able to produce the requested products because of third-party objections, Elm may then have a legitimate basis to move to compel. Until then, this appears to be a made-up dispute manufactured by Elm merely so that it can include Samsung in its motion. Indeed, you acknowledged during the meet and confer that Elm “does not want to do this more than once,” as part of your justification for prematurely adding Samsung to your motion against Micron and Hynix.

Samsung nevertheless remains amenable to working through these issues, but proper procedures need to be followed.

Thanks,
Phillip

From: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Sent: Monday, August 10, 2020 4:54 PM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Jung, Soyoun <soyoungjung@paulhastings.com>; apoff@ycst.com; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com; pkraman@ycst.com; Mailing List - Leedy <leedy@bartlitbeck.com>
Subject: RE: Discovery Update

Nosson,

We double checked the products you identified. Some appear in the downstream chart and some don't. We noticed that copying and pasting product numbers when searching does not always work, so we recommend typing the numbers instead. The accused products with downstream sales missing from the downstream chart are sold as modules. The attached chart identifies the modules that include the accused products.

Regarding representative products, Samsung generally agrees with the approach outlined in your email but proposes a slight variation to No. 3 below.

1. While Samsung believes that it has identified all relevant products, to the extent it discovers a newly relevant product (or additional sales data that results in a product having sales above one or more thresholds), that product should be grouped according to the same criteria, to the extent possible. For example, if the newly relevant product has the same node as a previously existing group of products, that product should not be added to a group of products with a different node.
2. Elm can unilaterally select which product group to include the newly relevant product only with respect to any unknown criteria. For example, if the node is known for the newly relevant product but the remaining criteria are not, Elm can unilaterally select which group of products having the same node to which to add the newly relevant product.
3. Elm can unilaterally select which product group to include the newly relevant product if no group exists with the same criteria, as long as the selection is reasonable based on the criteria. For example, a DRAM product should not be added to a group of NAND products, a wire product should not be added to a group of TSV products, etc.

With respect to the thresholds, Samsung proposes using [REDACTED] for all thresholds. This number reasonably reduces the number of accused products, which will simplify the representative products process. Please let us know if Elm agrees with these modifications and the proposed number for the thresholds.

We have attached the latest court-ordered representative products chart.

Finally, Samsung contacted other e-discovery vendors since our last call in hopes of finding a cheaper set up that provides similar access and protections, but they are all similarly priced. Did you have a chance to consult further with your client regarding cost splitting? Specifically, will Elm agree to cover 1/3 of the cost? Again, while we believe the parties should split the cost 50-50, we believe this is a reasonable compromise that allows Elm to access the documents while also sufficiently protecting Samsung's highly sensitive information.

Thanks,
Phillip

From: Nossou Knobloch <nossou.knobloch@bartlitbeck.com>
Sent: Friday, July 24, 2020 2:42 PM
To: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Jung, Soyoun <soyoungjung@paulhastings.com>; apoff@ycst.com; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com; pkraman@ycst.com; Mailing List - Leedy <leedy@bartlitbeck.com>
Subject: [EXT] RE: Discovery Update

Counsel,

On our call today, we discussed the fact that there appear to be accused products for which Samsung has downstream sales, but that were omitted from the downstream product inventory chart you sent earlier this week. You asked that I provide some examples. Here are a few examples:

1. [REDACTED]: Shows about [REDACTED] in downstream product sales, but doesn't show up in the downstream product inventory chart.
2. [REDACTED]: Shows over [REDACTED] in downstream product sales, but doesn't show up in the downstream product inventory chart.
3. [REDACTED]: Shows over [REDACTED] in downstream product sales, but doesn't show up in the downstream product inventory chart.

You also asked me to send you an email explaining how we might address the concerns I raised in the event the parties use revenue data to narrow the number of representative product groups. As I explained on our call, my concern is that Samsung's sales data figures have fluctuated a lot over the past months/year, and that such an agreement would need to take into account the possibility of future fluctuations. The idea I raised on the call today would address that possibility as follows:

1. The parties would agree on certain sales thresholds below which Elm would agree not to include the products in the case. As discussed, these thresholds would likely be set differently for US component sales, US downstream products sales, and non-US component sales. These thresholds would be based on the latest data supplied by Samsung.
2. The parties would create representative product groups, and select representative products, only for the products that are above one or more the sales thresholds.
3. To the extent that Samsung later discovers additional products falling above the sales thresholds (or identifies additional sales for an existing product that would push it above one or more of the sales thresholds), that product would be added to the list of accused

products. For purposes of this agreement, we'd call this a "newly relevant product." Elm would have the right to unilaterally determine which product group to include the newly relevant product in. Samsung would have to accept Elm's choice, regardless of any technical or other differences between the newly relevant product and the other products in the group. Samsung would be precluded from arguing that the newly relevant product differed from the other products in the group.

We also talked about Samsung's prior refusal to identify the third party products that contain relevant Samsung components.



We also talked about the following issues on which you said you'd follow-up:

1. Non-US sales to US based customers: you indicated you were expecting to produce this updated data shortly.
2. Sending us the native excel version of the court-ordered representative products chart.
3. Update us on the image sensor and memory products for which samples are available, so we can finalize an initial set of samples to order.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch

Sent: Thursday, July 23, 2020 9:54 PM

To: Citroen, Phillip W. <phillipcitroen@paulhastings.com>

Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Jung, Soyoun <soyoungjung@paulhastings.com>; apoff@ycst.com; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com; pkraman@ycst.com; Mailing List - Leedy <leedy@bartlitbeck.com>

Subject: RE: Discovery Update

Counsel,

In advance of our meet and confer tomorrow, I wanted to update Elm's position on one of the issues we've been discussing, namely, Samsung's request that Elm share the cost of the setup Samsung has proposed for Elm's review of Samsung's PRP documents. As I've explained before, Elm believes that the steps Samsung has insisted upon are overly restrictive. Elm believes that Samsung should be able to simply ship Elm's expert a standalone computer that is configured to restrict any network access or copying of the files on the computer. This option would be significantly cheaper. Our very generous estimate is that it would cost no more than \$3,000. Accordingly, Elm is willing to contribute up to \$3,000 to the cost of the setup Samsung has proposed.

Please let me know whether Samsung will agree to finally provide these materials to our expert.

Please also let me know if Samsung has any additional updates on the issues we've been discussing. I am particularly interested in hearing any new thoughts on grouping memory devices into representative product groups. Given the lack of progress on this issue in the last couple weeks, I am concerned that we've reached an impasse and may need the Court's assistance.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Thursday, July 23, 2020 3:43 PM

To: Citroen, Phillip W. <phillipcitroen@paulhastings.com>

Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Jung, Soyoun <soyoungjung@paulhastings.com>; apoff@ycst.com; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com; pkraman@ycst.com; Mailing List - Leedy <leedy@bartlitbeck.com>

Subject: Re: Discovery Update

Great. That works for me. Assuming it works for Michael or Brian could you please send around a dial in for that time?

BartlitBeck LLP

Nosson D. Knobloch | p: [303.592.3122](tel:303.592.3122) | c: [773.301.2851](tel:773.301.2851) | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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On Jul 23, 2020, at 2:58 PM, Citroen, Phillip W. <phillipcitroen@paulhastings.com> wrote:

We are free at 12:30 ET tomorrow. Thanks.

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Thursday, July 23, 2020 3:47 PM
To: Citroen, Phillip W. <phillipcitroen@paulhastings.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Jung, Soyoung <soyoungjung@paulhastings.com>
Cc: apoff@ycst.com; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com; pkraman@ycst.com; Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] RE: Discovery Update

Phillip—my apologies for the delayed response. I'm not available at that time today. What time tomorrow works for you?

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Sent: Thursday, July 23, 2020 8:49 AM
To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Jung, Soyoung <soyoungjung@paulhastings.com>
Cc: apoff@ycst.com; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com; pkraman@ycst.com; Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: RE: Discovery Update

We are available at 3:30 ET today. We may have more flexibility tomorrow.

Thanks,
Phillip

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Wednesday, July 22, 2020 12:14 AM
To: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Citroen, Phillip W. <phillipcitroen@paulhastings.com>; Soobert, Allan M. <allansoobert@paulhastings.com>; Jung, Soyoung <soyoungjung@paulhastings.com>
Cc: apoff@ycst.com; bfarnan@farnanlaw.com; MFarnan@farnanlaw.com; pkraman@ycst.com; Mailing List - Leedy <leedy@bartlit-beck.com>
Subject: [EXT] Discovery Update

Counsel,

As you know, we are scheduled to provide the Court a further update on the outstanding discovery issues this coming Monday (i.e., the issues addressed in our

last letter to the Court). Please let me know when you are available to meet and confer to discuss those issues this week.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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Exhibit 39

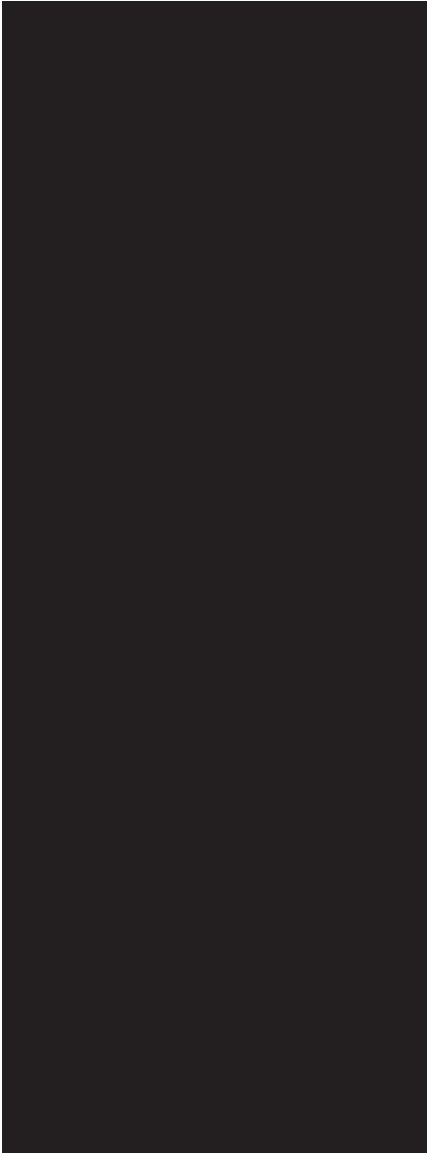
Kidokoro, Koichiro

From: Citroen, Phillip W.
Sent: Monday, October 26, 2020 9:33 PM
To: Nosson Knobloch
Cc: Mailing List - Leedy; Brian Farnan; Michael J. Farnan; ServicePH Samsung-ELM 3DS; apoff@ycst.com
Subject: Elm | Representative Products Spreadsheet
Attachments: Elm v. Samsung - Amended Representative Products Spreadsheet (Served 10.26.2020).XLSX

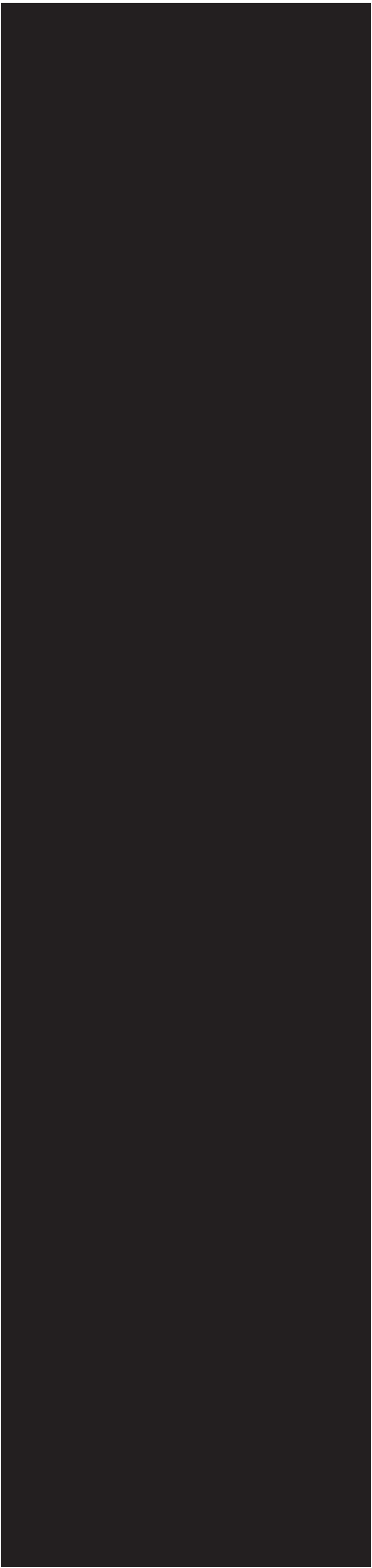
Nosson,

Per our discussion on Friday, please find attached an updated Representative Products Spreadsheet. In addition to updated financial numbers, the spreadsheet includes updated node information for the products listed below.

Thanks,
Phillip







PAUL
HASTINGS

Phillip Citroen | Of Counsel, Litigation Department

Paul Hastings LLP | 2050 M Street NW, Washington, DC 20036 | Direct: +1.202.551.199

Main: +1.202.551.1700 | Fax: +1.202.551.0491 | phillipcitroen@paulhastings.com |

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Exhibit 40

Kidokoro, Koichiro

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Wednesday, July 8, 2020 1:55 PM
To: Citroen, Phillip W.; Mailing List - Leedy; mfarnan@farnanlaw.com; bfarnan@farnanlaw.com
Cc: ServicePH Samsung-ELM 3DS; Poff, Adam; Kraman, Pilar
Subject: [EXT] Elm/Samsung Meet and Confer

Counsel,

During yesterday's meet and confer, we discussed among other things why the financial data went down so significantly between the chart you provided pursuant to the Court's order on June 19 and the update you sent on Monday. You explained that Monday's chart showed reduced sales solely because you had eliminated sales of wirebonded products from after April 2017, when many of the asserted patent claims expired.

We have investigated your explanation and it is simply not true. Among other things, Monday's chart shows significantly lower sales of TSV products than the June 19 chart. Samsung's whiplashing disclosures are preventing Elm from moving this case forward. At this late stage of the case, there is no excuse for Samsung's inability to provide accurate information in discovery. We intend to raise this issue to the Court in Friday's update.

In addition, please let us know your thoughts on the following issues we discussed yesterday so that we can determine whether they also need to be raised with the Court in Friday's update:

1. Representative products agreement: We discussed the fact that Samsung's current position would require so many different product groups that it would render any representative products agreement largely useless. Please let us know whether you have any new thoughts on how to narrow the number of criteria for product grouping, or if this is an issue we need to raise with the Court on Friday.
2. Substantially flexible claim term: As discussed yesterday, it seems increasingly clear that one of the main reasons Samsung has insisted on additional criteria for the representative products groups relates to its understanding of the "substantially flexible" claim limitations. Elm believes that the Court's construction of those terms is clear, and that some of the criteria Samsung has insisted on including in the agreement are unnecessary in light of that construction (e.g., the packaging processes for the chips that are thicker than 50 microns). Please let us know whether Samsung is willing to explain the relevance of these criteria, or if this is another issue we need to raise with the Court on Friday.

3. PRP document review: We discussed Samsung's proposal regarding Elm's expert's review of the PRP documents. I explained that we view Samsung's proposal as overly restrictive and frankly insulting. We said we'd consider whether Elm would share some of the cost of the setup, and get back to you on that. In the meantime, we ask that Samsung reconsider its draconian proposal.
4. Non-US revenue from sales to US-based customers: We have been discussing this issue for weeks, and are frustrated by Samsung's failure to supplement this data to date. Please let us know when Samsung will provide this data. In light of Samsung's recent significant reduction in reported US sales revenue, this issue has taken on even greater urgency. We intend to raise this issue with the Court on Friday if Samsung cannot commit to a timeline for providing this data.

Given the number of potential issues in dispute, we believe a further meet and confer tomorrow makes sense. I am currently available from 10:30-11:30am; or 12:30-3:30pm. All in Mountain time. Please let me know if you'd like to talk then.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Tuesday, July 7, 2020 8:02 AM

To: Citroen, Phillip W. <phillipcitroen@paulhastings.com>; Mailing List - Leedy <leedy@bartlit-beck.com>; mfarnan@farnanlaw.com; bfarnan@farnanlaw.com

Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Poff, Adam <APOFF@ycst.com>; Kraman, Pilar <PKraman@ycst.com>

Subject: RE: Elm 3DS Innovations, LLC v. Samsung Electronics Co., Ltd., C.A. No. 14-1430-LPS

Phillip,

Please be prepared to explain the fluctuations in your sales figures on today's meet and confer.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Sent: Monday, July 6, 2020 6:55 PM
To: Mailing List - Leedy <leedy@bartlit-beck.com>; mfarnan@farnanlaw.com; bfarnan@farnanlaw.com
Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Poff, Adam <APOFF@ycst.com>; Kraman, Pilar <PKraman@ycst.com>
Subject: RE: Elm 3DS Innovations, LLC v. Samsung Electronics Co., Ltd., C.A. No. 14-1430-LPS

Counsel,

We have updated the spreadsheet served on June 19 to bold nodes that correspond to a die that has a thickness of 50 microns or less, to the extent Samsung was able to find this information after a reasonable search. [REDACTED]
[REDACTED] The spreadsheet also includes updated financial data.

Additionally, regarding image sensor products, Samsung proposes that we group these products using the following criteria:

1. Process node with the same node size, trench isolation fabrication process, and number of metal layers; and
2. Number of stacked chips.

We aim to provide the information corresponding to No. 1 this week, to the extent not already provided.

Thanks,
Phillip

From: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Sent: Friday, June 19, 2020 6:20 PM
To: Mailing List - Leedy <leedy@bartlit-beck.com>; mfarnan@farnanlaw.com; bfarnan@farnanlaw.com
Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Poff, Adam <APOFF@ycst.com>; Kraman, Pilar <PKraman@ycst.com>
Subject: Elm 3DS Innovations, LLC v. Samsung Electronics Co., Ltd., C.A. No. 14-1430-LPS

Counsel,

Pursuant the Court's May 27 Oral Order, please see the attached spreadsheet, which mirrors the columns in Ex. 30 to Elm's May 19 letter to the Court with the modifications proposed in Samsung's May 22 letter and approved by the Court's Oral Order.

Although not required by the Court's Oral Order, the spreadsheet also includes similar information for the accused image sensor products to assist the parties in reaching a representative products agreement for those products.

The following notes apply to the memory products:

1. The list of memory products includes:
 - a. all stacked memory products sold in the relevant time period with at least one die having a minimum thickness of 50 microns, and

- b. [REDACTED]
- 2. [REDACTED]
- 3. [REDACTED]
- 4. For certain inventory, a minimum numbers of products must be purchased. Also, some inventory may currently be allocated to customers.

Please note the information in the spreadsheet was collected from numerous divisions, groups, engineers, and resources for a large number of products and in a short period of time, so Samsung reserves the right to revise the information in the spreadsheet should the need arise.

We look forward to working with you to address any questions you may have and select representative products.

Regards,
Phillip



Phillip Citroen | Of Counsel, Litigation Department

Paul Hastings LLP | 875 15th Street, N.W., Washington, DC 20005 | Direct: +1.202.551. [REDACTED]
| Main: +1.202.551.1700 | Fax: +1.202.551.0491 | phillipcitroen@paulhastings.com | www.paulhastings.com

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Exhibit 41

Kidokoro, Koichiro

From: Citroen, Phillip W.
Sent: Thursday, July 9, 2020 10:36 AM
To: Nosson Knobloch; Mailing List - Leedy; mfarnan@farnanlaw.com; bfarnan@farnanlaw.com
Cc: ServicePH Samsung-ELM 3DS; Poff, Adam; Kraman, Pilar
Subject: RE: Elm/Samsung Meet and Confer

Counsel,

Our responses are below in red. If a call is necessary, we are still free at 10:30 a.m. MT.

Thanks,
Phillip

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Wednesday, July 8, 2020 1:55 PM
To: Citroen, Phillip W. <phillipcitroen@paulhastings.com>; Mailing List - Leedy <leedy@bartlit-beck.com>; mfarnan@farnanlaw.com; bfarnan@farnanlaw.com
Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Poff, Adam <APOFF@ycst.com>; Kraman, Pilar <PKraman@ycst.com>
Subject: [EXT] Elm/Samsung Meet and Confer

Counsel,

During yesterday's meet and confer, we discussed among other things why the financial data went down so significantly between the chart you provided pursuant to the Court's order on June 19 and the update you sent on Monday. You explained that Monday's chart showed reduced sales solely because you had eliminated sales of wirebonded products from after April 2017, when many of the asserted patent claims expired.

We have investigated your explanation and it is simply not true. Among other things, Monday's chart shows significantly lower sales of TSV products than the June 19 chart. Samsung's whiplashing disclosures are preventing Elm from moving this case forward. At this late stage of the case, there is no excuse for Samsung's inability to provide accurate information in discovery. We intend to raise this issue to the Court in Friday's update.

[PH] There appears to be an error introduced in our updating of the spreadsheet just to account for the shorter damages window for wire products. We are currently investigating and will send an update, if necessary. Either way, you already have all the underlying sales data, which the chart merely tries to summarize for your convenience. So, there is no reason to manufacture a dispute out of this.

In addition, please let us know your thoughts on the following issues we discussed yesterday so that we can determine whether they also need to be raised with the Court in Friday's update:

1. Representative products agreement: We discussed the fact that Samsung's current position would require so many different product groups that it would render any representative products agreement largely useless. Please let us know whether you have any new thoughts on how to narrow the number of criteria for product grouping, or if this is an issue we need to raise with the Court on Friday.

[PH] Samsung requires the product groupings that we have been discussing for many months in order to account for its non-infringement positions. Samsung should not be required to give up those positions because Elm is unhappy about the number of potential representative products. An easy solution to this issue is for Elm to accuse a reasonable number of products. You have said that Elm is most interested in Samsung's high-revenue products, so why not narrow the case to those products? That would reduce the number of representative products.

That said, as discussed on our call, [REDACTED]

[REDACTED] We hope to resolve this issue this week.

2. Substantially flexible claim term: As discussed yesterday, it seems increasingly clear that one of the main reasons Samsung has insisted on additional criteria for the representative products groups relates to its understanding of the "substantially flexible" claim limitations. Elm believes that the Court's construction of those terms is clear, and that some of the criteria Samsung has insisted on including in the agreement are unnecessary in light of that construction (e.g., the packaging processes for the chips that are thicker than 50 microns). Please let us know whether Samsung is willing to explain the relevance of these criteria, or if this is another issue we need to raise with the Court on Friday.

[PH] We have already explained the relevance numerous times by now, and we don't understand why you continue to ignore our explanation on this issue, unless your intent is to obtain Samsung's non-infringement arguments in detail. Simply put, the steps followed for packaging the chips (even those that are thicker than 50 microns) in the accused products are relevant to whether those products satisfy the "substantially flexible" terms—as construed by the Court—and the "stress" terms. This is a straightforward and entirely comprehensible explanation. You may disagree, but, as we noted in our June 1 letter to the Court, that doesn't mean Samsung is required to explain to you its non-infringement positions well before it is required to do so.

3. PRP document review: We discussed Samsung's proposal regarding Elm's expert's review of the PRP documents. I explained that we view Samsung's proposal as overly restrictive and frankly insulting. We said we'd consider whether Elm would share some of the cost of the setup, and get back to you on that. In the meantime, we ask that Samsung reconsider its draconian proposal.

[PH] Samsung's proposal is not "insulting" or "draconian." These are unprecedented times that require unprecedented solutions for providing Elm with access to some of Samsung's most sensitive information. Your proposal to send the files to your expert at his home because we have no reason to distrust him is unworkable on its face. If Elm is not willing to move forward with Samsung's proposal, the alternative is to wait until our San Diego office is open for your expert to inspect the laptop in person.

4. Non-US revenue from sales to US-based customers: We have been discussing this issue for weeks, and are frustrated by Samsung's failure to supplement this data to date. Please

let us know when Samsung will provide this data. In light of Samsung's recent significant reduction in reported US sales revenue, this issue has taken on even greater urgency. We intend to raise this issue with the Court on Friday if Samsung cannot commit to a timeline for providing this data.

[PH] Samsung has already provided complete revenue (US and non-US) for all customers worldwide. You recently asked that we segregate this data for Elm to indicate the non-US revenue for US-based customers. We told you we believe we can provide this information and will follow up with you. There is no reason to prematurely raise this issue with the Court and, consistent with your repeated tactics, this request is outside the bounds of our original discovery dispute and the Court order and has no place in the upcoming joint status letter. Nevertheless, we have followed up with Samsung and asked for an approximate ETA.

Given the number of potential issues in dispute, we believe a further meet and confer tomorrow makes sense. I am currently available from 10:30-11:30am; or 12:30-3:30pm. All in Mountain time. Please let me know if you'd like to talk then.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Tuesday, July 7, 2020 8:02 AM

To: Citroen, Phillip W. <phillipcitroen@paulhastings.com>; Mailing List - Leedy <leedy@bartlit-beck.com>; mfarnan@farnanlaw.com; bfarnan@farnanlaw.com

Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Poff, Adam <APOFF@ycst.com>; Kraman, Pilar <PKraman@ycst.com>

Subject: RE: Elm 3DS Innovations, LLC v. Samsung Electronics Co., Ltd., C.A. No. 14-1430-LPS

Phillip,

Please be prepared to explain the fluctuations in your sales figures on today's meet and confer.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Sent: Monday, July 6, 2020 6:55 PM
To: Mailing List - Leedy <leedy@bartlit-beck.com>; mfarnan@farnanlaw.com; bfarnan@farnanlaw.com
Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Poff, Adam <APOFF@ycst.com>; Kraman, Pilar <PKraman@ycst.com>
Subject: RE: Elm 3DS Innovations, LLC v. Samsung Electronics Co., Ltd., C.A. No. 14-1430-LPS

Counsel,

We have updated the spreadsheet served on June 19 to bold nodes that correspond to a die that has a thickness of 50 microns or less, to the extent Samsung was able to find this information after a reasonable search. [REDACTED]

[REDACTED] The spreadsheet also includes updated financial data.

Additionally, regarding image sensor products, Samsung proposes that we group these products using the following criteria:

1. Process node with the same node size, trench isolation fabrication process, and number of metal layers; and
2. Number of stacked chips.

We aim to provide the information corresponding to No. 1 this week, to the extent not already provided.

Thanks,
Phillip

From: Citroen, Phillip W. <phillipcitroen@paulhastings.com>
Sent: Friday, June 19, 2020 6:20 PM
To: Mailing List - Leedy <leedy@bartlit-beck.com>; mfarnan@farnanlaw.com; bfarnan@farnanlaw.com
Cc: ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>; Poff, Adam <APOFF@ycst.com>; Kraman, Pilar <PKraman@ycst.com>
Subject: Elm 3DS Innovations, LLC v. Samsung Electronics Co., Ltd., C.A. No. 14-1430-LPS

Counsel,

Pursuant the Court's May 27 Oral Order, please see the attached spreadsheet, which mirrors the columns in Ex. 30 to Elm's May 19 letter to the Court with the modifications proposed in Samsung's May 22 letter and approved by the Court's Oral Order.

Although not required by the Court's Oral Order, the spreadsheet also includes similar information for the accused image sensor products to assist the parties in reaching a representative products agreement for those products.

The following notes apply to the memory products:

1. The list of memory products includes:
 - a. all stacked memory products sold in the relevant time period with at least one die having a minimum thickness of 50 microns, and
 - b. [REDACTED]

- 2. 
- 3. 

4. For certain inventory, a minimum numbers of products must be purchased. Also, some inventory may currently be allocated to customers.

Please note the information in the spreadsheet was collected from numerous divisions, groups, engineers, and resources for a large number of products and in a short period of time, so Samsung reserves the right to revise the information in the spreadsheet should the need arise.

We look forward to working with you to address any questions you may have and select representative products.

Regards,
Phillip



Phillip Citroen | Of Counsel, Litigation Department

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Exhibit 42

Kidokoro, Koichiro

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Thursday, September 10, 2020 6:04 PM
To: Citroen, Phillip W.; apoff@ycst.com; ServicePH Samsung-ELM 3DS
Cc: Mailing List - Leedy; MFarnan@farnanlaw.com; bfarnan@farnanlaw.com
Subject: [EXT] Representative Products Agreement
Attachments: 20200910 Elm Samsung Representative Products Agreement.docx

Phillip,

As we've discussed, the parties need to memorialize a representative products agreement. I've attached a draft agreement that largely reflects issues we've already agreed upon, and adds additional detail where necessary. Please let us know your thoughts.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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Exhibit 43

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

ELM 3DS INNOVATIONS, LLC,
Plaintiff,
v.
SAMSUNG ELECTRONICS CO., LTD., et al.,
Defendants.

C.A. No. 14-cv-1430-LPS

JURY TRIAL DEMANDED

Amended Representative Products Agreement

Plaintiff Elm 3DS Innovations, LLC (“Elm”) and Defendants Samsung Electronics Co. Ltd., Samsung Semiconductor, Inc., Samsung Electronics America, Inc., Samsung Telecommunications America, LLC, and Samsung Austin Semiconductor, LLC (collectively “Samsung”), hereby enter this Representative Products Agreement.

On September 5, 2020, Samsung provided Elm an Excel file, attached hereto as Ex. A, listing all the products accused of infringement in this case and providing summary technical and sales data for each accused product. Samsung represents that the data in Exhibit A is accurate and complete, and acknowledges that Elm is relying on this data to enter this agreement.

A. Memory Products

The “Memory” tab to Exhibit A lists [REDACTED] accused memory products. The parties have agreed to organize those products into Memory Product Groups that share the following characteristics, which are included in Exhibit A: Number of Stacked Chips; Minimum Die Thickness; Process Node; and TSV/Wire (the “Relevant Criteria”). The Memory Product Groups are identified in Exhibit B, which includes a total of [REDACTED] Memory Product Groups.

For each Memory Product Group, the parties agree to identify one product that will be representative for purposes of the infringement issues in this case (“Representative Memory Product”). A Representative Memory Product may be identified by Memory Product Part Number, Corresponding Chip Part Number for Modules, or Downstream Product Number. Proof that the

Representative Memory Product infringes any asserted claim in this case will constitute proof that all the products in the same Memory Product Group also infringe that claim. Conversely, proof that the Representative Memory Product does not infringe any asserted claim in this case will constitute proof that all the products in the same Memory Product Group also do not infringe that claim. In addition, Samsung's production of all technical data in its possession, custody, and control that relates to the Representative Memory Product will discharge its obligation to provide such technical data for the other products included within that Memory Product Group.

Elm will select one Representative Memory Product for each Memory Product Group. Samsung agrees that it will raise any challenges to Elm's selection of Representative Memory Products within one week of receiving Elm's selection. If Samsung does not raise any challenges within a week, then the parties agree that the products Elm selects will be the Representative Memory Products for their respective Memory Product Groups. Elm's initial selection of Representative Memory Products is identified in Column ___ of Exhibit B. Samsung agrees to produce all technical data relating to those Representative Memory Products that is within Samsung's possession, custody, or control no later than September 23rd. To the extent Samsung has not already ordered samples of the Representative Memory Products for Elm, Samsung agrees to work to provide samples of each such product as soon as possible.

As can be seen in Column ___ of Exhibit B, Elm has not yet selected a Representative Memory Product for [] of the Memory Product Groups. Elm has been unable to select Representative Memory Products for those groups in large part due to the fact that Samsung does not have samples available for any of the products in that group and/or has not identified downstream products that include the products in that group that Elm is able to purchase. Samsung agrees to provide all the information in its possession, custody, or control that might aid Elm in

locating samples of the Memory Product Groups for which Elm has not yet selected a Representative Memory Product by September 23rd. Elm agrees to work diligently to locate samples of such products and to update Column ___ of Exhibit B with the identification of any additional Representative Memory Products.

Exhibit A lists [REDACTED] memory products for which one or more of the Relevant Criteria is missing. For each of the products missing Relevant Criteria, Samsung's discovery obligations are not discharged by producing information related to the Representative Memory Products. Samsung must, therefore, provide all technical data in its possession, custody, or control for each of those products by September 23rd. To the extent that such discovery fills in the gaps on the Relevant Criteria, the parties will work quickly to update Exhibit A to reflect that new information.

For any product that is missing Relevant Criteria, Elm may select a Memory Product Group in which to include that product, provided that the product was made using the same process node as the other products in that group. The parties agree that, in such a case, the Representative Memory Product will be representative of the product that is missing Relevant Criteria for all infringement issues other than dielectric stress and substantial flexibility.¹ Samsung agrees that it will raise any challenges to Elm's selection of the Memory Product Group in which to place the product missing Relevant Criteria within one week of receiving Elm's selection. If Samsung does not raise any challenges within a week, then the parties agree that Elm's selection is final, pending discovery of additional Relevant Criteria related to the product at issue.

B. Image Sensor Products

¹ This agreement does not prevent the parties from making any other appropriate arguments concerning the products that are missing Relevant Criteria. By way of example only, the parties will be free to argue—including in the form of expert testimony—that evidence regarding other relevant products is sufficient to establish whether or not the product missing Relevant Criteria also practices the dielectric stress and/or substantial flexibility limitations.

The “Image Sensor” tab to Exhibit A lists [REDACTED] accused image sensor products. The parties have agreed to organize those products into Image Sensor Product Groups that share the following characteristics, all of which are included in Exhibit A: Number of Stacked Chips; Process Node; Trench Isolation; Number of Metal Layers (Top Wafer); and Number of Metal Layers (Bottom Wafer). The Image Sensor Product Groups are identified in Exhibit B, which includes a total of [REDACTED] Image Sensor Product Groups.

For each Image Sensor Product Group, the parties agree to identify one product that will be representative for purposes of the infringement issues in this case (“Representative Image Sensor Product”). Representative Image Sensor Products may be identified by Image Sensor Product Number or Downstream Product Number. Proof that the Representative Image Sensor Product infringes any asserted claim in this case will constitute proof that all the products in the same Image Sensor Product Group also infringe that claim. Conversely, proof that the Representative Image Sensor Product does not infringe any asserted claim in this case will constitute proof that all the products in the same Image Sensor Product Group also do not infringe that claim. In addition, Samsung’s production of all technical data in its possession, custody, and control that relates to the Representative Image Sensor Product will discharge its obligation to provide such technical data for the other products included within that Image Sensor Product Group.

Elm will select one Representative Image Sensor Product for each Image Sensor Product Group. Samsung agrees that it will raise any challenges to Elm’s selection of Representative Image Sensor Products within one week of receiving Elm’s selection. If Samsung does not raise any challenges within a week, then the parties agree that the products Elm selects will be the Representative Image Sensor Products for their respective Image Sensor Product Groups. Elm’s initial selection of Representative Image Sensor Products is identified in Column ___ of Exhibit B.

Samsung agrees to produce all technical data relating to those Representative Image Sensor Products that is within Samsung's possession, custody, or control no later than September 23rd. To the extent Samsung has not already ordered samples of the Representative Image Sensor Products for Elm, Samsung agrees to work to provide samples of each such product as soon as possible.

As can be seen in Column ___ of Exhibit B, Elm has not yet selected a Representative Image Sensor Product for ___ of the Image Sensor Product Groups. Elm has been unable to select Representative Image Sensor Products for those groups in large part due to the fact that Samsung does not have samples available for any of the products in that group, has not identified downstream products that include the products in that group that Elm is able to purchase, or has asserted that Elm must pay Samsung [REDACTED] in order to obtain a sample. Samsung agrees to provide all the information in its possession, custody, or control that might aid Elm in locating samples of the Image Sensor Product Groups for which Elm has not yet selected a Representative Image Sensor Product by September 23rd. Elm agrees to work diligently to locate samples of such products and to update Column ___ of Exhibit B with the identification of any additional Representative Image Sensor Products.

C. Sales Thresholds

The parties agree to drop from this case any representative product group for which Exhibit A shows less than [INSERT] in sales. This will lead to the elimination of [] Memory Product Groups and [] Image Sensor Product Groups. The eliminated groups are listed in Exhibit C.

To the extent that Samsung later produces sales data indicating that any of the product groups in Exhibit C in fact had more than [INSERT] in sales, the parties agree to the following procedures:

1. Elm may unilaterally select an existing product group in which to include the previously excluded product group. To the extent possible, Elm must select an existing product group that shares Relevant Criteria with the newly-relevant group.
2. The representative product for the group Elm selects will then also be treated as representative for the products in the newly-relevant group.

D. Miscellaneous Provisions

This agreement will not be used to prejudice either party's ability to present their case. For example, neither party will assert that the omission of evidence that Samsung has withheld because of this agreement has led to a failure of proof on any issue.

September __, 2020

/s/ draft

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Respectfully submitted,

/s/ draft

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*Attorneys for Plaintiff Elm 3DS Innovations,
LLC*

Exhibit 44

















































































































Exhibit 45

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.;
MICRON TECHNOLOGY, INC.; and
SK HYNIX INC.
Petitioners,

v.

ELM 3DS INNOVATIONS, LLC,
Patent Owner.

Case IPR2016-00387
U.S. Patent No. 8,841,778

**PATENT OWNER'S RESPONSE
PURSUANT TO 37 C.F.R. § 42.120**

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2163	<i>Silicon dioxide</i> , https://en.wikipedia.org/w/index.php?title=Silicon_dioxide&oldid=738967693 (last visited Sept. 12, 2016).
2164	Transcript of Deposition of Paul D. Franzon, Ph.D. – October 6, 2016.
2165	Flexible and Substantial excerpts from the Oxford American Dictionary of Current English (1999).
2166	Declaration of Andrew D. Glew, PH.D.
2167	Prosecution History of U.S. Application 12/497,652 – Response to Office Action dated July 17, 2012.
2168	Prosecution History of U.S. Application 12/497,652 – Office Action mailed on May 20, 2014.
2169	HANDBOOK SEMICONDUCTOR MANUFACTURING TECHNOLOGY (Robert Doering & Yoshio Nishi eds., 2nd ed. 2008).

I. Introduction & Summary of Arguments

Petitioners fail to prove any challenged claim of U.S. Patent No. 8,841,778 is unpatentable because each Instituted Ground is based on two incorrect premises: (1) that the challenged claims do not require “substantially flexible” substrates, wafers or circuit layers; and (2) that one of ordinary skill in the art would believe that all dielectrics are fungible, so that any one dielectric is easily replaced by any other dielectric.

- *“Substantially Flexible” Cannot Be Read Out Of The Claims*

Most of the challenged claims explicitly require a “substantially flexible” semiconductor substrate, wafer, or circuit layer. But under the ordinary meaning of “substantially flexible,” none of the references of record disclose or suggest such a “substantially flexible” semiconductor substrate, wafer, or circuit layer—and Petitioners do not attempt to prove otherwise.

Instead, Petitioners argue that certain references disclose a “thinned,” “smoothed,” and “polished” substrate or wafer, with no argument or evidence that the “thinned” substrate is in fact actually “substantially flexible.” But **thinned does not mean flexible**: as Patent Owner stated in the intrinsic record, a substrate can be thinned yet not be flexible.

Petitioners’ challenge thus hinges on their claim construction argument that the claim language “flexible” means “thinned,” “polished,” and “smoothed.” This

attempt to rewrite the claims is wrong as a matter of law, Petitioners' claim construction argument must fail and, along with it, any ground of the IPR directed towards a claim element requiring "substantially flexible."

- *Dielectrics Are Not Fungible*

In each Instituted Ground, Petitioners admit that none of their primary references disclose the claimed low-stress dielectric, but argue it would have been obvious to substitute the low-stress dielectric disclosed in *Leedy '695* for particular dielectrics in the primary references. This argument is based on Petitioners' presumption that dielectrics are fungible—a presumption that they have wholly failed even to try to prove, and that is wholly incorrect.

Indeed, all of the evidence establishes that **dielectrics are not fungible**. Dielectrics have different requirements, characteristics, and behaviors depending on how they are being used and how they are made, so that one cannot simply replace another.

Moreover, all of the dielectrics that Petitioners argue would be obvious to replace with *Leedy '695*'s low-tensile-stress dielectric have numerous requirements in common, including the ability to be grown or deposited directly on silicon without damaging that silicon, the ability to have and maintain high purity, and the ability to withstand high temperatures without changing. Petitioners have not argued or attempted to prove that the *Leedy '695* low-tensile-stress dielectric

meets any, much less all, of these requirements. They could not because *Leedy* '695 low-tensile-stress dielectric is made with a process called Plasma-Enhanced Chemical Vapor Deposition, and, as result, cannot be deposited on silicon without damaging it, does not meet the required purity level, and cannot withstand high temperatures without changing its form.

For each and any of these reasons, one of ordinary skill would not have been motivated to use the *Leedy* '695 dielectric as Petitioners propose; to the contrary, one of ordinary skill would understand that *Leedy* '695 dielectric **could not** be used as Petitioners propose. This is another independent reason why their IPR fails in its entirety.

II. How Integrated Circuits Are Made

A. The Development Of Integrated Circuits

Today's integrated circuits trace their lineage back to the first computers of the 1940s, which used vacuum tubes to perform two key electrical functions: switching (*i.e.*, turning electrical current on and off) and amplification (increasing the amplitude of a signal while retaining its electrical characteristics). (Ex. 2166 at ¶18; Ex. 2158 at 2). Because vacuum tubes were large, power-hungry, and fragile, scientists soon developed solid-state transistors to perform the functions of and replace vacuum tubes. (Ex. 2166 at ¶18; Ex. 2158 at 3).

Where the earlier tubes used a vacuum to control the flow of electrons, the first solid-state devices used semiconducting material. (Ex. 2166 at ¶19; Ex. 2158 at 3). These were “discrete” because they had only one device (such a transistor, diode, capacitor, or resistor) per semiconductor chip. (Ex. 2166 at ¶19; Ex. 2158 at 2-3). As a result, more than one discrete semiconductor chip was needed to complete a circuit. (Ex. 2166 at ¶19; Ex. 2158 at 2). Although these were an improvement over vacuum tubes, the resulting circuits and computers were still relatively large. (*See* Ex. 2158 at 2-3).

This all changed in 1959 when Jack Kilby at Texas Instruments combined several transistors, diodes, and capacitors (five components total) to form a complete circuit on a single semiconducting chip. (Ex. 2166 at ¶20; Ex. 2158 at 4). Kilby’s invention was the first “integrated circuit,” meaning the first integration of a completed circuit in and on the same piece of semiconducting material. (Ex. 2166 at ¶20; Ex. 2158 at 4).

Kilby’s chip differed from modern integrated circuit chips in that it was not flat, but instead connected its components using individual wires. (Ex. 2166 at ¶21; Ex. 2158 at 4-5). Scientists at Fairfield Camera then developed a way of using metal patterns instead of individual wires, thereby modifying the Kilby integrated circuit to the form still prevalent today:

[Fairchild Camera]’s transistor used a layer of evaporated aluminum, that was patterned into the proper shape, to serve as the wiring for the device. ... [Fairchild Camera’s Robert] Noyce applied this technique to “wire” together the individual devices previously deposited in the silicon wafer surface.

(Ex. 2158 at 4-5).

B. The Stages Of Integrated Circuit Manufacture

In 1959, Kilby’s first integrated circuit had five components. (Ex. 2166 at ¶22; Ex. 2158 at 4). Through continued efforts to improve manufacturing processes to allow smaller components and circuits, by 1995, a single integrated circuit could include more than 250 million components. (Ex. 2166 at ¶22; Ex. 2158 at 5-6).

The intricate, complex manufacturing process developed over the years for achieving such highly-dense integrated circuits can be divided into four distinct stages: (1) material preparation; (2) wafer preparation; (3) wafer fabrication; and (4) packaging. (Ex. 2166 at ¶23; Ex. 2158 at 13). Around the ‘778 Patent’s priority date, each of these steps was typically done by separate manufacturers at separate plants. (Ex. 2166 at ¶23; Ex. 2158 at 12-13, 15-16).

In the first stage, the semiconductor material itself is created. (Ex. 2166 at ¶24; Ex. 2158 at 13). For a silicon semiconductor, the raw starting material is sand,

which is converted to pure silicon with a polysilicon structure. (Ex. 2166 at ¶24; Ex. 2158 at 13).

In the second stage, the semiconductor material is first formed into a silicon crystal with specific electrical and structural parameters, and then sliced into thin disks called “wafers.” (Ex. 2166 at ¶25; Ex. 2158 at 13-14). In 1995, each of these wafers were 8 to 10 inches in diameter. (Ex. 2166 at ¶25; Ex. 2158 at 8).

The third stage is wafer fabrication, during which individual integrated circuits are formed on the surface of the silicon wafer. (Ex. 2166 at ¶26; Ex. 2158 at 14). Around the priority date of the ‘778 Patent, several thousand identical integrated circuits could be formed on the surface of a single wafer. (Ex. 2166 at ¶26; Ex. 2158 at 14). The area of the wafer occupied by a single integrated circuit is known as a “die” or “chip.” (Ex. 2166 at ¶26; Ex. 2158 at 14).

In the packaging stage, the wafer is separated into individual dies. (Ex. 2166 at ¶28; Ex. 2158 at 14-15). Circa the ‘778 Patent’s priority date, each die that passed the wafer sort would then be placed into an individual protective package. (Ex. 2166 at ¶28; Ex. 2158 at 14-15). This package not only protects the integrated circuit chip from damage and contaminants, it also provides an electrical lead system that allows the chip to be connected to a printed circuit board or directly into an electronic product. (Ex. 2166 at ¶28; Ex. 2158 at 15).

C. The Wafer Fabrication Stage

The third manufacturing stage, wafer fabrication, takes several thousand steps, which can be divided into two primary phases: front end of the line (“FEOL”) and back end of the line (“BEOL”). (Ex. 2166 at ¶29; Ex. 2158 at 14). In FEOL, the transistors and other devices are formed in the wafer’s surface. (Ex. 2166 at ¶29; Ex. 2158 at 14). In (BEOL), the devices are wired together with metallization processes and the circuit is sealed with a protective layer. (Ex. 2166 at ¶29; Ex. 2158 at 14).

The steps involved in wafer fabrication are generally done using three categories of materials (conductors, semiconductor, and dielectrics) in four basic operations (layering, patterning, doping, and heat treatments). (See Ex. 2158 at 29-31, 71).

1. Wafer Fabrication Materials

Materials may be divided into three categories based on their ability to allow the flow of electrical current: conductors, dielectrics, and semiconductors. (Ex. 2166 at ¶31; Ex. 2158 at 29-31).

In a **conductor**, electric current can flow freely; it has high conductivity and low resistance. (Ex. 2166 at ¶32; Ex. 2158 at 29). Good conductors include copper and aluminum. (Ex. 2166 at ¶32; Ex. 2158 at 29, 398-400).

A **dielectric** is a material at the opposite end of the conductivity spectrum, having very low conductance and high resistance to the free flow of electrical current. (Ex. 2166 at ¶33; Ex. 2158 at 30). Dielectrics are therefore used as insulators in electrical circuits, and examples of include glass (such as silicon dioxide) ceramics (such as silicon nitride), and plastics. (Ex. 2166 at ¶33; Ex. 2158 at 30, 36, 73).

Semiconductors fall between conductors and dielectrics and have some conducting (and some resisting) ability. (Ex. 2166 at ¶34; Ex. 2158 at 31). Examples of semiconductors include silicon and germanium. (Ex. 2166 at ¶34; Ex. 2158 at 31).

2. Basic Wafer Fabrication Operations

To perform the steps necessary for wafer fabrication, manufacturers use four basic operations in different sequences and variations: layering, patterning, doping, and heat treatments. (Ex. 2166 at ¶35; Ex. 2158 at 71).

Layering is the operation used to add thin layers to the wafer surface. (Ex. 2166 at ¶36; Ex. 2158 at 72). For example, the transistor structure shown below shows a number of layers that have been added to the wafer surface. (Ex. 2166 at ¶36; Ex. 2158 at 72). The layers may be conductors, semiconductors, or dielectrics; and they can have a variety of functions and be made in a variety of ways. (Ex. 2166 at ¶36; Ex. 2158 at 72).

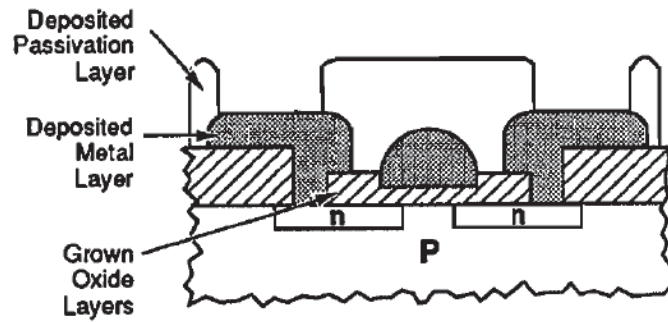


Figure 4.4 Cross section of completed metal gate MOS transistor with grown and deposited layers.

Patterning is the series of steps to remove selected portions of one or more layers of materials that was added during one or more prior layering operations. (Ex. 2166 at ¶37; Ex. 2158 at 72-73). This creates a pattern on the wafer surface. (Ex. 2166 at ¶37; Ex. 2158 at 72-73). The patterning may result in one or more holes in the layered material or one or more remaining islands of material. (Ex. 2166 at ¶37; Ex. 2158 at 72-73).



Figure 4.7 Patterning.

The repeated combination of layering and patterning in different sequences and variations is critical to the formation of transistors, diodes, capacitors, resistors, and metal conduction systems in and on the wafer surface:

These parts are created one layer at a time by the combination of putting a layer on the surface and removing portion, with a patterning

process, to leave a specific shape. The goal of the patterning operations is to create the desired shapes in the exact dimensions (feature size) required by the circuit design, and to locate them in their proper location on the wafer surface and in relation to the other parts. (Ex. 2158 at 73).

Doping is the process that puts specific amounts of “dopants” in the wafer surface through the openings created by patterning. (Ex. 2158 at 73-74). The “dopant” is substance inserted into a pure semiconductor to produce a desired electronic characteristic. (Ex. 2158 at 31-32). For example, doping pure silicon can create areas of very precise resistivity values in the semiconductor material. (Ex. 2166 at ¶39; Ex. 2158 at 32-34).

In addition, doping creates pockets in the wafer surface that are either rich in electrons or rich in electrical holes. (Ex. 2166 at ¶40; Ex. 2158 at 16). This is critical to the formation of the structure that makes semiconductor devices work, the “junction.” (Ex. 2166 at ¶40; Ex. 2158 at 16). A transistor requires two junctions, and each junction is formed by creating a “n-type” region that is rich in electrons (has negative polarity) next to a “p-type” region that is rich in holes (or put another way, is missing electrons and thus has a positive polarity). (Ex. 2166 at ¶40; Ex. 2158 at 16).

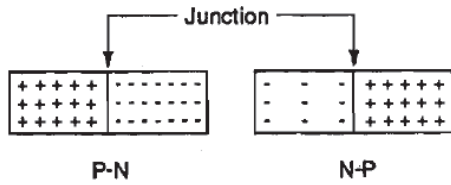


Figure 1.24 P-N and N-P junctions.

One doping technique is thermal diffusion—a chemical process that takes place when the wafer is heated to roughly 1000°C and exposed to vapors of the proper dopant. (Ex. 2166 at ¶41; Ex. 2158 at 74). Another technique is ion implantation, in which ionized dopants are shot at the wafer at high speeds, like a cannon. (Ex. 2166 at ¶41; Ex. 2158 at 74).

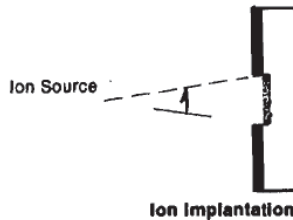


Figure 4.8 Doping.

Using thermal diffusion or ion implantation, doping is used to create n-type and p-type pockets in the wafer surface, allowing the formation of the electrically active regions and N-P junctions required for integrated circuit to work. (Ex. 2166 at ¶42; Ex. 2158 at 74).

Heat treatments are operations by which the wafer is heated and then cooled to achieve specific results. (Ex. 2166 at ¶43; Ex. 2158 at 74). One

important heat treatment takes place after ion implantation. (Ex. 2166 at ¶43; Ex. 2158 at 75). Because implantation of the ionized dopant materials causes a disruption of the wafer's crystal structure, after the doping the wafer is heated to about 1000°C to repair the disruption. (Ex. 2166 at ¶43; Ex. 2158 at 75). This type of heat treatment is known as an "anneal." (Ex. 2166 at ¶43; Ex. 2158 at 75).

3. Exemplary Fabrication

The following description is useful to illustrate how the different types of materials and manufacturing operations can be used in fabrication to make a simple Metal Oxide Semiconductor (MOS) silicon-gate transistor structure.

The illustrative MOS silicon-gate transistor comprises three regions, specifically an n-type "source" region and an n-type "drain" region formed in a p-type wafer. (Ex. 2166 at ¶45; Ex. 2158 at 510-513). A doped polysilicon gate connects the source and the drain regions such that when threshold voltage is applied to the gate, current travels from the source region through the gate to the drain. (Ex. 2166 at ¶45; Ex. 2158 at 510-513).

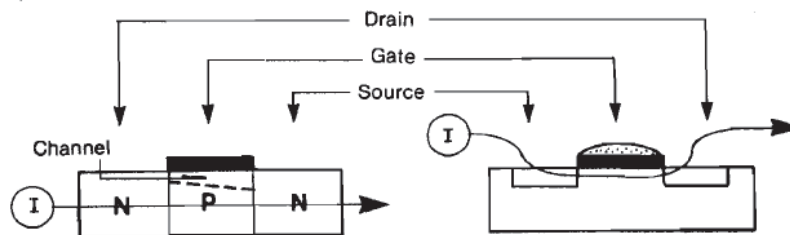
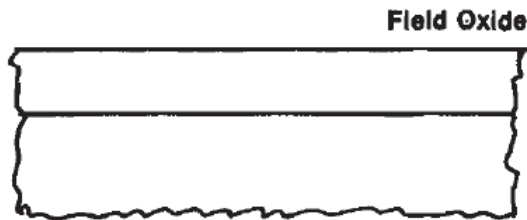


Figure 16.18 MOS transistor operation.

The following simplified steps (which could be thousands of discrete steps) show how layering, masking, doping and heat treatments can be used with dielectrics, semiconductors, and conductors to make such a MOS silicon-gate transistor on a wafer surface. (Ex. 2166 at ¶46; Ex. 2158 at 510-513).



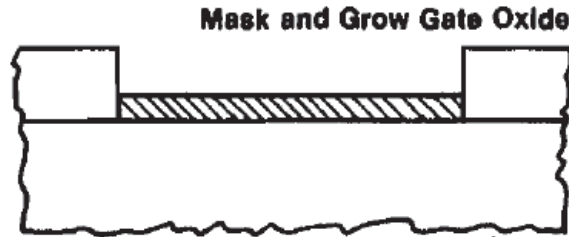
Layering Operation: To begin the front end of line phase of the fabrication, a layer of dielectric (silicon dioxide) is grown on a silicon wafer. (Ex. 2166 at ¶47; Ex. 2158 at 80-81). This dielectric is called a “field oxide” and serves as a protective layer and doping barrier. (Ex. 2166 at ¶47; Ex. 2158 at 80-81).



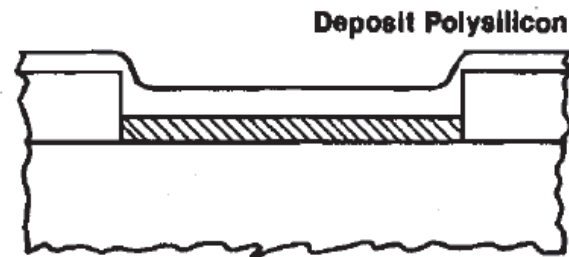
Patterning Operation: A patterning process is then used to create a hole in the field oxide dielectric to define the location of the source, gate, and drain areas of the transistor. (Ex. 2166 at ¶48; Ex. 2158 at 80-81).

Layering Operation: After the hole is made in the field oxide, another dielectric is grown over the exposed silicon. (Ex. 2166 at ¶49; Ex. 2158 at 80-81).

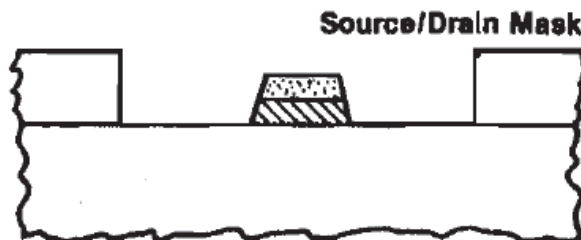
This silicon dioxide layer will serve as a “gate oxide”. (Ex. 2166 at ¶49; Ex. 2158 at 80-81).



Layering Operation: Another layering operation deposits a layer of polycrystalline silicon (polysilicon) over the gate oxide dielectric. (Ex. 2166 at ¶50; Ex. 2158 at 80-81). This will become part of the gate structure. (Ex. 2166 at ¶50; Ex. 2158 at 80-81).

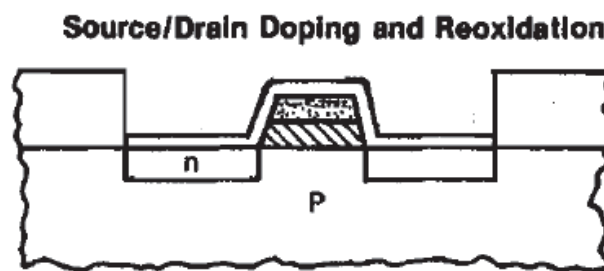


Patterning Operation: Next, patterning is used to create openings in the masking oxide and polysilicon layers. (Ex. 2166 at ¶51; Ex. 2158 at 80-81). These openings define the source and drain areas. (Ex. 2166 at ¶51; Ex. 2158 at 80-81).



Doping Operation: A doping operation then creates n-type pockets in the source and drain areas. (Ex. 2166 at ¶52; Ex. 2158 at 80-81).

Layering Operation: Following the doping, another layer of dielectric (silicon dioxide) is layered over the source and drain areas. (Ex. 2166 at ¶53; Ex. 2158 at 80-81). This layer is an example of a “pre-metal dielectric” or “PMD.”



Patterning Operation: Patterning then create holes (called “contact holes”) through the dielectric in the source, gate, and drain areas. (Ex. 2166 at ¶54; Ex. 2158 at 80-81).

Heat Treatment Operation: The wafer is next heated at a very high temperature to create a layer of silicide over the exposed contacts in the source and drain regions. (Ex. 2166 at ¶55; Ex. 2158 at 80-81). This silicide is necessary to ensure good electrical contact with the metal layer that will be deposited. (Ex. 2166 at ¶55; Ex. 2158 at 80-81).

This is the end of the front end of line. The next step marks the beginning of the back end of line (the addition of the metal systems necessary to connect the different components). (Ex. 2166 at ¶56; Ex. 2158 at 14, 395).

Layering Operation: In the first step of the BEOL phase, a thin layer of conducting material (such as aluminum) is deposited over the entire wafer. (Ex. 2166 at ¶57; Ex. 2158 at 80-81).

Patterning Operation: That metallization layer is then patterned to leave only the portions necessary to connect the surface components. (Ex. 2166 at ¶58; Ex. 2158 at 80-81).

Layering Operation: The final layer is a protective layer known as the “passivation layer” (not shown in the above figures), which is often a dielectric and is used to protect the components during testing, packaging, and use. (Ex. 2166 at ¶59; Ex. 2158 at 80-81).

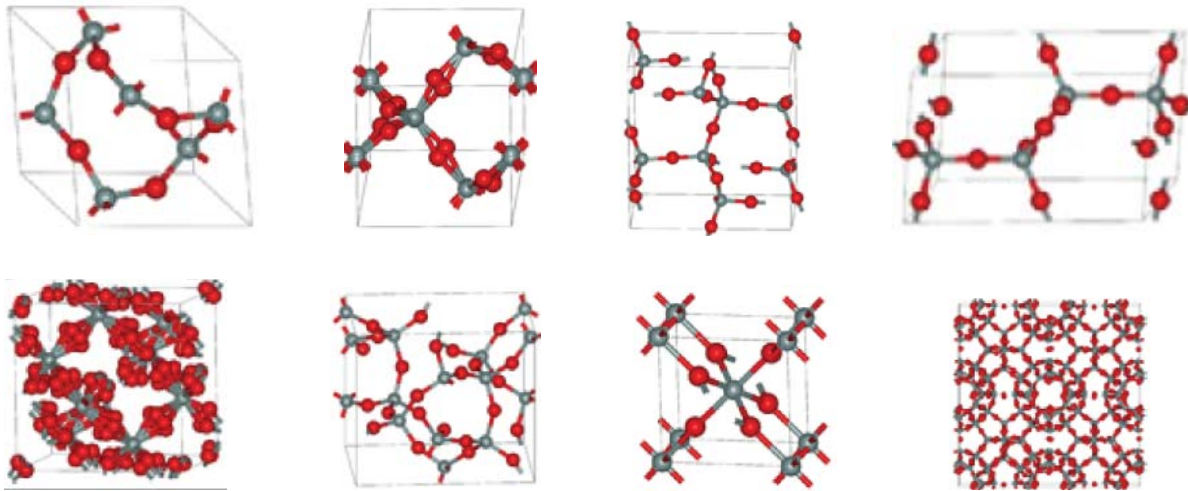
D. Different Techniques For Producing And Layering Dielectrics

As the foregoing example illustrates, many different dielectric materials are layered throughout the fabrication process, with each dielectric having a different location, being created at a different stage, and serving a different specific purpose. (Ex. 2166 at ¶61; Ex. 2158 at 72-73, 79, 81-82). As a result, each layered

dielectric needs to have certain specific properties, depending on where and when it is produced and the purposes it must serve. (Ex. 2166 at ¶61; Ex. 2162 at 47-48 of 895; *see also* Ex. 2164 at 78:21-79:1 (“There is likely quite a long list of factors that go into choosing between [dielectrics], and an engineer would weigh those using his knowledge and skills.”)).

Dielectrics can be applied using many different techniques, and the particular technique used will greatly impact the properties of the resulting dielectric (and, therefore, its usefulness for any particular purpose). (Ex. 2166 at ¶62). For example, silicon dioxide dielectrics can be created in hundreds of different ways, each resulting in a silicon dioxide with different properties (and potential uses). (Ex. 2166 at ¶62; Ex. 2158 at 154; Ex. 2146 at 225, 306; Ex. 2159 at 55).

For these reasons, dielectrics are not created equal: each silicon dioxide dielectric may have the same chemical formula— SiO_2 —but any one SiO_2 can have vastly different properties from any other SiO_2 , depending on how it is made and its resulting molecular structure and form. (Ex. 2166 at ¶63; Ex. 2165 at 72, 74-76 of 700; Ex. 2164 at 54:14-18). The following are a few examples of the many different structures that SiO_2 can take, depending on how it is made.



(Ex. 2166 at ¶63; Ex. 2163 at 9, 10 of 13).

The primary techniques for forming and layering different types of dielectrics fall into one of two general categories: (1) growing; and (2) depositing.

(Ex. 2166 at ¶64; Ex. 2158 at 72).

1. Growing Dielectrics Using Thermal Oxidation

To grow a dielectric is to form it from the wafer surface material itself. (Ex. 2166 at ¶65; Ex. 2158 at 157-158). There are many ways of growing dielectrics, including thermal oxidation and nitridation. (Ex. 2166 at ¶65; Ex. 2158 at 72).

Thermal oxidation is a technique for growing a dielectric from a silicon wafer. (Ex. 2166 at ¶66; Ex. 2158 at 72, 157). Oxidation is performed by exposing a silicon wafer's surface to oxygen, which converts the pure silicon into silicon dioxide. (Ex. 2166 at ¶66; Ex. 2158 at 157; Ex. 2159 at 53). In fabrication, this exposure is done between 900 °C and 1200 °C. (Ex. 2166 at ¶66; Ex. 2158 at 157).

As a result of the growth conditions of thermal oxides, the resulting dielectrics possess a dense and **pure** molecular structure. (Ex. 2166 at ¶67; Ex. 2158 at; Ex. 2159 at 53). Purity is equivalent to having no unwanted chemical elements or molecules in the film. (Ex. 2166 at ¶67; Ex. 2158 at 363).

Dielectrics that are grown using thermal oxidation exhibit internal **compressive stress** when returned to lower temperatures. (Ex. 2166 at ¶68; Ex. 2159 at 58-59; Ex. 1040 at 128; Ex. 2160 at 233). Stress is an internal force on a material, and may be either tensile or compressive. (Ex. 2166 at ¶68; Ex. 1040 at 114). If the force pushes inwardly along a layer's horizontal plane, it creates compression and is a "compressive" stress. (Ex. 2166 at ¶68; Ex. 1040 at 114). If the force pulls outwardly along a layer's horizontal plane, it creates tension and is a "tensile" stress. (Ex. 2166 at ¶68; Ex. 1040 at 114). Tensile stress can cause cracking, while excess compressive stress can cause buckling. (Ex. 2166 at ¶68; Ex. 1040 at 114, 117; Ex. 2146 at 195).

Other important characteristics of dielectrics grown using thermal oxidation include: ability to **withstand high temperatures** without changing; and **good adhesion** (the ability to stick well to other materials). (Ex. 2166 at ¶69).

2. Depositing Dielectrics

Deposition refers processes in which a material is physically deposited on the wafer. (Ex. 2164 at 68:7-17). Some primary methods include evaporation,

sputtering, spin-on processes, and chemical vapor deposition (“CVD”). (Ex. 2166 at ¶70; Ex. 2158 at 72; Ex. 2159 at 121).

There are many different kinds of CVD techniques, each resulting in different dielectric qualities, but each sharing some basic processing cycles. (Ex. 2166 at ¶71). First, wafers are loaded into a chamber containing an inert atmosphere. (Ex. 2166 at ¶71). Next, chemical vapors that include the atoms or molecules to be deposited are introduced into the chamber, and then energy is added to cause a CVD reaction, resulting in deposition of atoms or molecules on the wafer surface. (Ex. 2166 at ¶71.) The different CVD techniques can be categorized by the type of energy source used in the process: thermal energy or plasma energy. (Ex. 2166 at ¶72; Ex. 2158 at 366).

a. Thermal CVD

Thermal CVD can be done at either atmospheric pressure (known as atmospheric pressure CVD, or “APCVD”) or artificially lowered pressure (low pressure CVD or “LPCVD”). (Ex. 2166 at ¶73; Ex. 2158 at 366). In addition, the source of thermal energy can come from a variety of different sources, such as tube furnaces, hot plates, and RF induction. (Ex. 2166 at ¶73; Ex. 2158 at 366).

Thermal CVD can be performed at high temperatures (800 °C -1000 °C) to deposit a dielectric. (Ex. 2166 at ¶75; Ex. 2159 at 130). At these high temperatures, thermal CVD can result in oxides that has similar properties to a

thermally grown oxide, such a purity, compressive strength, resistance to high temperatures, and adhesion. (Ex. 2166 at ¶75; Ex. 2159 at 140). Thus, thermal CVD is often used as a substitute for thermal oxidation where oxidation cannot be used (such as where there is no available silicon surface on which to grow the desired silicon dioxide). (Ex. 2166 at ¶75).

b. Plasma Enhanced CVD

A chemical vapor deposition process that uses plasma as an energy source is known as Plasma-Enhanced CVD (“PECVD”). (Ex. 2166 at ¶76). PECVD is a vacuum process LPCVD (it is performed at low pressure, not atmospheric pressure), and because of the supplemental energy provided by the use of plasma, is able to be performed at low temperatures of 400°C or less. (Ex. 2166 at ¶76; Ex. 2158 at 373; Ex. 2159 at 130).

Dielectrics, including silicon dioxides, deposited using PECVD include impurities that make them unusable for a variety of applications requiring higher purity. (Ex. 2166 at ¶77; Ex. 2160 at 233; Ex. 2158 at 363). Silicon dioxide dielectrics deposited using PECVD are unable to withstand the higher temperatures used in FEOL without changing form. (Ex. 2166 at ¶78; Ex. 2169 at 29-30). They also suffer from higher dielectric constants, lack of planarization, susceptibility to pinholes, slow deposition rates, and high cost. (Ex. 2166 at ¶78; Ex. 2162 at 303). Further, low processing temperatures result in a soft and porous deposit. (Ex. 2166

at ¶78; Ex. 2159 at 140). Moreover, when using PECVD to deposit tensile films, it was known that the “[l]ow density tensile films tend to pick up water and form SiOH groups” causing “degradation of electrical and mechanical properties.” (Ex. 2166 at ¶78; Ex. 1049 at 5).

At the time of the ‘778 Patent’s priority date, it was typical to alleviate some of these problems by depositing PECVD layers in moderate compressive stress (rather than tensile) to enhance conformality, reduce pinhole counts, and improve adhesion. (Ex. 2166 at ¶79; Ex. 2133 at 10, 11; Ex. 1040 at 106). Further, unlike tensile films, “films deposited with an intrinsic compress stress are stable and are even able to withstand boiling water without increasing the SiOH content or absorbing water.” (Ex. 2166 at ¶79; Ex. 1049 at 5).

E. Different Kinds and Uses of Dielectrics

The properties and behaviors of a layered dielectric will vary greatly based on which of the many available layering techniques is used. The chosen method of layering can affect at least the following properties of a dielectric: (1) dielectric constant (the dielectric’s ability to store electrical energy in an electric field), (2) breakdown field strength, (3) leakage, (4) surface conductance, (5) moisture absorption or permeability to moisture, (6) stress, (7) adhesion to aluminum, (8) adhesion to dielectric layers above or below, (9) stability, (10) etch rate, (11) permeability to hydrogen, (12) amount of incorporated electrical charge or dipoles,

(13) amount of impurities, (14) quality of step coverage, (15) the thickness among other things. (Ex. 2166 at ¶80; Ex. 2146 at 195). Petitioners' expert admitted that one would need to consider these and other properties when selecting a dielectric. (Ex. 2164 at 77:13-88:6; 91:8-12).

Which factors are the most important—and thus which techniques can and cannot be effectively used—will depend on the type and use of the dielectric desired, such as whether the dielectric layer being produced is intended to be used, for example, as a field oxide, gate oxide, pre-metal dielectric, intermetal dielectric, or passivation layer. (Ex. 2166 at ¶81; Ex. 2158 at 154; Ex. 2146 at 225, 306; Ex. 2159 at 55; Ex. 2164 at 78:16-79:5; 121:4-10).

1. Front End Of Line Dielectrics

In the FEOL, the transistors and other devices are formed in the wafer's surface. (Ex. 2166 at ¶82; Ex. 2158 at 81). Types and uses of dielectrics produced and layered during the FEOL include field oxides, gate oxides, dopant barriers, and pre-metal dielectrics. (Ex. 2166 at ¶82; Ex. 2158 at 81).

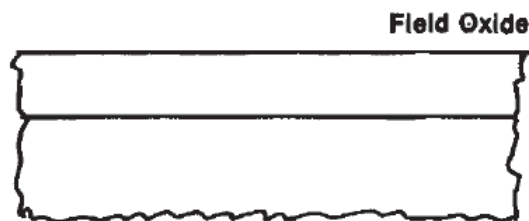
Because of their functions and placement, these types/uses of dielectrics share some similar requirements. (Ex. 2166 at ¶83). For example, due to their direct contact or proximity to the surface of the silicon wafer, each must be extremely pure. (Ex. 2166 at ¶83). In addition, because FEOL steps are often performed at high temperatures, dielectrics that are formed during FEOL must be

able to withstand the multiple high-heat steps of around 1000°C without altering their properties. (Ex. 2166 at ¶83; Ex. 2169 at 29-30). Thus, growth by thermal oxidation or nitridation is the favored technique for layering dielectrics during FEOL. (*E.g.*, Ex. 2160 at 75).

If a FEOL dielectric cannot be grown (for example, because there is not an available silicon surface on which to grow the desired silicon dioxide), then high temperature thermal CVD is typically used. (Ex. 2166 at ¶84). Because PECVD (such as in *Leedy '695*) results in low purity dielectrics that cannot withstand high heat without changing their properties (among other disadvantages), PECVD cannot be used to produce FEOL dielectrics such as field oxides, gate oxides, dopant barriers, and pre-metal dielectrics. (Ex. 2166 at ¶84).

a. Field Oxide Dielectrics

A field oxide is a layer of dielectric (such as silicon dioxide) that is grown covering the top surface of the wafer during the initial steps of FEOL. (Ex. 2166 at ¶85; Ex. 2158 at 80-81). They are very dense (nonporous) and very hard. (Ex. 2158 at 143).



A field oxide dielectric serves a number of purposes, including protecting the silicon wafer. (Ex. 2166 at ¶86; Ex. 2158 at 140). The field oxide also defines the active regions that are subject to doping, and to prevent channels from forming between transistors. (Ex. 2158 at 81). The field oxide must be thick enough to prevent a phenomenon known as induction. Induction can occur when an oxide allows an electrical charge in a metal layer to cause a buildup of charge in the wafer surface. (Ex. 2166 at ¶86). Surface charge can cause shorting and other unwanted electrical effects. (Ex. 2158 at 156).

Because field oxides contact the silicon, a high degree of purity is required to avoid degradation of the silicon. (Ex. 2166 at ¶87). Moreover, field oxides must adhere well to the semiconductor wafer's surface and withstand subsequent heating steps of around 1000°C or higher. (Ex. 2169 at 29-30).

Thus, field oxides must be grown using techniques such as thermal oxidation. (Ex. 2166 at ¶88). Plasma CVD (such as in *Leedy '695*) cannot be used to produce and layer a field oxide because the resulting dielectric would not (1) be sufficiently pure; (2) have the ability to adhere sufficiently; and (3) be able to withstand high temperatures of the remaining FEOL steps without changing its properties. (Ex. 2166 at ¶88; Ex. 2169 at 29-30). Additionally, PECVD cannot be used because ions present in the plasma can strike and damage the wafer itself. (Ex. 2166 at ¶88; Ex. 2159 at 139).

b. Gate Oxide Dielectrics

During FEOL, a dielectric can be grown directly on the wafer surface to form the transistor's gate. This layer is known as the gate oxide. (Ex. 2166 at ¶89; Ex. 2158 at 80-81, 156). Gate oxides, even more so than field oxides, need to be exceptionally pure. (Ex. 2166 at ¶91; Ex. 2158 at 173). Gate oxides are therefore thermally grown at about 1,000°C, and “[t]he growth of the gate oxide is a critical step, as defect-free, very thin (15-100 nm), high quality oxide without contamination is essential for proper device operation.” (Ex. 2146 at 331).

Thus, as with field oxide dielectrics, gate oxide dielectrics must use techniques such as thermal oxidation. (Ex. 2166 at ¶92) For the reasons discussed above, PECVD cannot be used to produce and layer a gate oxide dielectric due to impurities, property changes, poor adherence, and damaging the wafer. (Ex. 2166 at ¶92; Ex. 2169 at 29-30; Ex. 2159 at 139).

c. Pre-metal Dielectrics

Dielectrics layered between transistors and other devices on the surface of the wafer and the first overlaying metal layer are called “pre-metal dielectric” (PMD). (Ex. 2166 at ¶93; Ex. 2158 at 81, 397; Ex. 2146 at 188-189). Before metal is deposited, the wafer is heated at a very high temperature to ensure that those areas will make good electrical contact with the metal layer that will be deposited in the following phases. (Ex. 2166 at ¶93; Ex. 2158 at 80-81).

Because of its proximity to the silicon and components, a pre-metal dielectric must have relatively high purity. (Ex. 2166 at ¶94). Also, because it will be exposed to high levels of heat after it is layered and planarized (made level though a high-heat step), a pre-metal dielectric must also be able to withstand high temperature reflows of over 800-1000°C. (Ex. 2166 at ¶94; Ex. 2146 at 194-95, 208). Other characteristics and behaviors a pre-metal dielectric must possess include easy reflow planarization, and low moisture absorption. (Ex. 2166 at ¶94; Ex. 2146 at 195, 261-62).

For these reasons, it is preferred to produce and layer a pre-metal dielectric with a high temperature thermal CVD. (Ex. 2166 at ¶95). Again, PECVD cannot be used to produce and deposit proper silicon dioxide pre-metal dielectric because of its impurities, property changes, poor adherence, and damaging the wafer. (Ex. 2166 at ¶95; Ex. 2146 at 212, 241).

2. Back-End-Of-Line Dielectrics

In BEOL fabrication, devices are wired together with metallization processes and the circuit is then sealed with a protective layer. (Ex. 2166 at ¶96; Ex. 2158 at 14). The switch from front end of line to back end of line is marked by the deposition of the first metallization layer, and lower temperatures. (Ex. 2166 at ¶96; Ex. 2146 at 194).

Many devices require more than one level of metallization. (Ex. 2166 at ¶97). The device below has two levels of metallization, labeled “Metal-1,” and “Metal-2” respectively as shown below. (Ex. 2166 at ¶97; Ex. 2146 at 188).

Connecting those levels are columns of metal called “vias.”

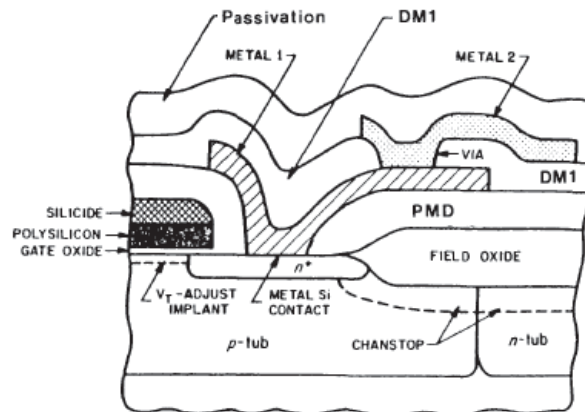


Fig. 4-7 Terminology of double-level-metal interconnects.

Dielectrics produced during the BEOL include intermetal dielectrics (dielectrics between two levels of metallization) and passivation dielectrics (dielectrics covering and protecting the top of the device). (Ex. 2166 at ¶98; Ex. 2158 at 397-98). Above, the intermetal dielectric is labeled DM1. (Ex. 2146 at 188).

Because metals used in metallization have low melting temperatures, the BEOL is done at much lower temperatures than the FEOL processes. (Ex. 2166 at ¶99; Ex. 2158 at 398-99). This affects the techniques available for layering and producing dielectrics in the BEOL phase.

a. Intermetal Dielectrics

Intermetal dielectrics electrically isolate one level of conductor from another in multilevel-interconnect systems. (Ex. 2166 at ¶100). A PHOSITA would have known that the list of requirements for these dielectric layers is “long and stringent.” (Ex. 2146 at 194).

At the time of the ’778 Patent’s priority date, it was taught that intermetal dielectrics should be in compressive stress “since dielectric films under tensile stress exhibit more of a tendency to crack.” (Ex. 2166 at ¶101; Ex. 2146 at 195). In addition, intermetal dielectrics had to be formed in moderate compressive stress to balance out the tensile stress of the metal layers: “moderate compressive stress [is] desirable to partially compensate tensile stress in the metal interconnects, thus avoiding film cracking.” (Ex. 2160 at 233).

b. Passivation Dielectrics

Following the final metal layer, a passivation layer is deposited over the surface of the wafer. (Ex. 2166 at ¶102; Ex. 2158 81-82). “This is an insulating, protective layer that prevents mechanical and chemical damage during assembly and packaging.” (Ex. 2146 at 273). Passivation layers were typically silicon nitride because “it provides an impermeable barrier to moisture and mobile impurities (e.g., sodium) and also forms a tough coat that protects the chips against scratching.” (Ex. 2146 at 274). Moreover, because passivation layers are the

outermost layers and serve to protect the chip, they must resist cracking and water absorption, and are therefore deposited in a compressive stress, unlike the tensile dielectric of Leedy '695. (Ex. 1049 at 3, 5).

III. The '778 Patent

The '778 Patent is titled “Three Dimensional Structure Memory” and issued to Glenn J. Leedy, President of Patent Owner Elm 3DS Innovations, LLC. (Ex. 1001 at Title Page). The '778 Patent has an effective priority date of April 4, 1997, and is part of a family of related applications sharing the same substantive specification. (Ex. 1001 at Title Page).

A. The '778 Patent Discloses Novel Substantially Flexible Stacked Circuit Layers

As explained in the '778 Patent, integrated circuit manufacturers seek to increase the number of circuit devices in an integrated circuit while still allowing for increased processing speed and performance of the integrated circuit. (Ex. 1001 at 1:10-24, 2:44-63; Ex. 2166 at ¶104). Other goals were lower fabrication costs and greater yields (more non-defective integrated circuits per wafer). (Ex. 1001 at 1:42-58, 2:44-63).

The '778 Patent describes that one approach to reaching these goals is to stack integrated circuits on top of one another (a “Three Dimensional Structure”), thereby allowing more devices per single integrated circuit. (E.g., Ex. 1001 at

2:21-34; Ex. 2166 at ¶106). The '778 Patent also describes additional benefits can be gained by dividing functionality between different circuit layers, with one layer containing the controller circuitry and the other layers containing memory circuitry. (*E.g.*, Ex. 1001 at 3:1-3, 4:19-26). This includes the ability to fabricate memory circuit layers separately and independently from controller circuits, allowing different manufacturing methods to be used for each type of circuit layer. (*E.g.*, Ex. 1001 at 6:18-36; *see also* Ex. 1001 at 6:9-17).

The '778 Patent described a novel structure for stacked integrated circuits, including flexible semiconductor substrates that could be stacked atop each other to make a flexible stacked circuit. (*E.g.*, Ex. 1001 at 3:5-10, 4:24-26, 6:18-31, 7:18-25, 8:36-46, 10:28-67; Ex. 2166 at ¶107). The '778 Patent describes making individual flexible memory circuits, each having a flexible semiconductor substrate, and then stacking those flexible memory substrate circuit layers. (*E.g.*, Ex. 1001 at 6:16-29, 7:14-23, 8:34-44, 10:28-67; Ex. 2166 at ¶107). Those flexible memory substrates circuit layers could be stacked on a common substrate, which itself could be another flexible memory substrate circuit layer or a common (shared) flexible controller. (*E.g.*, Ex. 1001 at 7:16-25, 8:36-46, 10:28-67).

B. The '778 Patent Discloses A Novel Method And Structure For Substantially Flexible Stacked Circuit Layers

The '778 Patent discloses preferred structures and techniques for making flexible semiconductor substrate circuit layers, such as a thinned substrate that is polished and made with a dielectric in low tensile stress. (E.g., Ex. 1001 at 3:1-10, 8:36-9:8; 9:50-58). One such flexible semiconductor substrate circuit layer is depicted in Figure 4, reproduced below:

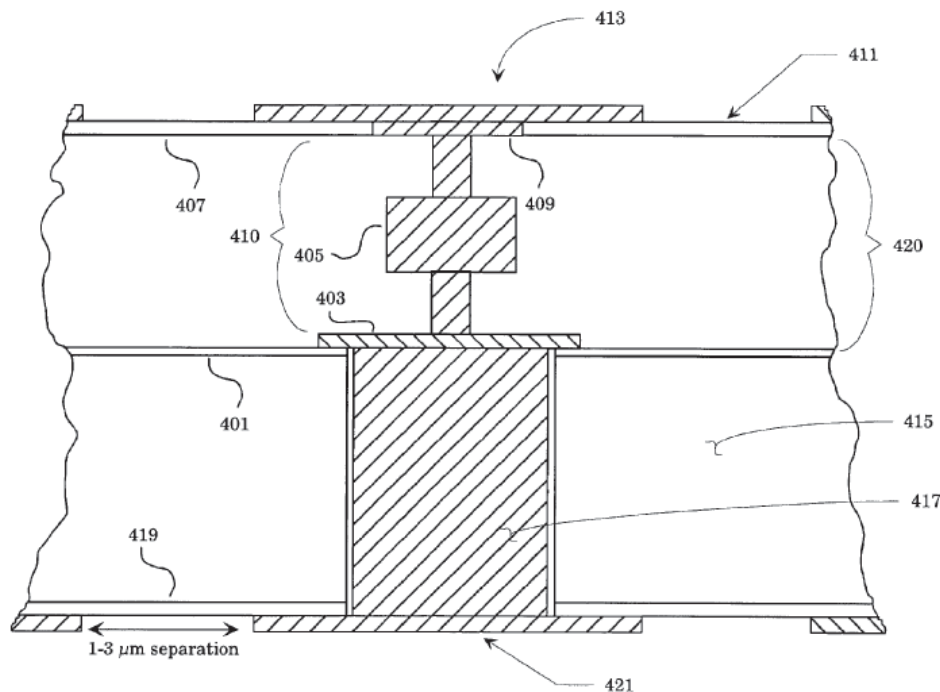


Figure 4

This flexible semiconductor substrate circuit layer comprises a silicon substrate 415 that has been thinned and polished, as well as intermetal dielectric layers 420 that are in low tensile stress. (E.g., Ex. 1001 at 8:36-46, 9:50-58).

Polishing removes defects that would cause the circuit layer to crack rather than flex when released from a rigid support substrate.

The use of the low tensile stress dielectric allows a free-standing semiconductor substrate circuit layer to flex when released from a rigid support substrate. The use of such a low tensile stress dielectric was against the conventional wisdom, which held that tensile dielectrics should not be used for a number of reasons. (Ex. 2166 at ¶110). The conventional wisdom was that:

- intermetal dielectrics should compressive rather than tensile “since dielectric films under tensile stress exhibit more of a tendency to crack” (Ex. 2146 at 195);
- intermetal dielectrics should have moderate compressive stress in order to balance out the moderate tensile stress of the metal layers: “moderate compressive stress [is] desirable to partially compensate tensile stress in the metal interconnects, thus avoiding film cracking” (Ex. 2160 at 233); and
- “[l]ow density tensile films tend to pick up water and form SiOH groups. This causes degradation of electrical and mechanical properties.” (Ex. 1049 at 5).

Even the textbook written by Petitioners’ expert warned against using tensile stress dielectrics rather than a compressive one because “[t]he compressive stress

in the film cancels the intrinsic tensile stress of metal films and produces a flat substrate.” (Ex. 2166 at ¶111; Ex. 2162 at 303).

C. The’778 Patent’s Prosecution History

During the prosecution of Application Serial No. 12/497,652, when the Examiner suggested that *Bertin* taught a substantially flexible substrate because it taught a thinned substrate, Patent Owner explained that a thinned substrate is not necessarily substantially flexible:

[B]oth *Bertin* and Kato fail to teach or suggest that at least one of the first and second circuit layers is substantially flexible, and the substrate thereof is a substantially flexible substrate. Two features are required to achieve substantial flexibility. One is that the semiconductor material must be sufficiently thin, e.g., 50 microns or less. *Bertin* and Kato are believed to satisfy this requirement. **The other is that the dielectric material used in processing semiconductor material must be sufficiently low stress. Otherwise, substantial flexibility is defeated.**

(Ex. 1023 at 28) (emphasis added). Also:

For a circuit layer to be substantially flexible, Applicant has found that the dielectric material must have a low tensile stress, for example, 5×10^8 dynes/cm² tensile. Kato does not contain any teaching or suggestion of the circuit layer being flexible. Similarly, *Bertin* does not contain any such teaching or suggestion.

(Ex. 1021 at 3) (emphasis added).

The Patent Owner emphasized that flexibility of a substrate or circuit must be determined in relation to whether it is attached to or part of anything else that may affect its flexibility. Patent Owner explained that a thinned substrate that remains attached to and cannot be removed from a rigid carrier is not substantially flexible:

Furthermore, both *Bertin* and Kato illustrate and describe stacked integrated circuits formed on a **rigid** carrier. At no point is any portion of the stacked integrated circuit allowed to be substantially flexible, suggesting that the stacked integrated circuit is in fact **inflexible**.

...

In the case of the present stacked integrated circuit, by contrast, the dielectric stress is low in order to allow the IC layers to be thinned without subsequently being subject to stress-related bowing.

(Ex. 1023 at 29) (emphasis in original).

The Examiner agreed that flexibility is not the equivalent of mere thinning.

For example:

Bertin also fails to specifically teach wherein at least one of the first and second circuit layers is substantially flexible. In particular, since *Bertin* teaches forming the insulation portion of the vertical interconnects by **thermal oxidation** resulting in high stress insulation layer, it fails to teach a flexible circuit layer (note: **the flexible circuit layer must possess a low stress dielectric in order for it to be flexible**).

(Ex. 2168 at 4 (emphasis added)).

IV. The Instituted Grounds

This IPR was instituted on the following Grounds:

Ground	References	Basis	Challenged Claims
1	<i>Bertin '754</i> and <i>Leedy '695</i>	§ 103(a)	1, 2, 8, 14, and 52
2	<i>Bertin '754</i> , <i>Poole</i> , and <i>Leedy '695</i>	§ 103(a)	2, 8, 31, 32, 44, 46, and 52-54
3	<i>Hsu</i> and <i>Leedy '695</i>	§ 103(a)	1, 2, 8, 14, 31, 32, 44, 46, and 52-54

A. The Challenged Claims

The Instituted Grounds challenge independent claim 1 (and its dependent claims 2, 31, 32), independent claim 8 (and its dependent claims 44 and 46), independent claim 14 (and its dependent claims 52-54). All of the challenged claims include limitations for a low-stress dielectric and/or a “substantially flexible” substrate, wafer, or circuit layer that is also thinned, polished or smoothed.

B. The Primary Asserted References

Each of the Instituted Grounds relies on combining the *Leedy '695* reference with *Bertin*, *Poole*, and *Hsu*.

1. *Leedy '695*

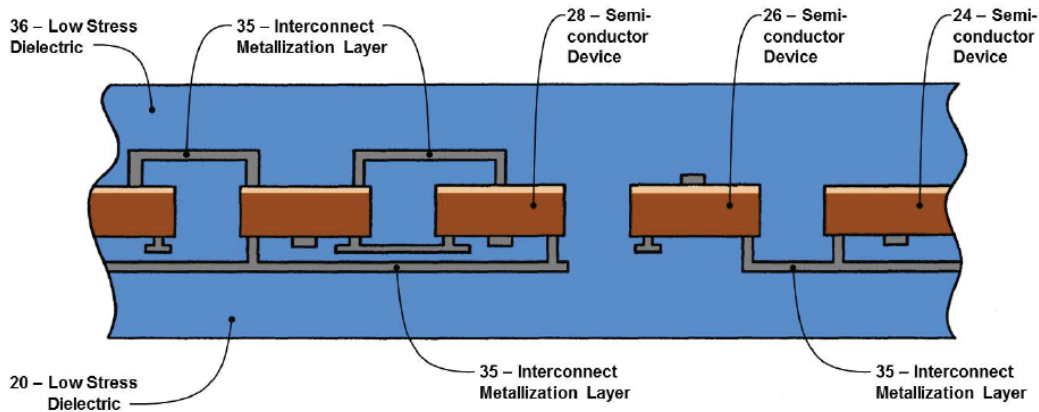
Leedy '695 issued to the same inventor as the challenged patent, and is titled “Membraned dielectric isolation IC fabrication,” and was incorporated by

reference into the '778 Patent. *Leedy '695* discloses a low tensile stress dielectric membrane, which Petitioners argue would have been obvious to substitute for specific dielectrics in the *Bertin* and Yu references.

Leedy '695 discloses producing and using a low tensile stress dielectric membrane in the context of an “approach to IC fabrication [that] falls under the generic industry-established title known as Dielectric Isolation (DI).” (Ex. 2166 at ¶114; Ex. 1006 at 1:21-23). Dielectric isolation is an alternate technique for producing integrated circuits that is distinctly different from – and was considered distinctly inferior to—the semiconductor substrate techniques discussed above; in the '778 Patent; and the *Bertin* and Yu references. (Ex. 2166 at ¶114; Ex. 2146 at 12, 67).

Leedy '695's approach to dielectric isolation is a free-standing, flexible membrane, as opposed to a traditional rigid semiconductor substrate. (Ex. 1006 at 1:7-8). *Leedy '695* calls these “membranes,” which, as illustrated in *Leedy '695* Figure 3a, is “typically framed or suspended or constrained at its edges by a substrate frame or ring” like a drum. (Ex. 1006 at 34-37).

As illustrated in annotated Figure 3, each membrane does not include a semiconductor substrate but instead encapsulates tiny silicon transistor “islands” in a sea of low tensile stress dielectric. (Ex. 1006 at Figure 3B, 3:23-33, 24:20-32).



a. *Leedy '695's Low Tensile Stress Dielectric*

The *Leedy '695* low stress dielectric:

- is created using Plasma-Enhanced CVD;
- is in tensile, not compressive, stress;
- cannot withstand temperatures in excess of approximately 400°C.

Plasma-Enhanced CVD: Notably, the *Leedy '695* low tensile stress dielectrics are created at low temperatures using plasma-enhanced CVD. (Ex. 2166 at ¶118; Ex. 1006 at 11:29-31). *Leedy '695* explains that “these membranes were produced on Novellus Systems Inc. (San Jose, Calif.) Concept One dielectric deposition equipment” (Ex. 1006 at 11:29-31), which, as Petitioners’ expert Dr. Franzon admits, was a commonly available plasma-enhanced CVD system. See

Ex. 1102 at ¶¶ 34, 88 (citing Ex.1049). Novellus was using PECVD to create compressive stressed films because, unlike tensile films, “films deposited with an intrinsic compressive stress are stable and are even able to withstand boiling water without increasing the SiOH content or adsorbing water.” (Ex. 2166 at ¶118; Ex. 1049 at 5). Despite the problems inherent with tensile films, *Leedy* ’695 uses PECVD to create *only* tensile films. (Ex. 2166 at ¶118). This is because tensile films, despite their shortcomings, are needed to provide structure to free-standing flexible membranes. (Ex. 2166 at ¶118; Ex. 1006 at 5:68-6:5).

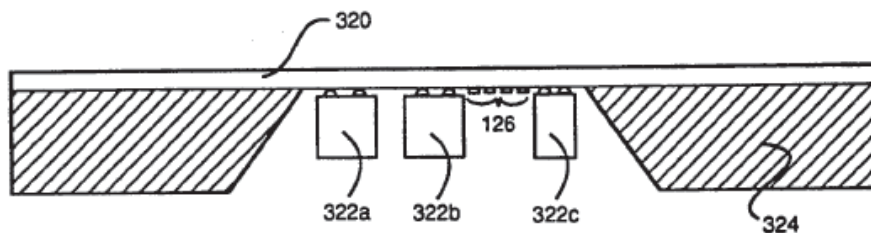
Low Tensile Stress: To give structure to the free-standing membrane, *Leedy* ’695 required the free-standing membrane to be in tensile stress. (Ex. 2166 at ¶119; Ex. 1006 at 5:68 – 6:5).

Inability To Withstand High Temperatures: *Leedy* ’695 describes that the temperature threshold of its low tensile stress dielectric is not much higher than 400°C: the “membrane is able to withstand a wide range of IC processing techniques and processing temperatures (of at least 400°C) without noticeable deficiency in performance.” (Ex. 1006 at 2:37-40; Ex. 2166 at ¶120). Even absent this disclosure, one of ordinary skill would understand that a dielectric deposited by PECVD at 400°C (like the *Leedy* ’695 dielectric) would not be able to withstand temperatures above deposition temperature without changing its form to compressive stress. (Ex. 2166 at ¶120; Ex. 1040 at 192).

b. Applications Of The *Leedy '695* Circuit Membrane

Leedy '695 describes several applications for its circuit membranes, including an “electrical interconnect” and in “three-dimensional [integrated circuit] structures.” (*E.g.*, Ex. 1006 at Abstract, 25:15-26:68, 45:49-47:9).

Electrical Interconnect: The Abstract states that the membrane can be used as “an electrical interconnect for conventional integrated circuit die bonded thereto.” In this application, the membrane is manufactured to encapsulate interconnects rather than active circuitry. (Ex. 1006 at 25:15-42; Ex. 2166 at ¶122). As illustrated in Figure 13a below, various individual integrated circuit die 322a, 322b, and 322c (which were already fabricated using conventional fabrication methods) can be attached to the Leedy membrane and thereby connected to one another using that membrane’s internal interconnects. (Ex. 1006 at 25:33-41, 25:58-62; Ex. 2166 at ¶122).

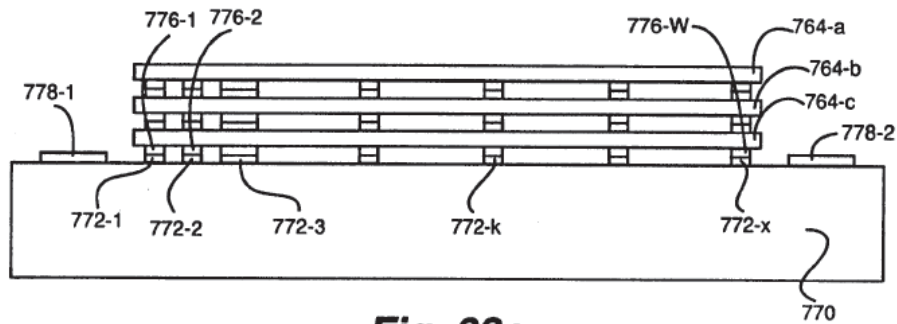


Fig_13a

This membrane is not an intermetal dielectric in the fabrication of an integrated circuit on a semiconductor substrate; rather, it is being used in the packaging phase

to connect and hold various integrated circuits that have already been fabricated through conventional means. (*See, e.g.*, Ex. 1006 at 25:33-41, 25:58-62).

Three-Dimensional IC Structures: In another application, the free-standing membranes may be stacked on top of one another to form a three-dimensional integrated circuit structure. (Ex. 2166 at ¶124; Ex. 1006 at 46:59-47:10). In one embodiment of this application shown in Figure 32c below, the stack circuit members may be bonded to a common “rigid” substrate during final packaging. (Ex. 1006 at 46:59-47:10).



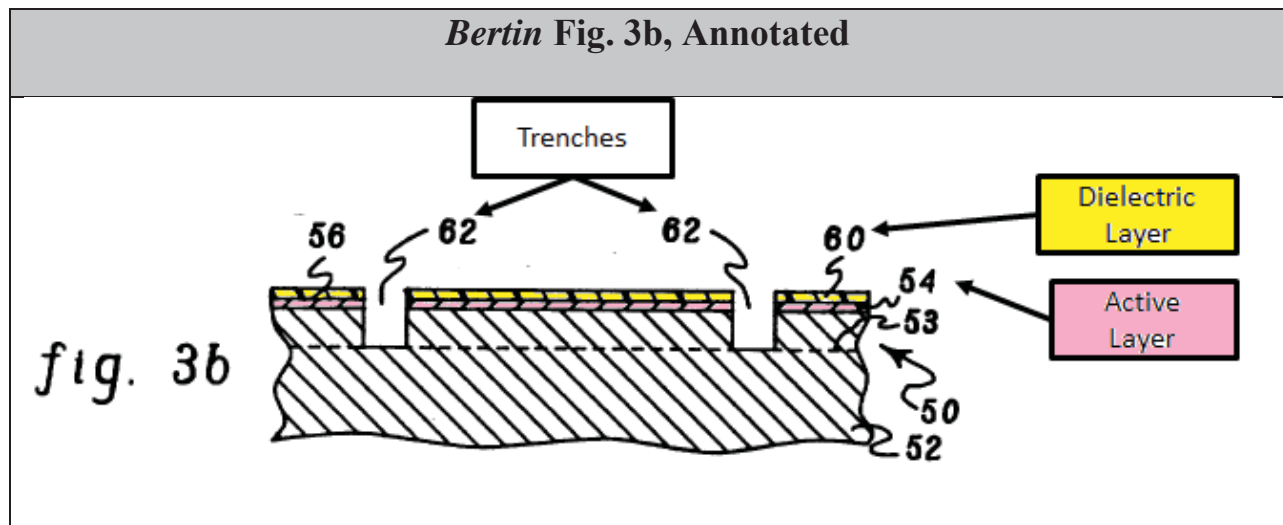
Fig_32c

2. *Bertin*

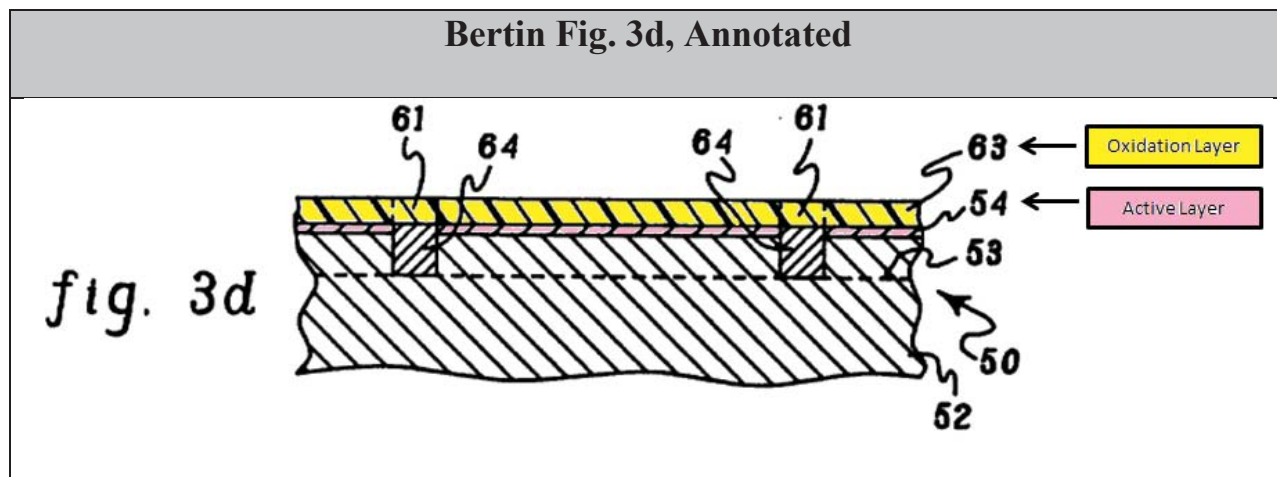
Bertin describes “semiconductor chips interconnected at least partially by means of a plurality of metalized trenches in the semiconductor chips.” (Ex. 1004 at 1:7-15).

a. ***Bertin*'s “dielectric layer 60” And “trench sidewalls” And “oxidation/connecting metallization layer 63” Were Grown Using Thermal Oxidation And Could Not Be Produced And Layered Using Plasma-Enhanced CVD**

As depicted in *Bertin*'s Figure 3b reproduced below, *Bertin* describes a “dielectric layer 60.” Instituted Grounds 1 and 2 are based on Petitioners' argument that it was obvious to replace *Bertin*'s dielectric layer 60 or layer 63 with the *Leedy* '695's low-tensile-stress Plasma-CVD dielectric.



Also described in *Bertin* are oxidized “trench sidewalls,” which are part of the “oxidation/connecting metallization layer 63” (“Layer 63”). (Ex. 1004 at 4:30-40). Petitioners concede that the oxidized trench sidewalls, which isolate vertical trenches 66, are the “oxidation portion of layer 63.” (Ex. 1002 at 88).



Petitioners’ do not attempt to identify the type or use of *Bertin*’s dielectric layer 60 or layer 63. However, a person of ordinary skill in the art would understand that dielectric layer 60 and layer 63 are high-purity silicon dioxide grown via thermal oxidation at high temperatures during the front-end-of-line phase of fabrication. (Ex. 2166 at ¶127). First, *Bertin* specifies that dielectric layer 60 is “grown,” not deposited, and is a silicon dioxide. (Ex. 2166 at ¶127; Ex. 1004 at 3:60-62). Regarding layer 63, a PHOSITA knows “[t]he oxidation reaction occurs at the Si/SiO₂ interface.” (Ex. 1040 at 114). Based on this description, one of ordinary skill in the art would know that the dielectric layer 60 and layer 63 were produced and layered using thermal oxidation to grow exposed silicon components into silicon dioxide. (Ex. 2166 at ¶127; Ex. 2158 at 102-103).

Second, if a silicon dioxide dielectric contacts circuit components, the silicon dioxide must be high-purity to not damage the circuit components. (Ex.

2166 at ¶128; Ex. 2158 at 68-70; Ex. 2159 at 54). Therefore, because *Bertin* describes the silicon dioxide dielectric layer 60, and, later, layer 63, as being grown directly over active silicon components (such as a silicon source, gate, or drain), one of ordinary skill also would understand that the dielectric layer 60 and layer 63 need to be highly pure, which again would mean it was grown at high temperatures using thermal oxidation. (Ex. 2166 at ¶128; Ex. 1004 at 3:60-4:3; Ex. 2158 at 68-70; Ex. 2159 at 54, 139).

Third, the change from front end of line (which requires high purity and high temperatures) to back end of line is marked by the deposition of the first metallization connection layer. (Ex. 2166 at ¶129; Ex. 2158 at 14). Accordingly, one of ordinary skill would understand that dielectric layer 60 and layer 63 were grown using thermal oxidation during the front end of line phase because *Bertin* describes the layer as being grown several steps before the deposition of the connecting metallization and wiring, which would mark the end of the front end of line phase and the start of the back end of line phase. (Ex. 2166 at ¶129; Ex. 1004 at 3:60-62, 4:30-47).

And just as one of ordinary skill in the art would understand that dielectric layer 60 and layer 63 were grown using thermal oxidation during the front end of line phase, one would also understand that it could not be deposited using a Plasma-Enhanced CVD such as that described in *Leedy '695*. (Ex. 2166 at ¶130).

Plasma-Enhanced CVD cannot be used during front end of line to produce and deposit a high-purity silicon dioxide dielectric over active circuit components because the resulting dielectric would not (1) be sufficiently pure; (2) have the ability to adhere sufficiently to the semiconductor wafer; and (3) be able to withstand high temperatures of the remaining FEOL steps without changing its form. (Ex. 2166 at ¶130; Ex. 2169 at 29-30). Plasma-Enhanced CVD also cannot be used because positive ions present in the plasma can strike and damage the wafer and the exposed active components in and on its surface. (Ex. 2166 at ¶130; Ex. 2159 at 139).

b. Bertin’s “dielectric layer 60” Is Removed From The Chip

Bertin’s dielectric layer 60 is removed during subsequent processing and is not part of the final integrated circuit. (Ex. 2166 at ¶131). It is common to create a dielectric layer and subsequently remove it during fabrication. (Ex. 2166 at ¶131; Ex. 2158 at 141). Because dielectric layer 60 is removed during processing, it is not included in the final package. (Ex. 2166 at ¶131).

c. Bertin Does Not Disclose Or Suggest A Substantially Flexible Substrate Or Circuit

Under the ordinary meaning of “flexible,” *Bertin* does not disclose or suggest a flexible substrate, wafer, or circuit layer, and Petitioners do not argue or attempt to show otherwise. Instead, Petitioners have argued only that *Bertin*

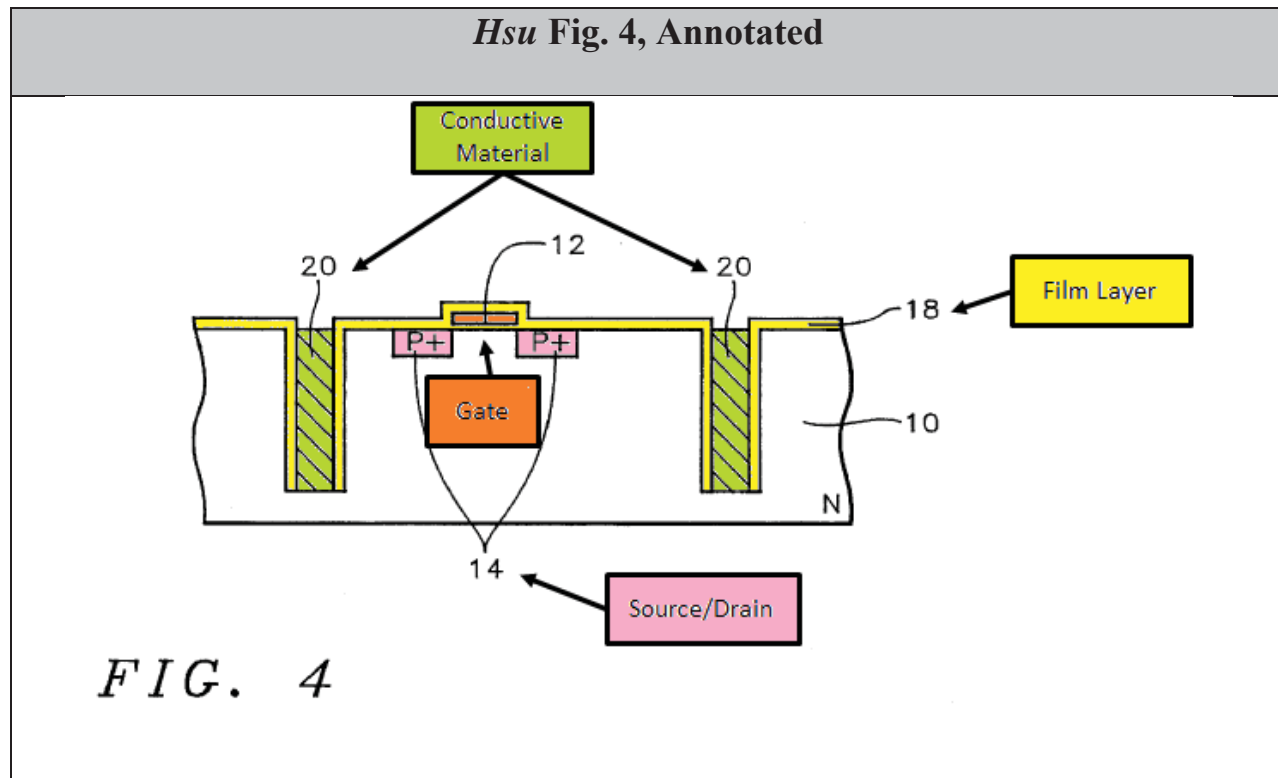
discloses a substrate that has been thinned and/or smoothed and polished, without any regard for whether the substrate or the resulting circuit is in fact flexible.

3. *Hsu*

Hsu describes connecting three-dimensional integrated circuit chips using a trench method. (Ex. 1008 at 1:7-10).

a. *Hsu*'s "silicon dioxide film 18" Was Deposited Using A High Temperature Thermal CVD And Could Not Be Produced And Layered Using A Plasma-Enhanced CVD

As depicted below in the annotated *Hsu* Figure 4 below, *Hsu* describes a "silicon dioxide film 18" that is formed over the entire surface of silicon semiconductor substrate 10. (Ex. 1008 at Fig. 4, 2:2:63-67). Instituted Ground 3 is based on Petitioners' argument that it was obvious to replace this silicon dioxide layer 18 with the *Leedy* '695's low-tensile-stress Plasma-CVD dielectric.



Petitioners do not attempt to identify the type or use of *Hsu*'s "silicon dioxide film 18." A person of ordinary skill in the art would understand that silicon dioxide 18 is a high-purity pre-metal dielectric deposited on the silicon substrate using high temperature thermal CVD. (Ex. 2166 at ¶138).

A person of ordinary skill would understand that *Hsu*'s "silicon dioxide film 18" would need to be of very high purity. (Ex. 2166 at ¶139; Ex. 2158 at 104-106; Ex. 2159 at 73). During fabrication, if silicon dioxide directly contacts the substrate surface or circuit components, the silicon dioxide must be high-purity to not damage the substrate. (Ex. 2166 at ¶139; Ex. 2158 at 104-106; Ex. 2159 at 73). Thus, because *Hsu* describes that film 18 is deposited over the entire silicon

substrate, including transistor gate electrode 12 and source/drain regions 14 formed therein (Ex. 1008 at 2:63-67), a person of ordinary skill would understand it must have high purity. (Ex. 2166 at ¶139).

One would understand that film 18 is being layered during the early stages of the front end of line phase of fabrication and therefore must be able to withstand handle subsequent high-temperature processing steps. (Ex. 2166 at ¶139). For example, *Hsu* describes that film 18 acts as a masking agent to create trenches 62. (Ex. 1008 at 3:1-3). A conductive material layer 20 is then deposited using a selective tungsten CVD process. (Ex. 1008 at 3:5-7). Later, metal layer 26 is deposited and connected to transistor gate electrode 12. (Ex. 1008 at FIG. 12, 4:7-8). One skilled in the art understands that silicide is used to connect transistor gate electrode 12 to metal layer 26. (Ex. 2166 at ¶140). The silicide process is performed at temperatures in excess of 700°C. (Ex. 2166 at ¶140; Ex. 2160 328; Ex. 2158 417, 524). Film 18 thus must, without failing or otherwise becoming inoperable, withstand high temperature processes such as silicide processing. (Ex. 2166 at ¶140).

Because of the foregoing requirements and *Hsu*'s explicit disclosure, a person of ordinary skill in the art would further understand that silicon dioxide film 18 was formed using thermal CVD at high temperatures and atmospheric pressure. (Ex. 2166 at ¶141). First, *Hsu* explicitly states that silicon dioxide film 18 is

deposited using CVD at atmospheric pressure. (Ex. 1008 at 2:63-67). One of skill in the art would realize that to obtain the required purity and temperature resistance at atmospheric pressure, the CVD in question would likely be thermal CVD at high temperatures. (Ex. 2166 at ¶141).

In contrast, a person of skill would also know that *Hsu*'s silicon dioxide film 18 could not be deposited using a PECVD such as that described in *Leedy '695*. (Ex. 2166 at ¶142). PECVD cannot be used during front end of line to produce and deposit a high-purity silicon dioxide dielectric over active circuit components because the resulting dielectric would not (1) be sufficiently pure; (2) have the ability to adhere; and (3) be able to withstand high temperatures of the remaining FEOL steps. (Ex. 2166 at ¶142; Ex. 2169 at 29-30). Plasma-Enhanced CVD also cannot be used because ions in the plasma strike and damage the wafer. (Ex. 2166 at ¶142; Ex. 2159 at 139).

a. *Hsu* Does Not Disclose Or Suggest A Substantially Flexible Substrate Or Circuit

Under the ordinary meaning of “flexible,” *Hsu* does not disclose or suggest a flexible substrate or circuit, and Petitioners do not attempt to show otherwise. Instead, Petitioners have argued only that *Hsu* discloses a substrate that has been thinned, without any regard for whether the substrate or the resulting circuit is in fact flexible.

4. *Poole*

Poole relates to “charge-coupled devices and in particular, such devices which are thinned to allow illumination of the backside of the device to improve quantum efficiency and UV spectral response.” (Ex. 1005 at 1:8-11).

a. ***Poole’s Two-Step Grinding And Polishing Would Not Be Used In Bertin***

Poole discloses manufacturing a silicon membrane by thinning the membrane, securing it to a rigid substrate for support, and then polishing the membrane to achieve an optically-smooth surface with little to no surface damages or defects. (Ex. 1004 at 3:12-14, 44-50). Polishing a two-step process. (Ex. 2166 at ¶144). First, a 700 Grit material is added to the surface to be polished and removes a majority of the membrane, and then a finer polishing pad is used to polish the surface to remove additional membrane and any imperfections on the surface. (Ex. 2166 at ¶144; Ex. 1004 at 6:27-48).

After operational devices are selected, “the wafer is **waxed** to a support structure and is diced on a wafer dicing saw, as indicated in step 2 shown by FIG. 2a.” (Ex. 1005 at 4:32-34) (emphasis added). The use of wax for temporary bonding in *Poole*, make clear that *Poole* is not particularly concerned with maintaining a “clean” environment. (Ex. 2166 at ¶145). A person of ordinary skill

would recognize that there would be significant risk in using *Poole*'s thinning process with *Bertin* due to contamination. (Ex. 2166 at ¶145; Ex. 2158 at 92-97).

V. The Correct Claim Construction of Material Disputed Terms

A. The Controlling Claim Construction Standard

The Board has ordered that the district court standard applies. Under that standard, claim terms are given their ordinary and customary meaning, as would be understood by a person of ordinary skill in the art at the time of the invention, in light of the language of the claims, the specification, and the prosecution history of the record. *E.g.*, *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313-1317 (Fed. Cir. 2005) (en banc); *Hill-Rom Services, Inc. v. Stryker Corporation*, 755 F.3d 1367, 1371 (Fed. Cir. 2014).

Under this standard, there is “a ‘heavy presumption’ that a claim term carries its ordinary and customary meaning.” *Starhome GmbH v. AT&T Mobility LLC*, 743 F.3d 849, 857 (Fed. Cir. 2014). Because of this presumption, a claim term may be construed contrary to its ordinary meaning only “under two circumstances: ‘(1) when a patentee sets out a definition and acts as [its] own lexicographer, or (2) when the patentee disavows the full scope of a claim term either in the specification or during prosecution.’” *Aventis Pharma S.A. v. Hospira, Inc.*, 675 F.3d 1324, 1330 (Fed. Cir. 2012) (quoting *Thorner v. Sony Computer Entm’t Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012)); *Hill-Rom*, 755 F.3d at 1371.

Each of these exceptions requires a showing of **clear** intent. As to the first: “‘To act as its own lexicographer, a patentee must clearly set forth a definition of the disputed claim term other than its plain and ordinary meaning’ and ‘must clearly express an intent to redefine the term.’” *Hill-Rom*, 755 F.3d at 1371 (quoting *Thorner v. Sony Computer Entm’t Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012)). “It is not enough for a patentee to simply disclose a single embodiment or use a word in the same manner in all embodiments, the patentee must ‘clearly express an intent’ to redefine the term.” *Thorner*, 669 F.3d at 1365; *Hill-Rom*, 755 F.3d at 1371.

As to the second, there must be a “clear disavowal of claim scope.” *Aventis*, 675 F.3d at 1330. “A statement in the prosecution history can only amount to a disclaimer if the applicant ‘clearly and unambiguously’ disavowed claim scope.” *Toshiba Corp. v. Imation Corp.*, 681 F.3d 1358, 1367 (Fed. Cir. 2012) (internal citations omitted). Similarly, the patentee cannot disavow claim scope in the specification absent a “clear intention to limit the scope using words or expressions of manifest exclusion or restriction, which is necessary to further narrow the claim language.” *Linear Tech Corp. v. Int’l Trade Comm’n*, 566 F.3d 1049, 1058 (Fed. Cir. 2009).

In either case, the party wishing to alter the meaning of a clear claim term bears the burden of overcoming the presumption that the ordinary and accustomed

meaning controls by establishing the required clear special definition or disclaimer. *K-2 Corp. v. Salomon S.A.*, 191 F.3d 1356, 1363 (Fed. Cir. 1999). “Absent disclaimer or lexicography the plain meaning of the claim controls.” *Toshiba Corp. v. Imation Corp.*, 681 F.3d 1358, 1369 (Fed. Cir. 2012).

B. The Correct Construction Of “Substantially Flexible”

The Board should only construe terms to the extent such construction is necessary to resolve a controversy material to the Petition. *See, e.g., Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011); *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999). Based on the Petition and this Response, the only material claim construction issue currently facing the Board concerns the term “substantially flexible.”

1. “Substantially Flexible” Should Be Construed To Have Its Ordinary Meaning

“Substantially flexible” was not clearly and explicitly specially defined or disclaimed, so its ordinary meaning must apply. According to contemporaneous dictionaries such as the *Oxford American Dictionary of Current English*, the applicable ordinary meaning of “flexible” is “able to bend without breaking; pliable,” while the applicable ordinary meaning of “substantial” is “true in large part.” (Ex. 2165). Accordingly, the ordinary meaning and correct construction of “substantially flexible is “largely able to bend without breaking.”

When modifying “substrate,” Petitioners proposed that “substantially flexible” should be construed to mean “thinned to a thickness of less than 50 microns and subsequently polished or smoothed.” (Petition at 9-10). The Board preliminarily construed the term as “thinned to a thickness of less than 50 microns.” (Decision at 11). When modifying the phrase “circuit layer,” Petitioners propose that “substantially flexible” should mean “a circuit layer having a semiconductor substrate that has been thinned to a thickness of less than 50 μm and subsequently polished or smoothed, and where the dielectric material used in processing the semiconductor substrate must have a stress of 5×10^8 dynes/cm² tensile or less.” (Petition at 13). The Board did not construe a preliminary definition of “substantially flexible” when modifying “circuit layer.” Regardless, neither of these constructions is the ordinary meaning of “substantially flexible”: something can be thinned, polished or smoothed and still be rigid rather than flexible, and Petitioners have not argued or presented any evidence to the contrary.

These proposed constructions also violate the doctrine of claim differentiation. For example, challenged claims 52 and 53 require a substantially flexible semiconductor that is thinned and polished or smoothed. *Digital-Vending Services Int’l LLC v. University of Phoenix, Inc.*, 672 F.3d 1270 (Fed. Cir. 2012); (rejecting claim construction that would render a claim term meaningless); *Cat*

Tech. LLC v. TubeMaster, Inc., 528 F.3d 871, 885 (Fed. Cir. 2008 (refusing to adopt a claim construction that would render a claim limitation meaningless)).

In contrast, those limitations make sense if “substantially flexible” is given its ordinary meaning (that the substrate actually be substantially flexible--largely able to bend without breaking).

2. “Substantially Flexible” Was Not Clearly And Unambiguously Specially Defined

Petitioners argue that the ordinary meaning of “substantially flexible” should not apply. But the party wishing to alter the meaning of a clear claim term bears the burden of overcoming the presumption that the ordinary meaning controls. *K-2 Corp. v. Salomon S.A.*, 191 F.3d 1356, 1363 (Fed. Cir. 1999). “To act as its own lexicographer, a patentee must clearly set forth a definition of the disputed claim term other than its plain and ordinary meaning” and “clearly express an intent to redefine the term.” *Thorner*, 669 F.3d at 1366. 1365. This standard is “exacting” and Petitioners have not met it. *Id.* at 1366.

Petitioners have not pointed to anything purporting to define “substantially flexible” or any statement by patentee indicating a clear intent to redefine that term. Instead, Petitioners point to a specification passage explaining an example of how a “substantially flexible” substrate may be achieved in one embodiment:

2A. Grind the backside or exposed surface of the second circuit substrate to a thickness of less than 50 μm and then polish or smooth

the surface. The thinned substrate is now a substantially flexible substrate.

(Ex. 1001 at 9:1-6). Nothing here indicates a special definition for “substantially flexible” or that patentee intended “substantially flexible” to include things that are rigid (even if thinned and polished). “[I]t is improper to read limitations from a preferred embodiment described in the specification – even if it the only embodiment – into the claims absent a clear indication in the intrinsic record that the patentee intended the claims to be so limited.” *Dealertrack, Inc. v. Huber*, 674 F.3d 1315, 1327 (Fed. Cir. 2012).

Petitioners’ citation to the prosecution history likewise indicates that the patentee is describing a way of achieving substantial flexibility, not redefining the term to include things that are in fact substantially rigid rather than substantially flexible:

A substantially flexible semiconductor substrate **may be achieved by** grinding until considerably thin, **for example** to a thickness of less than 50 microns, and polishing the resulting surface.

(Ex. 1021 at 2; Ex. 1022 at 2)(emphasis added). Indeed, this passage makes clear that Petitioners are pointing to “definitions” where none exist: although this statement explicitly states that a thickness of less than 50 microns is only **an example** of a considerably thin substrate, Petitioners argue that this statement requires that **all** such substrates be 50 microns or less.

Petitioners argument that substantially flexible does not actually mean substantially flexible is also contrary to the prosecution histories, wherein the patentee made clear that something rigid or inflexible is not substantially flexible.

For example:

- “At no point is any portion of the stacked integrated circuit allowed to be substantially flexible, suggesting that the stacked integrated circuit is in fact **inflexible**.” (Ex. 2013 at 29) (emphasis in original).
- “Moreover, given the minute dimensions of such an island [of semiconductor material], the island of semiconductor itself is not flexible as claimed; rather, it is rigid.” (Ex. 2167 at 31).

3. “Substantially” Is Not Indefinite

Petitioners’ argument that a “special definition” is necessary to save “substantially flexible” from indefiniteness is improper¹ and unnecessary. Terms that include the word “substantially” are capable of construction. *Verve v. Crane Cams*, 311 F.3d 116, 1120 (Fed. Cir. 2002) (“Expressions such as “substantially” are used in patent documents when warranted by the nature of the invention, in order to accommodate the minor variations that may be appropriate to secure the

¹ 35 U.S. Code §311; 37 C.F.R. §42.104(b)(2).

invention”); *Cordis Corp. v. Medtronic AVE, Inc.*, 339 F.3d 1352, 1360 (Fed. Cir. 2003).

VI. All Challenged Claims: None Of The References Disclose The “Substantially Flexible” Limitations

All challenged claims but claims 1 and 14 require a “substantially flexible” substrate or circuit layer. Properly construed, this requires a substrate that is “largely able to bend without breaking.” Not a single reference of record teaches or suggests such a semiconductor substrate and Petitioners have not argued otherwise. Accordingly, Petitioner have failed to teach the presence of this limitation in any of the references or any instituted combination thereof, and Petitioner has thus failed to carry its burden on every challenged claim requiring this limitation.

Petitioners only attempt to identify a substantially flexible substrate hinged on its incorrect claim construction, under which a substrate satisfied this limitation regardless of whether it was actually substantially flexible, so long as it was thinned and polished. For example, Petitioners argue that the combination of *Bertin* and *Poole* satisfies the “substantially flexible” limitation “as construed by the Petitioner” because that combination results in a substrate 52 that is thinned to 20 micrometers and subsequently polished or smoothed. (Petition at 36). This argument is repeated throughout the petition, but Petitioners do not argue, much

less prove, that this proposed *Bertin* and *Poole* combination results in a semiconductor substrate that is actually substantially flexible (*e.g.*, largely able to bend without breaking).

Instituted Ground 3 likewise addresses this limitation only under Petitioners' incorrect claim construction: "*Hsu*'s 'thinned wafer' is a 'substantially flexible semiconductor substrate' **under Petitioner's interpretation** of that claim term because it is first ground and then polished to thin the wafer to 50 μm ." (Petition at 52) (emphasis added). Petitioners do not argue, much less prove, that *Hsu* discloses a semiconductor substrate that is actually substantially flexible (*e.g.*, largely able to bend without breaking), and any argument made by Petitioners in this regard must fail under the correct construction. (Petition at 48-49).

VII. All Challenged Claims: Petitioners Failed To Prove That The Proposed Combinations Were Obvious

Petitioners admit that none of their primary references disclose a low-stress dielectric as required by the challenged claims, but Petitioners argue it would have been obvious to substitute the low tensile stress dielectric disclosed in Leedy '695 for particular dielectrics in *Bertin* (Ground 1 and 2) and *Hsu* (Ground 3). (Ex. 2166 at ¶146). But Petitioners have failed to meet their burden of showing that proposed combinations were even possible, much less obvious.

To combine references for an obviousness ground, a petition for *inter partes* review must demonstrate that the proposed combination would have been obvious to one of ordinary skill in the art, including (1) **how** such a person would combine the elements to reach the claimed invention and (2) **why** such a person would have been motivated to do so. *See, e.g., Symantec Corp.*, IPR2014-00355, Paper 12 at 36-37 (PTAB Jul. 12, 2014); *Callcopy v. Verint Americas, et al.*, IPR2013-00486, Paper 11 at 11 (PTAB Feb. 5, 2014); *Ariosa Diagnostics v. Verinata Health, Inc., et al.*, IPR2013-00276, Paper 43 at 16 (PTAB Oct. 23, 2014). For each Instituted Ground, Petitioners failed to demonstrate either of these requirements.

At his deposition, Petitioners' expert, Dr. Franzon, conceded that when selecting a dielectric and method of formation, many of the following dielectric properties must be evaluated: (1) dielectric constant, (2) breakdown field strength, (3) leakage, (4) surface conductance, (5) moisture absorption or permeability to moisture, (6) stress, (7) adhesion to aluminum, (8) adhesion to dielectric layers above or below, (9) stability, (10) etch rate, (11) permeability to hydrogen, (12) amount of incorporated electrical charge or dipoles, (13) amount of impurities, (14) quality of step coverage, (15) the thickness and uniformity of the film, (16) ability to provide good doped uniformity across a wafer, (17) defect density, (18) amount of residual constituents that outgas during later processing. (Ex. 2146 at 195). Dr. Franzon also testified that how these properties would affect the dielectric choice,

and that the choice was highly dependent on the desired use and context. (Ex. 2146 at 195). While Dr. Franzon admitted that these factors must be considered when choosing a dielectric, he did not consider them, and repeatedly admitted that he did not know (or research) how the different techniques of applying dielectrics affected those qualities. (Ex. 2164 at 133:22-137:6).

Thus, although Petitioners and Dr. Franzon conclude that it was obvious to substitute the Leedy '659 dielectric for particular dielectrics in *Bertin* and Yu, they admittedly never considered any of these necessary factors or the use and context of the dielectric they sought to replace with the *Leedy* '695 dielectric. (Ex. 2164 at 133:22-137:6). Nor could they, because *Leedy* '695 does not address or disclose most of these properties and they are therefore unknown for the *Leedy* '695 dielectric. (Ex. 2166 at ¶148).

Instead of performing this admittedly necessary analysis, Petitioners and Dr. Franzon simply based their obviousness arguments on their presumption that all dielectrics are fungible, that the Leedy 695 dielectric could replace the specified *Bertin* and Yu dielectrics simply because they were both dielectrics. Petitioners failed even to try to prove this presumption, which is wholly incorrect. This failure to address (1) **how** such a person would combine the elements to reach the claimed invention and (2) **why** such a person would have been motivated to do so, alone requires rejection of all Instituted Grounds in their entirety.

As discussed below, if this analysis was done on the cited references, it would show that any such combination, far from suggesting itself to a person of ordinary skill, would indeed have been thought impossible.

A. All Challenged Claims (Grounds 1 and 2): The *Leedy* '695 Dielectric Could Not And Would Not Be Substituted For the *Bertin* Thermal Oxide Dielectric

Instituted Grounds 1 and 2 is based on Petitioners' argument that it was obvious to replace *Bertin*'s dielectric layer 60 or the oxidation portion of layer 63 with the *Leedy* '695's low-tensile-stress Plasma-CVD dielectric. As established above, a person of ordinary skill in the art would understand that *Bertin*'s layer 60 and 63 are high-purity silicon dioxide grown over active circuit components via thermal oxidation at high temperatures during the front-end-of-line phase of fabrication. (Ex. 2166 at ¶149).

One of ordinary skill in the art also would understand that *Bertin*'s layer 60 and 63 could not be deposited using a Plasma-Enhanced CVD such as that described in *Leedy* '695. (Ex. 2166 at ¶150). Plasma-Enhanced CVD cannot be used during front end of line to produce and deposit a high-purity silicon dioxide dielectric over active circuit components because the resulting dielectric would not (1) be sufficiently pure; (2) have the ability to adhere sufficiently to the semiconductor wafer; and (3) be able to maintain its properties when subjected to high temperatures of the remaining FEOL steps without changing its form. (Ex. 2166 at

¶150). Plasma-Enhanced CVD also cannot be used because positive ions present in the plasma can strike and damage the wafer and the exposed active components in and on its surface. (Ex. 2166 at ¶150; Ex. 2159 at 139).

Additionally, there was significant teaching away from using tensile stressed dielectrics, as it was known in the art that tensile stressed dielectrics were inferior. (Ex. 2166 at ¶151). Tensile stress can cause cracking, while excess compressive stress can cause buckling. (Ex. 1040 at 114, 117; Ex. 2146 at 195 (“the preferred stress [in a dielectric] is compressive...since dielectric films under tensile stress exhibit more of a tendency to crack”)). “[l]ow density tensile films tend to pick up water and form SiOH groups.” (Ex. 1049 at 5). This causes “degradation of electrical and mechanical properties.” *Id.*

At the time of the filing date, it was typical to try to alleviate some of these problems by depositing PECVD layers in moderate compressive stress (rather than tensile) to enhance conformality, reduce pinhole counts, and improve adhesion. (Ex. 2166 at ¶152; Ex. 2133 at 10, 11; Ex. 1040 at 106). Further, it was known to use compressive stressed dielectrics because, unlike tensile films, “films deposited with an intrinsic compress stress are stable and are even able to withstand boiling water without increasing the SiOH content or absorbing water.” (Ex. 1049 at 5).

Even if there was a reason to using tensile stress films, which there is not in this reference, substituting the *Leedy '695* membrane would not work. (Ex. 2166 at

¶153). The subsequent FEOL heating steps and anneals would necessarily change the properties of the membrane such that it would become compressive stressed—thus removing any perceived benefits of tensile stress. (Ex. 2166 at ¶153; Ex. 2169 at 29-30).

Finally, in addition to the reasons stated above, to the extent Petitioners argue the Leedy '695 dielectric should be substituted into *Bertin*'s layer 60, *Bertin* clearly shows that dielectric layer 60 is replaced with an oxidation/connecting metallization layer 63 and does not exist in the final embodiment. (Ex. 1004 at figure 3c and 3d).

As such, one would not have been motivated to use Leedy '695 dielectric as Petitioners propose; to the contrary, the Leedy '695 dielectric **could not** be used to replace *Bertin*'s layer 60 or 63.

Petitioners fail to address, much less prove, how or why one of skill in the art would replace a front end of line oxide dielectric with the *Leedy* '695 PECVD dielectric. This failure requires rejection of Instituted Grounds 1 and 2.

B. All Challenged Claims (Ground 3): The *Leedy* '695 Dielectric Could Not And Would Not Be Substituted For the *Hsu* Silicon Dioxide Layer 18

Instituted Ground 3 is based on Petitioners' argument that it was obvious to replace Yu's field oxide dielectric with the *Leedy* '695's low-tensile-stress Plasma-

CVD dielectric. As described, *Hsu*'s silicon dioxide field oxide is grown on the "Si Substrate" at high temperatures using thermal oxidation. (Ex. 2166 at ¶155).

One would understand that *Hsu*'s field oxide could not be replaced with a dielectric deposited using a Plasma-Enhanced CVD such as that described in *Leedy* '695. (Ex. 2166 at ¶156). Plasma-Enhanced CVD cannot be used during FEOL to produce and deposit a high-purity silicon dioxide dielectric over a silicon substrate because the resulting dielectric would not (1) be sufficiently pure; (2) have the ability to adhere; and (3) be able to withstand high temperatures of the FEOL steps. (Ex. 2166 at ¶156). PECVD also cannot be used because positive ions present in the plasma can strike and damage the surface of the silicon substrate. (Ex. 2166 at ¶156; Ex. 2159 at 139).

There was teaching away from using tensile stressed dielectrics, as it was known in the art that tensile stressed dielectrics were inferior. (Ex. 2166 at ¶157; Ex. 1040 at 114, 117; Ex. 2146 at 195 ("the preferred stress [in a dielectric] is compressive...since dielectric films under tensile stress exhibit more of a tendency to crack")). "[l]ow density tensile films tend to pick up water and form SiOH groups." (Ex. 1049 at 5). This causes "degradation of electrical and mechanical properties." *Id.*

At the time of the filing date, it was typical to try to alleviate some of these problems by depositing PECVD layers in moderate compressive stress (rather than

tensile) to enhance conformality, reduce pinhole counts, and improve adhesion. (Ex. 2133 at 10, 11; Ex. 1040 at 106). Further, it was known to use compressive stressed dielectrics because, unlike tensile films, “films deposited with an intrinsic compress stress are stable and are even able to withstand boiling water without increasing the SiOH content or absorbing water.” (Ex. 1049 at 5).

Even if there was a reason to using tensile stress films, which there is not in this reference, substituting the *Leedy* ’695 membrane would not work. (Ex. 2166 at ¶159). The subsequent FEOL heating steps and anneals would cause the membrane to become compressive stressed—thus removing any perceived benefits of tensile stress. (Ex. 2166 at ¶159; Ex. 2169 at 29-30).

One of ordinary skill would not be motivated to, and would understand that *Leedy* ’695 dielectric **could not** be used as to replace Yu’s field oxide dielectric. (Ex. 2166 at ¶160).

Petitioners fails to address, much less prove, **how** or **why** one of skill in the art would replace a field oxide dielectric with the *Leedy* ’695 PECVD dielectric. This failure requires rejection of Instituted Ground 3 in its entirety.

**C. Challenged Claims 2, 8, 31, 32, 44, 46, 52-54 (Grounds 1 and 2):
Poole’s Two-Step Grinding And Polishing Would Not Be Used In
*Bertin***

Poole relates to a very different technology area than the ‘239 Patent. The invention “relates to charge-coupled devices and in particular, such devices which

are thinned to allow illumination of the backside of the device to improve quantum efficiency and UV spectral response.” (Ex. 1005 at 1:8-11). One of ordinary skill in the art of 3D integrated circuit structures would not look to *Poole*. (Ex. 2166 at ¶161).

Within *Poole*, the description of the devices and various aspects of the thinning process itself, including the use of wax for temporary bonding, make clear that *Poole* is not particularly concerned with maintaining a “clean” environment. (Ex. 2166 at ¶162). A person of skill in the art would recognize that there would be significant risk in using *Poole*’s thinning process with *Bertin*. (Ex. 2166 at ¶162). Integrated circuit devices are incredibly sensitive to contamination and are therefore fabricated in “clean” environments. Introduction of the slightest contaminant can lead to device failure. (Ex. 2166 at ¶162). The risks posed by the combination of *Bertin* and *Poole* would prevent a person of skill in the art from attempting the combination. (Ex. 2166 at ¶162).

VIII. Conclusion

For the foregoing reasons, the Board should find that the Petitioners have failed to meet their burden of proving that the challenged claims are unpatentable under any of the instituted Grounds.

Dated: October 14, 2016

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CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. §42.24(d), Patent Owner hereby certifies, in reliance on the word count of the word-processing system (Microsoft Office Word 2010) used to prepare this preliminary response, that the number of words in this paper is 13,572. This word count excludes the tables of contents, tables of authorities, certificate of word count, certificate of service, and appendix of exhibits.

Dated: October 14, 2016

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CERTIFICATE OF SERVICE

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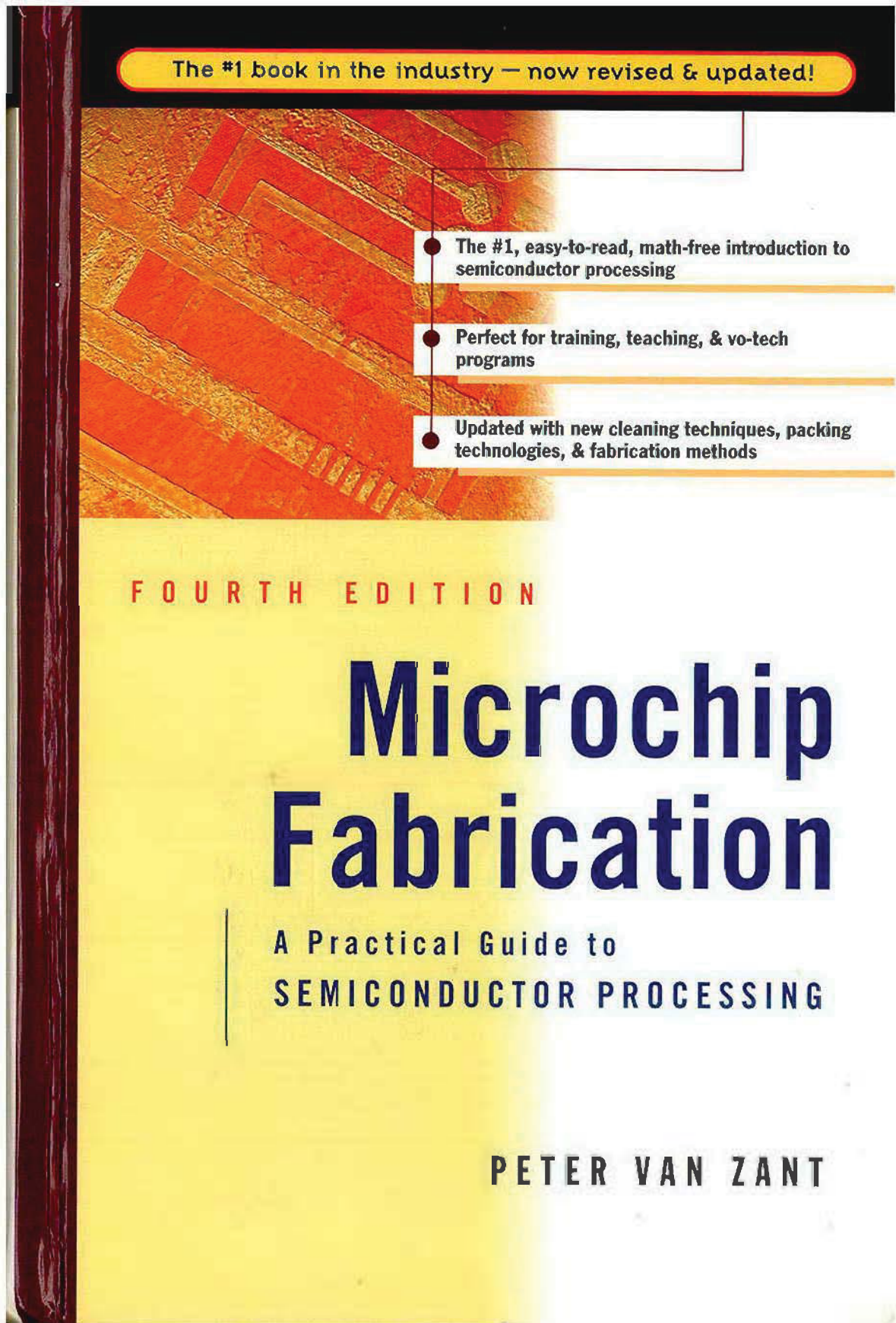
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Exhibit 46



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**Microchip
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Microchip Fabrication

A Practical Guide to Semiconductor Processing

Peter Van Zant

Fourth Edition

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Many thanks to Mary DeWitt, my ever patient and supportive wife, and my sons, Patrick, Jeffrey, and Stephen. They have all brought great joy to my life and all have managed to live through the demands of my microelectronics career. Thank you.

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Preface to the Fourth Edition

Little did I think in 1984 that Microchip Fabrication would continue into a fourth edition. Yet with the supportive guidance of McGraw-Hill and my editor Steve Chapman here is the new edition. Readers will note that this edition was written sooner than the usual time for major technical books. To microchip professionals and observers the reason is obvious: the pace of technical change in this industry is increasing, not slowing down.

I've tried to purge the previous edition of old and minor process descriptions and replace them with new ones. The advent of copper technology and multilevel metallization has spawned a number of new process steps. As reported in the first three editions, some day optical imaging will be replaced by other technologies. It is still a true statement, but clever engineers have continued to wring smaller and smaller images out of optical technology. Someday I will get to drop this imaging technique from the book, but probably not soon.

The chapter subjects are essentially the same as the previous edition with the exception of placing the *Overview of Wafer Fabrication* as Chapter 4. This switch was intended to give the reader a grounding in the basics of processing before tackling the process specific chapters.

The Semiconductor Industry Association is reporting that soon the industry will soon be producing the equivalent of one billion transistors for each person on earth. With this type of growth we can expect many more years of advances in this industry. In the mean time the physics, chemistry, and electronics of integrated circuit operation and semiconductor processing are still valid and this fourth edition is focused on these foundations.

I wish to thank Anne Miller, Semiconductor Services, Jim Hayes, Consultant, and David Hata, of Portland Community College for sug-

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gesting new material for this edition. I also thank Lucy Luckenbaugh of Pro-Image Corp. for her fine editing support and patience with my missed deadlines.

*Peter Van Zant
Grass Valley, California*

Chapter

1

The Semiconductor Industry

Overview

In this chapter, you will be introduced to the Semiconductor industry via a brief history, as well as by the importance of the industry in the world economy, an overview of the significant technical developments, and the trends that have made the industry the world's leading industrial segment. The major manufacturing stages are introduced by product types, and transistor building structures along with integration levels will be explained.

Objectives

Upon completion of this chapter you should be able to:

1. Describe the difference between discrete devices and integrated circuits.
2. Define the terms "solid state," "planar processing" and "N" and "P" type semiconducting materials.
3. List the four major stages of semiconductor processing.
4. Explain the Integration Scale and the implications of processing circuits of different levels of integration.
5. List the major process and device trends in semiconductor processing.

Birth of an Industry

The electronic signal processing industry got its jump start with the discovery of the audion vacuum tube in the 1906 by Lee DeForest.¹ It

2 Chapter One

made possible the radio, television, and other consumer electronics. It also was the brains of the world's first electronic computer, named the Electronic Numeric Integrator and Calculator (ENIAC), first demonstrated at the Moore School of Engineering in Pennsylvania in 1947.

This ENIAC hardly fits the modern picture of a computer. It occupied some 1500 square feet, weighed 30 tons, generated large quantities of heat, required the services of a small power station, and cost \$400,000 in 1940 dollars. The ENIAC was based on 19000 vacuum tubes along with thousands of resistors and capacitors (Fig. 1.1).

A vacuum tube consists of three elements, two electrodes separated by a grid in a glass enclosure (Fig. 1.2). Inside the enclosure is a vacuum, required to prevent the elements from burning up, and to allow the easy transfer of electrons.

Tubes perform two important electrical functions, switching and amplification. Switching refers to the ability of an electrical device to turn a current on or off. Amplification is a little more complicated. It is the ability of a device to receive a small signal (or current) and amplify it while retaining its electrical characteristics.

Vacuum tubes suffer from a number of drawbacks. They are bulky, prone to loose connections and vacuum leaks, fragile, require rela-

Size, ft	30 x 50
Weight, tons	30
Vacuum Tubes	18,000
Resistors	70,000
Capacitors	10,000
Switches	6000
Power Requirements, W	150,000
Cost (in 1940)	\$400,000

Figure 1.1 Eniac statistics. (*Foundations of Computer Technology*, J. G. Giarratano, Howard W. Sams & Co., Indianapolis, Ind., 1983.)

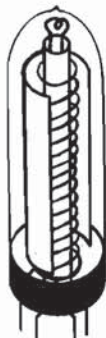


Figure 1.2 Vacuum tube.

The Semiconductor Industry 3

tively large amounts of power to operate, and their elements deteriorate rather rapidly. One of the major draw backs to the ENIAC and other tube-based computers was a limited operating time due to tube burn-out.

These problems were the impetus leading many laboratories around the country to seek a replacement for the vacuum tube. That effort came to fruition on Dec. 23, 1947 when three Bell Lab scientists demonstrated an electrical amplifier formed from the semiconducting material Germanium (Fig. 1.3).

This device offered the electrical functioning of a vacuum tube, but with the advantages of the solid state (no vacuum), small and light weight, low power requirements and long lifetime. First named a transfer resistor, the new device soon became known as the *transistor*.

The three scientists, John Bardeen, Walter Brattin and William Shockley were awarded the 1956 Nobel Prize in physics for their invention.

The Solid State Era

That first transistor was a far distance from the high density integrated circuit of today. But it was the component that gave birth to the solid state electronics era with all its famous progeny. Besides transistors, solid state technology is also used to create diodes, resistors and capacitors. Diodes are two-element devices that function in a circuit as a switch. Resistors are monoelements devices that serve to limit current flow. Capacitors are two-element devices that store charge in a circuit. In some circuits, the technology is used to create fuses. Refer to Chapter 14 for an explanation of these concepts and a explanation of how these devices work.

These devices, containing only one device per chip, are called discrete devices (Fig 1.4). Most discrete devices have less demanding operational and fabrication requirements than integrated circuits. In



Figure 1.3 The first transistor.

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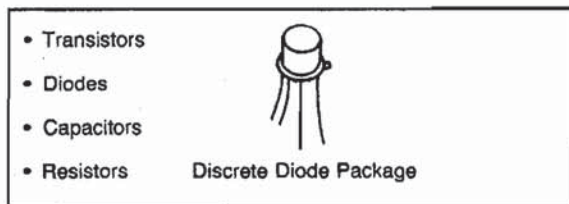


Figure 1.4 Solid-state discrete devices.

general, discrete devices are not considered leading edge products. Yet they are required in most sophisticated electronic systems. In 1998, they accounted for 12% of the dollar volume of all semiconductor devices sold.² The semiconductor industry was in full swing by the early 1950's, supplying devices for transistor radios and transistor based computers.

Integrated Circuits (I.C.'s)

The dominance of discrete devices in solid state circuits came to an end in 1959. In that year Jack Kilby, a new engineer at Texas Instruments in Dallas, Texas, formed a complete circuit on a single piece of the semiconducting material germanium. His invention combined several transistors, diodes and capacitors (five components total) and used the natural resistance of the germanium chip (called a bar by Texas Instruments) as a circuit resistor. This invention was the *integrated circuit*, the first successful integration of a complete circuit in and on the same piece of a semiconducting substrate.

The Kilby circuit did not have the form that is prevalent today. It took Robert Noyce, then at Fairchild Camera, to furnish the final piece of the puzzle. In Fig. 1.5 is a drawing of the Kilby circuit. Note that the devices are connected with individual wires.

Earlier Jean Horni, also at Fairchild Camera, had developed a process of forming electrical junctions in the surface of a chip to create a

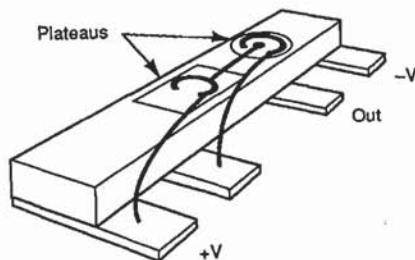


Figure 1.5 Kilby integrated circuit from his notebook. (Courtesy of Texas Instruments.)

solid state transistor with a flat profile (Fig. 1.6). The flattened profile was the outcome of taking advantage of the easily formed natural oxide of silicon, that also happened to be a dielectric (electrical insulator). Horni's transistor used a layer of evaporated aluminum, that was patterned into the proper shape, to serve as wiring for the device. This technique is called *planar technology*.

Noyce applied this technique to "wire" together the individual devices previously formed in the silicon wafer surface.

The Kilby/Noyce integrated circuit became *the* model for all integrated circuits. The techniques used not only met the needs of that era, but contained the seeds for all the miniaturization and cost effective manufacturing that still drives the industry. Kilby and Noyce shared the patent for the integrated circuit.

Process and Product Trends

Since 1947, the semiconductor industry has seen the continuous development of new and improved processes. These process improvements have in turn led to the more highly-integrated and reliable circuits that have, in their turn, fueled the continuing electronics revolution. These process improvements fall into two broad categories; process and structure. Process improvements are those that allow the fabrication of the devices and circuits in smaller dimensions, in ever higher density, quantity and reliability. The structure improvements are the invention of new device designs allowing greater circuit performance, power control and reliability.

Device component size and the number of components in an IC are the two common trackers of IC development. Component dimensions are characterized by the smallest dimension in the design. This is called the *feature size*, and is usually expressed in microns. A micron is 1/10,000 of a centimeter or about 1/100 the diameter of a human hair.

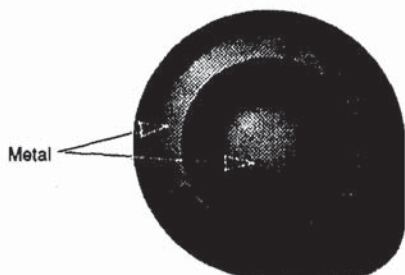


Figure 1.6 Horni "teardrop" transistor.

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In 1964, Gordon Moore, a founder of Intel, predicted that integrated circuit density would double in eighteen months. This prediction became known as Moore's law and has proven very accurate (Fig. 1.7).

Circuit density is tracked by the *integration level*, which is the number of components in a circuit. Integration levels (Fig. 1.8) range from Small Scale Integration (SSI) to Ultra Large Scale Integration (ULSI). ULSI chips are sometimes referred to as Very Very Large Scale Integration (VVLSI). The popular press calls these newest products *megachips*.

In addition to the integration-scale, memory circuits are identified by the number of memory bits contained in the circuit (a four-meg memory chip can store four million bits of memory). Logic circuits are often rated by their number of "gates." A gate is the basic operational component of a logic circuit.

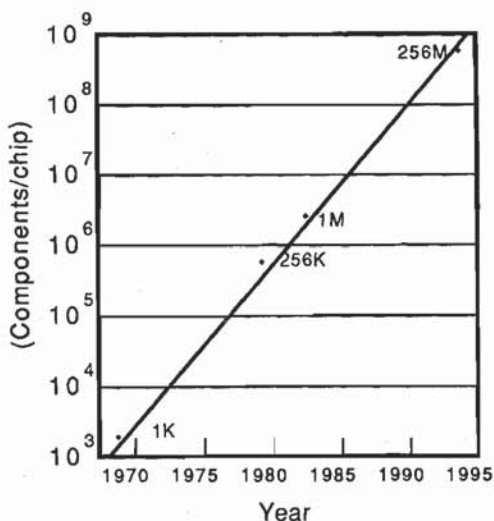


Figure 1.7 Growth of Dram Density (After Campbell, *The Science of Engineering and Microelectronics fabrication*, Oxford Press.)

Level	Abbreviation	# Components per Chip
Small Scale Integration	SSI	2 - 50
Medium Scale Integration	MSI	50 - 5000
Large Scale Integration	LSI	5000 - 100,000
Very Large Scale Integration	VLSI	Over 100,000 - 1,000,000
Ultra Large Scale Integration	ULSI	> 1,000,000

Figure 1.8 IC integration table.

Decreasing feature size

The journey from Small Scale Integration to today's megachips has been driven primarily by reductions in the feature size of the individual components. This decrease has been brought about by dramatic increases in the imaging process, known as photolithography, and the trend to multilayers of conductors. Actual and projected feature sizes over a twenty-five year span are shown in Fig. 1.9. The Semiconductor Industry Association (SIA) has projected feature sizes decreasing to 50 nanometers (0.005 microns) by the year 2012.³ Along with the ability to make components on the chip smaller, comes the benefit of crowding them closer together further increasing density.

An analogy used to explain these trends is the layout of a neighborhood of single family homes. The density of the neighborhood is a function of the house size, lot size and the width of the streets. Accommodating a higher population could come by increasing size of the neighborhood (increasing the chip area). Another possibility is to reduce the size of the individual houses, and place them on smaller lots. We can also reduce the street size to increase density. However, at some point the streets cannot be reduced anymore in size or they won't be wide enough for autos and at some point the houses cannot be further reduced in size and still function as dwelling units. At this point an option is to replace individual homes with apartment buildings. All of these options are used in semiconductor technology.

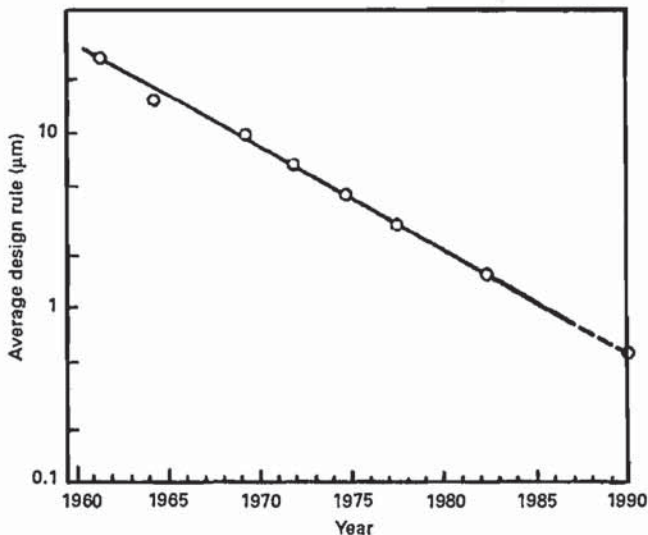


Figure 1.9 Decreasing image feature size. (After Wolf and Tauber, "Silicon Processing for the VLSI Era.")

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There are several benefits to the reduction of the feature size and its attendant increase in circuit density. At the circuit performance level there is an increase in circuit speed. With less distances to travel and with the individual devices occupying less space, information can be put into and gotten out of the chip in less time. Anyone who has waited for their personal computer to perform a simple operation can appreciate the effect of faster performance. These same density improvements result in a chip or circuit that requires less power to operate. The small power station required to run the ENIAC has given way to powerful lap top computers that run on a set of batteries.

Increasing chip and wafer size

The advancement of chip density from the SSI level to ULSI chips has driven larger chip sizes. Discrete and SSI chips average about 100 mils (0.1 inch) on a side. ULSI chips are in the 500 mil (0.5 inch) per side, or larger, range. IC's are manufactured on thin disks of silicon (or other semiconductor material, see Chapter 2) called *wafers*. Placing square or rectangular chips on a round wafer leaves unavailable areas around the edge. These unavailable areas can become large as the chip size increases (Fig. 1.10). To desire to offset the loss of usable silicon has driven the industry to larger wafers. As the chip size increases, the 1 inch diameter wafers of the 1960's have given way to 200 and 300 mm (8" and 12") sized wafers.

Reduction in defect density

As feature sizes have decreased, the need for reduced defect density and defect size on the chips, and in the manufacturing process, becomes critical. A one micron piece of dirt on a 100 micron sized transistor may not be a problem. On a one micron sized transistor it becomes a killer defect that can render the component inoperable (Fig.

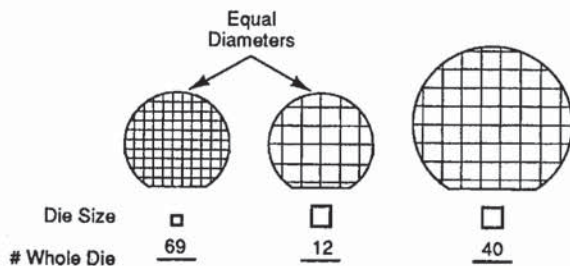


Figure 1.10 Effect of processing larger die on larger wafers.

1.11). Contamination control needs has driven the cost of building an IC manufacturing facility into the billion dollar range.

Increase in interconnection levels

The component density increase has led to a “wiring” problem. In the neighborhood analogy, reducing street widths was one strategy to increase density. But at some point the streets become too narrow to allow cars to travel. The same thing happens in IC design. The increased component density and close packing rob the surface space needed on the surface to connect the components. The solution is multiple levels of “wiring” stacked (Fig. 1.12) above the surface components in layers of insulators and conducting layers (Chapter 13).

The SIA roadmap

These major IC parameters are inter-related. Moore’s law predicts the future of component density, which triggers the calculation of the integration level (component density), chip size, defect density (and

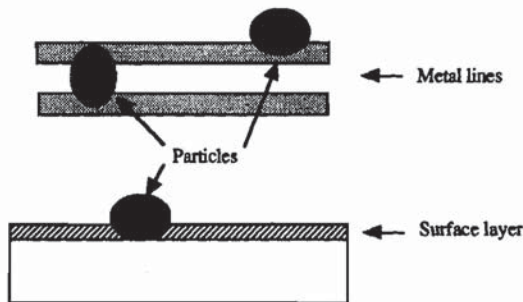


Figure 1.11 Relative size of airborne particles and wafer dimensions.

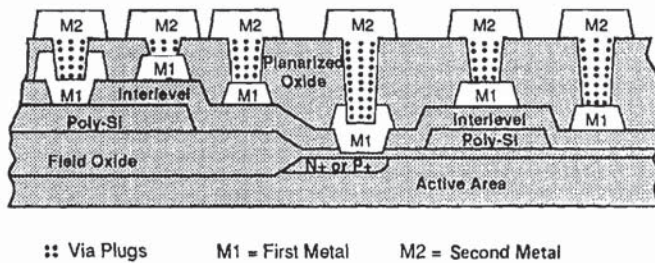


Figure 1.12 Cross section of typical planarized two-level metal VLI structure showing range of via depths after planarization. (Courtesy of Solid State Technology)

10 Chapter One

size), and the number of interconnection levels required. The Semiconductor Industry Association has made these projections into the future in a series of "roadmaps" covering these and other critical device and production parameters (Fig. 1.13).

Chip cost

Perhaps the most significant effect of these process and product improvements is the cost of the chips. Fig. 1.14 shows the year by year drop in memory chips through the 1980's. The curves are typical for any maturing product. Prices start high and, as the technology is mastered and manufacturing efficiencies increase, the prices drop and eventually become stable. These chip prices have constantly declined even as the performance of the chips have increased. In its first 30 years, the semiconductor industry had 2 to 5 times the economic impact in the U.S. that the railroads had in a similiar period.⁴ The factors affecting chip cost are discussed in Chapter 15.

The two factors, increased performance at less cost, have driven the explosion of products using solid state electronics. By the 1990's, an

Year of Production	2001	2006	2012
Line width (nm)	150	100	50
Memory size	1 Gb	16Gb	64 Gb
Logic Bits/cm ²	380M	2.2B	17B
Chip Size-DRAM (mm ²)	445	790	1580
Max wiring levels	7	7-8	9
Mask layers	23	24/26	28
Defect density-DRAM (D/m)	875	490	250
Chip conections-I/O's	1195	1970	3585
Wafer diameter (mm)	300	300	450

Figure 1.13 Wafer fabrication (and electrical test).

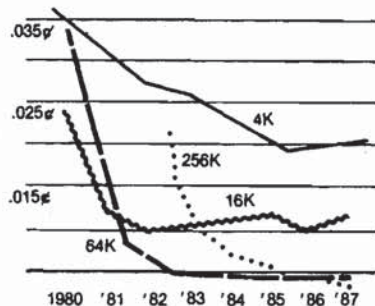


Figure 1.14 Price of chips per bit of memory.

auto had more computing power on-board than the first lunar space shots. Even more impressive is the personal computer. Today, for a moderate price, a desk top computer can deliver the same power of an IBM mainframe manufactured in 1970. Major industry use of chips is shown in Fig. 1.15. By 2008, the world wide industry will be producing a billion transistors per person world wide.⁵

Semiconductor industry growth

Overall, the semiconductor industry has experienced world-wide continual growth. From its birth in the 1950's, it is now approaching world wide sales of \$200 billion dollars a year, supported by a supplier industry of over \$30 billion.⁶ The millions of chips are supplied by factories located through out the world. Interestingly, even as the industry shows signs of maturing, it is still growing faster than other "mature" industries, indicating that microchips still have a lot of growth potential (Fig. 1.16).

An example of increasing chip power is shown in Fig. 1.17, which indicates the number of volumes of the Encyclopaedia Britannica that can be stored on larger capacity DRAM memory chips.

The history of the semiconductor industry is one of continual developments and advances emerging to world dominance in the mid-1990's. In that year, the semiconductor industry became the nation's leading value added industry, out performing the auto industry (Fig. 1.18).

Industry Organization

The electronics industry is divided into two major segments: semiconductors and systems (or products). Semiconductors encompasses the material suppliers, circuit design, chip manufacturers, and all of the equipment and chemical suppliers to the industry. The systems seg-

CHIP USES	1996
Computer	48.0%
Consumer	21.2%
Telecom	14.7%
Industrial	9.8%
Automotive	4.4%
Military	1.9%
Total	100.0%

Figure 1.15 Semiconductor chip uses. (Courtesy In-Stat-1995 SEMI ISS seminary)

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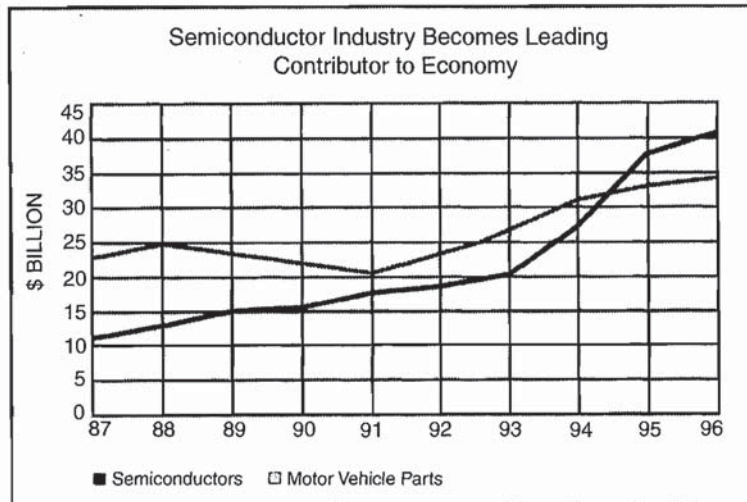


Figure 1.16 Semiconductor and vehicle parts growth (Courtesy Semiconductor Industry Association)

Year	1993	1996	1999	2002	2005
DRAM Capacity	16Mb	64Mb	256Mb	1Gb	4Gb
Feature Size (micron)	0.5	0.35	0.25	0.18	0.08
Volumes of Enc. Britannics	1/4/ Vol	1 Vol.	4 Vol.	16 Vol.	2 Sets

Figure 1.17 Future DRAM capacity. (Source: Business Week, July, 1994)

ment encompasses the industry that designs and produces the vast number of semiconductor device based products, from consumer electronics to space shuttles. The electronics industry includes the manufacturers of printed circuit boards.

The semiconductor segment is composed of two major subsegments. One is the firms that actually make the semiconductor solid state devices and circuits. The manufacturing process is named *wafer fabrication*. And within this segment there are three types of chip suppliers. Vertically integrated companies design, manufacture, package, and market chips. Waferless (or fabless) companies design and market chips, buying finished chips from chip foundries, which are the third type of chip company. Chip foundries set up manufacturing wafer fabrication facilities designed to make a variety of chips for customers.

Chips are fabricated by both merchant and captive producers. Merchant suppliers manufacture just chips and sell them on the open mar-

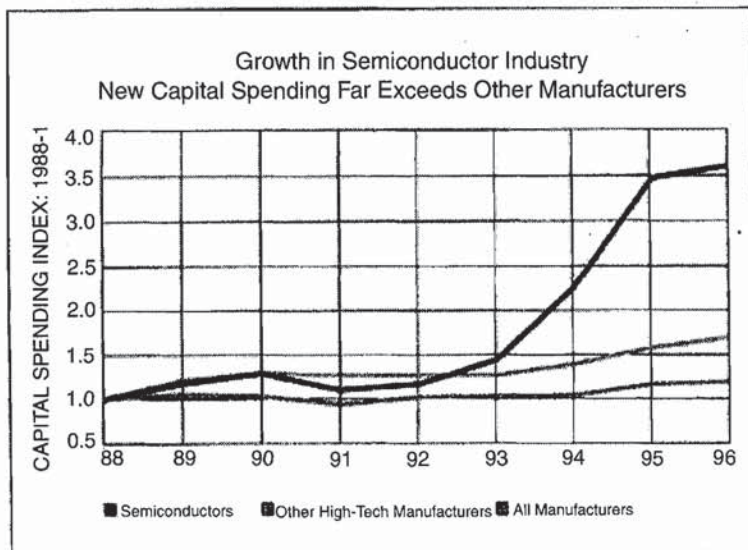


Figure 1.18 Growth of semiconductor industry-capital spending (Courtesy of Semiconductor Industry Association)

ket. Captive suppliers are firms whose final product is a computer, communications system, etc., and produce chips in-house for their own products. Some firms produce chips for in-house use and also sell on the open market, and others produce specialty chips in-house and buy others on the open market. During the 1980's, the trend has been to a greater percentage of chips being fabricated in captive fab areas.

Stages of Manufacturing

Solid state devices are manufactured in four distinct stages (Fig. 1.19). They are: material preparation, crystal growing and wafer preparation, wafer fabrication, and packaging.

In the first stage, material preparation (see Chapter 2), the raw semiconducting materials are mined and purified to meet semiconductor standards. For silicon, the starting material is sand, which is converted to pure silicon with a polysilicon structure. (Fig. 1.21).

In stage two, the material is formed into a crystal with specific electrical and structural parameters. Next, thin disks called wafers, are cut from the crystal and surface treated (Fig. 1.21) in a process called

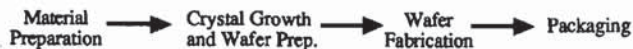


Figure 1.19 Stages of semiconductor manufacturing.

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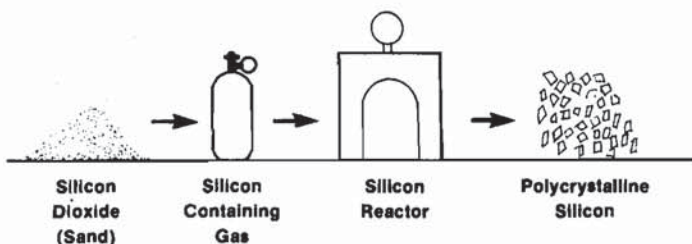


Figure 1.20 Conversion of silicon dioxide to semiconductor grade silicon.

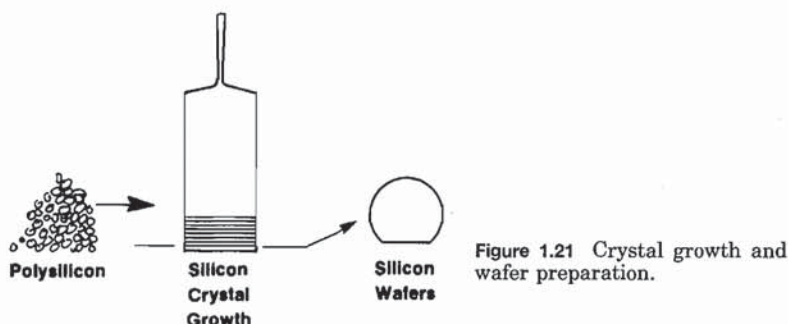


Figure 1.21 Crystal growth and wafer preparation.

crystal growth and wafer preparation (see Chapter 3). The industry also makes devices and circuits from germanium, and compounds of different semiconductor materials.

It is in stage three (Fig. 1.22), wafer fabrication, that the devices or integrated circuits are actually formed in and on the wafer surface. Up to several thousand identical devices can be formed on each wafer, although two to three hundred is a more common number. **The area on the wafer occupied by the discrete device or integrated circuit is called a chip or die.** The wafer fabrication process is also called fabrication, fab, chip fabrication or microchip fabrication. While a wafer fabrication operation may take several thousand individual steps there are two major activities. In the front end of the line (FEOL), the transistors and other devices are formed in the wafer surface. In the back end of the line (BEOL), the devices are wired together with metalization processes and the circuit is protected with a final sealing layer.

Following wafer fabrication, the chips on the wafer are complete, but untested and still in wafer form. Next comes an electrical test (called wafer sort) of every chip to identify those that meet customer specifications. Wafer sort may be the last step in the wafer fabrication or the first step in the *packaging* process.

Packaging (Fig. 1.23) is the series of processes that separates the wafer into individual die, and places them into protective packages. A

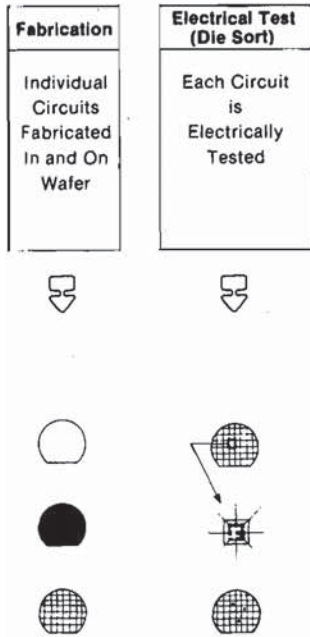


Figure 1.22 Wafer fabrication (and electrical test).

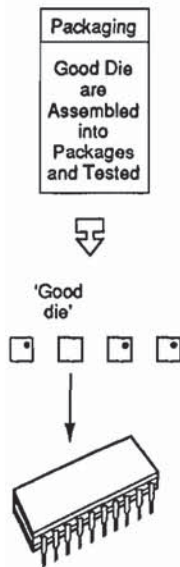


Figure 1.23 Packaging stage.

protective chip package is necessary to protect the chip from contamination and abuse, and to provide a durable and substantial electrical lead system to allow connection of the chip onto a printed circuit board or directly into an electronic product. Packaging takes place in a dif-

ferent department of the semiconductor producer and quite often in an off-shore plant.

The vast majority of chips are packaged in individual packages. But a growing percentage are being incorporated into hybrid circuits, in multichip modules (MCMs), or mounted directly on printed circuit boards (chip-on-board, COB). An integrated circuit is an electrical circuit formed entirely by semiconductor technology on a single chip. A hybrid circuit combines semiconductor devices (discretes and IC's) with thick or thin film resistors and conductors, and other electrical components on a ceramic substrate. These techniques are explained in Chapter 18.

The Development Decade (1951–1960)

While the tremendous advantages of solid state electronics was recognized early-on, the advances possible from miniaturization were not realized until two decades later. During the 1950's, engineers set to work and defined many of the basic processes and materials still used today.

The structure that makes semiconductor devices function is the *junction* (Fig. 1.24). It is formed by creating a structure that is rich in electrons (negative polarity or *n-type*) next to a region rich in *holes* (locations with missing electrons that act electrically positive or *p-type*) (see Chapter 11).

A transistor requires two junctions to work (see Chapter 16). Early commercial transistors were of the Bipolar type (see Chapter 14), which dominated production well into the 1970's. The term bipolar refers to a transistor structure that operates on both negative and positive currents. The other major method of building a solid state transistor is the Field Effect Transistor (FET). William Shockley published the operational basics of a FET in 1951. These transistors operate with only one type of current and are also called unipolar devices. The FET came to the market place in volume in a structure known as the Metal Oxide Semiconductor (MOS) transistor.

William Shockley and Bell Labs get much of the credit for the spread of semiconductor technology. Shockley left Bell Labs in 1955 and formed Shockley Laboratories in Palo Alto, California. While his

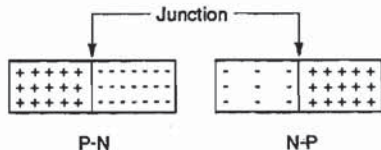


Figure 1.24 P-N and N-P junctions.

Exhibit 47

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.;

MICRON TECHNOLOGY, INC.; and

SK HYNIX INC.

PETITIONERS

V.

ELM 3DS INNOVATIONS, LLC

PATENT OWNER

CASE IPR2016-00387

PATENT No. 8,841,778

**PATENT OWNER'S PRELIMINARY RESPONSE TO
PETITIONERS' PETITION FOR INTER PARTES REVIEW OF UNITED
STATES PATENT NO. 8,841,778**

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37 C.F.R. §42.104(b)(4) 59
37 C.F.R. § 42.107 1
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LIST OF EXHIBITS

EXHIBIT NO.	REFERENCE
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2101	“Dec. 22, 2015 Power Outage Updates,” http://www.uspto.gov/about-us/news-updates/dec-22-2015-power-outage-updates (last visited February 4, 2016).
2102	“Communications With the Patent and Trademark Office,” 61 Fed. Reg. 56439 (November 1, 1996).
2103	“Filing of Papers During Unscheduled Closings of the Patent and Trademark Office,” 1097 Off. Gaz. Pat. Office 53 (December 20, 1988) (republished at 1170 Off. Gaz. Pat. Office 8 (January 3, 1995)).
2104	35 U.S.C.A. § 21 “Filing date and day for taking action.”
2105	Pub. L. No. 97-247, 1982 U.S.C.C.A.N., 96 Stat. 775.
2106	USPTO gives free pass on filing deadlines until December 28, https://blog.oppedahl.com/?p=1152 , last visited February 4, 2016.
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2119	“United States Postal Service Interruptions and Emergency Terminated,” 1262 Off. Gaz. Pat. Office 94 (August 19, 2003) (republished 1421 Off. Gaz. Pat. Office 133 (December 29, 2015)).
2120	<i>Howard Florey Institute v. Dudas</i> , 87 U.S.P.Q.2d 1913 (E.D. Va. 2008).
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2124	RESERVED
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2129	RESERVED

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2132	Prosecution History of U.S. Application 12/497,653 – Response to Office Action dated July 22, 2014.
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2138	RESERVED
2139	RESERVED
2140	RESERVED
2141	RESERVED
2142	RESERVED
2143	Table of Petitions for Inter Partes Review filed on Dec. 28, 2015 and Service Dates for Related District Court Litigation, and Corresponding Docket Sheets

Pursuant to 37 C.F.R. § 42.107, Patent Owner Elm 3DS Innovations, LLC submits this Preliminary Response to the above-captioned Petition for *Inter Partes* Review of U.S. Patent No. 8,841,778 (“Pet.,” Paper 1).

I. INTRODUCTION

The present Petition is barred by 35 U.S.C. § 315(b). Institution must be denied because at least one real party in interest was served with a patent infringement complaint more than one year before the Petition was filed.

Even if the Petition had been timely filed, it would offend 35 U.S.C. § 325(d) for being redundant. The Ground raises the same issue that was specifically raised and overcome during related prosecution.

On the merits, the Board should not institute *inter partes* review because the Petition fails to present a **single** credible reason for why one of ordinary skill would combine the Prior Art References as set forth in the Grounds of the Petition.¹ Although the Petition purports to provide various “reasons” to combine at pp. 19-23, 32-35, and 44-47, the discussion therein consists primarily of rote

¹ Patent Owner does not concede that each and every element of the challenged claims is present in the Prior Art References. Should the Board institute *inter partes* review, Patent Owner reserves the right to argue that one or more elements of the challenged claims are not found in the Prior Art References.

recitations of “magic language” from *KSR*, and does not set forth the “articulated reasoning with some rational underpinning to support the legal conclusion of obviousness” that *KSR* mandates. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007). As such, the Petition fails to meet the requirements of 35 U.S.C. §§ 314-315, and Petitioners’ request for institution should be denied.

The Petition’s central premise is the unfounded contention that it was obvious to substitute a known dielectric that provides insulation in a conventional stacked integrated circuit (“IC”) **with silicon substrates** (*i.e.*, Bertin or Hsu) with an unknown dielectric that principally provides structural support in an unconventional IC **without a silicon substrate** (*i.e.*, Leedy ’695).

fig. 3h

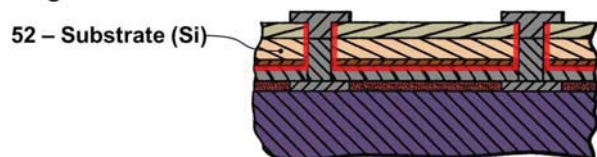


FIGURE 1 – Ex. 1004 – Bertin (annotation and color added)

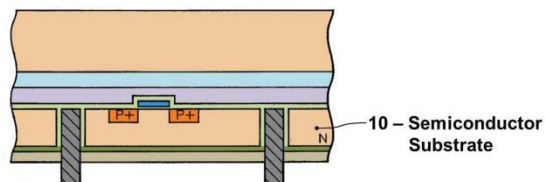


FIGURE 2 – Ex. 1008 – Hsu (Fig. 8) (annotation and color added)

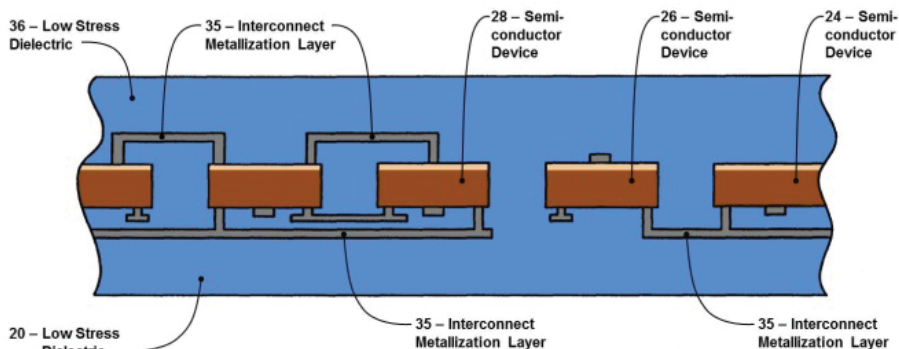


FIGURE 3 – Ex. 1006 – Leedy ’695 (Fig. 3b) (annotations and color added)

The Petition's central failing is that the reasons needed to support this contention are absent. The Petition fails to identify a need or problem known in the field of fabricating stacked ICs with silicon substrates that would have provided a reason for combining the elements in the manner claimed. *KSR*, 550 U.S. at 420. Neither Bertin nor Hsu identifies any problems with their dielectric(s), nor do they suggest a need for an improved dielectric in stacked ICs with silicon substrates. And Leedy '695 does not provide any indication that its dielectric would improve Bertin, Hsu, or any stacked IC **with silicon substrates**. That is because Leedy '695 teaches a dielectric that provides support for an IC **without a silicon substrate**.

The Petition's purported reasons to combine at pp. 19-23, 32-35, and 44-47 are deficient. Many of these "reasons" are not reasons at all. For example, Petitioners contend that it would have been obvious to a person of ordinary skill to "simply substitute" Leedy '695's low tensile stress dielectric for certain of the dielectrics found in Bertin and Hsu. But the simplicity of substitution is not a reason to combine because it does not speak to why a person of ordinary skill would have pursued the substitution in the first place.

The Petition's reasons also gloss over the technical details associated with the proposed substitution and lack sufficient factual or expert support. Indeed, in many instances, the Petition's reasons are contradicted by Petitioners' own evidence. Petitioners assert that substituting one dielectric for another is a simple

matter, but semiconductor fabrication development is a complex and unpredictable process. One of ordinary skill cannot simply substitute one dielectric with another dielectric and have a reasonable expectation of success, as one might doorknobs of different materials. *See Hotchkiss v. Greenwood*, 52 U.S. 248, 267 (1851). A dielectric cannot be removed and replaced from a finished IC. Rather, one must use the “new” dielectric when fabricating the IC. But as Petitioners’ own reference instructs, “Thin Films for use in VLSI fabrication must satisfy a large set of rigorous chemical, structural, and electrical requirements.” Ex. 1040 at 109. For example, some dielectrics can and must perform certain functions—like sealing out moisture—that others cannot. *Id.* at 188-189, 191, 334. And some dielectrics will cause corrosion in signal lines while others will not. *Id.* Thus, one cannot **assume** that the “new” dielectric is an acceptable substitute for the dielectric it replaces.

Perhaps most critically, the Petition ignores numerous significant reasons why a person of ordinary skill would **not** have combined a conventional stacked IC reference (*i.e.*, Bertin or Hsu) with the dielectric disclosed in the unconventional Leedy ’695 reference. For instance, Leedy ’695 is largely silent on its dielectric’s chemical, structural, and electrical properties, and does not provide the information a person of ordinary skill would require to implement the substitution.

Furthermore, the conventional thinking at the time strongly preferred compressive dielectrics to tensile dielectrics. *See, e.g.*, Ex. 2133 at 442.

Petitioners consistently construct a façade of similarity and simplicity to conceal the important differences between the prior art, and the complexity that the proposed combinations entail. Petitioners never provide a reasoned, factually supported explanation or rationale for (1) why a dielectric intended for use in devices without a silicon substrate would improve a device with a silicon substrate; (2) whether Leedy '695's low stress dielectric has the properties/characteristics required for the application in which it will be used; or (3) how one of ordinary skill would go about substituting a known dielectric that has been proven to work for an unknown dielectric that has not been proven to work. When these differences and challenges are sufficiently considered, Petitioners' central premise—that it was obvious to substitute the dielectric materials in prior art stacked ICs with the low stress dielectric in Leedy '695—collapses.

The Petition fails to demonstrate a reasonable likelihood that Petitioners will prevail on at least one challenged claim. Thus, the Board should deny the Petition.

II. THE PETITION IS STATUTORILY BARRED BECAUSE IT IS UNTIMELY

A petitioner must request *inter partes* review within one year of being served with a complaint alleging infringement of the challenged patent. 35 U.S.C. §315(b). Two of the real-parties-in-interest—Samsung Austin Semiconductor LLC (“SAS”) and Samsung Semiconductor Inc. (“SSI”)—were served December 24,

2014. Ex. 2100 at 1 and 3. The remaining parties were served between December 29, 2014 and March 3, 2015. This Petition was filed December 28, 2015, four days after the statutory one-year period for SAS and SSI expired.

In instances involving multiple real-parties-in-interest, the Board has already held that a Petition must be filed within one year of the earliest service date for a real-party-in-interest named in a Petition. *See Terremark N. Am. LLC v. JOAO Control & Monitoring Sys., LLC*, IPR2015-01482, Paper 10, at 14 (Dec. 28, 2015). In that case, two of the six real-parties-in-interest had been served with complaints on June 23, 2014. Thus, the statutory bar date for those two parties was June 23, 2015. But the Petition was filed on June 24, 2015—one day late. Petitioner attempted to argue that because another petitioning party was not served with a complaint until August 18, 2014, the petition was not time barred. *Id.* at 6-7. The Board disagreed with the petitioner, holding that the petition was, in fact, time barred. *Id.* at 14. The Board reasoned that the two late filers were admitted real-parties-in-interest. Thus the Board found that, under § 315(b), the statutory bar date was one year after those two real-parties-in-interest were served. It did not matter that another real-party-in-interest was served later. Here, SAS and SSI are admitted real-parties-in-interest. Pet. at 1. The Petition was filed four days after their statutory bar date, and therefore the Petition is time barred.

Petitioners allege the Petition was timely filed because the PTO considered

December 24, 2015, to be a Federal holiday (Pet. at 3 n.2), thereby extending the deadline under 35 U.S.C. § 21(b). In fact, that day was not a Federal holiday, and the PTO has no power to consider it one and waive a statutory deadline. Interested attorneys knew the PTO had no authority to treat December 24, 2015 as a Federal holiday and that papers with deadlines should be filed by mail. As one practitioner blog observed, “If you have a statutory deadline, file it in paper.” Ex. 2106 at 4. Indeed, no other petitioner relied on the announcement to exceed the statutory deadline for filing a petition for *inter partes* review. Ex. 2143.

Congress establishes Federal holidays. They do not include December 24, 2015. 5 U.S.C. § 6103. The language of 35 U.S.C. § 21 counters any notion the PTO has discretion to treat a day that is not a Federal holiday as if it were one for the purpose of a statutory deadline. By providing the Director some authority to designate a postal emergency under §21(a) but not providing the Director any authority to designate a Federal holiday under §21(b), Congress has clearly spoken.

The requirement for a “Federal” holiday in 35 U.S.C. § 21 is no accident. At the same time Congress added § 21(a) permitting mailing dates to be considered filing dates, it amended the language of § 21(b) to specify only a “Federal” holiday can extend a deadline. Ex. 2104 at 19 (1982 Pub. L. 97-247 amendment). The legislative history explained “[t]he word ‘federal’ has been inserted before the phrase ‘holiday within the District of Columbia’ to clarify the nature of the

holiday.” Ex. 2105 at 775. That amendment to the statute makes sense. There was no need for Congress to permit any other kind of holiday to extend a deadline under § 21(b) when the public could obtain a filing date through the U.S. Postal Service (USPS) under § 21(a). A “power outage holiday” affecting only the PTO would not qualify as a Federal holiday under 35 U.S.C. § 21(b).

PTO rules describe a “Federal holiday within the District of Columbia” as a day “when the Patent and Trademark Office is officially closed for business for the entire day.” 37 C.F.R. §1.9(h). However, closure of the PTO is insufficient to establish a Federal holiday under 35 U.S.C. § 21(b). Federal holidays are declared by Congress in 5 U.S.C. § 6103, not by the PTO. The PTO has no authority to act contrary to statute. *Baxter Int’l, Inc. v. McGaw, Inc.*, 149 F.3d 1321, 1334 (Fed. Cir. 1998) (overturning PTO decision to accord filing date); *Howard Florey Institute v. Dudas*, No. 1:07-cv-778, 2008 U.S. Dist. LEXIS 51639, at *29 (E.D. Va. July 7, 2008) (PTO does not have authority to waive or suspend statutory deadline). Ex. 2120.

Moreover, Petitioners offered no evidence the PTO was “officially closed for business for the entire day” on December 24, 2015, as provided by 37 CFR §1.9(h). Such closure requires the entire PTO be officially closed for business for the entire day by Executive Order of the President or by the Office of Personnel Management (OPM). *See* Exs. 2102 and 2103. OPM did not close the PTO. Ex.

2107. The President ordered only half-day closing. Ex. 2108 at 2.

It appears the PTO was in fact open for business part of the day on December 24, 2015, including at least (1) the USPTO Patents Electronic Business Center, (2) the USPTO Inventor's Assistance Center, and (3) all employees not affected by the December 22, 2015, power outage. Beginning December 23, 2015, the PTO suggested its Patents Electronic Business Center (PEBC) was available by telephone. Ex. 2101 at 5-11; Ex. 2106 at 3. PTO advised the public to telephone the USPTO Inventor's Assistance Center with any questions regarding alternate filing methods such as Priority Mail Express. Ex. 2101 at 13-14. The Patent Office Professional Association advised PTO employees: "Employees who are not affected by the system outage should continue to work." Ex. 2109 at 1.

Petitioners could have, and should have, timely filed the Petition by mail. The PTO notified the public it could timely file papers on December 24, 2015, by depositing them with the Priority Mail Express® service of the USPS. Ex. 2101 at 3 and 5. Although PTAB Rule 42.6(b)(1) sets electronic filing as the default manner for filing documents with the Board, Rule 42.6(b)(2) provides a way for filing a document by other means. Inability to file electronically is explicitly stated as a consideration for accepting non-electronic filings. Ex. 2121 at 48617.

Petitioners do not contend the Petition would have been timely deposited with USPS, but for postal service interruptions or emergencies under 35 U.S.C.

§ 21(a). That section only provides relief for exigencies affecting delivery of U.S. mail. Exs. 2115, 2116, 2117, 2118 at 500-118, and 2120 at n.5. It provides no relief for other exigencies “such as the unavailability of a computer.” Ex. 2119 at 1.

The Petition was filed more than one year after service of the Complaint and is barred under 35 U.S.C. § 315(b). Granting the Petition would be *ultra vires*.

III. FACTUAL BACKGROUND

A. The 8,841,778 Patent

The '778 patent comes from a family of more than 20 U.S. patents that disclose novel methods and structure for three-dimensional stacked memory (“3DS Memory”). The common specification, shared among all 3DS patents, instructs that a 3DS Memory includes (A) physical

separation of memory circuits and the control logic circuit onto different layers;

(B) one control logic circuit layer (101)

for several memory circuits layers (103); (C) substantially flexible memory circuit layers; and (D) fine-grain high density inter-layer vertical bus connections (105).

Ex. 1001 at Fig. 1(a); 2:66-3:11.

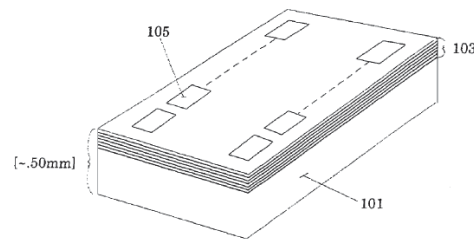


FIG. 4 – Ex. 1001 – '778 (Fig. 1a)

The '778 patent distinguishes over the prior art in claiming some—but not all—of these features, as well as additional features. Important to this Petition is the fact that the '778 patent teaches and claims a stacked IC with substantially

flexible substrates and low stress dielectric. The use of low stress dielectric reflects the inventor's unique and nonobvious insight that stacked ICs are improved when individual layers are able to flex. No prior art reference of record, or in this Petition, teaches this novel combination or the importance of flexibility.

B. Overview of Petition for *Inter Partes* Review

Petitioners base their request for IPR on three primary grounds and two additional grounds that Petitioners purport should apply in the event the Patent Owner takes certain claim construction positions. Petitioners challenge 11 total claims of the '778 patent. **Ground 1** challenges claims 1 and 14 as obvious under 35 U.S.C. § 103(a) over U.S. Patent No. 5,202,754 ("Bertin") (Ex. 1004) and U.S. Patent No. 5,354,695 ("Leedy '695") (Ex. 1006). **Ground 2** challenges the other nine claims, claims 2, 8, 31, 32, 44, 46, and 52-54, as obvious under 35 U.S.C. § 103(a) over Bertin, Leedy '695, and U.S. Patent No. 5,162,251 ("Poole") (Ex. 1005). **Ground 3** challenges all 11 of the challenged claims, claims 1, 8, 14, 31, 32, 44, 46, and 52-54, as obvious under 35 U.S.C. § 103(a) over U.S. Patent No. 5,627,106 ("Hsu") (Ex. 1008) and Leedy '695. Conditional **Ground 4** is purportedly identical to Ground 3, with Japanese Pub. H3-151637 ("Kowa") (Ex. 1007) replacing Leedy '695. Conditional **Ground 5** challenges claims 2, 8, and 52 as obvious under 35 U.S.C. § 103(a) over Bertin and Leedy '695.

IV. THE GROUNDS ASSERTED IN THE PETITION ARE REDUNDANT

Petitioners concede that Leedy '695 was already considered by the PTO in relation to the claimed features. Pet. at 17-19. Despite this, the Petition's section on non-redundancy offers no argument that the proposed Grounds based on Leedy '695 are new. *Id.* at 59-60. The Grounds are redundant.

At most, the proposed Grounds swap out a previously considered primary reference for a new one allegedly disclosing the same thing. The specific argument of the proposed Grounds is that it would have been obvious to replace the dielectrics of a 3D stacked IC disclosed by a primary reference with the Leedy '695 dielectric having low tensile stress of about 5×10^8 dynes/cm² or less, to obtain benefits such as increased structural integrity and durability and thereby arrive at the claimed invention. *See, e.g.*, Pet. at 19-23, 32-35, and 44-47. But the Petition lists related patent prosecutions in which the same issue was previously considered and overcome. *Id.* at 19.

For example, all the independent claims of application 10/672,961 ("the '961 application") were initially rejected by the Examiner in an Office Action on the basis that it would have been obvious to use the thinned substrate disclosed by Leedy '695 in the semiconductor device of Sugiyama to aid in providing structural integrity in the device. Ex. 1029 at 1 and 13; *see also* Ex. 2122 at 2-8 (prior Office Action of 10/10/2008). The Examiner expressly referenced column 5, lines 62-68

of Leedy '695. Ex. 2122 at 3-4. Leedy '695 instructs that “the surface tension of semiconductor membrane be in low tensile stress” (Ex. 1006 at 5:63-68) because “[i]f the membrane is not in tensile stress, but in compressive stress, surface flatness and membrane structural integrity will in many cases be inadequate for subsequent device fabrication steps or the ability to form a sufficiently durable free standing membrane.” Ex. 1006 at 5:68-6:5. Applicant responded (1) use of low stress dielectrics as described in Leedy '695 provides for the structural integrity in **thin** IC structures, (2) Sugiyama uses substrates of ordinary thickness, (3) the structural integrity of ordinary thickness substrates without the need for any further measures is well established and, thus, (4) there is no reason to combine Sugiyama with Leedy '695. Ex. 2123 at 2-3.

After Applicant's arguments were presented, the Examiner added Watanabe to the same base rejection of Sugiyama and Leedy '695. *See* Exs. 2125 and 2136. Applicant argued Watanabe was not combinable with Sugiyama and reiterated there was no reason to combine Sugiyama with Leedy '695 to ensure the structural integrity of a thinned substrate or IC membrane. *See* Exs. 2123 and 1029. After minor amendments (adding only the surface polishing of the thinned substrate), the Examiner no longer asserted the combination as preventing patentability. Ex. 2127 at 18. The '961 application issued as US 7,705,466 after further prosecution.

Additionally, references that perform similar functions to Sugiyama were

considered by the PTO, yet the examiner never asserted them as part of a combination with Leedy '695. For example, Leedy '695 was considered by the examiner in application 13/963164 (“the '164 application”). Ex. 2134 at 24. In the same application, Bertin was also considered by the examiner. *Id.* at 3. Yet a combination of Leedy '695 and Bertin was never raised as prior art that would prevent patentability.

In the present Petition, Bertin and Hsu are being cited for substantially the same facts as Sugiyama, then being combined with Leedy '695 in substantially the same way for substantially the same purported purpose of increasing structural integrity and durability in a stacked 3D IC device. Patent Owner already overcame this combination of prior art teachings and motivations during prosecution of at least the related '961 application, and Bertin was never raised as a reference preventing patentability in the '164 application—despite the examiner’s explicit consideration of the reference. Thus, the Petition’s proposed grounds using Leedy '695 are redundant to those previously considered by the PTO. *Compare Prism Pharma Co., Ltd. v. Choongwae Pharma Corp.*, IPR2014-00315, Paper 14, at 13 (May 20, 2014) (institution denied where argument was already considered during initial prosecution). Petitioners offer no argument to the contrary.

The express abandonments in applications 12/497,652 and 12/497,653 (Pet. at 17-19) do not compel a different result. Each Letter of Express Abandonment

explicitly stated abandonment was “for reasons unrelated to patentability” and Applicant “in no way acquiesces to rejections made or positions taken in the Office Action.” Exs. 1034 and 1036 at 2. Applicant consistently traversed any rejections combining Leedy ’695 with Bertin (alone or buttressed with another reference) as hindsight reconstruction. *See, e.g.*, Exs. 2131 and 2132 at 3-7. The express abandonments say nothing about whether the Petition’s proposed grounds are redundant with those considered and overcome during the ’961 application prosecution.

The Petition offers no reason why the PTO should reconsider substantially the same prior art teachings and substantially the same arguments. Pet. at 59-60. Institution should be denied under 35 U.S.C. §325(d) and 37 C.F.R. §42.22(a)(2).

V. CLAIM CONSTRUCTION

Petitioners’ proposed constructions are irrelevant to this proceeding and place an unnecessary burden on the Board. Petitioners assert that the challenged claims are unpatentable under both Petitioners’ constructions and Patent Owner’s likely constructions. Pet. at 12, 14-15. Thus, Petitioners have acknowledged that these claim terms are not determinative to validity. Rather, these claim terms are relevant to infringement. That is evident in the unreasonably narrow constructions Petitioners propose, which turn the Broadest Reasonable Interpretation standard upside down. The Board should reject Petitioners’ attempt to involve the Board in

the parties' district court litigation, and should decline to invest resources in construing terms that will not impact this proceeding.

Patent Owner submits that the challenged claims should be given their plain and ordinary meaning for the purposes of this proceeding. Patent Owner reserves the right to assert its own claim constructions in the district court litigation.

VI. PETITIONERS GLOSS OVER THE TECHNICAL DETAILS THAT WOULD DISSUADE ONE OF ORDINARY SKILL FROM EVEN ATTEMPTING THE PROPOSED COMBINATION

Petitioners rely on the same misguided premise—across every one of their petitions for *inter partes* review—that one of ordinary skill would seek to combine a conventional stacked IC, *e.g.*, Bertin or Hsu, with Leedy '695. Specifically, Petitioners posit that a person of ordinary skill would have thought it obvious to **replace** one or more dielectrics from the stacked-IC base references with Leedy '695's low tensile stress dielectric. Because this premise is the central pillar of many, if not all, of the petitions, the following discussion provides context and technical detail—omitted by Petitioners—for the proposed substitution.

Petitioners' proposal entails modifying a complex semiconductor fabrication process and giving up a dielectric with known properties, all for the purpose of using a dielectric with unknown properties save lower stress, despite the lack of any indication that the new dielectric would improve the resulting device. As a general matter, in conventional semiconductor devices, a dielectric's role is to

provide insulation. This is the role the relevant dielectrics serve in Bertin (“dielectric layer 60” and “interconnect insulators” (Pet. at 20)) and Hsu (“silicon dioxide film 18” (Pet. at 44)). As discussed below, Leedy ’695’s low tensile stress dielectric also provides an insulative effect, but the primary problem being solved was to provide structural support for a device that has **no semiconductor substrate**. Structural support is not an issue for Bertin or Hsu because they find their support during processing from a rigid carrier and a sacrificial rigid substrate, respectively. Ex. 1004 at 4:63-5:2; Ex. 1008 at 3:14-17. Thus, one of ordinary skill would not understand Leedy ’695 to have anything to offer in the context of Bertin or Hsu, regardless of how beneficial the dielectric is in the Leedy ’695 context.

A. Conventional Integrated Circuit Formation

Conventional IC fabrication is a complex undertaking that calls for the manufacture of billions of microscopic and electrically interconnected transistors on a piece of silicon. That complexity of this process is amply demonstrated by the Wolf textbook submitted by Petitioners, which, at more than 600 pages long, covers Process Technology only and leaves Manufacturing Technology to a separate treatise. Ex. 1040 at vii.

“The fabrication of complex integrated circuits involves the correct performance of a large number of sequential steps, as well as the use and interaction of many materials.” *Id.* at 586. The materials used as “thin films” in

“VLSI fabrication must satisfy a large set of rigorous chemical, structural, and electrical requirements.” *Id.* at 109. Different materials have different mechanical (stress, adhesion, etc.) and electrical properties (resistivity, dielectric constant, etc.), each of which may be desirable or undesirable depending on the application at issue, and the other materials with which they are used. *Id.* at 183, 192, 331, 334.

“The process technologies used to fabricate VLSI consist of a sequence of sub-processes. Each of the sub-processes is specified by a recipe that is developed to produce a desired set of outcomes for each sub-process step. The recipes are typically derived from experiments designed especially to identify an optimum set of sub-process conditions.” *Id.* at 618. Again, each sub-process has a unique set of considerations, such as its compatibility with the materials already present on the chip at run-time, and the sub-processes that will subsequently be performed.

Conventional IC fabrication begins with a rigid silicon wafer, generally several hundred microns in thickness, which provides structural support for the ICs that will be formed on top of it. Ex. 1002 at ¶ 17; Ex. 1040 at xxiii-xxiv, 117.

Transistors are formed in the surface of the silicon wafer, by forming source, drain, and gate regions. Ex. 1040 at xxiii. Various layers of metal and dielectric materials are then formed through a series of sub-processes that can be hundreds of steps long, in order to form circuitry connecting the transistors, and to insulate said circuitry. The resulting IC rests atop the silicon wafer, or “substrate.” Ex. 1002 at

¶ 17; Ex. 1040 at xxiii-xxiv.

The various metal and dielectric films are generally less than a micron thick, such that the sum of the metal and dielectric films is ordinarily less than 10 microns thick. Ex. 1040 at 117. Thus, the IC represents a thin sliver of material built upon the rigid silicon substrate.

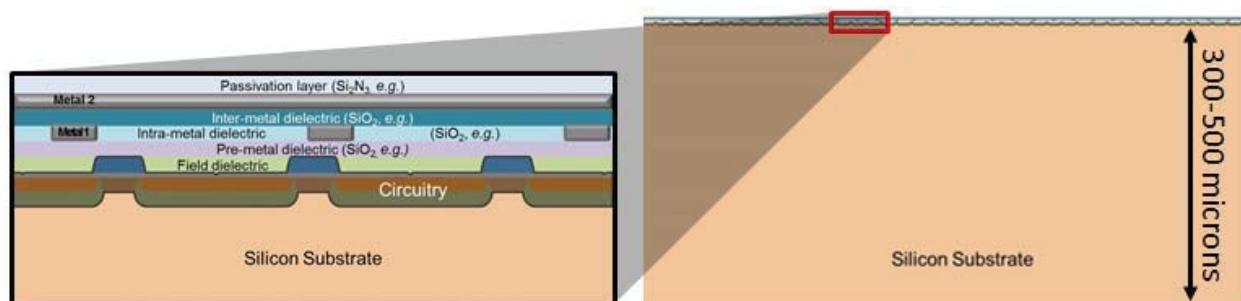


FIGURE 5 – Exemplary Conventional IC

Although the metal and dielectric materials are extremely thin, they can cause the silicon wafer on which they are formed to warp when they generate sufficient stress. A material can cause a silicon wafer to warp in a concave or convex direction, depending on the state of the material's stress. Ex. 1002 at ¶ 26-27; Ex. 1040 at 117.

Each individual material contributes stress, either tensile or compressive. Thus, the net stress is the sum of the individual materials' contributions, since each is additive. Ex. 1002 at ¶ 25. As the Wolf treatise notes, stress—and the warpage it can produce—is important because “[t]he flatness of a wafer must be tightly maintained throughout the entire fabrication process in order to allow fine

geometrical features to be precisely printed.” Ex. 1040 at 54.

Given these circumstances, the successful design and fabrication of an IC depends upon a delicate balance of materials and processes that are able to co-exist alongside one another during manufacture and operations. The modification of any one of these materials or processes is likely to have ripple effect of unknown proportions. Thus, the wholesale replacement of one material for a different material is not a simple and straightforward process—it is a process that requires a significant amount of analysis and consideration.

1. Overview of the Bertin Reference

Bertin describes a fabrication method for building a three-dimensional multi-chip package with semiconductor chips thinned using a chemical etch (rather than, as Petitioners concede, the grinding and polishing process described in the ’778 patent), and interconnected by a plurality of metallized trenches. Ex. 1004 at Abstract. Bertin outlines an exemplary fabrication process. “[P]rocessing begins with a semiconductor device 50 (preferably comprising a wafer) having a substrate 52 and an active layer 54, which is typically positioned at least partially therein.” *Id.* at 3:50-53. Thus, Bertin discloses an invention in traditional semiconductor fabrication, **not** in dielectric isolation or SOI. “A dielectric layer 60, for example, SiO₂, is grown over active layer 54 of device 50.” *Id.* at 3:60-62. To enable the chemical etch process, which comes later in the process, the wafer is modified “by

placing a burred [*sic*, buried] etch stop 53 below the surface of the substrate.” *Id.* at 4:4-6. “[T]hin, deep trenches 62 [are] defined in integrated circuit 50.” *Id.* at 4:11-14. “The trench sidewalls are oxidized to provide isolation from the bulk silicon (such that the trenches can be used for wiring without shorting the devices), with doped polysilicon or other conductor 64” *Id.* at 4:30-33. Bertin thus teaches to oxidize trench sidewalls by a **thermal oxide** process. *Pet.* at 21.

In an embodiment in which the chips are singulated before being stacked, the first chip in the stack is flipped over and bonded to a carrier 70 using “a suitable adhesive material 73, such as polyimide.” *Id.* at 4:63-5:2. The chip is thus bonded to a rigid carrier **before** any thinning occurs. At no point in the process is a thinned wafer unsupported by either a rigid carrier or a thick wafer. *See id.* Next, the exposed surface of the chip “is etched in a suitable selective chemical etch” (*id.* at 5:10-13), stopping at etch stop layer 53 (*id.* at 5:17-20). The thinned device is depicted in Figure 3*h* below. By way of example only, Bertin notes that “the overall thickness ‘y’ of each device [*i.e.*, chip, including active layer 54] may be only 20 micrometers [μm] or less” after thinning. *Id.* at 3:35-38.

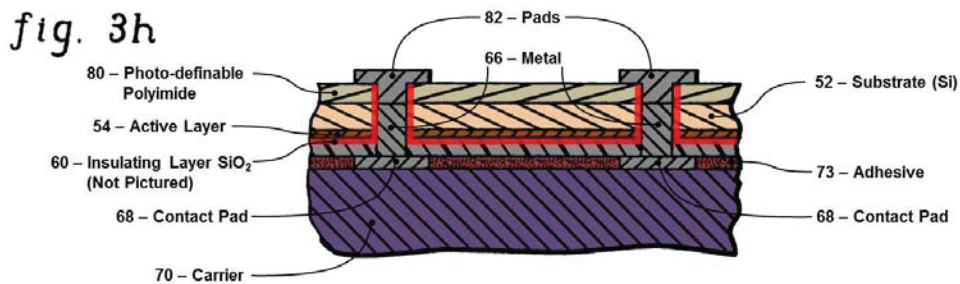


FIGURE 6 – Ex. 1004 – Bertin (Fig. 3*h*) (annotations and color added)

2. Overview of the Hsu Reference

Hsu discloses “a method of connecting three-dimensional integrated circuit chips, and more particularly, . . . a method of connecting integrated circuit chips using a trench method.” Ex. 1008 at 1:8-11. The process involves the formation of metal “protrusions” extending through the bottom of a subordinate chip, and fitting the two chips together. *Id.* at Abstract.

The Hsu method begins with processing the subordinate chip. *Id.* at 2:52-54. Unlike Leedy ’695, Hsu’s device retains a contiguous semiconductor substrate, and thus, Hsu involves traditional semiconductor fabrication. “[D]eep trenches 16 are etched into the silicon substrate,” then “[a] silicon dioxide film 18 for insulation is formed on the entire surface of the substrate” (*id.* at 2:60-64), including “within the deep trenches” (*id.* at 1:58-60). The insulation film “is formed by atmospheric pressure chemical vapor deposition (APCVD) . . .” *Id.* at 2:63-67.

After subsequent steps to complete top-side processing, “[t]he bottom side of the first semiconductor substrate is ground, polished, and selectively etched so that the deep trenches form protrusions from the bottom surface of the first semiconductor substrate.” *Id.* at 2:1-5. During thinning, “[i]n order to handle a thin wafer more easily, a sacrificial wafer is used.” *Id.* at 3:14-17. After the sacrificial wafer is attached, “the bottom surface of the substrate [10] is ground and polished so that only a thin portion of the substrate remains over the tungsten-filled trenches

20.” *Id.* at 3:21-23. Next, “[b]ack side selective etching is used to etch away the silicon substrate from the bottom leaving the tungsten-filled trenches protruding” from the bottom of the substrate. *Id.* at 3:24-27. Various additional steps follow. The final, bond-ready first semiconductor substrate structure is depicted in Fig. 8.

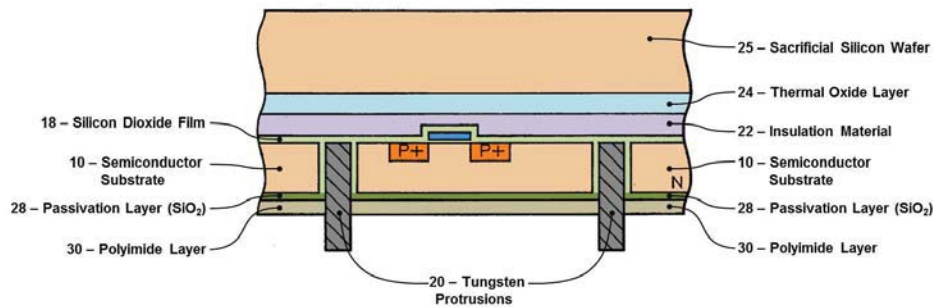


FIG. 8

FIGURE 7 – Ex. 1008 – Hsu (Fig. 8) (annotations and color added)

B. Unconventional (Leedy '695) Integrated Circuit Formation

The ICs described in Leedy '695 differ from conventional ICs in two important ways. **First**, they do not rest upon a silicon substrate. Instead, Leedy '695 discloses ICs that are formed on and in flexible, free-standing dielectric membranes. Ex. 1006 at 1:7-8. **Second**, the transistors are not in one contiguous piece of silicon. Instead, each transistor is dielectrically isolated from the others, such that the IC comprises millions of miniscule silicon “islands.” Ex. 2136 at 14. Leedy '695 teaches that the key to enabling such a device is a low tensile stress dielectric, which is used to form the free-standing membrane that encapsulates the IC, and provides the structural integrity ordinarily provided by a silicon substrate. Unlike a conventional silicon wafer that is thick and rigid, the free-standing

dielectric membrane is extremely thin (typically less than 8 μm thick) (Ex. 1006 at 1:17-20) and flexible (*id.* at 2:32-37, Fig. 13c).

In order to fully appreciate Leedy '695's unconventional approach, it is important to understand that Leedy '695 has its origins in probe card technology. *Id.* at 1:17-20. Membrane probe technology is described in U.S. Patent Nos. 4,924,589 and 5,103,557, which Leedy '695 incorporates by reference. *Id.* at 1:11-17. The semiconductor industry uses probe cards to test ICs prior to dicing and packaging in order to determine which die are defective.

Membrane probe cards generally consist of a flat test surface that has thousands of probe points on one side. Ex. 2135 at 2:27-29.

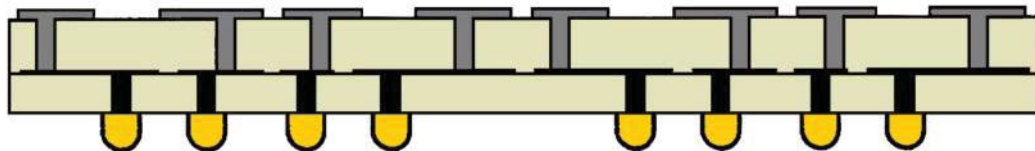


FIGURE 8 – Exemplary Membrane Probe Card

The cards are lowered down onto the finished wafer such that the probes contact predetermined points on the device under test, whereupon tests can be conducted to determine whether the device is functional. *Id.* at 9:25-30. The '589 and '557 patents teach an improvement to probe card technology by using as the test surface, an ultrathin flexible dielectric membrane. *Id.* at Abstract. The benefit of using a flexible dielectric membrane as the tester surface is that, when pressure is applied to the flexible tester surface, the surface can “conform” to the “wafer 1

under test and to ensure that the numerous corresponding contact points on the tester surface 10 and the wafer 1 come together and make firm electrical contact.”

Id. at 3:67-4:2.

Leedy '695 seeks to combine the flexible membrane probe card technology disclosed in the '589 and '557 patents with semiconductor processing techniques to improve dielectric isolation technology. Ex. 1006 at 1:17-20. Dielectric isolation refers to the process of fabricating an IC whose constituent transistors are dielectrically isolated from the rest of the silicon substrate, thereby leading to increased performance. *Id.* at 1:20-33; Ex. 1040 at 151.

Dielectric isolation can be accomplished by fabricating the IC on a silicon-on-insulator “SOI” wafer. A common type of SOI wafer is a bulk silicon wafer whose surface has been implanted with oxygen, forming a thin layer of silicon dioxide (dielectric) several microns below the silicon surface. Ex. 1040 at 154. Thus, when transistors are formed in the silicon surface, they are dielectrically isolated from the silicon substrate below. *Id.* at 154-55.

Leedy '695 proposes a radical departure from conventional dielectric isolation fabrication methods. Whereas conventional dielectric isolation sought to isolate the transistors from the silicon substrate by forming a dielectric layer underneath the transistors formed at the silicon surface, Leedy '695 seeks to isolate the transistors from the silicon substrate by eliminating the silicon substrate

altogether. Ex. 1006 at 2:9-20. Of course, when the silicon substrate is removed, another material in the device must provide structural support—specifically, to hold everything together—so the device does not fall apart during fabrication, packaging, and use. Leedy '695 provides such support in the form of a flexible dielectric membrane, similar to the membranes used in the '589 patent's probe card technology. Further, in order to ensure that the membrane will remain flat (planar) during fabrication, during pre-packaging handling of individual die, or in use, Leedy '695 teaches forming the membrane out of a low tensile stress dielectric.

Leedy '695 refers to ICs formed in dielectric membranes as “circuit membranes.” It teaches two methods for forming these circuit membranes. Each results in an IC comprising an archipelago of thousands or millions of electrically interconnected but dielectrically isolated silicon transistor “islands” suspended in a sea of low tensile stress dielectric. Ex. 1006 at 3:23-33, 24:20-32.

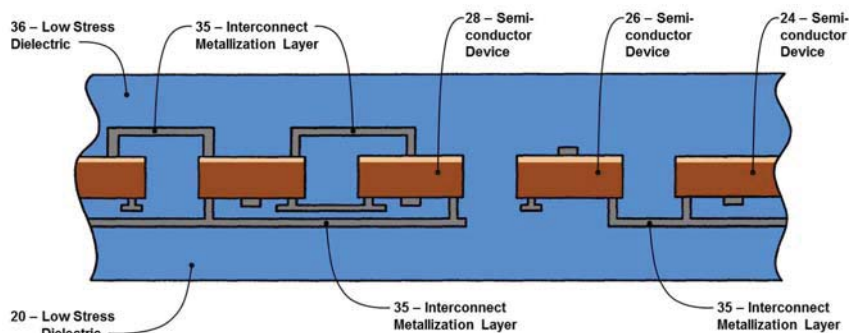


FIGURE 3 – Ex. 1006 – Leedy '695 (Fig. 3b) (annotations and color added)

The first process for making circuit membranes disclosed in Leedy '695 begins with a bulk silicon wafer, which will be, in turn, processed, trenched, and

thinned until all that is left are the discrete, individual transistor-sized islands. A dielectric membrane is formed as part of the interconnect metallization dielectric and as a layer over the one- or two-sided interconnect metallization.

First, an etch barrier layer is formed in the silicon substrate. This is the point at which the backside etch will stop, later in the process. *Id.* at 7:1-13. Next the transistors are formed in the surface of the silicon substrate above the buried etch stop layer. *Id.* Then, the transistors are trench isolated by forming trenches that encircle the transistor device areas. *Id.* Trench isolation is the etching of a space (typically less than 2 μm wide) between semiconductor devices on all sides of the devices and is an established IC process technique. *Id.* at 10:49-53. The trenches are formed to a depth below the active semiconductor devices. *Id.* at 7:25-27.

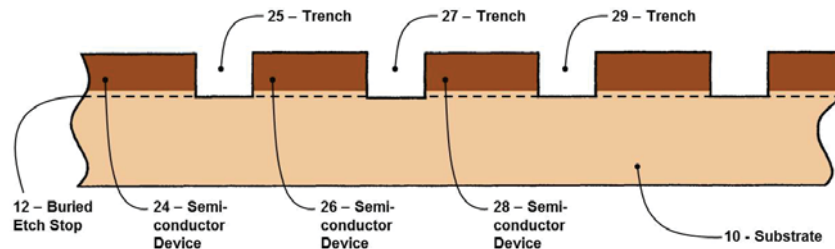


FIGURE 9 – Leedy '695 Demonstrative

Next the trenches are filled with low stress dielectric (*id.* at 10:53-54), and the IC structure is formed using conventional semiconductor processing techniques. *Id.* at 7:1-13. During these steps, the low stress dielectric is used for the interconnect dielectric, and to form the low stress dielectric membrane that supports the transistors and interconnects once all of the silicon substrate is

removed. *Id.* at 9:24-33.

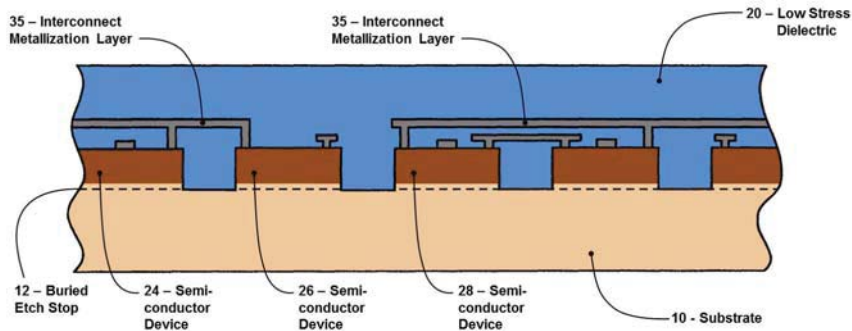


FIGURE 10 – Leedy ’695 Demonstrative

Once the front-side processing is complete, the back-side of the wafer is etched to the barrier layer. *Id.* at 7:1-13. Because the trenches extend below active device layer, when the back-side etch is complete the transistors device areas will be completely isolated from one another, and the contiguous silicon substrate will be eliminated. As a result, “[t]he low stress dielectric membrane formed on the semiconductor substrate (along with interconnect metallization) becomes the only structural circuit membrane component after the semiconductor substrate portion of the membrane is etched or trenched into independent semiconductor devices.”

Id. at 10:30-35.

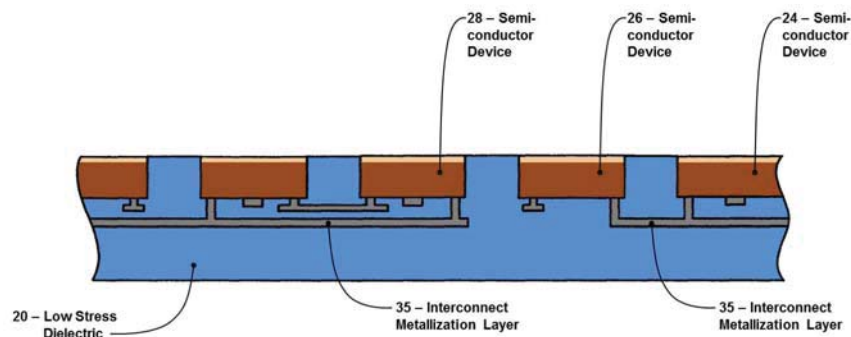


FIGURE 11 – Leedy ’695 Demonstrative

Once these processes are complete, the back-side of the device can be passivated and sealed with a low tensile stress dielectric for a conventional one-

sided structure, or additional processing can occur to form additional interconnections on the back-side. *Id.* at 9:34-39. Regardless, the silicon islands are completely isolated and encased in the thin free-standing dielectric membrane. *Id.* at Fig. 3b; *see also* Figure 3, *supra*.

The strength of Leedy '695 comes largely from “the ability to make a large area flexible thin film free standing dielectric membrane” (Ex. 1006 at 2:34-35), with complete electrical isolation of all semiconductor devices (*id.* at 3:26-33). Thus, Leedy '695 is fundamentally about using low tensile stress free-standing dielectric films to fabricate dielectrically isolated ICs that lack a substrate. *Id.*

C. The Leedy '695 Dielectric Is Inapplicable to the Dielectric in Conventional Integrated Circuits.

Leedy '695 discloses a dielectric that provides a solution to a problem that does not exist in conventional wafer-supported IC fabrication: *i.e.*, how to provide structural support for the IC that will be fabricated **without a silicon substrate**. Petitioners do not explain why, then, one of skill in the art attempting to fabricate an IC **with a silicon substrate**, would look to the unorthodox dielectrics in Leedy '695 instead of conventional dielectrics—particularly when Leedy '695 does not suggest any benefit for the low tensile stress dielectrics beyond their ability to form free-standing membranes.

1. Leedy '695 lacks critical information regarding the dielectric.

Because Leedy '695 is primarily concerned with structural stability, its descriptions focus exclusively on the physical properties of the disclosed dielectric. Namely, Leedy '695 emphasizes that the dielectric has a stress of less than 8×10^8 dynes/cm² (preferably 1×10^7 dynes/cm²) tension and is able to form supportive, very thin, planar, free-standing membranes. Ex. 1006 at 6:44-47; 11:33-37.

Leedy '695 is silent on the many critical electrical and material properties of the dielectric. For instance, although Leedy '695 notes that “[t]he dielectric constant of a dielectric (insulating) material is a primary determining factor when consideration is given to the use of the material” (*id.* at 12:27-29), it does not disclose the dielectric constant for its low stress dielectric materials. Nor does Leedy '695 disclose the dielectric's etch rate or refractive index. *Id.* at 11:47-64.

An exemplary list of electrical and material properties that would guide one of ordinary skill's selection of a dielectric material can be seen in Ex. 1040 at 192, depicted below as FIGURE 12. These characteristics enable one of skill to assess whether or not a given dielectric is suitable for a given application. For instance, certain applications may require a dielectric with a specific dielectric constant. And certain manufacturing processes may require, *e.g.*, a dielectric with a specific etch rate or step coverage capability.

Property	HT-CVD—NP 900°C	PE-CVD—LP 300°C
Composition	Si ₃ N ₄	Si ₂ N _x H _z
Si/N ratio	0.75	0.8–1.0
Density	2.8–3.1 g/cm ³	2.5–2.8 g/cm ³
Refractive index	2.0–2.1	2.0–2.1
Dielectric constant	6–7	6–9
Dielectric strength	1 × 10 ⁷ V/cm	6 × 10 ⁶ V/cm
Bulk resistivity	10 ¹² –10 ¹⁷ ohms/cm	10 ¹⁵ ohms/cm
Surface resistivity	> 10 ¹³ ohms/square	1 × 10 ¹³ ohms/square
Stress at 23°C on Si	1.2–1.8 × 10 ¹⁰ dyn/cm ² (tensile)	1–8 × 10 ⁹ dyn/cm ² (compressive)
Thermal expansion	4 × 10 ⁻⁶ /°C	> 4 < 7 × 10 ⁻⁶ /°C
Color, transmitted	None	Yellow
Step coverage	Fair	Conformal
H ₂ O permeability	Zero	Low–none
Thermal stability	Excellent	Variable > 400°C
Solution etch rate		
HFB 20–25°C	10–15 Å/min	200–300 Å/min
49% HF 23°C	80 Å/min	1500–3000 Å/min
85% H ₃ PO ₄ 155°C	15 Å/min	100–200 Å/min
85% H ₃ PO ₄ 180°C	120 Å/min	600–1000 Å/min
Plasma etch rate		
70% CF ₄ /30% O ₂ , 150 W, 100°C	200 Å/min	500 Å/min
Na ⁺ penetration	< 100 Å	< 100 Å
Na ⁺ retained in top 100 Å	> 99%	> 99%
IR absorption		
Si–N max	~870 cm ⁻¹	~830 cm ⁻¹
Si–H minor	—	2180 cm ⁻¹

FIGURE 12 – Ex. 1040 – Wolf (Table 3)

Wolf instructs that “Thin Films for use in VLSI fabrication must satisfy a large set of rigorous chemical, structural, and electrical requirements.” *Id.* at 109. Given Leedy ’695’s dearth of information about these properties, it is implausible that one of skill would select the Leedy ’695 dielectric for inclusion in an IC at all, much less that one would be “motivated” to do so.

a. The prior art teaches away from the Leedy ’695 dielectric.

Leedy ’695 is also unconventional in its required use of **tensile** dielectrics. As Wolf notes, tensile dielectrics are prone to cracking if the elastic limits are exceeded. Ex. 1040 at 114-15. Cracks in the dielectric can allow electrical current to flow between adjacent conductors, resulting in short circuits and fatal defects.

Ex. 1045 at 8. A 1995 journal article from IBM specifically teaches away from using tensile dielectrics, noting that with PECVD, “film properties degrade at lower power; e.g., film stress becomes tensile.” Ex. 2133 at 447.

The conventional wisdom at the time of the invention called for the use of compressive dielectrics in ICs. The IBM article states that “[m]oderately compressive oxide films are desirable for passivating and insulating layers because they resist cracking and minimize stress-induced voiding in the Al(Cu) interconnect layers.” *Id.* at 442. This view is confirmed by the November 1997 declaration of Dr. Alain Harrus, the CTO of Novellus, which was submitted during the prosecution of a divisional of Leedy ’695. Ex. 2137. There, Dr. Harrus explained that while he was at Novellus, “[m]ost of [the customers’ dielectric] requirements were quite conventional,” and “[m]ost customers requested films having a stress of about $[-1.0 \times 10^9 \text{ dynes/cm}^2 \text{ compressive}]$.” *Id.* at 3. In fact, customers did not want tensile films “because of the propensity of such films to crack.” *Id.* Because dielectric films are often used in passivation layers, which seal the IC device, cracking “can result in device contamination and failure in the field.” *Id.* Thus, the request for a dielectric film having a very low tensile stress was a “very unconventional request” that “no customer had made before.” *Id.*

b. The Leedy '695 benefits relate to circuit membranes, not the low tensile stress dielectric.

Petitioners' reliance on Leedy '695's disclosed benefits is misleading. These benefits are unique to Leedy '695's MDI process and would not be transferred to another base reference merely by employing the low tensile stress dielectric by itself without the full infrastructure of the MDI processes.

For example, Benefit 1 is "complete electrical isolation" of the semiconductor device. Ex 1006 at 3:18-24. This benefit comes from the separation of the transistors from each other and from a substrate by a dielectric—any dielectric. Whether the dielectric is low tensile stress or not is irrelevant to this benefit. The same concept applies to benefits 2-13. *Id.* at 3:61-4:13. In all these cases, the benefit derives from the free-standing membrane and its applications and not specifically from the low tensile stress dielectric.

Although at first glance, Benefits 8 and 11 appear to apply to all ICs, placed in context, this is not true. Benefit 8 is the creation of "three dimensional IC structures through the bonding of circuit membrane IC layers." *Id.* at 4:5-6. These are described at 45:47-47:35 and Figure 32. Benefit 11 is "higher performance ICs." *Id.* at 4:11. But these benefits are linked to the MDI structures themselves, not the low stress dielectric used to make them. One can make three-dimensional IC structures because dielectrically encapsulated circuit membranes can be

thermally or anodically bonded. *Id.* at 46:10-13. And IC performance is improved because the circuits are dielectrically isolated, which reduces, *e.g.*, “substrate current leakage.” *Id.* at 2:20-24.

In summary, Petitioners’ suggested use of the Leedy ’695 dielectrics raises more questions than answers. Why abandon a dielectric that has been proven to work in the base reference? Why use a dielectric whose sole purported benefit is to provide structural support, in an IC already supported by a substrate? Why use a dielectric whose essential material and electrical properties are unknown? Why use a dielectric that is tensile when the conventional wisdom was that compressive dielectrics are preferred because tensile dielectrics tend to crack?

Because Petitioners have not answered these (and other) important questions, Petitioners have not shown that the proffered combinations involve a simple substitution that would lead to predictable results. Replacing a “known” dielectric with an “unknown” dielectric is highly complex and unpredictable. Such an exercise cannot be said to have a reasonable likelihood of success, and Petitioners have not sufficiently explained or provided any evidence supporting the contention that one of ordinary skill would have such an expectation.

VII. THE COMBINATION OF BERTIN AND LEEDY ’695 DOES NOT RENDER OBVIOUS CLAIMS 1 AND 14 (GROUND 1)

Petitioners argue “it would have been obvious to modify Bertin such that the

interconnect insulator material has a stress of 5×10^8 dynes/cm² tensile or less, based on the disclosure of Leedy '695." *Id.* at 26 (as to claim 1); 31-32 (as to claim 14, referencing argument for claim 1). Petitioners make their entire argument for "claim 1c" through reference back to Part IX.B.1 of the Petition. *Id.* at 26. The only dielectric claim elements in claims 1 and 14 are interconnect insulators (as opposed to dielectrics located on the substrate); but Part IX.B.1 of the Petition is not specific to interconnect insulators. The crux of Petitioners' argument in Part IX.B.1 is that it would have been beneficial to incorporate the low tensile stress dielectric disclosed by Leedy '695 into the Bertin device for several reasons including: (1) improved surface flatness and structural integrity; (2) capability of insulating the circuit devices and interconnect metallization of Bertin while increasing structural integrity and durability; and (3) the ability to obtain lower stress than in thermally grown oxides, like those used in Bertin. *Pet.* at 21. The problem with Petitioners' argument is threefold. First, Bertin does not identify any of these as problems to solve with respect to its device. Second, Petitioners mischaracterize Leedy '695 in suggesting that the disclosed dielectric could provide these benefits in the context of a conventional stacked-IC device. Third, Petitioners ignore the complexity of what they propose, and the numerous reasons one of ordinary skill would not even attempt what Petitioners propose. Thus, Petitioners fail to adequately support this Ground.

A. Legal Standard

As the moving party, a Petitioner “has the burden of proof to establish that it is entitled to the requested relief.” 37 C.F.R. § 42.20(c). “Inter partes review shall not be instituted for a ground of unpatentability unless the Board decides that the Petition supporting the ground would demonstrate a reasonable likelihood that at least one of the claims challenged in the Petition is unpatentable.” § 42.108(c).

In *KSR*, the Supreme Court held “rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” 550 U.S. at 418 (quotation omitted). The need for articulated reasoning is particularly acute for motivation to combine arguments. *Id.* Mere recitation of one of *KSR*’s obviousness formulations, without more, cannot support a finding of obviousness. *See id.* at 419. Indeed, allowing such conclusory reasoning to succeed would contradict the central premise of *KSR*—that findings of obviousness require case-by-case factual analysis. *Id.* It is Petitioners’ burden to present such analysis.

B. Petitioners Provide No Articulated Reasoning with Some Rational Underpinning to Support Their Legal Conclusion of Obviousness with Regard to Claims 1 and 14.

Petitioners have failed to provide some articulated reasoning with a rational underpinning to support their combination of Bertin and Leedy ’695. Petitioners’

“reasoning” is the general assertion that simply swapping out one of Bertin’s dielectrics—specifically, for claims 1 and 14, one of Bertin’s interconnect insulators—for Leedy ’695’s low tensile stress dielectric is an obvious and straightforward design choice. Nothing could be further from the truth.

First, Petitioners’ arguments in Part IX.B.1 with respect to the dielectric elements of the challenged claims are too general. A stacked IC structure, such as Bertin’s, incorporates multiple dielectric materials that perform different functions. Thus, the different requirements for these dielectrics mandate their being made by different methods. But Petitioners ignore the differences between dielectrics, and refers to them generically, as if any dielectric could simply be replaced by a different one without regard to the purpose of the dielectric or the requirements placed on it. Petitioners provide no separate analysis with respect to each different dielectric they suggest could be replaced in the Bertin device, *i.e.*, dielectric layer 60 and the interconnect insulators. Thus, Petitioners fail to explain why the low tensile stress dielectrics disclosed by Leedy ’695 would be suitable for use in specific applications as required by *KSR*. 550 U.S. at 418, 424.

Further, Petitioners’ arguments lack expert support. Petitioners cite paragraphs 101-114 of Dr. Franzon’s Declaration to support their contention that a person of ordinary skill would have been motivated to combine Bertin and Leedy ’695. Those paragraphs provide few, if any, facts, data, or analysis to support the

opinion stated, but merely repeat the substantive arguments in the Petition.

“Merely repeating an argument from the Petition in the declaration of a proposed expert does not give that argument enhanced probative value.” *Kinetic Tech. Inc. v. Skyworks Solutions, Inc.*, IPR2014-00529, Paper 8, at 15 (Sept. 23, 2014). The declaration must explain the “‘how, ‘what,’ and ‘why’ of the proposed combination of references.” *Id.*

Petitioners also utterly disregard important questions such as (1) whether Bertin suggests a need for improved dielectrics; (2) whether the Leedy '695 dielectrics provide advantages that would be useful in the Bertin device; and (3) whether the Leedy '695 dielectric is compatible with the applications and fabrication processes set forth for the Bertin device. When these questions are properly considered, it is clear that Petitioners have failed to meet their burden to show that one of ordinary skill would have been motivated to set aside conventional dielectrics successfully used in Bertin, in favor of unknown dielectrics that provide no obvious benefit and introduce uncertainty.

1. Petitioners do not identify a need or problem in Bertin.

Petitioners have not provided a sufficient explanation as to why a person of ordinary skill in the art would have wanted to replace the dielectrics of the Bertin device, including the interconnect insulators. *See NJOY, Inc. v. Fontem Holdings I B.V.*, IPR2015-01299, Paper 15, at 11-12 (Dec. 8, 2015) (holding Petition must

provide a sufficient explanation regarding why a person having ordinary skill would seek to improve a base reference). Specifically, Petitioners do not direct the Board to statements in Bertin with respect to the sufficiency or insufficiency of the dielectrics described therein. *Id.* Indeed, Bertin does not discuss any problems associated with the dielectrics it discloses, and therefore provides no reason to look to outside references such as Leedy '695.

2. Petitioners mischaracterize Leedy '695 and the benefits it can purportedly provide in the context of the Bertin device.

Petitioners' assertion that it would have been advantageous to replace dielectrics in Bertin with the Leedy '695 dielectric relies on ignoring what Leedy '695 actually says. When one consults the actual text of Leedy '695, it is clear that Petitioners' purported benefits are illusory. That is because (1) Petitioners take quotations out of context and/or draw unsupported inferences therefrom, and (2) Leedy '695 espouses the benefits of circuit membranes formed with a low tensile stress dielectric, rather than the benefits of using a low tensile stress dielectric in **any** application, including a conventional stacked IC.

Petitioners first err in asserting that Leedy '695 suggests its dielectric would improve surface flatness and structural integrity in a conventional stacked IC. Petitioners' quotation from Leedy '695 distorts what Leedy '695 actually teaches:

There are many established methods for forming thin semiconductor substrates or membranes. The MDI process requires

that the **semiconductor** membrane forming process (thinning process) produce a highly uniform membrane typically less than 2 μm thick and that the surface tension of the **semiconductor** membrane be in low tensile stress. If the membrane is not in tensile stress, but in compressive stress, surface flatness and membrane structural integrity will in many cases be inadequate for subsequent device fabrication steps or the ability to form a sufficiently durable free standing membrane.

Ex. 1006 at 5:62-6:5 (emphasis added). As the full quotation makes clear, this passage is concerned with the characteristics required of a free-standing **semiconductor** membrane in order for it to have sufficient flatness and durability to accept subsequent processing steps. The passage does not speak to the benefit of controlling stress in a dielectric. As a result, it says nothing about the benefits of using a low tensile stress **dielectric** in a conventional stacked IC.

Petitioners err again in suggesting that it would be “advantageous” to use the Leedy ’695 dielectric “to insulate circuit devices and interconnect metallization, while at the same time increasing structural integrity and durability.” Pet. at 21. In this statement, Petitioners seem to imply that Leedy ’695’s dielectric could be used to replace Bertin’s “dielectric layer 60” (part of which is deposited over Bertin’s active layer, such that it insulates Bertin’s circuit devices, and which is not at issue in claims 1 and 14) and to insulate the trenches (*i.e.*, “TSV sidewalls” as described by Dr. Franzon) in Bertin’s device, *i.e.*, that Leedy ’695’s dielectric could replace

Bertin’s “interconnect insulators.” *See* Pet. at 20. This contention relies on the idea that Leedy ’695’s PECVD process delivers a dielectric that is sufficiently conformal to coat the TSV sidewalls. *See* Ex. 1002 at ¶ 111. Film conformality, often referred to as “step coverage,” refers to “coverage in which equal film thickness exists over all substrate topography regardless of its slope (*i.e.*, vertical and horizontal surfaces are coated with equal film thickness, Fig. 17a).” Ex. 1040 at 185. “Film conformality of CVD films is a function of film species and reactor type, and deposition conditions.” *Id.*

Petitioners provide no evidence that the PECVD oxide of Leedy ’695 is capable of delivering a conformal coating for the trenches in Bertin’s device, the preferred embodiment for which utilizes high aspect-ratio (20:1) trenches. Ex. 1004 at 4:14-16. Petitioners cite two passages in Leedy ’695 in support of this contention, but these passages do not address conformality or the presumed improved ability of low stress dielectrics to coat the insides of vias at all. Petitioners also cite the Franzon Declaration, but the only part of it that addresses TSV sidewalls, paragraph 111, provides no support for the assertion that the Leedy ’695 PECVD process would be “capable of coating TSV sidewalls, like those disclosed in Bertin and Hsu, to provide TSV insulation.” Ex. 1002 at ¶ 111.

In contrast to Dr. Franzon’s bare assertions, Wolf explains that film conformality can degrade in low-pressure CVD and PECVD processes. When “the

mean free path of the reactant gases is high (e.g. due to the low operating pressure of LPCVD and PECVD reactors), a shadowing effect can occur.” Ex. 1040 at 186.

“In such . . . cases . . . the film thickness decreases with depth into the trench”

Id. It is clear from this discussion and Figure 17b in Wolf that the very low pressure PECVD-deposited dielectrics of Leedy ’695 (Ex. 1006 at 11:55) would not be appropriate to coat the high aspect-ratio trenches of Bertin because it could lead to uneven dielectric thickness or non-conformal coverage that would allow current to leak into the substrate. Ex. 1040 at 185.

Wolf provides no guidance on step coverage produced by PECVD of SiO₂ deposited using SiH₄ + N₂O, the combination disclosed in the Leedy ’695 patent.

Id. at 194. In contrast to low-pressure CVD processes, higher temperature processes such as the thermal oxidation that is used to make field oxides provide excellent conformality. *Id.* at 183, 186-87. Thermal oxidation provides conformal step coverage because the SiO₂ is “grown” on the entirety of the exposed silicon substrate. *Id.* at 198-99.

Petitioners next err in contending that dielectrics like Leedy ’695’s “advantageously have lower stress than thermally grown oxides, like those used in Bertin.” Pet. at 21. Petitioners cite one passage from Leedy ’695 in support of this contention, but the passage cited—which relates to compressive films and has nothing to do with a low-stress versus high-stress distinction—is a *non sequitur*:

“Thermally formed silicon dioxide forms as a strongly compressive film and most deposited dielectrics currently in use form typically with compressive surface stress.” Ex. 1006 at 6:30-33. Nowhere do Petitioners indicate how this lower stress provides a benefit at all, much less in the context of Bertin’s device, nor does it indicate that the dielectric would have predictable value in such an IC.

Petitioners also err in asserting that PECVD-deposited dielectrics “can easily be used in place of other dielectrics, including thermal oxide insulators, like the interconnect insulators disclosed in Bertin” Pet. at 22. Petitioners support this contention by stating that the “well-known and widely used [PECVD] deposition technique,” like the technique used in Leedy ’695, “provided conformal deposition at lower substrate temperatures and at faster rates compared to other deposition techniques. *Id.* Petitioners contend that using Leedy ’695’s PECVD-deposited dielectric in place of Bertin’s thermal process would have been a simple substitution with predictable results. *Id.* But again, Petitioners provide no indication as to why these purportedly advantageous process parameters would be beneficial in the context of Bertin. Petitioners’ erroneous contention that the substitution **could** be performed says nothing about **why** it **would** be performed.

Further, the cited ability of Leedy ’695’s dielectric “to withstand a wide range of IC processing techniques and process temperatures (of at least 400 C.) without noticeable deficiency in performance” (*id.*) provides no benefit in the

context of Bertin, where the Leedy '695 dielectric would be replacing a **thermal** oxide. Numerous moderate- and high-stress dielectrics can also withstand a wide range of IC processing techniques. For example, thermal oxidation produces a silicon dioxide layer often formed early in the fabrication process for delimiting transistor regions, and thus, the layer must withstand a very wide range of subsequent high-temperature IC processing techniques. Ex. 1040 at 198-99.

3. Petitioners ignore the complexity of what they propose.

Petitioners obscure the practical complexity of combining the dielectric of Leedy '695 with the structure of Bertin through the conclusory assertion that one of ordinary skill would “simply substitute” Leedy '695’s dielectric for the dielectrics disclosed in Bertin. Pet. at 22. This combination is not, however, the canonical simple swap articulated in *Hotchkiss*—which found that a clay doorknob was obvious in light of wooden and metal doorknobs. 52 U.S. at 267. Instead, the substitution Petitioners suggest here is akin to the scenario contemplated by *KSR*, where “the claimed subject matter [involves] more than the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for improvement.” 550 U.S. at 417.

Petitioners provide no support for the conclusion that the substitution of Leedy '695’s low-stress dielectric for the dielectric of Bertin would yield predictable results with known benefits. The Petition merely cites to paragraphs

111-114 of the Franzone Declaration. Pet. at 22-23. And the analysis in the cited paragraphs merely repeats the language of the Petition. This circular analysis fails to explain the predictability of the “‘how,’ ‘what,’ and ‘why’” of the proposed substitution. *Kinetic*, Paper 8, at 15. The Franzone Declaration also does not address the potential detriment of replacing a dielectric that was presumably chosen for specific reasons, thereby losing **its** attendant benefits.

Petitioners rely on their assertion that Leedy '695 discloses known PECVD techniques using “a commonly available deposition technique” to support their contention that substituting Leedy '695's dielectric for the dielectrics in Bertin would yield predictable results. Pet. at 22-23. But to say that a person of ordinary skill knows how to perform a specific process does not speak to whether that particular process would work in a series of hundreds of complex processes that are performed during the fabrication of a complex semiconductor device.

The Petition does not explain **why** a person of ordinary skill would expect to succeed. For example, neither Petitioners nor Dr. Franzone discuss the process steps that occur prior to the deposition of the substituted dielectric, or the steps that follow, or why the substituted deposition would be compatible with those process steps. *See, e.g.*, Ex. 1040 at 618. Will the Leedy '695 dielectric be able to withstand temperatures associated with subsequent processing? Is the (unknown) dielectric constant of the Leedy '695 dielectric suitable for the Bertin application?

Is the (unknown) etch rate of the Leedy '695 dielectric acceptable for subsequent etch steps? Are the underlying and overlying materials amenable to adjoining a tensile film? The Board is left to speculate because Petitioners fail to address compatibility of the substituted PECVD process from a temperature, chemical, and mechanical perspective.

4. Petitioners ignore the reasons one of ordinary skill would not even attempt what Petitioners propose.

First, as discussed above, Leedy '695 does not give a person of ordinary skill in the art the information needed to predict whether the disclosed dielectric would work in the Bertin device. Leedy '695 does not disclose any other details concerning the characterization or material properties of its low stress dielectrics. Without access to this information, a person of ordinary skill would consider the result of this combination unpredictable.

Second, as can be seen in the Harrus Declaration and the IBM article, at the time of the invention, the industry standard was to use compressive dielectrics due to the perceived problems with tensile dielectrics. *See* p. 32, *supra*. Additionally, the IBM article specifically teaches the benefits of using compressive dielectrics, thereby teaching away from using tensile dielectrics: “Moderately compressive oxide films are desirable for passivating and insulating layers because they resist cracking and minimize stress-induced voiding in the Al(Cu) interconnect layers.”

Ex. 2133 at 442. Petitioners have failed to explain why a person of ordinary skill would have deviated from the norm to incorporate a tensile dielectric.

In sum, Petitioners have failed to provide a rational underpinning for why—never mind how—one of ordinary skill would or even could substitute the Leedy '695 dielectrics for the **any** of the dielectrics in Bertin. It is Petitioners' burden to show that the Leedy '695 dielectrics **could predictably** replace the dielectrics in the Bertin device, and that one of ordinary skill would have had a reason to attempt that task. Having failed to satisfy their burden, institution should be denied.

VIII. THE COMBINATION OF BERTIN, POOLE, AND LEEDY '695 DOES NOT RENDER OBVIOUS CLAIMS 2, 8, 31, 32, 44, 46, AND 52-54 (GROUND 2)

Ground 2 relies on an identical set of arguments as Ground 1. The difference is that the dielectrics at issue in Ground 1 are limited to “interconnect insulators,” and the dielectrics at issue in Ground 2 are not.

A. Petitioners Provide No Articulated Reasoning with Some Rational Underpinning to Support Their Legal Conclusion of Obviousness with Regard to Claims 2, 8, 31, 32, 44, 46, and 52-54.

The extent of Petitioners' argument as to the dielectric elements at issue in Ground 2 is a mere “as discussed above” (Pet. at 32), with no reference provided. Assuming Petitioners intended to reference Part IX.B.1 of the Petition, Petitioners' argument in Ground 2 is the same as Ground 1. Patent Owner thus incorporates by reference Section VII.B, *supra*. Petitioners fail to adequately support this Ground.

1. Petitioners do not meet their burden to show that it would have been obvious to combine Bertin and Poole.

a. Petitioners do not identify a need or problem in Bertin's etch.

Poole is cited by Petitioners for claim elements related to substrate thinning. Petitioners have not provided a sufficient explanation as to why a person of ordinary skill in the art would have wanted to replace the wet etch process of the Bertin device. *NJOY*, Paper 15, at 11-12. Specifically, Petitioners do not direct the Board to statements in Bertin with respect to the sufficiency or insufficiency of the wet etch process described therein. *Id.* Indeed, Bertin does not discuss any problems associated with its wet etch process, thus providing no reason to look to outside references like Poole. Poole suggests its method is necessary in the context of an **optical device** to avoid a rough surface and “frequent etch pits,” which lead to “degraded performance, especially when used in fast (small f number) optical systems.” Ex. 1005 at 2:38-45. Bertin identifies no such problem.

b. Petitioners do not adequately set forth the “what, why, how” for replacing Bertin’s thinning process with Poole’s and make no showing that Poole would work in a stacked IC process.

The thinning process of Poole utilizes a device bonded to a specifically sized, square glass substrate, then bonds the glass substrate to an apparently specialized “work holder 15” with wax, and uses “a modified MI 165 lap/polish fixture.” Ex. 1005 at 5:66-68. Petitioners do not explain how one would modify the

Bertin method to work with a specialized, modified tool designed to work with Poole's specific device, glass substrate, and work holder structure. Petitioners also fail to provide any evidence that Poole's process would work in Bertin, where devices are bonded to either a rigid carrier or another IC before thinning, *i.e.*, whether the abrasive grinding process of Poole would damage the Bertin device's stacking bonds. For these reasons alone,² Petitioners fail to carry their burden.

B. Petitioners Do Not Establish a Reasonable Likelihood that Claims 2, 8, 31, 32, 44, 46, and 52-54 are Unpatentable.

With regard to claim 2, Petitioners admit that Bertin does not teach polishing. Pet. at 36. Through a reference back to Part IX.C.1 of the Petition, Petitioners contend that it would have been obvious to replace Bertin's wet etch with Poole's thinning process. *Id.* Petitioners fail to articulate why a person of ordinary skill would have been motivated to do so. Petitioners similarly fail with regard to claims 8 (*see id.* at 38), 31 (*see id.* at 41), 32 (*see id.* at 41), 44 (*see id.* at 42), 53 (*see id.* at 43), and 54 (*see id.* at 44).

Also with regard to claim 2, Petitioners admit that Bertin does not "expressly teach that the dielectric layer 60 has 'a stress of less than 5×10^8 dynes/cm² tensile.'"

² Elm reserves the right to raise other arguments regarding Poole should *inter partes* review be instituted.

Id. at 35. Through a reference back to Part IX.B.1, Petitioners contend “it would have been obvious to modify Bertin such that the dielectric layer 60 has a stress of less than 5×10^8 dynes/cm² tensile, based on the disclosure of Leedy ’695.” *Id.* As discussed at length above, however, Petitioners fail to establish a credible reason to combine Bertin and Leedy ’695. Petitioners similarly fail with regard to claim 8, where Petitioners reference the arguments for “claim 2a” and “claim 14f.” *Id.* at 40. Petitioners also fail as to claims 31, 32, 44, 46, 52, 53, and 54 because they depend from claims 2, 8, and 14. Petitioners have thus not established that it is more likely than not that claims 2, 8, 31, 32, 44, 46, and 52-54 are unpatentable.

IX. THE COMBINATION OF HSU AND LEEDY ’695 DOES NOT RENDER OBVIOUS CLAIMS 1, 2, 8, 14, 31, 32, 44, 46, AND 52-54 (GROUND 3)

As with Bertin, the crux of Petitioners’ argument for Hsu is that it would have been beneficial to incorporate the low tensile stress dielectric disclosed by Leedy ’695 into the Hsu device for several reasons including: (1) improved surface flatness and structural integrity; and (2) capability of insulating the circuit devices and interconnect metallization of Hsu while increasing structural integrity and durability. Pet. at 45. The same three fatal problems apply to Petitioners’ Hsu argument as outlined above regarding their Bertin argument. First, Hsu does not identify any of these as problems to solve with respect to its disclosed device. Second, Petitioners mischaracterize Leedy ’695 in suggesting that the disclosed

dielectric could provide these benefits in the context of a conventional stacked-IC device. Third, Petitioners ignore the complexity of what they propose, and the numerous reasons one of ordinary skill would not even attempt what Petitioners propose. Thus, Petitioners fail to adequately support this Ground.

A. Petitioners Provide No Articulated Reasoning with Some Rational Underpinning to Support Their Legal Conclusion of Obviousness with Regard to Claims 1, 2, 8, 14, 31, 32, 44, 46, and 52-54.

Petitioners have failed to provide some articulated reasoning with a rational underpinning to support their combination of Hsu and Leedy '695. Petitioners' "reasoning" is the general assertion that simply swapping out one of Hsu's dielectrics for Leedy '695's low tensile stress dielectric is an obvious and straightforward design choice. For the same reasons articulated above regarding Bertin, this is unsupported and false.

Petitioners' arguments with respect to the dielectric elements of the challenged claims are again too general. As a stacked IC structure, Hsu incorporates multiple dielectric materials that perform different functions, *i.e.*, silicon dioxide film 18, including the surface portion and the portions "on the walls of Hsu's vertical interconnects." Pet. at 44. Petitioners ignore the differences between dielectrics and provide no separate analysis with respect to each different dielectric they suggest could be replaced in the Hsu device. Thus, Petitioners fail to explain why the Leedy '695 dielectric would be suitable for use in specific

applications as required by *KSR*. 550 U.S. at 418.

Further, Petitioners' arguments lack expert support. Petitioners repeatedly cite paragraphs 109-114 of the Franzon Declaration, again failing to provide facts, data, or analysis to support Dr. Franzon's opinions. *See Kinetic*, Paper 8, at 15. There is no "how, what, or why" provided. *Id.*

Petitioners also again disregard important questions such as (1) whether Hsu suggests a need for improved dielectrics; (2) whether the Leedy '695 dielectrics provide advantages that would be useful in the Hsu device; and (3) whether the Leedy '695 dielectric is compatible with the applications and fabrication processes set forth for the Hsu device/method. When these questions are properly considered, it is clear that Petitioners have failed to meet their burden to show that one of ordinary skill would have been motivated to set aside conventional dielectrics successfully used in Hsu, in favor of unknown dielectrics that provide no obvious benefit and introduce uncertainty.

1. Petitioners do not identify a need or problem in Hsu.

Petitioners have not provided a sufficient explanation as to why a person of ordinary skill in the art would have wanted to replace the dielectrics of the Hsu device. *See NJOY*, Paper 15, at 11-12. Specifically, Petitioners do not direct the Board to statements in Hsu with respect to the sufficiency or insufficiency of the dielectrics described therein. *Id.* Indeed, like Bertin, Hsu does not discuss any

problems associated with the dielectrics it discloses, and therefore provides no reason to look to outside references such as Leedy '695.

2. Petitioners mischaracterize Leedy '695 and the benefits it can purportedly provide in the context of the Hsu device.

Petitioners' arguments as to purported "express motivations" provided by Leedy '695, or purported reasons why the Leedy '695 dielectric could be used in place of certain dielectrics in Hsu, are largely similar to Petitioners' arguments regarding Bertin. As to the purported "improved surface flatness and structural integrity" motivation from Leedy '695, for example, Patent Owner's discussion, set forth in Section VII.B.2, *supra*, applies with equal weight to Hsu as with Bertin, and it is hereby incorporated by reference. Leedy '695 says nothing about any benefit of using a low tensile stress dielectric in a conventional stacked IC.

In this regard, among others, Petitioners' contention that there are "considerable similarities between Leedy '695 and Hsu's teachings," Pet. at 47, falls flat. As to these purported similarities, Petitioners argue that "Hsu teaches the formation of a 'silicon dioxide film 18 for insulation [...] on the entire surface of a [silicon] substrate' using APCVD." *Id.* (alterations in original). "Similarly," Petitioners contend, "Leedy '695 describes 'the fabrication of integrated circuits from flexible membranes formed of very thin low stress dielectric materials, such as silicon dioxide' using PECVD." *Id.* However, these statements do not point to

similarity at all. As described above, Leedy '695 teaches how to provide structural support for an IC when there is **no silicon substrate**. The membrane itself provides the structural support. The dielectric of Leedy '695 is not, as Petitioners contend, part of a device that retains its silicon substrate. Petitioners thus lack support in contending that there was “a motivation to look to other references that discuss formation of silicon dioxide layers in integrate circuits, such as Leedy '695, for other attributes of these layers and depositions methods thereof.” *Id.*

Petitioners also argue that it would be advantageous to incorporate Leedy '695's low tensile stress dielectric to “insulate circuit devices and interconnect metallization, while at the same time increasing structural integrity and durability.” Pet. at 45. In this statement, Petitioners seem to imply that Leedy '695's dielectric could be used to replace the portion of Hsu's “dielectric layer 18” (or “silicon dioxide film 18”) that is deposited over Hsu's substrate, and the portion of dielectric layer 18 on the vertical walls of Hsu's vertical interconnects. This contention relies on the idea that Leedy '695's PECVD process delivers a dielectric that is sufficiently conformal to coat the walls of the vertical interconnects. *See* Ex. 1002 at ¶ 111. Conformality/ step coverage are discussed extensively in Section VII.B.2 at pp. 40-42, *supra*, which is hereby incorporated by reference. Again, as with Bertin, Petitioners provide no evidence that the PECVD oxide of Leedy '695 is capable of delivering a conformal coating for the trenches

in Hsu's device, or capable of delivering a better conformal coating than the APCVD technique used in Hsu. The cited passages from Leedy '695 do not address conformality; the cited portions of the Franzon Declaration, including paragraph 111, again provide no support for the assertion that Leedy '695's PECVD process would be "capable of coating TSV sidewalls, like those disclosed in Bertin and Hsu, to provide TSV insulation." Ex. 1002 at ¶ 111. Petitioners' contentions are unsupported and inadequate.

Petitioners also err in asserting that Leedy '695 discloses that its PECVD-deposited dielectrics "can easily be used in place of other dielectrics." Pet. at 46. In support, Petitioners cite two passages from Leedy '695, neither of which has anything to do with the PECVD method, and paragraph 113 of the Franzon Declaration (which relates to process compatibility and says little more than the Petition). But again, Petitioners provide no indication as to why these purportedly advantageous process parameters would be beneficial in the context of Hsu. Petitioners' erroneous contention that the substitution **could** be performed says nothing about **why** it **would** be performed.

As with Bertin, Petitioners cite the purported versatility of the dielectric of Leedy '695 and its ability "to withstand a wide range of IC processing techniques and processing temperatures (of at least 400 C.) without noticeable deficiency in performance." Pet. at 46. Petitioners do not, however, provide any indication that

the APCVD-deposited dielectric of Hsu is not similarly versatile or able to withstand such techniques and temperatures.

3. Petitioners ignore the complexity of what they propose.

Petitioners obscure the practical complexity of combining the dielectric of Leedy '695 with the structure of Hsu, as they did with Bertin, through the conclusory assertions that Leedy '695's PECVD deposition "can easily be used in place of other dielectrics" (Pet. at 45) and that "Leedy '695's technique could have been used in place of Hsu's technique to obtain [a] predictable result . . . with a reasonable expectation of success" (*id.*). For the same reasons discussed above regarding Bertin at Section VII.B.3, *supra*, which is incorporated by reference, the proposed replacement is more than a simple swap. *See KSR*, 550 U.S. at 417.

Petitioners provide no support for the conclusion that "[m]odifying the dielectric [*sic*, in] Hsu to be a low tensile stress layer as in Leedy '695 would have been the use of a known technique to improve similar devices in the same way to manufacture improved 3D integrated circuits." Pet. at 47. The Petition merely cites to ¶ 113 of the Franzon Declaration. *Id.* And the analysis in the cited paragraph merely repeats the language of the Petition. This circular analysis fails to explain the predictability of the "'how,' 'what,' and 'why'" of the substitution. *Kinetic*, Paper 8, at 15. Nor does Dr. Franzon address the potential detriment of replacing a dielectric that was presumably chosen for specific reasons, thereby losing **its**

attendant benefits. The Board is again left to speculate about the expectation of success because Petitioners fail to address compatibility of the substituted PECVD process from a temperature, chemical, and mechanical perspective.

4. Petitioners ignore the reasons one of ordinary skill would not even attempt what Petitioners propose.

With Hsu, Petitioners again ignore the many reasons why a person of ordinary skill would not attempt the substitution Petitioners propose. First, as discussed above, Leedy '695 does not give a person of ordinary skill in the art the information needed to predict whether the disclosed dielectric would work in the Hsu device. *See* Section VII.B.4, *supra*.

Second, at the time of the invention, the industry standard was to use compressive dielectrics due to the perceived problems with tensile dielectrics. *See* Section VII.B.4, *supra*. Petitioners have failed to explain why a person of ordinary skill would have deviated from the norm to incorporate a tensile dielectric in Hsu.

In sum, Petitioners have failed to provide a rational underpinning for why—never mind how—one of ordinary skill would or even could substitute the Leedy '695 dielectrics for the **any** of the dielectrics in Hsu. It is Petitioners' burden to show that the Leedy '695 dielectrics **could predictably** replace the dielectrics in the Hsu device, and that one of ordinary skill would have had a reason to attempt that task. Having failed to satisfy their burden, institution should be denied.

B. Petitioners Do Not Establish a Reasonable Likelihood that Claims 1, 2, 8, 14, 31, 32, 44, 46, and 52-54 are Unpatentable.

With regard to claim 1, Petitioners admit that “Hsu does not expressly teach that its silicon-based dielectric insulator layer 18 has a stress of less than 5×10^8 dynes/cm² tensile.” Pet. at 49. Petitioners simply contend that “layer 18 has a stress of less than 5×10^8 dynes/cm² tensile when the teachings of Leedy ’695 are incorporated into Hsu such that the dielectric layer creation techniques of Leedy ’695 are used to create layer 18 of Hsu.” *Id.* Petitioners make this conclusory argument without providing a single reason why a person of ordinary skill would be motivated to do so, other than citing (but not quoting, or even paraphrasing) four pages of claim chart from the Franzon Declaration. As discussed above, however, Petitioners fail to establish a credible reason to combine Hsu and Leedy ’695. Petitioners similarly fail with regard to claims 2 (*see* Pet. at 50), 8 (*see id.* at 51-53 (referencing analysis for “claim 2a”)), and 14 (*see id.* at 55 (referencing analysis for “claim 1c”)). Petitioners also fail as to claims 31, 32, 44, 46, and 52-54 because they depend from claims 2, 8, or 14. Petitioners have thus not established that it is more likely than not the challenged claims are unpatentable.

X. THE COMBINATION OF HSU AND KOWA DOES NOT RENDER OBVIOUS CLAIMS 1, 2, 8, 14, 31, 32, 44, 46, AND 52-54 (GROUND 4)

Kowa discloses depositing stress-balanced alternating silicon nitride (SiN) layers. Kowa also discloses a plasma CVD method for “alternately stacking a thin

film having compressive stress and a thin film having tensile stress” Ex. 1007 at 8. Kowa does not address inherently low-stress films.

A. Petitioners Provide No Articulated Reasoning with Some Rational Underpinning to Support Their Legal Conclusion of Obviousness with Regard to Claims 1, 2, 8, 14, 31, 32, 44, 46, and 52-54.

Petitioners contend that “a person of skill would have been motivated to use the alternative taught in Kowa to manage stresses in Hsu.” Pet. at 58. Petitioners’ perfunctory explanation of Ground 4 (Pet. at 57-58) with its supporting Declaration (Ex. 1002 at ¶¶ 147-148) is inadequate. The explanation is no more than a conclusory statement. Petitioners provide no explanation as to why, *e.g.*, a person of skill would have accepted Kowa’s silicon nitride layer in place of Hsu’s silicon dioxide layer 18. Ground 4 should be denied because the Petition fails to comply with 37 C.F.R. §§42.22(a)(2) and 42.104(b)(4) and fails to establish a reasonable likelihood that any of the challenged claims are unpatentable. The combination of Hsu and Kowa does not render obvious claims 1, 2, 8, 14, 31, 32, 44, 46, and 52-54 under Ground 4 for the same reasons articulated above in Section IX.A.

Further, Ground 4 is redundant to Ground 3 and is improper in that it is based on claim construction issues that have no impact on the Board’s decision.

XI. THE COMBINATION OF BERTIN AND LEEDY ’695 DOES NOT RENDER OBVIOUS CLAIMS 2, 8, 31, 32, 44, 46, AND 52-54 (GROUND 5)

Ground 5 is redundant to Ground 2 and is improperly based on claim

construction issues that have no impact on the Board's decision. In any event, the combination of Bertin and Leedy '695 does not render obvious claims 2, 8, 31, 32, 44, 46, and 52-54 under Ground 5 for the same reasons discussed in Section VIII.

XII. CONCLUSION

Petitioners have not established a reasonable likelihood that any of the challenged claims 1, 2, 8, 14, 31, 32, 44, 46, and 52-54 are unpatentable. Further, the Petition is barred as untimely. Further still, its Grounds are redundant with those already considered by the PTO.

If the Petition succeeds in anything at all, it is in convincingly establishing that the challenged claims are **not** obvious. The Petition was filed by three of the largest memory manufacturers in the world: Samsung, Micron, and SK hynix. Every year, each devotes in excess of a billion dollars to research and development, files for and receives dozens of patents, and authors scores of technical articles. And yet not a single one has directed the Board's attention to one of their own products, patents, or articles describing these allegedly obvious inventions. Presumably, at least one of these sophisticated companies would have produced, patented, or at least written about an invention were it as obvious as they now claim. But no one did. Only Mr. Leedy saw what Petitioners now say, in hindsight, is plain to see. The challenged claims are not obvious, and trial should not be instituted.

IPR 2016-00387
U.S. Patent No. 8,841,778

Respectfully submitted,

Dated: April 5, 2016

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that on April 5, 2016, the foregoing
PATENT OWNER'S PRELIMINARY RESPONSE TO PETITIONERS'
PETITION FOR INTER PARTES REVIEW OF UNITED STATES

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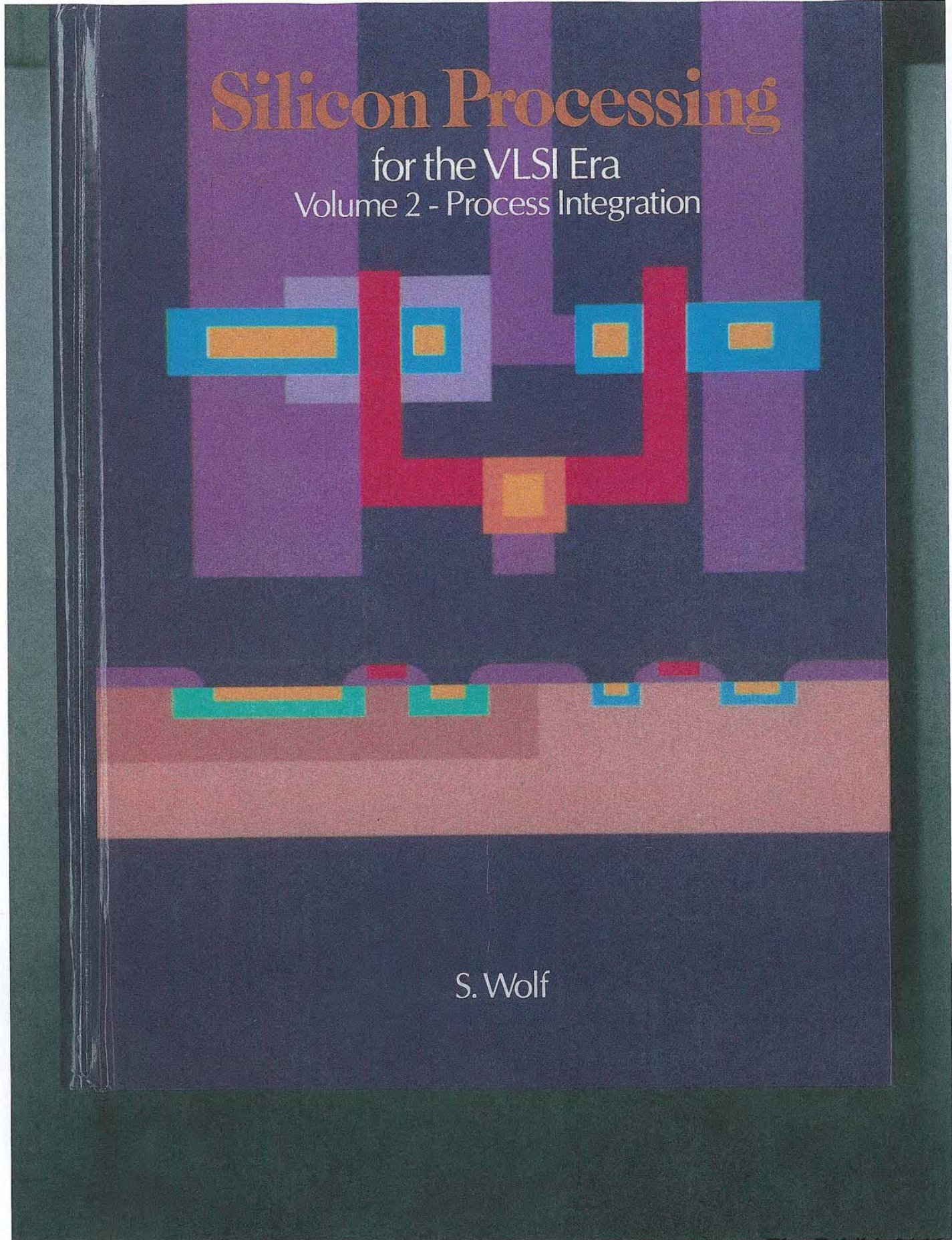
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Exhibit 48



SILICON PROCESSING
FOR
THE VLSI ERA
VOLUME 2:
PROCESS INTEGRATION

SILICON PROCESSING
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- PECVD TEOS film, deposited at 330°C. (Figure 4-54c shows that the resulting hillock size and density are both small.)¹⁷²
- ECR deposition (see section 4.4.10).
- Photo-CVD SiO₂.¹⁸³
- Afterglow-CVD of SiO₂.²⁴
- Anodized Al deposition.¹⁸⁴

Once such dielectric films are in place, they suppress hillock growth during later thermal cycling.

- *Use of refractory metal films such as W or Mo (which exhibit much less propensity to form hillocks at 400°-500°C) in place of Al.*
- *Use of an ionized cluster beam deposition process to deposit smooth Al/CaF₂/Si films.* According to the report on this process, the films remained hillock free up to temperatures of 500°C.¹⁸⁵

4.7.4.2 Dielectric Void Reliability Problems. If the voids are opened following an etchback step, they can trap moisture or photoresist residues that can cause long term reliability problems. In addition, metal may be deposited into the voids that can be very difficult to remove by etching, thus producing shorting between neighboring metal lines.

4.8 PASSIVATION LAYERS

Following patterning of the final metal layer, a *passivation layer* is deposited over the entire top surface of the wafers. This is an insulating, protective layer that prevents mechanical and chemical damage during assembly and packaging. The desired properties of the passivation materials are given in Table 4-5. In general, the thicker the passivation layer the better, since a thicker layer will provide better protection and improve the electromigration resistance of underlying Al lines. On the other hand, because thicker CVD films (especially silicon nitride films) have a higher tendency to crack, there is normally an upper limit to the thickness.

The final mask, called the *pad mask* or *bonding contact mask*, is used to define patterns corresponding to the regions in which electrical contact to the finished circuit will be made. These patterns in a resist layer allow openings in the passivation layer to be etched down to Al areas on the circuit called bonding pads (see chap. 5, Fig. 5-16). Either wet or dry etching can be used to etch the passivation layer. Since the dimensions of the pads are so large (i.e., normally 100 x 100 μm), wet etching is still frequently used to etch PSG films, while silicon nitride films are more easily etched by means of a dry etching process.

Phosphorus-doped, low-temperature CVD SiO₂ films were the first passivation layers to be used. The phosphorus is added to the SiO₂ to reduce the stresses in the film (and to thereby decrease the tendency of the film to crack), as well as to improve the gettering

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properties of the film (with respect to sodium ions and other fast-diffusing metallic contaminants). The higher the phosphorus concentration, the better these characteristics will be.

On the other hand, if more than 6 wt% phosphorus is added to the film, corrosion can become a serious problem, especially in the case of chips mounted in plastic, nonhermetic packages. Water vapor can rapidly penetrate the plastic packaging material, transporting with it contaminants from the surface of the package. If the PSG contains excess phosphorus, the moisture can react with it to form phosphoric acid (HPO_3), which will eventually penetrate the film. As noted earlier, electrochemical corrosion of the Al lines can lead to metallization failure. While the transport of contaminated moisture through the PSG is a relatively slow process, if cracks or defects (e.g., pinholes) exist in the film, the water vapor will be able to penetrate it much more rapidly.

Silicon nitride has also been used as a passivation-layer material because it provides an impermeable barrier to moisture and mobile impurities (e.g., sodium) and also forms a tough coat that protects the chips against scratching. Its high dielectric constant is not a disadvantage for this application, since the passivation layer is deposited on top of the last metal layer.

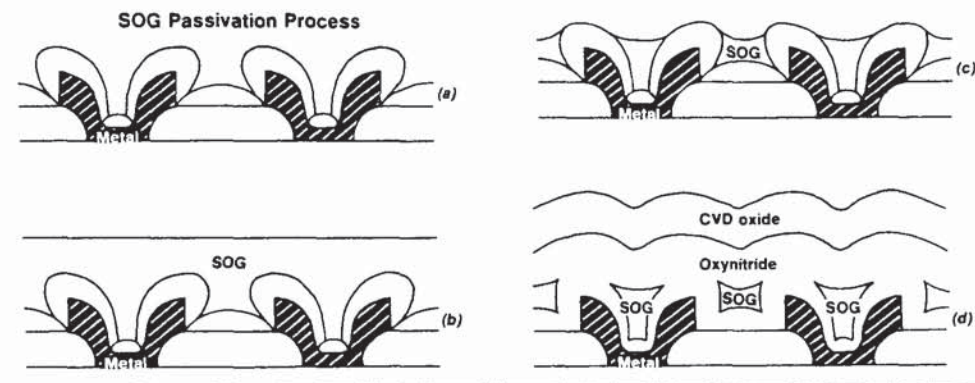
However, because the passivation layer must be deposited over Al films, only PECVD silicon nitride can be used for this application (since it is deposited at $\sim 300^\circ\text{C}$). Unfortunately, PECVD nitride films normally exhibit a high mechanical stress ($\sim 6\text{--}8 \times 10^8 \text{ Pa}$), which can cause cracks in the film during heating after deposition (especially at steps). The high compressive stresses in the films have also been shown to enhance void formation in Al interconnects (see section 4.7).

In addition, PECVD silicon nitride tends to be nonstoichiometric and contains substantial quantities of atomic hydrogen (10-30 at%). Large quantities of hydrogen have been found to accelerate hot-electron aging effects in MOS devices (see section 5.6.6). It has also been reported that the hydrogen from PECVD nitride is responsible for the formation of bubbles or cavities at the metal-plasma nitride interface when Al:Si alloys are used as the metallization. These appear after the 450°C anneal that is carried out following nitride deposition. It is supposed that the hydrogen reacts with the Si precipitates in the Al film to form gaseous compounds that produce the bubbles.^{186,187} It has been recommended that a low-hydrogen-content passivation film be used, if nitride passivation is selected for MOS technologies with gate lengths of less than $1.5 \mu\text{m}$ (in which hot-electron degradation is significant).

Work has been done to develop processes for growing nitride films with low hydrogen concentration and stress, and more is now understood about the relationship of the film properties to such deposition conditions as rf frequency, power, and bias.¹⁸⁸ Lower H_2 concentrations in the nitride have been obtained when the film is formed with $\text{SiH}_4\text{-N}_2$ mixtures rather than with conventional $\text{SiH}_4\text{-NH}_3$ mixtures.¹⁸⁹ Fluorinated nitride (F-SiN) films have been developed that exhibit only 0.6% of hydrogen (in the form of Si-H).^{190,191}

The use of PECVD silicon-oxynitride films (deposited with SiH_4 , NH_3 , N_2 , and N_2O mixtures) as alternative passivation materials has also been investigated, since they exhibit nearly the same the moisture and sodium barrier characteristics of nitrides.

MULTILEVEL-INTERCONNECT TECHNOLOGY FOR VLSI AND ULSI 275



1. (a) Deposition of the first oxynitride layer, (b) SOG applied, (c) after SOG etch back, and (d) finished passivation process after second oxynitride and CVD oxide depositions.

Fig. 4-56 Using SOG film as a part of the passivation overcoat improves EPROM reliability.²⁵⁶ Reprinted with permission of Semiconductor International.

While not quite as good as those of nitrides, the characteristics are better than those of oxides.¹⁹² However, their stress is between that of APCVD oxide (tensile) and plasma nitride and oxide (compressive).¹⁹³ In addition, because the stress is a function of applied rf power, pressure, and bias, it is possible to optimize the stress by using bias. Ideally, a very low-stress dielectric oxynitride film can be formed that will still maintain good diffusion-barrier properties. (It is important to characterize the stress over the entire temperature range of operation to which the dielectric film will be subjected, since the stress can exhibit hysteresis effects. These may be due to structural changes in the film due to loss of material during heating.) Finally, it is reported that PECVD oxynitride films can be formed that contain considerably less H₂ (~one-half, in one report) than do PECVD nitrides.¹⁹⁴

Another, more recently adopted approach to the formation of passivation layers involves multilayer passivation coating. An initial coating of PECVD oxide is deposited, followed by a PECVD nitride. The oxide layer reduces the mechanical stress (~40%) and the hydrogen content of the passivation layer, while the nitride protects the device against handling, humidity, and mobile ions. This inorganic bilayer may be followed by a polyimide layer that is several microns thick (especially useful in automated bump-bonding processes) and a thick layer of silicone gel, or similar material, for cushioning and for void elimination during die bonding.

In a second variation of this technique applied to EPROMs, a sandwich oxynitride-(etchedback) SOG-oxynitride layer is first formed. This film is then covered with a low phosphorus-content CVD-oxide layer to complete the composite passivation film (Fig. 4-56). Sandwiching the SOG film between the two oxynitride layers reduces the occurrence of voids and seams in the passivation layer. These voids and seams caused degraded passivation film coverage, which in turn correlated with increased EPROM array failures after steam stressing.²⁵⁶

Table 4.5 Desired Properties of a Passivation-Layer Material

1. Provides good scratch protection to underlying circuit structures. In general, the thicker the passivation layer the better, subject to cracking and patterning restrictions.
 2. Impermeable to moisture, as moisture is one of the main catalysts for corrosion.
 3. Exhibits low stress, preferably compressive ($\sim 5 \times 10^8$ dynes/cm²).
 4. Conformal step coverage.
 5. High thickness uniformity.
 6. Impermeable to sodium atoms and other highly mobile impurities.
 7. Easily patterned.
 8. Good adhesion to conductors, as well as to the interlevel dielectric beneath the last level of metal.
-

4.9 SURVEY OF MULTILEVEL METAL SYSTEMS

As noted earlier, with NMOS IC technology it was possible to exploit the polysilicon layer as an extra level of interconnect, while in bipolar technology it was necessary to develop a two-level-metal system in order to obtain comparable flexibility of interconnect routing. As a result, the problems of two-level-metal systems (primarily, the implementation of low-temperature planarization techniques) first had to be tackled by bipolar IC manufacturers. When CMOS replaced NMOS as the dominant MOS VLSI technology, CMOS ICs also required a two-level-metal system, since the polysilicon could not perform the function of a local interconnect level as effectively as it had in NMOS (see chaps. 2 and 6). However, the polysilicon gate structures and the nonrecessed LOCOS field-oxide steps in CMOS created an even more difficult topography for two-level-metal CMOS systems than for bipolar systems.

4.9.1 Bipolar Double-Level-Metal Systems

The first example we present is that of a structure described in 1984 by Ghate et al. of Texas Instruments.¹⁹⁵ The Metal-1 pitch is 4 μm , and the Metal-2 pitch is 6 μm . Metal 1 is a 575-nm-thick bilayer film of Ti:W covered with Al:Cu, and the contact to silicon is made by self-aligned PtSi formed in the contact holes. Metal 2 is also a bilayer film of Ti:W and Al:Cu, 775 nm thick. The intermetal-dielectric layer is a 600-nm-thick PECVD oxide layer in which 1.1- μm vias are opened to allow contact between Metal 2 and Metal 1. No planarization of the intermetal dielectric was reported for this DLM process.

A second example, detailed by Bergeron et al. of IBM, uses a bilayer PECVD silicon-nitride/polyimide film as the intermetal dielectric. Smoothing of the underlying metal topography is achieved through use of the polyimide.¹⁹⁶ The Metal-1 pitch is 5 μm and the Metal-2 pitch is 7.0 μm . Metal 1 and Metal 2 are both Al:4%Cu films defined by lift-off, and Metal 2 is 2 μm thick. The bilayer intermetal-dielectric film is etched by

Exhibit 49

2017-2474, -2475, -2476, -2478, -2479, -2480, -2482, -2483,
2018-1050, -1079, -1080, -1081, -1082

**United States Court of Appeals
for the Federal Circuit**

SAMSUNG ELECTRONICS CO. LTD., MICRON TECHNOLOGY, INC.,
SK HYNIX, INC.

Appellants,

v.

ELM 3DS INNOVATIONS LLC,

Appellee.

*Appeals from the United States Patent and Trademark Office, Patent Trial and
Appeal Board in Inter Partes Review Nos. IPR2016-00386, IPR2016-00387,
IPR2016-00388, IPR2016-00390, IPR2016-00391, IPR2016-00393,
IPR2016-00394, IPR2016-00395, IPR2016-00708, IPR2016-00687,
IPR2016-00691, IPR2016-00770, and IPR2016-00786*

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April 20, 2018

CERTIFICATE OF INTEREST

Counsel for Appellee Elm 3DS Innovations LLC certifies the following:

1. The full name of every party represented by me is:

Elm 3DS Innovations LLC

2. The name of the real party in interest (if the party named in the caption is not the real party in interest) represented by me is:

None.

3. All parent corporations and any publicly held companies that own 10 percent or more of the stock of the party represented by me are:

None.

4. The names of all law firms and the partners or associates that appeared for the party now represented by me in the trial court or agency or are expected to appear in this Court (and who have not entered an appearance in this Court) are:

Robins Kaplan LLP (Cyrus A. Morton and Kelsey Thorkelson).

Carmichael IP, PLLC (James Carmichael).

5. The title and number of any case known to counsel to be pending in this or any other court or agency that will directly affect or be directly affected by this court's decision in the pending appeal:

The following cases pending before the Delaware District Court: *Elm 3DS Innovations LLC v. Samsung Electronics Co. Ltd.*, Civil Action No. 1:14-cv-01430-LPS, *Elm 3DS Innovations LLC v. Micron Technology Inc.*, Civil Action No. 1:14-cv-01431-LPS, and *Elm 3DS Innovations LLC v. SK hynix Inc.*, Civil Action No. 1:14-cv-01432-LPS.

Dated: April 20, 2018

/s/ William A. Meunier
William A. Meunier

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STATEMENT OF RELATED CASES

Appellee Elm 3DS Innovations LLC is unaware of any other appeal from the same proceedings below that is now before this Court or any other appellate court.

Elm is asserting the patents at issue in these consolidated appeals in the following district court cases pending in the Delaware District Court, and the Court's decisions in these consolidated appeals may affect these cases: *Elm 3DS Innovations LLC v. Samsung Electronics Co. Ltd.*, Civil Action No. 1:14-cv-01430-LPS; *Elm 3DS Innovations LLC v. Micron Technology Inc.*, Civil Action No. 1:14-cv-01431-LPS; and *Elm 3DS Innovations LLC v. SK Hynix Inc.*, Civil Action No. 1:14-cv-01432-LPS.

Elm previously filed a Complaint seeking judicial review of USPTO Director Michelle K. Lee's and the USPTO's authority to issue a rule declaring December 22-24, 2015 a Federal holiday within the District of Columbia. *Elm 3DS Innovations, LLC v. Lee*, No. 1:16-cv-01036-LO-IDD, Docket No. 1 (E.D. Va. Aug. 8, 2012). This rule affected whether there was a statutory bar to the Petitions in one or more of the IPRs that are the subject of this appeal, an issue that is not the subject of Appellants' appeals. The District Court dismissed the Complaint with prejudice on December 2, 2016, and Elm filed an appeal, *Elm 3DS Innovations, LLC v. Lee*, 17-1572 (Fed. Cir. 2017). On February 9, 2018, the

parties filed a stipulated motion to voluntarily dismiss the appeal, and the Federal Circuit issued an Order Dismissing Appeal on February 13, 2018.

INTRODUCTION

These consolidated appeals concern Appellants Samsung, Micron, and Hynix’s thirteen failed IPRs against a total of 105 claims across eleven different Elm Patents. Br. at 20.¹ The eleven Elm Patents are all related, share the same substantive specification, and generally concern improved three-dimensional integrated circuits.

In each of the thirteen IPRs, the Board upheld the validity of each challenged claim, finding that Appellants failed to prove the challenged patent claims were obvious. According to the Board, Appellants failed to prove that their proposed prior art combinations disclosed or made obvious at least two claim limitations: (1) a “substantially flexible” substrate or circuit, and (2) use of a “low-stress dielectric.” Each of the challenged claims includes at least one of these missing limitations, and most include both.

Substantially Flexible: All but two of the challenged claims require a “substantially flexible” semiconductor substrate or circuit. In the appealed IPRs, Appellants did not argue, much less prove, that the asserted prior art disclosed or made obvious substrates or circuits that were actually flexible, as opposed to rigid. Instead, Appellants, argued that certain references teach a “thinned” substrate or circuit, with no argument or evidence that the “thinned” element was in fact

¹ Cites to “Br. __” are to Appellants’ Opening Brief.

actually “substantially flexible.” But **thinned does not mean flexible**: as the Board found, a substrate or circuit can be thinned yet not be flexible. Appellants’ own expert admitted this fact, testifying that whether a substrate or circuit is flexible will depend on many factors other than mere thinning, including the materials used and the crystal orientation.

Appellants’ IPRs (and their current appeals) wholly depend on their claim construction argument that the claimed “substantially flexible” substrate or circuit should be construed to mean a “thinned” substrate or circuit, regardless of whether that substrate or circuit is actually flexible or rigid. The Board rejected Appellants’ construction as contrary to the ordinary meaning of “substantially flexible,” and inconsistent with the intrinsic record (which distinguished between rigid and flexible elements). The Board further found that Appellants’ construction would effectively read the limitation out of the claims: “[W]e agree with Patent Owner that ‘substantially flexible’ cannot be read out of the claims, which would result if [Appellants’] proposed construction were adopted.” Appx26.

The Board also found that Appellants did not prove that the prior art references taught the “substantially flexible” limitations under the Board’s “substantially flexible” construction, and on appeal Appellants do not challenge this finding of fact as unsupported by substantial evidence. Accordingly, Appellants’ appeals on these claims hinge solely on their assertion that the Board

incorrectly rejected Appellants’ “substantially flexible” claim construction. The Board’s decision should be affirmed because the Board’s construction is correct.

Low-Stress Dielectric: Both below and on appeal, Appellants admit that none of their primary references disclose the claimed low-stress dielectric, but they contend it would have been obvious to substitute the low-tensile-stress dielectric of the *Leedy ’695* reference for particular dielectrics in the primary references. This argument is based on Appellants’ assumption that different dielectrics are fungible and can be interchangeably substituted for one another without functional change.

The Board rejected this assumption as contrary to the evidence, finding that dielectrics used in semiconductor fabrication are not fungible. Rather, the Board found that circuit fabrication is exceptionally complex, and “different dielectric materials are layered throughout the fabrication process, with each dielectric layer having a different location, each being created at a different stage, and each serving a different purpose.” Appx51 (quoting Appx2385 ¶ 61). One dielectric cannot simply replace another because “dielectrics have different requirements, characteristics, and behaviors depending on how they are being used, where they are being used, and how they are made.” Appx63.

Appellants’ obviousness arguments and evidence ignored these complexities, and so the Board made findings of fact that Appellants have “not demonstrated by a preponderance of the evidence that one of ordinary skill in the

art would have a reason to combine the references in the manner proposed by [Appellants] to have arrived at the claimed invention and would have had a reasonable expectation of success of doing so.” Appx48. On appeal, **Appellants do not assert that either of these dispositive findings of fact is unsupported by substantial evidence.** This failure alone means that Appellants’ appeal must fail.

COUNTERSTATEMENT OF THE ISSUES

1. As to the Board’s determination that Appellants failed to meet the “substantially flexible” limitations, whether the Board correctly rejected Appellants’ construction of “substantially flexible” where the Board found that (1) Appellants’ construction was contrary to the term’s ordinary meaning, (2) the patentee did not specially define or disavow the scope of “substantially flexible,” and (3) Appellants’ proposed construction would render other express limitations meaningless in violation of the doctrine of claim differentiation.

2. As to the Board’s determination that Appellants failed to meet the “low stress dielectric” limitations, whether the Court should affirm the Board’s finding that Appellants did not demonstrate by a preponderance of the evidence that one of ordinary skill in the art would have had a motivation to combine the references in the manner proposed by Appellants where that finding of fact is

supported by substantial evidence and Appellants do not assert otherwise on appeal.

3. As to the Board’s determination that Appellants failed to meet the “low stress dielectric” limitations, whether the Court should affirm the Board’s finding that Appellants did not demonstrate by a preponderance of the evidence that one of ordinary skill in the art would have had a reasonable expectation of success in Appellants’ proposed combinations where that finding of fact is supported by substantial evidence and Appellants do not assert otherwise on appeal.

COUNTERSTATEMENT OF THE FACTS AND THE CASE

I. The Uses of Dielectrics in Integrated Circuit Fabrication

A Dielectrics Have Varying Properties and Functions

As the Board found, “the [challenged] patents generally relate to a three-dimensional structure (3DS) for integrated circuits.” Appx5. The materials used to fabricate integrated circuits are divided into three general categories based on their ability to allow the flow of electrical current: conductors, semiconductors, and dielectrics. Appx2375 ¶31; Appx12953-12954.

In a conductor (such as aluminum or copper), electric current can flow freely—it has high conductivity and low resistance. Appx2375 ¶32; Appx12953.

As implied by their name, semiconductors (such as silicon or germanium) are not as conductive as conductors, having both some conductivity and some resisting ability. Appx2375 ¶34; Appx12955.

Dielectrics are the opposite of conductors, as they impede the free flow of electrical current by having high resistance and low conductivity. Appx2375 ¶33; Appx12954. Examples of dielectrics include glass (such as silicon dioxide), ceramics (such as silicon nitride), and plastics. Appx2375 ¶33; Appx12954; Appx12960; Appx12997.

The properties and behaviors of a dielectric vary greatly depending on which of the many available methods is used to create and “layer” the dielectric in and on the integrated circuit. The chosen method of layering can alter the physical, chemical, and electrical characteristics of that dielectric, affecting at least the following properties of a dielectric: (1) dielectric constant (the dielectric’s ability to store electrical energy in an electric field), (2) breakdown field strength, (3) leakage, (4) surface conductance, (5) moisture absorption or permeability to moisture, (6) stress, (7) adhesion to aluminum, (8) adhesion to dielectric layers above or below, (9) stability, (10) etch rate, (11) permeability to hydrogen, (12) amount of incorporated electrical charge or dipoles, (13) amount of impurities, (14) quality of step coverage, and (15) thickness. Appx2393 ¶80; Appx12327. The Board found, and Appellants’ expert admitted, that one would need to consider

these and other properties when selecting a dielectric for use in an integrated circuit. *See* Appx60-61; Appx66-67; Appx15269-15280 at 77:13-88:6; Appx15283 at 91:8-12.

Which factors are the most important—and thus which techniques can and cannot be effectively used—will depend on what the dielectric is being used for within the integrated circuit, what materials the dielectric will adhere to, and which step in the integrated circuit manufacturing process the dielectric will be formed.

In a single integrated circuit, there are many different types of dielectrics, such as field oxides, gate oxides, pre-metal dielectrics, intermetal dielectrics, and passivation layers—each with their own unique purpose and requirements.

Appx2394 ¶81; Appx13078; Appx12357, Appx12438; Appx13621; Appx15270-15271 at 78:16-79:5, Appx15313 at121:4-10.

B. The Board Found that Appellants and Their Expert Dr. Franzon Did Not Support Appellants’ Assumption that Dielectrics are Fungible

The Board weighed the evidence and correctly rejected Appellants’ contentions that dielectrics can be easily and interchangeably substituted for one another, finding, for example, that Appellants’ “assertion that ‘dielectrics can be easily used in place of other dielectrics’ is not supported by the record.” Appx58. To the contrary, the Board found that “[w]ithout question, fabrication of integrated circuits is a complex technology” and “different dielectric materials are layered

throughout the fabrication process, with each dielectric layer having a different location, each being created at a different stage, and each serving a different purpose.” Appx49-51 (quoting Appx2385 ¶61).

In weighing and rejecting Appellants’ assertions about dielectrics, the Board determined that the evidence and testimony provided by Appellants and their expert, Dr. Franzon, were “conclusory,” lacking “explanation or analysis,” “does not support [Appellants’] contention,” had “minimal probative value,” and were “insufficient.” Appx53-56, Appx61; *see* Appx52-77. The Board found that Dr. Franzon’s testimony actually “weighs against” Appellants’ assertions concerning dielectrics, finding that Appellants’ contentions were “in marked contrast to Dr. Franzon’s testimony” and “counter to [Dr. Franzon’s testimony].” Appx60-61, Appx62-63, Appx66-67, Appx68, Appx69-70.

In contrast, the Board found Elm’s detailed discussion and evidence showing how different dielectrics fit into the overall integrated circuit manufacturing process, Appx1721-1748, to be “[m]ost helpful.” Appx50. The Board found Appellants’ “conclusory” and unsupported assertions concerning dielectrics “insufficient to overcome [Elm’s] well-reasoned and supported arguments.” Appx63-64, Appx52-77. The Board determined that Elm’s expert, Dr. Alexander Glew, explained and showed in detail that dielectrics are not fungible, but that instead (1) different dielectrics have different properties depending on factors such

as their method of formation; (2) different dielectrics have many different locations, uses, and purposes in an integrated circuit, each requiring a dielectric with a particular set of properties; and (3) different dielectrics would be individually assessed and chosen based on a long list of factors, including the purpose and location of the dielectric, the properties required by the particular purpose and location, and the properties and method of manufacture of the potential dielectric candidates. Appx49-51, Appx60-63, Appx66-73.

For example, the Board concluded that Dr. Glew’s testimony “is supported by his well-reasoned explanation, liberal citations to background references, and liberal citations to the asserted prior art.” Appx72, Appx69-73. It explained that “[n]o less than four prior art text books, ranging from 600 pages to nearly 850 pages and describing the fabrication of integrated circuits, have been provided as background references, principally in support of the declaration testimony of Alexander D. Glew, Ph.D., Patent Owner’s expert.” Appx49. The Board found that this testimony and detailed supporting evidence refuted Appellants’ allegations concerning dielectrics, finding “most helpful” the “explanation of different techniques for producing and layering dielectrics [Appx1734-1748], including growing dielectrics using thermal oxidation [Appx1736-1737], depositing dielectrics [Appx1737], and a comparison of thermal chemical vapor deposition

[Appx1738] with plasma-enhanced chemical vapor deposition [Appx1739].” Appx50-51.

Based on Dr. Glew’s “well-reasoned,” detailed and heavily supported explanations, the Board concluded that “fabrication of integrated circuits is complex technology” and “a typical fabrication of a semiconductor integrated circuit may include thousands of process steps.” Appx49, Appx51. Many of these steps concern the production and layering of different dielectrics for various applications and uses: “different dielectric materials are layered throughout the fabrication process, with each dielectric layer having a different location, each being created at a different stage, and each serving a different specific purpose.” Appx51, (quoting Appx2385 ¶61).

The Board found that different dielectrics have different properties depending on how they are formed, and that these different properties affect whether a particular dielectric is suitable for a particular location and function in the circuit. Appx50-51, Appx60-61, Appx66-67. The Board relied on the testimony of both experts on this issue, explaining, for example that Appellants’ own expert supported this finding:

- “[B]oth Dr. Franzon and Dr. Glew agree that dielectrics have different properties and different methods of forming dielectrics in integrated

circuit fabrication result in dielectrics having different properties.”

Appx60, Appx66.

- “Dr. Franzon testifies that ‘[t]here is quite likely a long list of factors that go into choosing between them [dielectrics], and an engineer would weigh those using his knowledge and skills.’” Appx67 (quoting Appx15270-15271 at 78:23-79:1).
- “Dr. Franzon further testifies that the variety of factors that an engineer would consider ‘can be very context specific’ and that ‘factors matter to different degrees, depending on the application, the materials, the other materials, the overall process flow, the overall process integration, the recipes, and so forth.’” *Id.* (quoting Appx15301-15302 at 109:19-110:3).

The Board thus concluded that the different dielectrics used and made in an integrated circuit are not interchangeable and easily swapped, but rather, “selecting a dielectric material involves choosing particular fabrication techniques that are part of an overall fabrication process for a particular integrated circuit.” Appx51, Appx61-63. Quoting Dr. Glew, the Board explained:

These dielectrics can be produced and layered using a large number of techniques, and **the particular technique used will greatly impact the properties of the resulting dielectric (and, therefore, its usefulness for any particular dielectric layer and purpose)**. For example, dielectric silicon dioxide layers can be produced and applied in hundreds of different ways, each resulting in a silicon dioxide with different properties (and potential uses).

Appx51 (emphasis added).

II. The Challenged Elm Patents

The eleven challenged Elm Patents² were issued to the late Glenn J. Leedy, who was President of Patent Owner Elm 3DS Innovations, LLC. Appx871. They are part of a family of related applications sharing the same substantive specification and are variously titled “Three Dimensional Structure Integrated Circuit,” “Three Dimensional Structure Memory,” and the like. *Id.*

A. The Challenged Elm Patents Disclose Novel Substantially Flexible Stacked Circuit Layers

As explained in the Elm Patents, integrated circuit manufacturers seek to increase the number of circuit devices in a single package while still allowing for increased processing speed and performance of the integrated circuit. Appx882 at 1:10-24, 2:44-63; Appx2403 ¶104. Other goals are lower fabrication costs and greater yields. Appx882 at 1:42-58, 2:44-63.

Traditionally, chip manufacturers achieved these goals by shrinking the size of the transistors used in these chips to increase the number of transistors on the same chip. The Elm Patents concern a different approach to reaching these goals—stacking integrated circuits on top of one another (a “Three Dimensional Structure”). *E.g., id.* at 2:21-34; Appx2404 ¶106.

² U.S. Patent Nos. 7,193,239; 7,474,004; 7,504,732; 8,410,617; 8,841,778; 8,629,542; 8,653,672; 8,796,862; 8,907,499; 8,928,119; 8,993,570.

Because it was difficult to make such stacked integrated circuits without an unacceptable amount of defects and cracking, the Elm Patents describe a novel structure that features flexible (rather than rigid) semiconductor substrates, including the use of low-stress dielectrics to help achieve the desired flexibility.

I. Substantially Flexible Substrates

The Elm Patents describe a novel structure for stacked integrated circuits, including flexible semiconductor substrates that could be stacked atop each other. *E.g.*, Appx883 at 3:5-10, 4:22-24; Appx884 at 6:16-29; Appx885 at 7:14-23, 8:34-44; Appx886 at 10:28-67; Appx2405 ¶107. The Elm Patents describe making individual flexible semiconductor substrate circuit layers (essentially a flexible integrated circuit die) and then stacking at least one such flexible semiconductor substrate on top of another integrated circuit. Appx884 at 6:16-29; Appx885 at 7:14-23, 8:34-44; Appx886 at 10:28-67; Appx2405 ¶107.

One such flexible semiconductor substrate circuit layer is depicted in Figure 4, reproduced below:

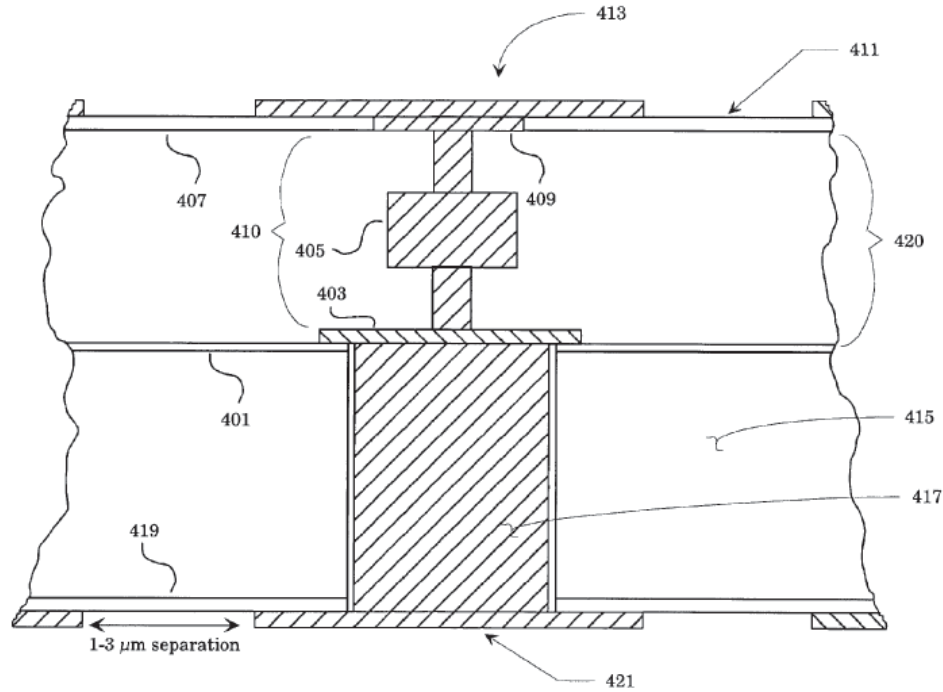


Figure 4

2. Low Tensile Stress Dielectrics

The use of the low tensile stress dielectric allows a free-standing semiconductor substrate circuit layer to flex when released from a rigid support substrate. The use of such a low tensile stress dielectric was against the conventional wisdom, which held that tensile dielectrics should not be used for a number of reasons. Appx2406 ¶110. The conventional wisdom was that:

- intermetal dielectrics should be in compressive rather than tensile stress “since dielectric films under tensile stress exhibit more of a tendency to crack” Appx12356;
- intermetal dielectrics should have moderate compressive stress in order to balance out the moderate tensile stress of the metals:

“moderate compressive stress [is] desirable to partially compensate tensile stress in the metal interconnects, thus avoiding film cracking”

Appx14270; and

- “[l]ow density tensile films tend to pick up water and form SiOH groups. This causes degradation of electrical and mechanical properties.” Appx1103.

Even the textbook written by Appellants’ expert warned against using a tensile stress dielectric rather than a compressive one because “[t]he compressive stress in the film cancels the intrinsic tensile stress of metal films and produces a flat substrate.” Appx2407 ¶111; Appx14587.

B. The Challenged Claims

These consolidated appeals concern 105 claims from eleven different Elm Patents. Br. at 20. All but two of these claims (’778 claims 1 and 14) require a substrate and/or integrated circuit that is “substantially flexible.” For example, challenged independent claim 58 of the ’570 patent requires a circuit and semiconductor substrate that are thinned, polished, and “substantially flexible,” reading in part:

wherein at least one of the first integrated circuit and the second integrated circuit is **thin and substantially flexible** and comprises a **thinned, substantially flexible** monocrystalline semiconductor substrate of one piece made from semiconductor wafer **thinned** from a backside thereof by at least one of abrasion, etching and parting, and

subsequently **polished** or smoothed to form a polished or smoothed surface.

Appx1164 at 19:66-20:18 (emphases added).

All but nine of the challenged claims include the “low stress dielectric” limitation.³ For example, the ’570 patent’s challenged claim 60 depends from the foregoing claim 58, and further requires:

60. The apparatus of claim 58 wherein the at least one of the first integrated circuit layer and the second integrated circuit layer is formed with a **low stress dielectric material**, wherein the low stress dielectric material is at least one of a silicon dioxide dielectric material and an oxide of silicon dielectric material and **has a tensile stress of less than 5×10^8 dynes/cm²**.

Id. at 20:23-29 (emphases added).

C The Prosecution Histories

Thin and flexible are not the same thing. During the prosecution of Application Serial No. 12/497,652, in response to the Examiner suggesting that *Bertin* (one of the two primary references Appellants assert on appeal) taught a substantially flexible substrate because it taught a thinned substrate, Elm explained that a thinned substrate is not necessarily substantially flexible:

[B]oth *Bertin* and *Kato* fail to teach or suggest that at least one of the first and second circuit layers is substantially flexible, and the substrate thereof is a substantially flexible substrate. Two features are

³ The claims that do not include a low-stress dielectric limitation are the ’239 Patent claims 60, 67, 70, and 77; ’542 Patent claims 1 and 44; ’239 Patent claims 60 and 67; and ’119 Patent claim 1. All of these claims include one or more “substantially flexible” limitations.

required to achieve substantial flexibility. One is that the semiconductor material must be sufficiently thin, e.g., 50 microns or less. *Bertin* and *Kato* are believed to satisfy this requirement. The other is that the dielectric material used in processing semiconductor material must be sufficiently low stress. Otherwise, substantial flexibility is defeated. Appx16038.

...

For a circuit layer to be substantially flexible, Applicant has found that the dielectric material must have a low tensile stress, for example, 5×10^8 dynes/cm² tensile. *Kato* does not contain any teaching or suggestion of the circuit layer being flexible. Similarly, *Bertin* does not contain any such teaching or suggestion. Appx10314.

Elm also emphasized that a thinned substrate that remains attached to and cannot be removed from a rigid carrier is not substantially flexible:

Furthermore, both *Bertin* and *Kato* illustrate and describe stacked integrated circuits formed on a **rigid** carrier. At no point is any portion of the stacked integrated circuit allowed to be substantially flexible, suggesting that the stacked integrated circuit is in fact **inflexible**.

...

In the case of the present stacked integrated circuit, by contrast, the dielectric stress is low in order to allow the IC layers to be thinned without subsequently being subject to stress-related bowing.

Appx16039 (emphasis in original).

The Examiner agreed that flexible and thin are not equivalent:

***Bertin* also fails to specifically teach wherein at least one of the first and second circuit layers is substantially flexible.** In particular, since *Bertin* teaches forming the insulation portion of the vertical interconnects by thermal oxidation resulting in high stress insulation layer, it fails to teach a flexible circuit layer (Note: the flexible circuit layer must possess a low stress dielectric in order for it to be flexible).

Appx15404 (emphases added).

III. The IPRs

The Board instituted the thirteen IPRs that are the subject of these appeals on numerous grounds, each of which proposes combining one primary reference (*Bertin*, *Yu*, *Hsu*, or *Finnila*) with the *Leedy* '695 reference (and, in some instances, one or more additional references). Appellants waived any appeal based on the *Hsu* and *Finnila* references, having failed to argue those grounds in their opening brief. The following thus addresses only the *Leedy* '695, *Bertin*, and *Yu* references.

A. The Relevant Asserted References

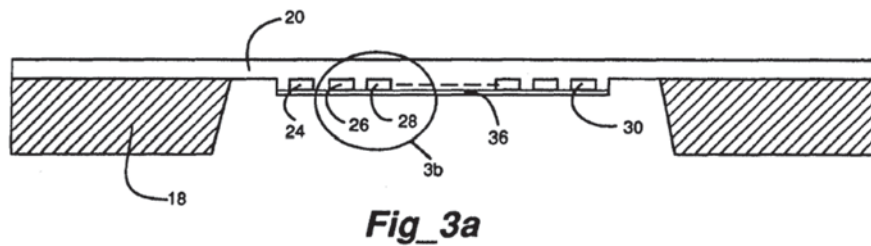
I. *Leedy* '695

Leedy '695 issued to the same inventor as the challenged patents, is titled “Membraned dielectric isolation IC fabrication,” and was incorporated by reference into the Elm Patents. *Leedy* '695 discloses a low tensile stress dielectric membrane, which Appellants argue would have been obvious to substitute for specific dielectrics in the *Bertin* and *Yu* references.

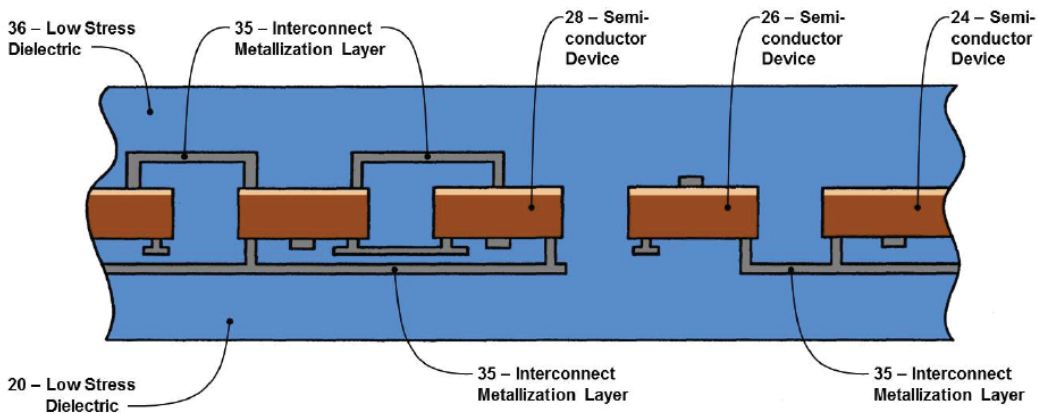
Leedy '695 discloses producing and using a freestanding low tensile stress dielectric membrane, which was disclosed in the context of an “approach to IC fabrication [that] falls under the generic industry-established title known as Dielectric Isolation (DI).” Appx2408 ¶114; Appx1294 at 1:21-23. Dielectric isolation is an alternate technique for producing integrated circuits that is distinctly different from—and was considered inferior to—the semiconductor substrate

techniques used in the Elm Patents, in the *Bertin* and *Yu* references, and in most integrated circuits in the market today. Appx1294 ¶114; Appx12173; Appx2408.

Leedy '695's approach to dielectric isolation is to produce circuits within a free-standing, flexible membrane, as opposed to on a traditional rigid semiconductor substrate. Appx1294 at 1:7-8. *Leedy '695* calls these “membranes,” which, as illustrated in *Leedy '695* Figure 3a, is “typically framed or suspended or constrained at its edges by a substrate frame or ring” like a drum. Appx1262-1265.



As illustrated in annotated Figure 3 below, each membrane does not include a semiconductor substrate but instead encapsulates tiny silicon transistor “islands” in a sea of low tensile stress dielectrics. Appx1236 at Figure 3B, Appx1295 at 3:23-33, Appx1305 at 24:20-32.



a. Leedy '695's Low Tensile Stress Dielectric

The *Leedy '695* low stress dielectric:

- is created using Plasma-Enhanced CVD;
- is in tensile, not compressive, stress; and
- cannot withstand temperatures much higher than approximately 400°C.

Plasma-Enhanced CVD ("PECVD"): Notably, the *Leedy '695* low tensile stress dielectrics are created at low temperatures using plasma-enhanced CVD. Appx2410 ¶118; Appx1299 at 11:29-31. *Leedy '695* explains that "these membranes were produced on Novellus Systems Inc. (San Jose, Calif.) Concept One dielectric deposition equipment," Appx1299 at 11:29-31, which, as Appellants' expert Dr. Franzon admits, was a commonly available plasma-enhanced CVD system. See Appx16558 ¶ 34, Appx16589 ¶88 (citing Appx10999-11006). At the time, Novellus was using PECVD to create compressive stressed films because, unlike tensile films, "films deposited with an intrinsic compressive stress are stable and are even able to withstand boiling water without increasing the

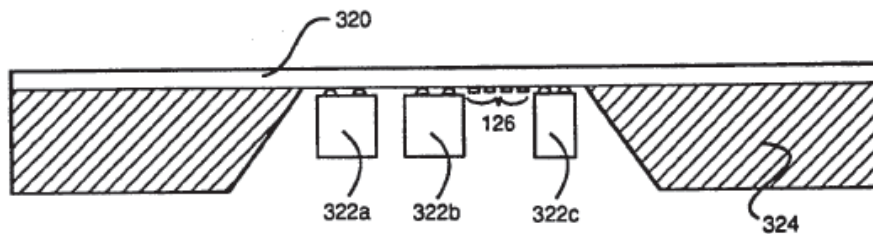
SiOH content or adsorbing water.” Appx2410 ¶118; Appx11003. Despite the problems inherent with tensile films, *Leedy* ’695 uses PECVD to create **only** tensile films. Appx2410 ¶118. This is because tensile films, despite their shortcomings, are needed to provide structure to freestanding flexible membranes, which lack a substrate that would normally provide that needed structure. *Id.*; Appx1296 at 5:68-6:5.

Low Tensile Stress: *Leedy* ’695 required the free-standing membrane to be in tensile stress to give that freestanding membrane structure and help it hold its shape within its frame. Appx2410-2411 ¶119; Appx1296 at 5:68-6:5.

Inability To Withstand High Temperatures: *Leedy* ’695 describes that the temperature threshold of its low tensile stress dielectric is not much higher than 400°C: the “membrane is able to withstand a wide range of IC processing techniques and processing temperatures (of at least 400°C) without noticeable deficiency in performance.” Appx1294 at 2:37-40; Appx2411 ¶120. Even absent this disclosure, one of ordinary skill would understand that a dielectric deposited by PECVD at 400°C (like the *Leedy* ’695 dielectric) would not be able to withstand temperatures much above deposition temperature without changing its form to compressive stress. Appx2411 ¶120; Appx10643.

b. Applications of the *Leedy* '695 Circuit Membrane

Leedy '695 describes several applications for its circuit membranes, including an “electrical interconnect.” *E.g.*, Appx1229 (Abstract), Appx1306 at 25:15-26:68, Appx1316-1317 at 45:49-47:9. The Abstract states that the membrane can be used as an “electrical interconnect for conventional integrated circuit die bonded thereto.” Appx1229. In this application, the membrane is manufactured to encapsulate interconnects rather than active circuitry. Appx1306 at 25:15-42; Appx2412 ¶122. As illustrated in Figure 13a below, various individual integrated circuit die 322a, 322b, and 322c (which were already fabricated using conventional fabrication methods) can be attached to the *Leedy* membrane and thereby connected to one another using that membrane’s internal interconnects. Appx1306 at 25:33-41, 25:58-62; Appx2412 ¶122.



Fig_13a

This membrane is not an intermetal dielectric in the fabrication of an integrated circuit on a semiconductor substrate; rather, it is being used in the packaging phase to connect and hold various integrated circuits that have already

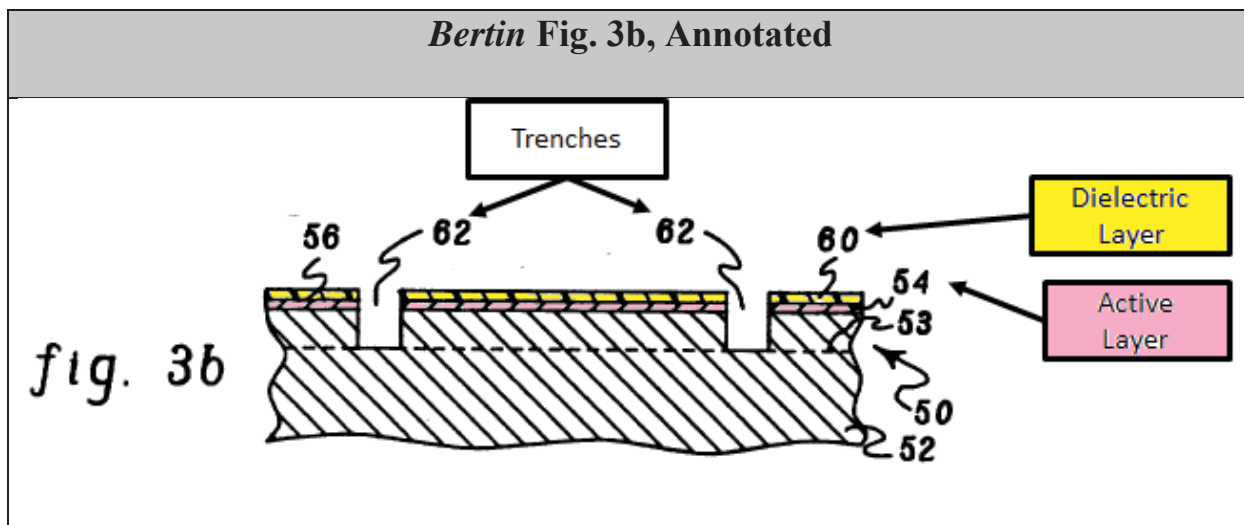
been fabricated through conventional means. *See, e.g.*, Appx1306 at 25:33-41, 25:58-62.

2 Bertin

Bertin describes stacked “semiconductor chips.” Appx1215 at 1:7-15.

a. Bertin’s “dielectric layer 60” Was Grown Using Thermal Oxidation and Could Not Be Produced and Layered Using Plasma-Enhanced CVD

As depicted in *Bertin*’s Figure 3b reproduced below, *Bertin* describes a “dielectric layer 60.” The instituted *Bertin* grounds were based on Appellants’ argument that it was obvious to replace *Bertin*’s dielectric layer 60 with the *Leedy* ’695’s low-tensile-stress PECVD dielectric.



Below, Appellants did not attempt to identify the type or use of *Bertin*’s “dielectric layer 60.” However, a person of ordinary skill in the art would understand that dielectric layer 60 is a high-purity silicon dioxide grown via thermal oxidation at high temperatures during the active circuit formation phase of

fabrication. Appx2414 ¶127. First, *Bertin* specifies that dielectric layer 60 is “grown,” not deposited, and is a silicon dioxide. *Id.*; Appx1216 at 3:60-62. Based on this description, one of ordinary skill in the art would know that *Bertin*’s dielectric layer 60 was produced and layered using thermal oxidation, which converts oxygen-exposed silicon into a silicon dioxide dielectric layer, and that this “growth” process requires temperatures over 1000° C. Appx2414 ¶127; Appx13042-13043.

Second, if a silicon dioxide dielectric contacts active circuit components, the silicon dioxide must be high-purity to not damage the circuit components. Appx2415-2416 ¶128; Appx13098-13101; Appx13639. Therefore, because *Bertin* describes the silicon dioxide dielectric layer 60 as being grown directly over active silicon components (such as a silicon source, gate, or drain), one of ordinary skill also would understand that the dielectric layer 60 needs to be highly pure, which again would mean it was grown at high temperatures (that is, over 1000° C) using thermal oxidation. Appx2415-2416 ¶128; Appx1216 at 3:60-4:3; Appx13098-13101; Appx13639, Appx13724.

And just as one of ordinary skill in the art would understand that dielectric layer 60 was grown using thermal oxidation during the active circuit fabrication phase, one would also understand that it could not be deposited using a PECVD such as that described in *Leedy* ’695. Appx2416-2417 ¶130. PECVD cannot be

used to deposit a high-purity silicon dioxide dielectric over active circuit components because the resulting dielectric would not (1) be sufficiently pure; (2) have the ability to adhere sufficiently to the semiconductor wafer; and (3) be able to withstand high temperatures of the remaining steps without changing its form. *Id.*; Appx15466-15467. PECVD also cannot be used because positive ions present in the plasma can strike and damage the silicon wafer and the exposed active components in and on its surface. Appx2416-2417 ¶130; Appx13724.

b. *Bertin*'s "dielectric layer 60" Is Removed from the Chip

Bertin's dielectric layer 60 is removed during subsequent processing, and is not part of the final integrated circuit. Appx2417 ¶131. *Bertin* describes that dielectric layer 60 is formed on top of active layer 54, then high-aspect ratio trenches 62 are formed, trench walls are oxidized, and the trenches are filled with conductor 64. Appx1216 at 4:11-33. To complete the device, *Bertin* shows that dielectric layer 60 is replaced with an oxidation/connecting metallization layer 63. Appx2416-2417 ¶131; Appx1209 at figure 3c and 3d. It is common to create a dielectric layer and subsequently remove it during fabrication. Appx2417 ¶131; Appx13088. Because dielectric layer 60 is removed during processing, it is not included in the final package. Appx247 ¶131.

c. Bertin Does Not Disclose or Suggest a Substantially Flexible Substrate or Circuit

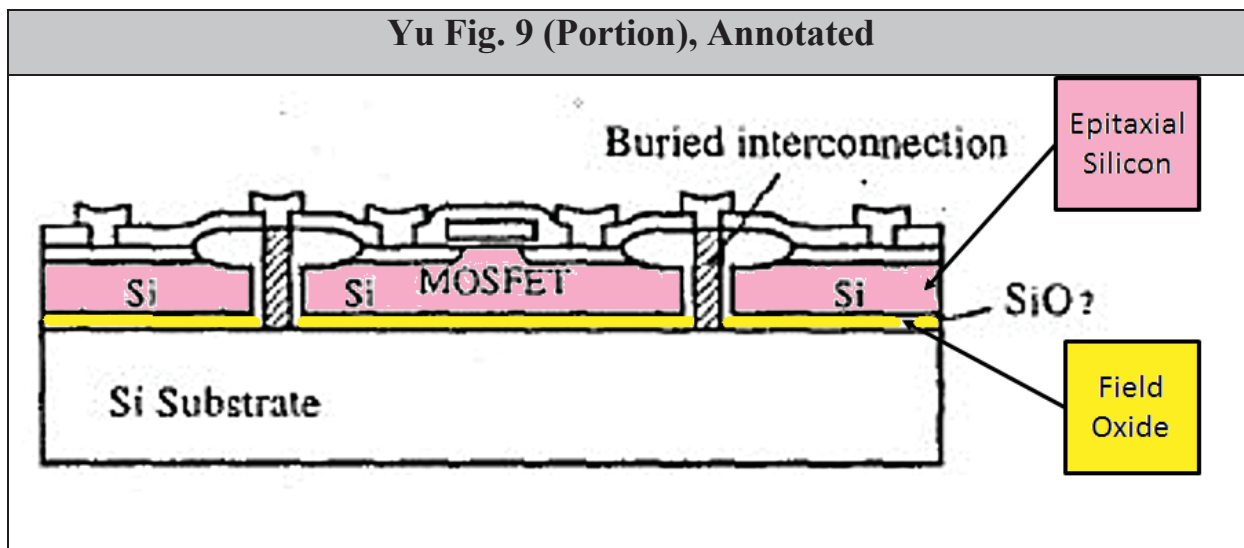
Under the ordinary meaning of “flexible,” *Bertin* does not disclose or suggest a flexible (bendable) substrate or circuit, and Appellants did not argue or attempt to show otherwise below. Instead, Appellants argued only that *Bertin* discloses a substrate that has been thinned, without any regard for whether the substrate or the resulting circuit is in fact flexible.

3. Yu

Yu describes a microvision system for analyzing image data in real time. Appx1347. *Yu* describes that the microvision system is fabricated using “micro-bumps” to bond a thinned wafer to a thick wafer. Appx1347, Appx1350.

a. Yu’s “field oxide” Was Grown Using Thermal Oxidation and Could Not Be Produced and Layered Using Plasma-Enhanced CVD

Yu’s Figure 9 reproduced below depicts a layer of “SiO₂,” which *Yu* describes as a layer of “field oxide.” Appx1350. The instituted *Yu* grounds were based on Appellants’ argument that it was obvious to replace this field oxide with the *Leedy* ’695’s low-tensile-stress PECVD dielectric.



Appellants did not address that the layer of silicon dioxide (“SiO₂”) on which they rely is described in *Yu* as a “field oxide,” nor did they otherwise attempt to identify the type or use of this particular silicon dioxide dielectric. Appx2418 ¶134; Appx1350 (“The buried interconnections are formed by depositing n⁺ poly-Si into trenches which are formed **through the field oxide.**”). One of ordinary skill would understand that, by definition, a silicon dioxide field oxide is grown directly on the “Si Substrate” at high temperatures (above 800°C) using thermal oxidation. Appx2418 ¶134; Appx13042-13043.

This is confirmed by the fact that *Yu* illustrates the silicon dioxide field oxide as directly atop the silicon substrate. Appx2419 ¶135; Appx1350 at Fig. 9. Because it is touching the silicon substrate, the silicon dioxide “field oxide” must have high purity, which again means a person skilled in the art would understand it

was grown at high temperatures using thermal oxidation. Appx2419 ¶135; Appx13098-13101; Appx13643.

A person of ordinary skill also would understand that the *Yu* “field oxide” must be able to withstand high temperatures such as those used in the active circuit formation phase of fabrication. Appx2419. For example, *Yu* describes that a **thermal** CVD process, which is performed at temperatures in excess of 800°C, is used to deposit silicon on top of the field oxide to form the epitaxial silicon layer. *Id.*; Appx13725; Appx13318; Appx1350. Trenches are then formed through the field oxide and filled with n+ doped poly-silicon, which is performed at temperatures in excess of 600°C. Appx2419 ¶136; Appx1350; Appx13325-13326. Circuit components (*e.g.*, MOSFET source, drain, and gate) are formed and Ohmic contacts are created using a silicide process, which is performed at temperatures in excess of 700°C. Appx2419 ¶136; Appx13332, Appx13441. The field oxide thus must, without changing its relevant properties, withstand these subsequent processes including thermal CVD of epitaxial silicon, deposition of poly-silicon, and formation of Ohmic contacts via a silicide process, all of which exceed the 400°C limit of dielectrics deposited by PECVD as disclosed in *Leedy* ’695. Appx2419 ¶136.

And just as one of ordinary skill in the art would understand that *Yu*’s “field oxide” was grown using thermal oxidation during the front end of line phase, one

would also understand that it could not be deposited using a PECVD such as that described in *Leedy '695* because the resulting dielectric would not (1) be sufficiently pure; (2) have the ability to adhere sufficiently to the silicon substrate; nor (3) be able to withstand high temperatures of the remaining steps without changing its relevant properties. Appx2420 ¶137; Appx15466-15467. Plasma-Enhanced CVD also cannot be used because positive ions present in the plasma can strike and damage the surface of the silicon substrate. Appx2420 ¶137; Appx13724.

b. *Yu* Does Not Disclose or Suggest a Substantially Flexible Substrate or Circuit

Under the ordinary meaning of “flexible,” *Yu* does not disclose or suggest a flexible substrate or circuit, and Appellants did not argue or attempt to show otherwise. Instead, Appellants argued only that *Yu* discloses a substrate that has been thinned, without any regard for whether the substrate or the resulting circuit is in fact flexible.

B. The Board’s Final Written Decisions

In the Final Written Decisions for the thirteen IPRs at issue here, the Board upheld the validity of each challenged claim, finding that Appellants failed to prove the claims were obvious under any of the instituted grounds, including the ones that are the subject of these appeals. According to the Board, Appellants

failed to prove that their proposed prior art combinations disclosed or made obvious both the “substantially flexible” and the “low-stress dielectric” limitations.

I. The Board Found that Appellants Failed to Satisfy the “Substantially Flexible” Limitations Because They Only Attempted to Prove These Limitations Under the Wrong Claim Construction

In its Final Written Decisions, the Board noted that Appellants’ argument that the prior art disclosed the “substantially flexible” limitations were based solely on Appellants’ proposed claim constructions, which the Board rejected in favor of Patent Owner Elm’s proposed construction.

The Board considered and rejected Appellants’ proposed “substantially flexible” constructions, which differed depending on which element was described, a substrate or a circuit:

[Appellants] construe[] the term “substantially flexible semiconductor substrate” [as] “a semiconductor substrate that has been thinned to a thickness of less than 50 μm and subsequently polished or smoothed.”

* * *

[Appellants propose] that a “substantially flexible integrated circuit” or “circuit substrate” is “an integrated circuit [circuit substrate] having a semiconductor substrate that has been thinned to a thickness of less than 50 μm and subsequently polished or smoothed, and where the dielectric material used in processing the semiconductor substrate must have a stress of 5×10^8 dynes/cm² tensile or less.”

E.g., Appx23 (citations omitted).

The Board rejected Appellants’ different constructions of flexible—which would have covered things that were rigid as opposed to flexible—in favor of the

term's ordinary meaning. The Board found that Appellants' constructions were contrary to the term's ordinary meaning, the patentee did not specially define or disavow the scope of "substantially flexible," and Appellants' proposed construction would render other express limitations meaningless in violation of the doctrine of claim differentiation. The Board also noted that unlike Appellants' proposed constructions, Patent Owner Elm's "substantially flexible" construction was the same for all claims. Appx381, Appx383.

The Board also found that Appellants did not attempt to satisfy the "substantially flexible" limitations under the ordinary meaning construction proposed by Elm:

Tellingly, [Appellants do] not address in [their] Reply how the claims as Patent owner construes them would have been obvious over the asserted prior art. Rather, although [Appellants] argue[] that the prior art shows a particular thinning of a substrate, [Appellants do] not argue that the combination of [the prior art] would have conveyed to one of ordinary skill in the art a substrate that is (largely) able to bend without breaking, which is required by the construction of substantially flexible semiconductor substrate.

Appx42.

The Board also found that a thinned element is not necessarily flexible: "thickness is not the only factor that determines whether a material is flexible. After all, a thicker piece of rubber is more flexible than a thinner potato chip." Appx44. The Board further found that Appellants' own expert, Dr. Franzon, had

admitted that thinness alone cannot determine flexibility. Appx45-46; Appx2192

¶73. Specifically, Dr. Franzon stated:

In the context of semiconductor processing, the flexibility of a semiconductor substrate depends on a number of factors, including for example, the type of semiconductor substrate (e.g., while silicon and gallium arsenide are both semiconductors, they have a different elastic moduli), the crystal orientation of the material (e.g., {100} and {101} silicon wafers have different elastic moduli) and the physical dimensions of the substrate (e.g., width and thickness). The flexibility of more complex structure, such as an integrated circuit, that comprises multiple different materials (e.g., semiconductors, dielectrics, conductors, must take into account additional factors, including the type and dimensions of all the materials in that structure.

Appx2191-2192 at ¶71; Appx43-44. But at Appellants' request, Dr. Franzon did not consider whether any substrates or circuits were in fact flexible under these required factors, and instead only applied and considered Appellants' proposed constructions which did not include any actual flexibility requirements. Appx44-45; Appx2192 at ¶72.

The Board thus found that Appellants failed to prove that any of the proposed combinations satisfied the "substantially flexible" limitations found in all but two of the challenged claims.

2 The Board Found that Appellants Failed to Satisfy the "Low Stress Dielectric" Limitation Because They Did Not Prove that the Proposed Combinations Were Obvious

The Board recognized that Appellants' "low tensile stress" arguments hinged on their assertions that it would have been obvious to substitute the

dielectric material of *Leedy '695* for certain dielectrics in *Bertin* and *Yu*. The Board addressed and weighed the evidence presented on this issue in over 35 pages of detailed analysis, finding as fact that Appellants failed to meet their burden of proof on this issue:

At the heart of this issue is whether [Appellants have] demonstrated by a preponderance of the evidence a reason why one of ordinary skill in the art would have substituted the dielectric material of *Leedy '695* and would have had a reasonable expectation of success of doing so. This substitution would require substituting at least some portions of *Leedy '695*'s fabrication techniques in which integrated circuit elements are formed on a low tensile stress dielectric membrane for some of the conventional fabrication process steps of [the primary reference *Bertin* or *Yu*].

For the reasons that follow, **we determine that [Appellants have] not demonstrated by a preponderance of the evidence that one of ordinary skill in the art would have a reason to combine the references in the manner proposed by [Appellants] to arrive at the claimed invention and would have had a reasonable expectation of success of doing so.**

Appx47-48 (emphases added). As discussed below in more detail, these findings of fact are supported by substantial evidence. Appellants do not assert otherwise on appeal.

SUMMARY OF THE ARGUMENT

Substantially Flexible: All but two of the challenged claims ('778 patent claims 1 and 14) require a substrate and/or an integrated circuit that is “substantially flexible.” The Board correctly found that Appellants did not prove

that any of the prior art references taught these “substantially flexible” limitations under the Board’s “substantially flexible” construction, and Appellants do not challenge this finding of fact as unsupported by substantial evidence. Accordingly, Appellants’ appeal on these claims hinges on the contention that the Board incorrectly rejected Appellants’ “substantially flexible” claim construction. The Board’s construction, not Appellants’, is the correct one.

The Board correctly concluded that the intrinsic evidence showed that the patentee distinguished between rigid and flexible elements and, therefore, it would be improper to construe “substantially flexible” to cover rigid, rather than flexible, elements as Appellants proposed. Instead, the Board construed “substantially flexible” to have its ordinary meaning, (“largely able to bend without breaking”). It based this construction on its findings that Appellants failed to prove that the patentee disclaimed this ordinary meaning or specially defined “substantially flexible.”

There is no dispute that Appellants’ proposed constructions are **not** the ordinary meaning of “substantially flexible.” Neither of Appellants’ constructions contains any requirement that the structure be in any way flexible as opposed to rigid—materials can be thinned, polished or smoothed, and still be rigid rather than flexible, and Appellants neither argued nor presented any evidence to the contrary. In fact, they proved the opposite, with their own expert testifying that flexibility

depended on a number of other factors, such as the material, crystal orientation, and dimensions. Appx2191-2192 ¶71; Appx43-44.

The Board agreed, and accordingly, found that Appellants' constructions effectively read "substantially flexible" out of the challenged claims. *See* Appx26 ("[W]e agree with the Patent Owner that 'substantially flexible' cannot be read out of the claims, which would result if [Appellants'] proposed construction were adopted.").

Low Stress Dielectric: Appellants based their "low stress" arguments solely on their assertions that it would have been obvious to substitute the low tensile stress dielectric material of *Leedy '695* for certain dielectrics in *Bertin* and *Yu*, but the Board correctly found that Appellants had failed to meet their burden of proof on this issue because Appellants did not:

- (1) "demonstrate by a preponderance of the evidence that one of ordinary skill in the art would have a reason to combine the references in the manner proposed by [Appellants] to have arrived at the claimed invention" or
- (2) "demonstrate by a preponderance of the evidence that one of ordinary skill in the art ... would have had a reasonable expectation of success of doing so."

Appx48.

Because it was Appellants' burden to prove both of the foregoing elements of obviousness, findings of fact on each of these issues independently defeats Appellants' obviousness and "low stress dielectric" arguments. Moreover, each of

these findings of fact was supported by substantial evidence, and critically, on appeal, Appellants do not argue otherwise. They could not reasonably do so in the face of the Board’s findings that the evidence and testimony provided by Appellants and their expert, Dr. Franzon, were “conclusory,” lacking “explanation or analysis,” “does not support [Appellants’] contention,” have “minimal probative value,” and were “insufficient” as issues of law rather than fact. Appx53, Appx54, Appx55, Appx56, Appx61; *see* Appx52-77.

Unable to address and refute these controlling (and dispositive) findings of fact, Appellants try to create a *de novo* question of law, arguing that the Board (1) ignored key arguments and evidence, Br. at 63, and (2) required Appellants to prove combinability of unclaimed elements. Br. at 58. None of these complaints is accurate or legal error. The Board did not **ignore** Appellants’ arguments and evidence, the Board **rejected** them, and did so only after considering and evaluating their arguments and evidence (or lack thereof) and finding them wanting and unpersuasive. Likewise, the Board did not add in additional claim limitations but considered the very factors that Appellants and their expert conceded a POSITA would need to consider in evaluating whether and how to combine the references as Appellants proposed.

Appellants are attempting to rehash their rejected factual arguments while avoiding the insurmountable substantial evidence standard by recasting their

factual arguments as legal ones. Substantial evidence indisputably supports the Board’s findings of fact that Appellants failed to meet their obviousness burdens, and that alone defeats their appeal.

ARGUMENT

I. Standard of Review

This Court reviews the Board’s underlying factual findings for substantial evidence, and its legal conclusions *de novo*. *Redline Detection, LLC v. Star Envirotech, Inc.*, 811 F.3d 435, 449 (Fed. Cir. 2015) (citation omitted).

As to claim construction, the ultimate interpretation of a term is a question of law that is reviewed *de novo*. *Teva Pharms. USA, Inc. v. Sandoz, Inc.*, 135 S.Ct. 831, 841 (2014). The subsidiary factual findings that form the “evidentiary underpinnings” of claim construction, however, are “fact-finding [and] must be reviewed for clear error on appeal.” *Id.*

As to obviousness, Appellants had the burden of proving, for each proposed combination, that a skilled artisan would have had reason to combine the teaching of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success from doing so. *Par Pharm., Inc. v. TWI Pharms., Inc.*, 773 F.3d 1186, 1193 (Fed. Cir. 2014). The Board’s determinations that Appellants failed to prove the required motivation and

the required reasonable expectation of success are each findings of fact that are reviewed for substantial evidence. *See, e.g., Redline Detection, LLC*, 811 F.3d at 449; *Par Pharm., Inc.*, 773 F.3d at 1333.

II. Appellants Did Not Prove that the Prior Art Disclosed or Made Obvious the “Substantially Flexible” Limitations

All but two of the challenged claims (the ’778 patent claims 1 and 14) require a substrate and/or an integrated circuit that is “substantially flexible.” The Board correctly found that Appellants did not prove that any of the prior art references taught these “substantially flexible” limitations because (1) the correct construction of “substantially flexible” is “largely able to bend without breaking”; and (2) Appellants did not argue or present any evidence under this construction, but instead only attempted to prove whether substrates were thinned and polished, which their own expert admitted was not sufficient to determine flexibility.

▲ The Board Correctly Construed “Substantially Flexible” to Have Its Ordinary Meaning

The Board correctly concluded that “substantially flexible” should be construed to mean “largely able to bend without breaking.” It based this construction on its findings that (1) the applicable ordinary meaning of “substantially flexible” is “largely able to bend without breaking”; and (2) Appellants failed to prove that the patentees either disclaimed this ordinary meaning or specially defined “substantially flexible.”

Because the challenged Elm Patents have differing expiration dates, some were construed under the district court construction standard, while others were construed under the BRI standard. *See, e.g.*, Appx3-4; Appx379; Appx444-445; Appx509; Appx554-555; Appx604; Appx635; Appx705; Appx777; Appx817; Appx843. Regardless, the Parties and the Board agreed that the applicable test and construction was the same under both approaches. Appx3-4; Appx379; Appx444-445; Appx509; Appx554-555; Appx604; Appx635; Appx705; Appx777; Appx817; Appx843; Hearing at 13:8-13.

Under either standard, there is “a ‘heavy presumption’ that a claim term carries its ordinary and customary meaning.” *Starhome GmbH v. AT&T Mobility LLC*, 743 F.3d 849, 857 (Fed. Cir. 2014). Because of this presumption, under either standard a claim term may be construed contrary to its ordinary meaning only “under two circumstances: ‘(1) when a patentee sets out a definition and acts as [its] own lexicographer, or (2) when the patentee disavows the full scope of a claim term either in the specification or during prosecution.’” *Aventis Pharma S.A. v. Hospira, Inc.*, 675 F.3d 1324, 1330 (Fed. Cir. 2012) (quoting *Thorner v. Sony Computer Entm’t Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012)); *Hill-Rom Servs., Inc. v. Stryker Corp.*, 755 F.3d 1367, 1371 (Fed. Cir. 2014).

Each of these exceptions requires a showing of **clear** intent. As to the first: “‘To act as its own lexicographer, a patentee must clearly set forth a definition of

the disputed claim term other than its plain and ordinary meaning’ and ‘must clearly express an intent to redefine the term.’” *Hill-Rom*, 755 F.3d at 1371 (quoting *Thorner*, 669 F.3d at 1365). “It is not enough for a patentee to simply disclose a single embodiment or use a word in the same manner in all embodiments, the patentee must ‘clearly express an intent’ to redefine the term.” *Thorner*, 669 F.3d at 1365 (quoting *Helmsderfer v. Bobrick Washroom Equip., Inc.*, 527 F.3d 1379, 1381 (Fed. Cir. 2008)).

As to the second, there must be a “clear disavowal of claim scope.” *Aventis*, 675 F.3d at 1330. “A statement in the prosecution history can only amount to a disclaimer if the applicant ‘clearly and unambiguously’ disavowed claim scope.” *Toshiba Corp. v. Imation Corp.*, 681 F.3d 1358, 1367 (Fed. Cir. 2012) (internal citations omitted). Similarly, the patentee cannot disavow claim scope in the specification absent a “clear intention to limit the scope using words or expressions of manifest exclusion or restriction, which is necessary to further narrow the claim language.” *Linear Tech Corp. v. Int’l Trade Comm’n*, 566 F.3d 1049, 1058 (Fed. Cir. 2009).

In either case, the party wishing to alter the meaning of a clear claim term bears the burden of overcoming the presumption that the ordinary and accustomed meaning controls by establishing the required clear special definition or disclaimer. *K-2 Corp. v. Salomon S.A.*, 191 F.3d 1356, 1363 (Fed. Cir. 1999). “Absent

disclaimer or lexicography the plain meaning of the claim controls.” *Toshiba Corp.*, 681 F.3d at 1369.

Appellants argue without basis that the Board applied the wrong claim construction standard, Br. at 43-44, but the Board explicitly stated and followed the foregoing correct test:

A claim term may be construed contrary to its ordinary meaning only “under two circumstances: ‘(1) when a patentee sets out a definition and acts as [its] own lexicographer, or (2) when the patentee disavows the full scope of a claim term in the specification or during prosecution.’” *Aventis Pharm. S.A. Hosipra, Inc.*, 675 F.3d 1324, 1330 (Fed. Cir. 2012) (quoting *Thorner v. Sony Computer Entm’t Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012)); *Hill-Rom Sers., Inc. v. Stryker Corp.*, 755 F.3d 1367, 1371 (Fed. Cir. 2014).

Appx380.

Appellants’ argument that the Board violated this Court’s *Phillips* decision by favoring extrinsic evidence over intrinsic evidence, Br. at 42-44, also is without basis. As the Board itself explained and applied:

Specifically, **we apply the principles set forth in *Phillips v. AWH Corp.***, 415 F.3d 1303, 1312 (Fed. Cir. 2005). “In determining the meaning of the disputed claim limitation, **we look principally to the intrinsic evidence** of record, examining the claim language itself, the written description, and the prosecution history, if in evidence.” *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Ci. 2006) (citing *Phillips*, 415 F.3d at 1312-17).

Extrinsic evidence, such as expert testimony and dictionary definitions, can be helpful but is “less significant than the intrinsic record in determining the legally operative meaning of claim language. *Phillips* 415 F.3d at 1317 (quoting *C.R. Bard, Inc. v. U.S. Surgical Corp.*, 388 F.3d 858, 862 (Fed. Cir. 2004) (internal quotation

marks omitted)). Also, **extrinsic evidence is to be considered within the context of the intrinsic evidence.** *Id.*

Appx379-380 (emphases added).

I. The Board Correctly Found the Ordinary Meaning of “Substantially Flexible” in the Context of the Elm Patents Is “Largely Able to Bend Without Breaking”

The Board examined both the intrinsic and extrinsic evidence to determine that the ordinary meaning and correct construction of “substantially flexible is “largely able to bend without breaking.” Appx25-39.

Appellants argue—with no support or citation to the record—that “**rather than applying the ordinary meaning in the context of the intrinsic evidence, the Board started with a general-purpose dictionary for the definition in the abstract and only looked to the intrinsic evidence to determine if it redefined or disclaimed the dictionary definition.” Br. at 43 (emphases added). The record shows otherwise.**

First, regarding context, Appellants ignore that the Board explicitly analyzed “substantially flexible” in the context of the intrinsic evidence, finding that “[f]or the reasons set forth below, we determine that ‘substantially flexible’ in the context of the challenged patent[s] means ‘largely able to bend without breaking.’” Appx25. The Board then addressed the intrinsic record in ten pages of detailed analysis. Appx25-29, Appx32-37.

Second, Appellants’ (unsupported) representation that the Board “started with a general-purpose dictionary” is not only irrelevant, it is incorrect. The very first sentence of the Board’s analysis states: “We begin our analysis with the language of the claims.” Appx25. The Board then identified and analyzed the language of the challenged claims and determined that the “language of the claim[s], however, does not contextually define ‘substantially flexible.’” Appx26. Appellants do not challenge this finding, nor have they ever presented any argument or analysis to the contrary, either below or on appeal. *See, e.g.*, Br. 36-48. Indeed, Appellants do not analyze **any** contextual claim language, and their only relevant argument concerning the claim language is that the language “substantially flexible” should effectively be read out of the claims: in the words of the Board, “we agree with the Patent Owner that ‘substantially flexible’ cannot be read out of the claims, which would result if [Appellants’] proposed construction were adopted.” Appx26.

And the Board did not stop its intrinsic evidence analysis with the claim language: “We next turn to the written description.” Appx27. Citing, quoting, and explaining various passages from the specification, the Board concluded—and Appellants do not address—that the written description distinguishes between “flexible” on the one hand, and “rigid” on the other:

We understand these specification passages to mean that “flexible” and “rigid” have distinct meanings. And, moreover, we understand

the passages to suggest that flexible and rigid are opposite characteristics of semiconductor substrates.

Appx28. The Board’s understanding of the written description is confirmed by the prosecution histories, wherein the patentee made clear that something that is rigid or inflexible is not substantially flexible. For example:

- “At no point is any portion of the stacked integrated circuit [of *Bertin*] allowed to be substantially flexible, suggesting that the stacked integrated circuit is in fact **inflexible**.” Appx16039 (emphasis in original).
- “Moreover, given the minute dimensions of such an island [of semiconductor material], the island of semiconductor itself **is not flexible as claimed; rather, it is rigid**.” Appx15397 (emphasis added).

Contrary to Appellants’ assertions, only after considering the intrinsic evidence did the Board turn to the extrinsic evidence: “Next, we consider extrinsic evidence to discern how one of ordinary skill in the art would have understood the term ‘substantially flexible’ in the context of the patent specification.” Appx29.

The Board relied on *Phillips* to determine that in this particular circumstance, a general purpose dictionary was helpful in understanding the meaning of

“substantially flexible” in the context of the Elm patents:

After considering the arguments and weighing evidence presented by both parties, including evidence concerning the complexity of integrated circuit fabrication, we determine a general-purpose dictionary is helpful in understanding the meaning of the term

“substantially flexible” in the context of the challenged claims and written description.

Appx30. In so finding, the Board noted and relied in part on Appellants’ failure to offer any evidence on this issue, including any from its expert, Dr. Franzon:

Appellants do “not rely on testimony of [their] expert Dr. Franzon as to how one of ordinary skill in the art would have understood ‘substantially flexible semiconductor substrate’ in view of the specification.” Appx30-31.

Consistent with the intrinsic evidence’s distinction between flexible and rigid, and the unopposed evidence from contemporaneous dictionaries such as the *Oxford American Dictionary of Current English*, the applicable ordinary meaning of “flexible” is “able to bend without breaking; pliable,” while the applicable ordinary meaning of “substantial” is “true in large part.” Appx15365.

Accordingly, the Board correctly adopted Elm’s proposed construction: “[W]e determine that the ordinary meaning of ‘substantially flexible’ in the context of the challenged patent is ‘largely able to bend without breaking.’” Appx31.

2. Appellants’ Proposed Constructions of “Substantially Flexible” Are Not Based on the Ordinary Meaning in the Context of the Elm Patents and their Prosecution Histories

Appellants did not propose or argue for any ordinary meaning for “substantially flexible.” Instead, Appellants argued that “substantially flexible” was specially defined in the specification and related prosecutions. *E.g.*, Appx24-

25. Thus, there is no dispute that Appellants' proposed constructions are not the ordinary meaning of "substantially flexible."

Appellants proposed that "substantially flexible" be construed two different ways in the same exact claims depending on usage:

(1) "thinned to 50 microns or less and polished" (with respect to semiconductor substrates) or

(2) "thinned to 50 microns or less, polished, and processed with dielectric material having a stress of 5×10^8 dynes/cm or less" (with respect to integrated circuits).

See, e.g., Appx23-24.

Contrary to the written descriptions' and prosecution histories' distinctions between flexible and rigid, neither of Appellants' constructions contains any requirement that the material actually be in any way flexible. The Board recognized as a fact that something can be thinned, polished or smoothed and still be rigid rather than flexible, and Appellants neither argued nor presented any evidence to the contrary. In fact, they proved the opposite, with their own expert testifying that flexibility of something like the silicon substrate of an integrated circuit die depended on a number of other factors, such as the material, crystal orientation, and dimensions:

In the context of semiconductor processing, the flexibility of a semiconductor substrate depends on a number of factors, including for

example, the type of semiconductor substrate (e.g., while silicon and gallium arsenide are both semiconductors, they have a different elastic moduli), the crystal orientation of the material (e.g., {100} and {101} silicon wafers have different elastic moduli) and the physical dimensions of the substrate (e.g., width and thickness). The flexibility of more complex structure, such as an integrated circuit, that comprises multiple different materials (e.g., semiconductors, dielectrics, conductors, must take into account additional factors, including the type and dimensions of all the materials in that structure.

Appx2191-2192 ¶71; Appx45-46.

The Board agreed, finding, for example, that “‘thinning’ does not equate to flexibility” and “thickness is not the only factor that determines whether a material is flexible. After all, a thicker piece of rubber is more flexible than a thinner potato chip.” Appx43-44. Accordingly, the Board correctly found that Appellants’ constructions effectively read “substantially flexible” out of the challenged claims: “[W]e agree with the Patent Owner that ‘substantially flexible’ cannot be read out of the claims, which would result if [Appellants’] proposed construction were adopted.” Appx26.

In addition to being inconsistent with the written description, prosecution histories, and the “substantially flexible” limitation itself, the Board further found that Appellants’ proposed constructions also were inconsistent with other limitations in the claims, violating the doctrine of claim differentiation. For example:

- Challenged '570 Patent claim 86 requires a “substantially flexible integrated circuit” that also “has a thickness of one of 50 microns or less.” Appx1165 at 22:53-55. If “substantially flexible” means “less than 50 microns,” then there is no need to specify that the claimed integrated circuit is both “substantially flexible” **and** “has a thickness of 50 microns or less.” Appellants’ proposed constructions render the latter limitation superfluous and meaningless, and are thus incorrect under the doctrine of claim differentiation. *See, e.g., Digital-Vending Servs. Int’l LLC v. Univ. of Phoenix, Inc.*, 672 F.3d 1270 (Fed. Cir. 2012); *Cat Tech. LLC v. TubeMaster, Inc.*, 528 F.3d 871, 885 (Fed. Cir. 2008); *Phillips*, 415 F.3d at 1314.
- Challenged '570 Patent claim 1 specifies that the “substantially flexible” substrate must also be “thinned” and “polished or smoothed.” Appx160-1161 at 12:63-13:15. Again, if “substantially flexible” means thinned and polished as Appellants argue, there would be no need to claim that the substrate was “thinned” and “polished” in addition to being “substantially flexible.”
- Challenged '570 Patent claims 60, 61, and 67 require not only one or more substantially flexible circuit layers but also a dielectric having a “tensile stress of less than 5×10^8 dynes/cm².” Appx1164 at 20:23-29,

20:30-33, 20:59-64. But if substantially flexible is defined as having a dielectric material having a stress of 5×10^8 dynes/cm² or less as Appellants contend, then these additional limitations requiring that a substantially flexible circuit also include such a dielectric would be redundant and meaningless.

In contrast, all of the foregoing limitations make perfect sense if “substantially flexible” is given its ordinary meaning: the limitation “substantially flexible” requires that the substrate actually be substantially flexible (as opposed to rigid), while the remaining limitations further specify how such flexibility may be achieved when the dielectric is in tensile stress (such as by thinning and polishing).

3. The Board Correctly Found that “Substantially Flexible” Was Not Clearly and Unambiguously Specially Defined

Appellants argue that the unopposed ordinary meaning should not apply here because “substantially flexible” was specially defined. This Court has been explicit that the standard for departing from the plain meaning of a term is high, and that the party wishing to alter the meaning of a clear claim term bears the burden of overcoming the presumption that the ordinary and accustomed meaning controls by establishing that a clear and unambiguous special definition. *See K-2 Corp.*, 191 F.3d at 1363. “To act as its own lexicographer, a patentee must clearly set forth a definition of the disputed claim term other than its plain and ordinary meaning” and “clearly express an intent to redefine the term.” *Thorner*, 669 F.3d

at 1365 (citations omitted). This standard is “exacting” and the Board correctly concluded that Appellants did not meet it. *See id.* at 1366. Flexible is not a difficult term to understand, and this Court has recognized that the specification plays a more limited role where claim language has so “plain a meaning on an issue” that it “leav[es] no genuine uncertainties on interpretive questions relevant to the case.” *Straight Path IP Grp., Inc. v. Sipnet EU S.R.O.*, 806 F.3d 1356, 1361 (Fed. Cir. 2015).

Appellants have not pointed to any language purporting to define “substantially flexible” or any statement by patentee indicating a clear intent to redefine that term. Instead, Appellants point to a specification passage explaining an example of how a “substantially flexible” substrate may be achieved in one embodiment:

2A. Grind the backside or exposed surface of the second circuit substrate to a thickness of less than 50 μm and then polish or smooth the surface. The thinned substrate is now a substantially flexible substrate.

Appx1159 at 9:14-17. Nothing in this or other passages indicates that patentee has provided a special definition for “substantially flexible” or that patentee intended “substantially flexible” to include things that are rigid (even if thinned and polished). “[I]t is improper to read limitations from a preferred embodiment described in the specification – even if it is the only embodiment – into the claims

absent a clear indication in the intrinsic record that the patentee intended the claims to be so limited.” *Dealertrack, Inc. v. Huber*, 674 F.3d 1315, 1327 (Fed. Cir. 2012) (quoting *Enzo Biochem, Inc. v. Applera Corp.*, 599 F.3d 1325, 1342 (Fed. Cir. 2010), *cert. denied on other grounds*, 131 S. Ct. 3020 (2011)). Accordingly, the Board found that Appellants failed to prove the alleged special definition: “[T]his passage describes a way to achieve a substantially flexible substrate [and we] discern no clear intent to set forth a definition of the claim term.” Appx33. For that same reason, the Board correctly concluded that the patentee’s reference to this passage in response to an indefiniteness argument “was not a clear disavowal of claim scope.” Appx35-36.

Appellants’ additional citations to the prosecution history likewise indicates that the patentee is describing **a way of achieving** substantial flexibility, **not redefining** the term to include things that are in fact rigid rather than substantially flexible:

A substantially flexible semiconductor substrate **may be achieved by** grinding until considerably thin, **for example** to a thickness of less than 50 microns, and polishing the resulting surface.

Appx10313; Appx10316 (emphases added). The Board therefore correctly found that Appellants have “not shown that Patent owner, during examination . . . defined ‘substantially flexible’ and made a clear and unmistakable disavowal of claim scope.” Appx37.

Appellants’ argument that substantially flexible can include something that is rigid also contradicts the prosecution histories. During prosecution, the patentee made it clear that something that is rigid or inflexible is not substantially flexible:

- “At no point is any portion of the stacked integrated circuit [of *Bertin*] allowed to be substantially flexible, suggesting that the stacked integrated circuit is in fact **inflexible**.” Appx16039 (emphasis in original).
- “Moreover, given the minute dimensions of such an island [of semiconductor material], the island of semiconductor itself is not flexible as claimed; rather, it is rigid.” Appx15397.

B. The Board Correctly Found that Appellants Did Not Prove that the Prior Art Disclosed or Made Obvious the “Substantially Flexible” Limitations

That the Board correctly construed the “substantially flexible” limitations to require a substrate and/or circuit that is “largely able to bend without breaking” should be the end of the inquiry. The Board found as fact that Appellants did “not demonstrate[] by a preponderance of the evidence that the” asserted art showed substantially flexible substrates or circuits under this construction. *E.g.*, Appx42-48. **Substantial evidence supports this finding and, critically, Appellants do not assert otherwise on appeal.** *See, e.g.*, Br. at 50-51.

And any belated attempt to argue that this finding was not supported by substantial evidence would be both untimely and contrary to the record.

I. Appellants Never Argued in Their Briefs to the Board that the Prior Art Satisfied the Construction of “Substantially Flexible” Adopted by the Board

As the Board correctly found, Appellants did not even try to satisfy the Board’s “substantially flexible” construction, but instead only attempted to prove invalidity under their own, incorrect construction that merely required only thinning and not **any** flexibility:

Tellingly, [Appellants do] not address in [their] Reply how the claims as Patent Owner construes them would have been obvious over the asserted prior art. Rather, although [Appellants] argue[] that the prior art shows a particular thinning of a substrate, [**Appellants do not argue that the combination of [the prior art] would have conveyed to one of ordinary skill in the art a substrate that is (largely) able to bend without breaking**, which is required by the construction of substantially flexible semiconductor substrate.

Appx42 (internal citations omitted) (emphasis added).

Appellants do not assert that this finding was clearly erroneous and, in fact, the Board’s finding was based on substantial evidence. For example, in Appellants’ *Bertin* Ground against the ’570 Patent, they argued that the combination of *Bertin* and *Poole* satisfies the “substantially flexible” limitation “as construed by the Petitioner” because that combination results in a substrate 52 that is thinned to 20 micrometers and subsequently polished or smoothed. Appx9006-9007. Appellants did not argue, much less prove, that this proposed *Bertin* and *Poole* combination results in a semiconductor substrate that is actually

substantially flexible (*e.g.*, largely able to bend without breaking). Appx9005-9007. Their *Bertin* Grounds thus necessarily failed under the correct construction.

Appellants' Instituted *Yu* Grounds likewise addressed this limitation only under Appellants' incorrect claim construction, for example, arguing that "*Yu*'s 'thinned wafer' is a 'substantially flexible semiconductor substrate' under Petitioner's interpretation of that claim term because it is first ground and then polished to thin the wafer to 30 μm ." Appx1557. Appellants did not argue, much less prove, that *Yu* discloses a semiconductor substrate that is actually substantially flexible (*e.g.*, largely able to bend without breaking as opposed to rigid), and these *Yu* Grounds too necessarily failed under the correct construction. Appx1556-1557.

2 The Board Properly Rejected Appellants' Attempt to Raise a New Argument Related to the "Substantially Flexible" Limitation at Oral Argument

Although Appellants did not attempt to satisfy the correct construction of "substantially flexible" in their Petitions and Reply Briefs, they improperly attempted to do so for the first time at the oral argument. Raising this new argument at that late stage was improper under PTAB's rules, which explicitly state that "[n]o new evidence or arguments may be presented at the oral argument." Federal Register, Vol. 77, No. 157 at 48768.

In any event, the Board found that this untimely new argument was unsupported by any evidence, a finding that Appellants do not now assert was

unsupported substantial evidence. As the Board summarized, Appellants’ “counsel asserted at the oral hearing that the asserted art shows bendability in addition to thinning because the asserted ‘prior [art] mirrors the prior [preferred] embodiment.’” Appx44 (quoting Appx2005 at 175:21-176:2). In rejecting this argument, the Board found that Appellants’ “counsel [did not] identify with particularity any portion of the asserted prior art that ‘mirrors’ the preferred embodiment in the challenged patent, nor even identify what preferred embodiments [Appellants’] counsel had in mind as being mirrored by the prior art.” Appx45.

The Board also found that counsel’s contention at oral argument that their expert, Dr. Franzon, testified in support of this theory was belied by Dr. Franzon’s testimony, in which he stated that he was told to only apply **Appellants’ construction**, and he did not apply the Board’s and Elm’s construction or otherwise consider whether the prior art disclosed flexibility as opposed to thinness. Appx44-45 (quoting Appx2192 ¶72). The Board further found that Dr. Franzon testified that thinning alone was **not** sufficient to establish flexibility because flexibility depended on a number of additional factors, none of which he or the Appellants considered or presented evidence on. Appx43-44. As the Board summarized: “[T]hickness is not the only factor that determines whether a material is flexible. After all, a thicker piece of rubber is more flexible than a thinner potato

chip.” Appx44. Appellants’ expert agreed, declaring that flexibility depended on a number of other factors, such as the material, crystal orientation, and dimensions:

In the context of semiconductor processing, the flexibility of a semiconductor substrate depends on a number of factors, including for example, the type of semiconductor substrate (e.g., while silicon and gallium arsenide are both semiconductors, they have a different elastic moduli), the crystal orientation of the material (e.g., {100} and {101} silicon wafers have different elastic moduli) and the physical dimensions of the substrate (e.g., width and thickness). The flexibility of more complex structure, such as an integrated circuit, that comprises multiple different materials (e.g., semiconductors, dielectrics, conductors), must take into account additional factors, including the type and dimensions of all the materials in that structure.

Appx2191-2192 ¶71; Appx45-46.

Based on this thorough examination of the evidence—and Appellants’ marked lack thereof—the Board concluded that Appellants’ arguments concerning the thinness disclosed in the prior art were insufficient to carry their burden:

In essence, [Appellants] argue[] that [the prior art] discloses a semiconductor substrate that has been thinned to less than 50 μm and so discloses a substantially flexible substrate as required by the claims. A preponderance of the evidence establishes, however, that ... mere **thinning is not the same as flexibility—being able to bend without breaking**. We find that “thinning” does not equate to “flexibility” because thinning does not account for material and the processing steps acting on those materials.

Appx42-43 (emphasis added). Appellants do not and cannot contend that this finding of fact is unsupported by substantial evidence, including the evidence of their own expert. *See, e.g.*, Br. at 50-51.

Nor do Appellants contend or attempt to show a lack of substantial evidence supporting the Board’s finding that “we are not persuaded that [Appellants have] demonstrated by a preponderance of the evidence that the prior art embodiments mirror the preferred embodiment in the challenged patent and, therefore, the prior art shows bendability.” Appx45.

Accordingly, Appellants’ “substantially flexible” appeal must rise and fall on whether the Board correctly rejected Appellants’ attempt to read “substantially flexible” out of the challenged claims. For the reasons discussed above, the Board correctly construed term “substantially flexible” to have its ordinary meaning. The Board’s determination that Appellants did not prove the unpatentability of any of the substantially flexible claims (all challenged claims except ’778 patent claims 1 and 14) should be affirmed.

III. The Board Correctly Found that Appellants Did Not Prove that the Prior Art Disclosed or Made Obvious the “Low Stress Dielectric” Limitations

All but nine of the challenged claims include a “low stress dielectric” limitation. The Board recognized that Appellants’ “low tensile stress” arguments hinged on their assertions that it would have been obvious to substitute the dielectric material of *Leedy* ’695 for certain dielectrics in *Bertin* and *Yu*, and correctly concluded that Appellants had failed to meet their burden of proof on this issue because Appellants did not:

demonstrate by a preponderance of the evidence that [(1)] one of ordinary skill in the art would have a reason to combine the references in the manner proposed by [Appellants] to have arrived at the claimed invention and [(2)] would have had a reasonable expectation of success of doing so.⁴

Appx48.

Because it was Appellants' burden to prove both of the foregoing elements of obviousness, each of these findings of fact independently defeats Appellants' obviousness and "low stress dielectric" arguments. However, both of these findings of fact were supported by substantial evidence, and critically on appeal.

Appellants do not argue otherwise.

Having not addressed or attempted to refute these controlling (and dispositive) findings of fact, Appellants try to create a de novo question of law, arguing that the Board (1) ignored key arguments and evidence, Br. at 63, and (2) required Appellants to prove combinability of unclaimed elements, Br. at 58. For the reasons discussed below, each of these attempts to identify a legal error in the Board's unchallenged findings of fact fails.

⁴ Even if all elements of a claim are found in the prior art, the factfinder "must consider the factual questions of [(1)] whether a person of ordinary skill in the art would be motivated to combine those references, and [(2)] whether in making that combination, a person of ordinary skill would have had a reasonable expectation of success." *Dome Patent L.P. v. Lee*, 799 F.3d 1372, 1380 (Fed. Cir. 2015).

A Appellants’ Fail to Argue that the Board’s Conclusions about a Motivation to Combine or an Expectation of Success Are Unsupported by Substantial Evidence

Whether a person of ordinary skill in the art would have been motivated to combine *Leedy* ’695 with *Bertin* or *Yu*, to form the patented invention in the challenged patents, and would have had a reasonable expectation of success in doing so, are factual findings reviewed for substantial evidence. *Par Pharm., Inc.*, 773 F.3d at 1196. While acknowledging this legal standard (Br. at 32-33), Appellants do not argue, much less prove, that the Board’s decision is unsupported by substantial evidence. Instead, they just reargue the same assertions and evidence already rejected by the Board below (Br. at 51-58), which is not a basis for reversing the Board. *See Eli Lilly & Co. v. Teva Parenteral Meds., Inc.*, 845 F.3d 1357, 1372-73 (Fed. Cir. 2017) (simply rearguing facts fails to raise reversible error regarding a finding that a skilled artisan would not have been motivated to combine references).

Appellants’ failure to even argue a lack of substantial evidence supporting the Board’s critical findings of fact waives that issue and dooms the appeal of the “low stress dielectric” limitations. *See Fed. R. App. P. 28(a)(6), 28(c); Becton Dickinson & Co. v. C.R. Bard, Inc.*, 922 F.2d 792, 800 (Fed. Cir. 1990) (“An issue not raised by an Appellant in its opening brief . . . is waived.”). But even absent

waiver, Appellants could not establish that the Board’s findings are unsupported by substantial evidence.

I. Substantial Evidence Supports the Board’s Finding that Appellants Failed to Prove the Required Motivation to Combine

The Board devotes more than twenty-six pages to explaining in detail the evidence and analysis supporting its finding that Appellants have “not demonstrated by a preponderance of the evidence that one of ordinary skill in the art would have a reason to combine the references in the manner proposed by [Appellants] to have arrived at the claimed invention.” Appx48; Appx48-58, Appx65-77, Appx81-85. The evidence cited by the Board is not merely substantial, it is overwhelming.

a. Appellants Did Not Adequately Support Their Conclusory Arguments Concerning “Improvements”

In response to Appellants’ argument that a person of skill in the art would have been motivated to combine the references because they all concerned “the improvement” of integrated circuits, the Board explained that “[Appellants’] testimony is conclusory without explaining what types of improvements in 3D integrated circuits would have motivated one of ordinary skill in the art to make [Appellants’] proposed substitution of *Leedy* ’695’s dielectric in [the primary reference].” Appx53. The Board then addressed and weighed Appellants’ evidence purportedly supporting this argument and found it lacking. Appx52-55,

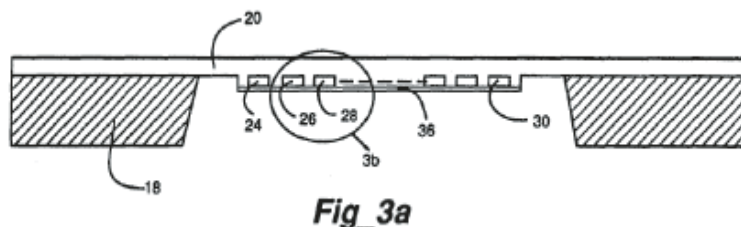
Appx81-84. Regarding the testimony of Appellants' expert, Dr. Franzon, the Board found it conclusory and overall lacking substance:

- “[Appellants] merely cite[] to three paragraphs of [their expert’s] declaration testimony without further discussing or explaining the relevance of the testimony” and the expert’s “testimony does not sufficiently support [Appellants’] position.” Appx53.
- “Dr. Franzon’s testimony ... is conclusory.” Appx54.
- “Dr. Franzon’s single sentence assertion lacks specifics as to what those similar challenges are, and he only provides a list of citations to various references without further explanation or analysis as to how those citations support his assertion. We weigh Dr. Franzon’s testimony accordingly.” *Id.*
- Dr. Franzon’s testimony that a person of ordinary skill in the art “*could have used* the techniques is not sufficient to support [Appellants’] contention that one of ordinary skill in the art would have had reason to combine the references as proposed.” Appx55 (emphasis in original).

b. Appellants Did Not Adequately Support Their Conclusory Arguments Concerning *Leedy '695*

The Board also weighed and found insufficient Appellants' evidence purportedly supporting their argument that “*Leedy '695* provides express

motivations for modifying [*Bertin's* or *Yu's*] process and device to incorporate *Leedy '695's* low tensile stress dielectric material.” Appx55-56. As the Board found, and as Appellants acknowledged in their Petition, the reason why *Leedy '695* uses a tensile stress dielectric is that its dielectric material is a “free standing membrane.” Appx56. Elm’s expert described how *Leedy '695's* free standing flexible dielectric membranes were typically suspended between an outer frame like a drum, as shown in Fig_3a below:



Appx2408-2409. The Board understood that this free-standing membrane is unlike the conventional rigid substrates disclosed by *Bertin* and *Yu*. Appx56; see Appx82 (rejecting combination with *Yu* for substantially the same reasons as for *Bertin*).

As a result, the Board found Appellants’ arguments and evidence of little probative value because *Leedy '695* advocated using the low tensile stress dielectric material for a reason—the creation of a novel low-stress **free-standing dielectric membrane**—not present in the *Bertin* and *Yu* references, which did not

feature or need such a membrane because they used dielectrics in conventional manners with a conventional rigid substrate:

[Appellants'] reliance on reasons that low tensile stress is important for *Leedy '695's* process for constructing *Leedy '695's* low tensile stress [free standing] dielectric **membranes** has **minimal probative value** in supporting [Appellants'] contention regarding using *Leedy '695's* dielectric material in *Bertin '754's* dielectric layer 60 and interconnect insulators created by *Bertin '754's* process relying on a **conventional, rigid substrate**. This is because **[Appellants do] not explain sufficiently why or how the importance of low tensile stress for *Leedy '695's* process for constructing low tensile stress dielectric membranes bears on why one of ordinary skill in the art would have substituted *Leedy '695's* dielectric material for *Bertin '754's* dielectric layer 60 and interconnect insulators.**

Appx56 (emphases added). The Board also found that Appellants' assertions that *Leedy '695* teaches the importance of using low tensile stress dielectrics generally were unfounded: Appellants "characterize *Leedy '695's* teaching to be about low tensile stress dielectrics. The citations relied on by [Appellants], however, discuss advantages of its low tensile stress dielectric flexible **membrane** or its membrane dielectric isolation fabrication techniques." Appx57 (emphasis added).

The Board devoted over eight pages to detailing and weighing Appellants' and Elm's proffered expert testimony. Appx65-74, Appx81-84. "Dr. Franzon's testimony about the benefits of *Leedy '695's* general process [was] insufficient to support [Appellants'] position regarding dielectric substitution of particular structures in *Bertin*." Appx70. In contrast to Dr. Franzon's conclusory,

unexplained, and unsupported testimony, the Board found that “Dr. Glew’s testimony is supported by his well-reasoned explanation, liberal citations to background references, and liberal citations to the asserted prior art.” Appx72. The Board noted that “no less than four prior art text books, ranging from 600 pages to nearly 850 pages and describing the fabrication of integrated circuits have been provided as background references, principally in support of Alexander D. Glew, Ph.D., Patent Owner’s expert.” Appx49.

While “Dr. Franzon’s testimony about the benefits of *Leedy ’695*’s general process [was] insufficient to support [Appellants’] position regarding dielectric substitution of particular structures in *Bertin*,” “Dr. Glew’s testimony [was] specific as to reasons why one of ordinary skill in the art would not have combined *Leedy ’695* [with *Bertin or Yu*].” Appx70, Appx70-74, Appx81-84. For example, the Board credited Dr. Glew’s testimony and supporting evidence on the following:

Dr. Glew further testified that one of ordinary skill in the art would understand that *Bertin ’754*’s dielectric layer 60 could not be deposited using plasma-enhanced chemical vapor deposition described by *Leedy ’695* “because the resulting dielectric would not (1) be sufficiently pure; (2) have the ability to adhere sufficiently to the semiconductor wafer; and (3) be able to withstand high temperatures of the remaining ... steps without changing its form.”

Appx71.

2. Substantial Evidence Supports the Board’s Finding that Appellants Failed to Prove the Required Expectation of Success

The Board devoted more than fourteen pages to explaining the evidence and analysis supporting its finding that Appellants did not “demonstrate by a preponderance of the evidence that one of ordinary skill in the art . . . would have had a reasonable expectation of success” in connection with Appellants’ proposed combinations. Appx48; Appx48-51, Appx58-65, Appx83-84. Once again, the evidence cited by the Board far exceeds the required threshold of substantial evidence.

For example, the Board explained in detail its finding that Appellants’ “assertion that ‘dielectrics can be easily used in place of other dielectrics’ is not supported by the record.” Appx58-63. The Board detailed why Appellants’ conclusory and unexplained citations to *Leedy ’695* did not support their assertion and, to the contrary, found that the “fact that *Leedy ’695* discloses that the use of a particular method—LOCOS—could be used in either of its two recipes for membrane dielectric isolation fabrication does not, without more, suggest that *Leedy ’695*’s dielectrics ‘could be easily’ used in place of other dielectrics.” Appx58-59 (emphases added).

The Board also addressed and found wanting Dr. Franzon’s testimony on this issue: “Even setting aside the fact that [Appellants] cite[] but [do] not explain

[their] expert’s testimony, Dr. Franzon does not explain how the cited portions of *Leedy ’695* show ‘its dielectrics can be easily used’” in place of other dielectrics. Appx59. The Board also noted that Dr. Franzon’s testimony concerning the different characteristics of different dielectrics actually weighed against expected success:

[B]oth Dr. Franzon and Dr. Glew agree that dielectrics have different properties and different methods of forming dielectrics in integrated circuit fabrication **result in dielectrics having different properties**. Dr. Franzon acknowledges dielectric properties should be considered when selecting a dielectric. . . . This **weighs against** a finding that one of ordinary skill in the art would have expected success substituting *Leedy ’695*’s low tensile stress dielectric material for *Bertin ’754*’s dielectric layer 60 and interconnect insulators.

Appx60-61 (internal citations omitted) (emphases added).

Here again, Appellants do not argue that the Board’s decision is unsupported by substantial evidence, but instead simply reargue the assertions and evidence already rejected by the Board below. For example, Appellants repeat—fourteen times—their rejected contention that “*Leedy* itself says that its dielectric is ‘compatible’ with most manufacturing processes,” and even include this contention in their Statement of the Issues. Br. at ix; *see also* Br. at 12, 27, 31, 54-55, 67.

As Appellants do not contest, substantial evidence supports the Board’s rejection of Appellants’ argument. For example, Appellants argue that “*Leedy* also explains that its dielectric is compatible with thicker, rigid substrates used in the

first layer of a stacked integrated circuit like those disclosed in the *Bertin* patents and the *Yu* article” (Br. at 13) but the *Leedy* ’695 quote on which they rely concerns the use of a low stress dielectric membrane as “sensor diaphragms,” not as an integrated circuit substrate. Br. at 12-13 (quoting Appx1306 at 26:6-13)

Appellants also repeatedly state that *Leedy* ’695 touts that its dielectric membrane is “compatible with most higher temperature IC processing techniques.” *E.g.*, Br. at 54. But the highest temperature discussed in *Leedy* ’695 is 400°C, which Appellants admit is a relatively low temperature. Br. at 53. The subsequent processing steps in both *Bertin* and *Yu* are much higher, and can exceed 1000°C. Appx2414 ¶127; Appx13042-13043. At 1000°C, any tensile stress in the dielectric would be changed to compressive stress. Appx2411 ¶120; Appx10643. *Leedy* ’695 recognizes this, and while discussing a “general compatibility of the MDI process” it also states that conventional IC fabrication techniques “may change the net tensile surface stress of the semiconductor substrate membrane layers.” This comports with Elm’s expert’s testimony. Appx2411 ¶120; Appx10643.

Thus, based on Appellants’ noted and unchallenged failures of proof, the Board correctly found that Appellants had not proven that a person of skill in the art would have expected success when substituting the dielectric used to construct

the *Leedy '695's* dielectric membrane for the different dielectrics identified by Appellant in the *Bertin* and *Yu* references:

Considering the complex field of integrated circuit fabrication and taking into account the level of ordinary skill in the art as set forth by [Appellants], there is insufficient evidence of record to conclude that ordinary creativity would support a conclusion that one of ordinary skill in the art would have expected success by substituting *Leedy '695's* dielectric material of *Bertin '754's* dielectric layer 60 and interconnect insulators. **This is particularly true in view of significant differences between *Leedy '695's* membrane dielectric isolation process and *Bertin '754's* process using thermal oxidation and conventional, rigid substrates to fabricate integrated circuits.**

Appx61-62 (emphases added); *see* Appx83-84.

B. Appellants Do Not Identify Any Reversible Legal Error

Unable to address and refute the foregoing controlling (and dispositive) findings of fact, Appellants attempt to create a reviewable issue of law by arguing that the Board ignored key arguments and evidence, (Br. at 63), and (2) required Appellants to prove combinability of unclaimed elements, (Br. at 58). But neither of these complaints is legal error, and neither is true. Instead, Appellants seek to tacitly re-litigate the factual findings of the Board.

I. The Board Properly Considered the Evidence and Arguments

Appellants argue that “the Board’s decisions were . . . legally erroneous, because it [sic] ignores key evidence and arguments.” Br. at 63. Appellants

confuse the Board **ignoring** evidence and arguments with the Board **rejecting** Appellants' positions after considering and evaluating their arguments and evidence (or lack thereof) and finding it wanting and unpersuasive.

a. Appellants' Assertions Are Contrary to the Record

Appellants criticize the Board for “ignoring key evidence identified in the petition” (Br. at 65), contending that “*Leedy '695* states that low tensile stress increases structural integrity [but t]he Board’s decision entirely ignores this explicit teaching.” Br. at 65. But the Board specifically **considered** and **rejected** this argument. Indeed, the Board quotes this exact section of *Leedy '695*, considers Appellants’ arguments about it, and then finds that the structural integrity discussed in *Leedy '695* relates to **free standing membranes** as opposed to rigid substrates like those used in *Bertin* and *Yu*. See Appx115 (“Petitioner does not sufficiently explain the relevance of this quotation [regarding structural integrity], which on its face is a general statement related to its integrated circuit fabrication process involving free standing membranes.”).

Appellants also wrongly contend that “[t]he Board’s decisions also entirely ignore . . . [that *Leedy '695*’s] dielectric could be applied at a lower temperature (and withstand higher temperatures).” Br. at 66. But again, the Board did consider this and along with Appellants’ associated arguments. Appx82 (considering Appellants’ argument that “*Leedy '695*’s low tensile stress dielectric would be able

to withstand a wide range of processing techniques and processing temperatures”); Appx115 (same).

Appellants also complain that “the Board refused to consider anything from their Reply brief simply because Appellants did not submit an additional declaration with the reply.” Br. at 64. This is just not true. The Board reached its conclusion only after it “considered the Petition, Patent Owner’s Response, **and Petitioner’s Reply**, as well as the relevant **evidence discussed in those papers.**” Appx102. The Board repeatedly cited the Appellants’ Reply. *See* Appx63-64 (quoting “Pet. **Reply 2**” in considering, and rejecting Appellants’ argument that it was trivial to substitute *Leedy ’695’s* dielectrics); Appx64 (quoting “Pet. **Reply 2-3**” in considering, and rejecting Appellants’ argument regarding enablement); Appx64 (“we determine Petitioner’s conclusory assertions in its **Reply** are insufficient to overcome Patent Owner’s well-reasoned and supported arguments”); Appx64 (citing “Pet. **Reply 3-16**” and “22-26” concerning front-end of the line dielectrics); Appx73 (considering arguments in “Pet. **Reply 11-15**”). In all, the Board cited to Appellants’ Reply over 35 times. Thus, the Board did not “refuse” to consider anything. Instead, after considering the Reply, the Board “determine[d] that Petitioner’s conclusory assertions in its Reply are insufficient to overcome Patent Owner’s well-reasoned and supported arguments.” Appx64.

Contradicting their own argument that the Board ignored their Reply Brief, Appellants next fault the Board for dismissing their Reply as attorney-argument. Br. at 64. But the Board considered Appellants' Reply argument and its Reply evidence, and weighed it against the argument and evidence Elm provided. This is entirely proper. See *Elbit Sys. of Am., LLC v. Thales Visonix Inc.*, 881 F.3d 1354, 1358 (Fed. Cir. 2018) ("Determining the weight and credibility of the evidence is the special province of the trier of fact") (quotations omitted). The Board weighed the argument and evidence Appellants presented in their Reply versus "Dr. Glew's well-reasoned and supported testimony" and found that

Petitioner's attorney-argument in its Reply consists of conclusory statements with insufficiently explained citations to *Leedy '695* and other references, and is insufficient to establish that one of ordinary skill in the art would have had reason to combine the references in the manner proposed by Petitioner.

Appx73.

There is no error in the Board's approach here. The Board found that "because of the complexity of integrated circuit fabrication, expert testimony is critical to explaining why one of ordinary skill in the art would have had a reason to combine the references." Appx72. The Board then considered all arguments and evidence, weighed the expert testimony and attorney arguments presented in the Appellants' Petition, Reply, and expert declaration versus those provided by Elm. In what should be considered an exemplar for other Final Written Decisions

from PTAB, the Board spent 31 pages detailing its reasoning before reaching its conclusion that Appellants did not meet their burden.

b. The Board Repeatedly Considered Evidence and Arguments that Appellants Did Not Timely or Properly Present

Likewise, the Board considered the arguments set forth in Dr. Franzon’s declaration, and included by reference in the Petition rather than actually argued within the petition, even though it did not have to. 37 C.F.R. § 42.6(a)(3); *Cisco Sys., Inc. v. C-Cation Techs., LLC*, Case IPR2014-00454, slip op. at 7–10 (PTAB August 29, 2014) (Paper 12) (Informative) (Board does not have to consider arguments in declaration that were not made in the Petition but only incorporated by reference.) Noting that Appellants violated § 42.6(a)(3) by citing expert testimony without discussing it, the Board set the violation aside and still considered Dr. Franzon’s testimony. Appx47 at fn.15; Appx53; Appx59.

Appellants now contend, “the meat of Dr. Franzon’s discussion on these topics is included in the claim charts. Yet there is no indication that the Board read, much less considered, these parts of Dr. Franzon’s declaration.” Br. at 67.

Appellants are mistaken. There is every indication that the Board considered these claim charts. For example, the claim charts at issue are set forth in ¶ 112 to Dr. Franzon’s expert declaration (Appx2211-2232), and the Board expressly cited ¶ 112 [the claim chart] of Dr. Franzon’s declaration, and considered the

conclusions he made in the claim chart. *See* Appx92 (citing Appx2211-2232 ¶ 112 of Dr. Franzon’s report and finding that it “does not expressly support Petitioner’s specific proposed *substitution of Bertin ‘754’s dielectric layer 60 and the interconnect insulators.*”) (emphasis in original). The Board also cites ¶ 112 [the claim chart] of Dr. Franzon’s declaration when describing Appellants’ contentions. Appx47. Thus, Appellants are just wrong to suggest that “there is no indication that the Board read, much less considered” Dr. Franzon’s claim charts. Br. at 67.

The Board also gave the Appellants the benefit of the doubt in considering facts concerning dielectric fabrication processes used in front-end and back-end of the line processes. Elm contended that the dielectric fabrication process described in *Leedy ‘695* was for back-end of the line processing only (lower temperature processes), while Appellants contended that those processes could be used in the front-end of line (higher temperature processes where transistors are actually formed on the silicon wafer). Appx64-65. The Board noted this disagreement, yet proceed by **assuming that Appellants were right**. Appx65 (“Even assuming that *Leedy ‘695* dielectrics are used in the front-end of the line and *Bertin’s* dielectrics could be used in the front-end of the line (as Petitioner contends), this does not explain, as Petitioner must, why one of ordinary skill in the art would have combined the references in the manner proposed by Petitioner[.]”) Thus, Appellants’ contention that “the Board failed to address Appellants’ argument that

Leedy '695 teaches that its dielectric can be used in the front-end-of-line stage” is baseless. The Board proceeded as if Appellants’ argument was correct.

c. Appellant’s Supporting Case Law Is Inapposite

The Board considered evidence and arguments the parties presented, including Appellants’ Reply, expert testimony, and attorney argument. In doing so, the Board gave the Appellants the benefit of the doubt at every turn. The Board then weighed the evidence and argument and determined that Appellants had not met their burden. This was appropriate and in no way constitutes legal error.

The cases relied upon by Appellants to suggest otherwise, all involve situations in which the Board either refused to, or entirely failed to consider evidence, such as background references offered as evidence of the understanding of skilled artisans. For example, in *Ariosa*, the Board expressly **refused** to consider an exhibit “even as evidence of the background understanding of skilled artisans . . . simply because the [exhibit] had not been identified at the petition stage as one of the pieces of prior art defining a combination for obviousness.” *Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1365 (Fed. Cir. 2015). This was a legal mistake because “[a]rt can legitimately serve to document the knowledge that skilled artisans would bring to bear in reading the prior art identified as producing obviousness.” *Id.* (citing *Randall Mfg. v. Rea*, 733 F.3d 1355, 1362-63 (Fed. Cir. 2013)).

Similarly, in *Randall* “the Board did not consider the background references Randall had cited as evidence of the knowledge of one of skill in the art. Instead, the Board looked to the content of the prior art [only].” *Randall Mfg.*, 733 F.3d at 1361 (emphasis added). *Qualtrics* had the same result—the Board focused on the specific disclosures of the prior art references, and failed to consider the knowledge of a skilled artisan as described in other evidence. *Qualtrics, LLC v. OpinionLab, Inc.*, 679 F. App’x. 1016, 1020 (Fed. Cir. 2017) (unreported).

The instant case is the opposite of *Ariosa*, *Randall*, and *Qualtrics*. Here, unlike those cases, the Board **did** consider all of the evidence, including background references offered by the parties in support of their experts’ arguments, relying upon “no less than four prior art text books, ranging from 600 pages to nearly 850 pages” and “two other background references of around 100 pages and 650 pages.” Appx49. The Board then considered the Appellants’ prior art combinations in light of that knowledge. Appellants do not, and cannot cite any evidence that they were prevented from presenting to the Board. Indeed, as noted above, the Board allowed arguments and evidence that it had authority to reject.

The other cases that Appellants rely upon are similarly inapposite. In *Shinn Fu Co. of Am. v. Tire Hanger Corp*, the Board so thoroughly misunderstood Petitioner’s arguments that it addressed the prior art by **removing** elements from the reference instead of **adding** elements as Petitioner had contended. 701 F.

App’x 942, 945 (Fed. Cir. 2017) (non-precedential). Here, the Board understood Appellants’ arguments, addressed them, and rejected them.

Belden Inc. v. Berk-Tek LLC, is particularly inapplicable. 805 F.3d 1064 (Fed. Cir. 2015). In *Belden*, the Board allowed a Petitioner to provide an expert declaration to support its **Reply**, even though it did not support its **Petition** with a declaration. *Id.* at 1071. In allowing the Reply declaration, this Court stated that “[n]o rule requires a **Petition** to be accompanied by a declaration.” *Id.* at 1079 (emphasis added). Appellants remove the word “Petition” from this quote and replace it with the bracketed phrase “[a filing before the Board in an IPR]” to suggest that their **Reply** did not require expert testimony to rebut Elm’s expert testimony. Br. at 64. This bracketed substitution highlights why *Belden* does not apply here. Here, Appellants **did** support their Petition with an expert declaration, Appx13, but when their expert was deposed, he testified in a way that contradicted their Petition. *See* Appx67-68. Likely because Appellants’ expert had already testified counter to their position, Appellants chose not to include an additional expert declaration with their Reply, but rather attempted to rebut Elm’s expert’s “well-reasoned and supported testimony” using bare attorney argument. Appx73-74.

The Board noted this, and found Elm’s expert testimony more convincing than Appellants’ attorneys’ arguments. Appx73. This in no way constitutes legal

error. It “was reasonable for the Board to accept [Elm’s] expert testimony over [Appellants’] bare attorney argument.” *Wasica Fin. GmbH v. Cont’l Auto. Sys.*, 853 F.3d 1272, 1284 (Fed. Cir. 2017). In fact, “a party’s ‘unsworn attorney argument . . . is not evidence’ and thus cannot rebut record evidence.” *Id.* at 1284-85 (quoting *Gemtron Corp. v. Saint-Gobain Corp.*, 572 F.3d 1371, 1380 (Fed. Cir. 2009)).

In reaching its decision, the Board “considered the Petition, Patent Owner’s Response, and Petitioner’s Reply, as well as the relevant evidence discussed in those papers,” Appx102, including Appellants’ expert declaration. Appx92. The Board weighed the evidence and argument and made factual determinations that are supported by substantial evidence.

2. The Board Did Not Require Appellants to Prove Combinability of Unclaimed Elements

Appellants’ other attempt to identify a legal error amidst the Board’s unchallenged findings of fact is their argument that the Board’s obviousness analysis added additional elements into the challenged claims. Br. 58. Again, Appellants are confusing the Board’s considering and rejecting their obviousness arguments and evidence with legal error.

a. The Board Considered the Proper Claim Scope in Finding that Appellants Failed to Prove a Motivation to Combine

Regarding motivation to combine, Appellants suggest that the Board should not have considered evidence about dielectric fabrication processes because the “challenged claims do not require any specific type of process.” Br. at 59.

Appellants miss the point. Appellants bear the burden of proving the required motivation and expected likelihood of success. This necessarily means showing that the dielectric in *Leedy* ’695 would and could be used in place of the identified dielectrics in *Bertin* and *Yu*, which again necessarily means showing that the substitution would indeed have worked within the manufacturing process as used by *Bertin* and *Yu*.

Appellants’ suggestion that the fabrication process for a particular dielectric is not relevant to whether a person of skill in the art would be motivated to combine prior art is both incorrect and also contrary to Appellants’ own arguments. In their Petition, it was Appellants’ who repeatedly urged the Board that “one of ordinary skill would have modified the **processes** and device disclosed in *Bertin*...based upon the disclosure in *Leedy* ’695.” Appx1542 (emphasis added); *see* Appx1545 (discussing modifying “the **processes**” in *Bertin* based upon *Leedy* ’695); Appx1550 (same); Appx1554 (modifying “the **processes**” in *Yu* based upon *Leedy* ’695); Appx1555 (replacing *Yu*’s dielectric based on alleged advantages of

Leedy '695's “CVD **process**” and “**fabrication techniques** for low-stress dielectrics”). As it was Appellants’ position that one of ordinary skill would have combined the processes of *Leedy '695* with those of *Bertin* and Yu, they cannot now argue it was legal error for the Board to consider those processes when rejecting their proposed combination.

Appellants also contend that “the Board entirely ignored the big picture motivation,” and then re-argue their position that dielectrics are basically fungible and “there were multiple reasons to incorporate [*Leedy '695's*] low tensile stress dielectric into *Bertin* or *Yu*.” Br. at 59. The Board did not ignore these reasons. It considered and rejected them. And, as Appellants do not challenge, the Board had substantial evidence for doing so. For example, Appellants primary argument is that *Leedy '695* teaches that a low tensile stress dielectric could improve structural integrity of an integrated circuit. Appellants repeat this mantra throughout their opening brief. *See* Br. at 9, 11, 22-23, 25-26, 28, 31, 52, 58, 62, and 65. As discussed above, the Board considered this “structural integrity” argument and rejected it because the tensile stress in *Leedy '695* provided structural integrity to a free standing dielectric membrane, and Appellants did not discuss how tensile stress in a free standing membrane would have benefited the conventional rigid substrates used in *Bertin* and *Yu*. Appx56, Appx62, Appx115.

As Elm's expert explained, stress is an internal force (per area) on a material and may be either tensile or compressive. Appx2338. If the force pushes inwardly along a layer's horizontal plane, it creates compression and is a "compressive" stress. *Id.* If the force pulls outwardly along a layer's horizontal plane, it creates tension and is a "tensile" stress. *Id.* Tensile stress can cause cracking far more readily than compression, while excess compressive stress can cause buckling. *Id.* The preferred stress in a dielectric was compressive since dielectric films under tensile stress exhibit more of a tendency to crack. Appx2338-2339. The art at the time stated that silicon fractures approximately four times more readily in tension than in compression. Appx2339.

Leedy '695 suggested tensile stress for his freestanding membranes to solve a challenge not present in traditional integrated circuits. As Elm's expert testified, if these free standing membranes were in compressive stress, which is the traditional stress condition for silicon dioxide thin films, the membranes would lack the necessary surface flatness and structural integrity needed for subsequent device fabrication steps. Appx2410. Appellants were unable to rebut this testimony. Their argument that the Board required additional claim elements is incorrect. All the Board required was that Appellants explain why one would use tensile stress in a rigid application like *Burton* despite the known shortcomings of tensile stress. Appellants failed to do so.

b. The Board Considered the Proper Claim Scope in Finding that Appellants Failed to Prove an Expectation of Success

Regarding expectation of success, the Board found that, considering the complex field of integrated circuit fabrication, and taking into account the level of ordinary skill in that art as set forth by Petitioner, **there is insufficient evidence of record** to conclude that one of ordinary skill in the art would have had expected success by substituting *Leedy* '695's dielectric material for *Bertin* '754's dielectric layer 60 in view of the significant differences between *Leedy*'s **membrane** dielectric isolation process and *Bertin* '754's thermal oxidation and conventional, **rigid substrates**. Appx61-62; *see* Appx83 (“we do not agree that such broad statements are sufficient to support a conclusion of reasonable expectation of success in view of the complexity of integrated circuit fabrication.”).

In discussing this insufficient evidence, the Board noted that “Dr. Franzon responded to many questions about dielectrics by indicating research would be needed to answer the particular question.” Appx62. The Board found that “the number of Dr. Franzon’s responses that research is required weighs against Petitioner’s conclusory assertions [regarding expectation of success].” Appx63.

Appellants admit that it is “certainly true” that “dielectrics have different properties and different methods of forming dielectrics in integrated circuit fabrication result in dielectrics having different properties.” Br. at 59. However,

they contend that this fact is “entirely immaterial” because “nothing in the challenged patents’ claims or specification indicates anything about the properties of the dielectric beyond that it must be in low-tensile stress.” Specifically, Appellants argue, “nothing in the claims requires the low-tensile-stress dielectric to meet any particular standard for purity, adherence, or temperature flexibility.” Br. at 61. Appellants again miss the point. They bear the burden of proving that a person of skill in the art would make the proposed combination with reasonable likelihood of success. The Board’s decision was that one would necessarily consider issues like purity, adherence, temperature flexibility and a host of other issues to determine whether the dielectric in *Leedy* ’695 could be substituted for the dielectrics identified in *Bertin* and *Yu*, and that Appellants failed to meet that burden. But nowhere did the Board suggest that the challenged claims required purity, adherence, temperature flexibility, or any other unclaimed elements. Appellants do not, and cannot, identify any place in which the Board actually required Appellants to combine these unclaimed elements. Instead, Appellants seem to suggest that the Board impliedly required these elements just because it discussed them in its decision.

This is markedly different from the cases Appellants use to support their position. For example, in *Intelligent Bio-Sys., Inc. v. Illumina Cambridge, Ltd.*, the Board found that there was no expectation of success in combining a first reference

with two other references because the first reference's chemical group would not be removed quantitatively, but the challenged patent claims did not require removal of the chemical group, let alone quantitative removal. 821 F.3d 1359, 1367 (Fed. Cir. 2016). Thus, it was of "no moment that [the first references' chemical] group would not be removed quantitatively... removal [was] simply not required by the claim." *Id.* In *Allergan, Inc. v. Apotex Inc.*, the district court wrongly required an expectation of success specifically for a single compound for hair growth, where the claim actually covered a broad class of chemical compounds. 754 F.3d 952, 962-63 (Fed. Cir. 2014).

Unlike *Intelligent Bio-Sys., Inc.* and *Allergan*, here the Board discussed various challenges that would make the combination of *Leedy '695* with *Bertin* or *Yu* ineffective or even harmful to the integrated circuit. *See* Appx71-72 (Board citing expert testimony that combining *Leedy* with *Bertin* would "damage the wafer" and circuit components). Because combining *Leedy '695* with *Bertin* would damage the wafer and circuit components, "[e]ven assuming that a person of ordinary skill might have some motivation to [combine]... the record does not show any reasonable expectation that this significant change would be successful." *Broadcom Corp. v. Emulex Corp.*, 732 F.3d 1325, 1335 (Fed. Cir. 2013). "An invention is not obvious just 'because all of the elements that comprise the invention were known in the prior art;' rather a finding of obviousness at the time

of invention requires a ‘plausible rational [sic] as to why the prior art references would have worked together.’” *Id.* (quoting *Power-One v. Artesyn Techs., Inc.*, 599 F.3d 1343, 1351 (Fed. Cir. 2010)). Here, just as in *Broadcom*, expert testimony indicated that the proposed combination would not have resulted in the claimed invention, and would not have worked for its intended purpose. *Id.* The Board did not thus require the combinability of additional elements, it merely found that a person of skill in the art would have known that replacing the dielectrics in *Bertin* or *Yu* with the dielectric in *Leedy* ’695 would have likely damaged the integrated circuit.

CONCLUSION AND STATEMENT OF RELIEF SOUGHT

For the reasons stated herein, the Board’s decisions in each of the subject IPRs should be affirmed.

Dated: April 20, 2018

Respectfully submitted,

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CERTIFICATE OF SERVICE

I, Julian Hadiz, being duly sworn according to law and being over the age of 18, upon my oath depose and say that:

Counsel Press was retained by MINTZ LEVIN COHN FERRIS GLOVSKY AND POPEO PC, Attorneys for Appellee ELM 3DS Innovations, LLC to print this document. I am an employee of Counsel Press.

On **April 20, 2018**, Counsel for Appellant has authorized me to electronically file the foregoing **BRIEF FOR APPELLEE ELM 3DS INNOVATIONS, LLC** with the Clerk of Court using the CM/ECF System, which will send notice of such filing to the following registered CM/ECF users, including the following principal counsel for the other parties.

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Upon acceptance by the Court of the e-filed document, six paper copies will filed with the Court, via Federal Express, within the time provided in the Court’s rules.

Dated: April 20, 2018

/s/ Julian Hadiz
Counsel Pres

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⁵ The Court’s November 7, 2017 order allowed Appellee’s response brief to contain up to 20,000 words.

Exhibit 50

**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE**

ELM 3DS INNOVATIONS, LLC, Plaintiff, v. SAMSUNG ELECTRONICS CO., LTD., et al., Defendants.	C.A. No. 14-cv-1430-LPS-CJB JURY TRIAL DEMANDED
ELM 3DS INNOVATIONS, LLC, Plaintiff, v. MICRON TECHNOLOGY, INC., et al., Defendants.	C.A. No. 14-cv-1431-LPS-CJB JURY TRIAL DEMANDED
ELM 3DS INNOVATIONS, LLC, Plaintiff, v. SK HYNIX INC., et al., Defendants.	C.A. No. 14-cv-1432-LPS-CJB JURY TRIAL DEMANDED

PLAINTIFF ELM 3DS'S THIRD SET OF COMMON INTERROGATORIES

Under Federal Rules of Civil Procedure 26 and 33, Plaintiff Elm 3DS Innovations, LLC (“Elm 3DS”) requests that Defendants answer the following interrogatories in writing, under oath, and serve a copy of the answers upon Bartlit Beck LLP, 1801 Wewatta Street, Suite 1200, Denver, CO 80202 within 30 days of service of these interrogatories. These interrogatories are continuing in nature and must be supplemented or corrected, or both, in a timely manner.

DEFINITIONS

1. The term “Elm 3DS” refers to the Plaintiff in these actions and all parents, subsidiaries, affiliates, assignees, predecessors, employees, and agents thereof.
2. The term “Elm 3DS Patents” refers to the asserted patents in these actions.
3. The terms “you” and “your” mean the Defendants in these actions and their parents, subsidiaries, divisions, affiliates, predecessors, assignees, successors, and acquired assets of business

units, and any of their present or former officers, directors, trustees, employees, agents, representatives, attorneys, patent agents, and all other persons acting on their behalf.

4. The term “Accused Products” means the stacked memory products identified in Elm 3DS’s infringement contentions on November 2, November 17, and November 20, 2015, and May 23, 2018, and all products sold by Defendants that include at least one stacked memory product, including but not limited to SSDs, memory modules, USB flash drives, chipsets, and end-user devices.

5. The terms “Product” and “Products” mean stacked semiconductor products, including but not limited to stacked memory products.

INSTRUCTIONS

1. *Lost or Destroyed Documents:* If any document or tangible thing for which identification is requested was formerly in existence or in your possession but no longer exists, or no longer is within your possession, custody or control, your response should state, for each such document or thing: (a) an identification of the document or thing and, if a document, its author and addressee; (b) the date and circumstances of such loss or destruction; and (c) the reason or justification for such loss or destruction.

2. *Documents for Which a Privilege Is Claimed:* To the extent of any claim that any information or document is privileged or in any other way free from discovery under the Federal Rules of Civil Procedure, you are requested, in lieu of producing said information or document, to produce a description of the information or document sufficient to allow Elm 3DS a specific understanding of the nature of the objection; and if a document, the identification of the author, the date of the document, the addressee(s), the person(s) who received copies of the document, and the general subject matter of the document.

3. *Ongoing Duty to Supplement:* Pursuant to Federal Rule of Civil Procedure 26(e), you are required to supplement your response to include further information that may become available after the date of your response to these interrogatories.

INTERROGATORIES

4. For any Product made or sold by you that contains a semiconductor layer that is 50 microns or less, identify on a worldwide, product-by-product basis the monthly revenue and profit from 2008 through 2018.

5. For any Product made or sold by you that contains a semiconductor layer that is 50 microns or less, identify on a product-by-product basis the monthly revenue and profit from 2008 through 2018 for Products manufactured, sold, offered for sale, or imported into the United States.

June 24, 2019

Respectfully submitted,

/s/ Michael J. Farnan

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CERTIFICATE OF SERVICE

I hereby certify that on June 24, 2019, a copy of Elm's Third Set of Common Interrogatories was served on the following as indicated:

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/s/ Michael J. Farnan

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Exhibit 51

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

ELM 3DS INNOVATIONS, LLC, a Delaware limited liability company,)	
)	
Plaintiff,	)	C.A. No. 14-1430-LPS
)	
v.	)	JURY TRIAL DEMANDED
SAMSUNG ELECTRONICS CO., LTD., a Korean business entity,)	
SAMSUNG SEMICONDUCTOR, INC., a California corporation,)	
SAMSUNG ELECTRONICS AMERICA, INC., a New York corporation, and)	
SAMSUNG AUSTIN SEMICONDUCTOR, LLC, a Delaware limited liability company,)	
Defendants.)	

**SAMSUNG’S OBJECTIONS AND RESPONSES TO
ELM 3DS’S THIRD SET OF COMMON INTERROGATORIES**

Pursuant to Rules 26 and 33 of the Federal Rules of Civil Procedure, Defendants Samsung Electronics Co., Ltd., Samsung Semiconductor, Inc., Samsung Electronics America, Inc., and Samsung Austin Semiconductor, LLC (collectively “Samsung”) hereby object and respond to Plaintiff Elm 3DS Innovations, LLC’s (“Elm”) Third Set of Common Interrogatories, dated June 24, 2019.

GENERAL OBJECTIONS

Samsung makes the following general responses and objections (“General Objections”) to each “Definition,” “Instruction,” and “Interrogatory” propounded in Elm’s Third Set of

Common Interrogatories. These General Objections are hereby incorporated into each specific response. The assertion of the same, similar or additional objections or partial responses to individual interrogatories does not waive any of Samsung's General Objections.

1. Samsung objects to Elm's definition of "Elm 3DS" as vague, ambiguous, overbroad, and unduly burdensome to the extent that it includes "all parents, subsidiaries, affiliates, assignees, predecessors, employees, and agents thereof." Samsung further objects to the definition as not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to the extent that these terms may include persons or entities that are not parties to this action.

2. Samsung objects to Elm's definitions of "you" and "your" as overbroad, unduly burdensome, and oppressive to the extent that they include Samsung "and their parents, subsidiaries, divisions, affiliates, predecessors, assignees, successors, and acquired assets of business units, and any of their present or former officers, directors, trustees, employees, agents, representatives, attorneys, patent agents, and all other persons acting on their behalf." Samsung will respond, subject to and without waiving all other objections, only as to the named Samsung Defendants: Samsung Electronics Co., Ltd., Samsung Semiconductor, Inc., Samsung Electronics America, Inc., and Samsung Austin Semiconductor, LLC.

3. Samsung objects to Elm's definition of "Accused Products" on the grounds that the definition is vague, ambiguous, overbroad, and unduly burdensome with respect to its scope and application, particularly to the extent that it seeks to include "all products sold by Defendants that include at least one stacked memory product, including but not limited to SSDs, memory modules, USB flash drives, chipsets, and end-user devices." Samsung further objects to the definition as not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this

case. Samsung further objects to the extent that this definition may include products that are not manufactured by a party to this case and/or products that are not imported, sold, or offered for sale in the United States by a party to this case. To the extent that Samsung provides discovery on such products, Samsung does not concede that such products are relevant or properly included or subject to any remedies in this case. Moreover, Elm has not reasonably limited the scope of the Accused Products based on any of the claimed features of the patents-in-suit.

4. Samsung objects to Elm's definitions of "Product" and "Products" on the grounds that the definitions are vague, ambiguous, overbroad, and unduly burdensome with respect to their scope and application, particularly to the extent that they seek to include "stacked semiconductor products, including but not limited to stacked memory products." Samsung further objects to the definitions as not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to the extent that these definitions may include products that are not manufactured by a party to this case and/or products that are not imported, sold, or offered for sale in the United States by a party to this case. To the extent that Samsung provides discovery on such products, Samsung does not concede that such products are relevant or properly included or subject to any remedies in this case. Moreover, Elm has not reasonably limited the scope of the Products or the definition thereof based on any of the claimed features of the patents-in-suit.

5. Samsung objects to Elm's Instruction No. 1 because it purports to impose requirements and obligations on Samsung other than as set forth in the Federal Rules of Civil Procedure.

6. Samsung provides these objections and responses to the best of its current knowledge. Discovery or further investigation may reveal additional or different information warranting amendment of these objections and responses. Samsung reserves the right to produce at trial and make reference to any evidence, facts, documents, or information not discovered at

this time, omitted through good-faith error, mistake, or oversight, or the relevance of which Samsung has not presently identified.

7. By responding to these interrogatories, Samsung does not concede the relevance or materiality of any of the interrogatories or of the subjects to which it refers. Samsung's responses are made subject to, and without waiving any objections as to the competency, relevancy, materiality, privilege, or admissibility of any of the responses, or of the subject matter to which they concern, in any proceeding in this action or in any other proceeding.

8. Samsung objects to any interrogatory to the extent that it seeks information that is protected from disclosure by the attorney-client privilege, the attorney work product doctrine, the joint defense or common interest privilege, or any other applicable privilege, doctrine, or discovery immunity. The inadvertent production by Samsung of information protected from disclosure by any such privilege, doctrine, or immunity shall not be deemed a waiver by Samsung of such privileges or protections.

9. Samsung objects generally to the interrogatories to the extent they seek confidential, proprietary, or trade secret information of third parties. Samsung will endeavor to work with third parties in order to obtain their consent, if necessary, before providing such information. To the extent an interrogatory seeks information of a confidential or proprietary nature to Samsung, or to others to whom Samsung is under an obligation of confidentiality, Samsung will respond pursuant to the terms of the protective order entered in this case and subject to notice to third parties, as necessary.

10. Samsung objects to each interrogatory and to Elm's "Definitions" and "Instructions" to the extent they are vague, ambiguous, overbroad, unduly burdensome, are not proportional to the needs of this case, or purport to impose upon Samsung any duty or obligation that is inconsistent with or in excess of those obligations that are imposed by the Federal Rules of Civil Procedure, the Civil Local Rules and/or the Patent Local Rules of this Court, or any other applicable rule.

11. Samsung objects to any interrogatory to the extent it seeks irrelevant information about Samsung's products or business operations, or is not otherwise proportional to the needs of this case. Such requests are overbroad and unduly burdensome. Samsung will only produce information that is relevant to the patents-in-suit, or that is otherwise related to the claims or defenses asserted by the parties in this litigation.

12. Samsung objects to each interrogatory to the extent that it would impose a duty on Samsung to undertake a search for or an evaluation of information, documents, or things for which Elm is equally able to search for and evaluate and/or is not proportional to the needs of this case. In particular, Samsung objects to each interrogatory to the extent that it seeks information or documents that are publicly available.

13. Samsung objects to each interrogatory to the extent that it seeks information that can be derived or ascertained from documents that will be produced in discovery, is not otherwise proportional to the needs of this case, or that is uniquely in Elm's possession, custody, and control.

14. Samsung objects to each interrogatory to the extent it would require Samsung to draw a legal conclusion or contention to make a proper response.

15. Samsung objects to each interrogatory to the extent that it purports to define words or phrases to have a meaning different from their commonly understood meaning, or to include more than their commonly understood definitions.

16. In Samsung's objections, the terms "and" and "or" are intended to be construed conjunctively or disjunctively as necessary to make the objections inclusive rather than exclusive.

17. Samsung objects to each interrogatory to the extent it purports to require Samsung to identify or describe "every," "each," "any," or other similarly expansive, infinite, or all-inclusive terms as overbroad and unduly burdensome.

18. Samsung objects to Elm's "Definitions," "Instructions" and the interrogatories to the extent they seek information that is not in the possession, custody, or control of Samsung, purport to require Samsung to speculate about the identity of persons who might have responsive documents, and/or purport to call for any description of documents that Samsung no longer possesses and/or was under no obligation to maintain.

19. Samsung objects to each interrogatory to the extent it is not limited in time and seeks information for periods of time that are not relevant to any claim or defense and is not otherwise proportional to the needs of this case.

20. Samsung objects to the interrogatories as a whole, and to each interrogatory contained therein, to the extent they are overbroad, unreasonably burdensome, and/or not proportional to the needs of this case. In particular, Samsung objects to the interrogatories as a whole, and to each interrogatory contained therein, to the extent they seek irrelevant information about accused products. By answering, objecting, and otherwise responding to the interrogatories, Samsung does not concede relevance or admissibility, both of which Samsung reserves the right to challenge.

21. Samsung objects to the interrogatories as a whole, and to each interrogatory contained therein, to the extent they are premature and/or to the extent they: (a) conflict with any schedule entered by the Court; (b) seek information that is the subject of expert testimony; (c) seek information and/or responses that are dependent on the Court's construction of the asserted claims of the patents-in-suit; or (d) are dependent on depositions and documents that have not been taken or produced.

22. Samsung's objections as set forth herein are made without prejudice to Samsung's right to assert any additional or supplemental objections pursuant to Rule 26(e).

23. Samsung will make, and has made, reasonable efforts to respond to Elm's Third Set of Common Interrogatories, to the extent that no objection is made, as Samsung reasonably understands and interprets each Interrogatory. If Elm subsequently asserts any interpretation of

any interrogatory that differs from the interpretation of Samsung, then Samsung reserves the right to supplement and amend its objections and responses.

OBJECTIONS AND RESPONSES TO COMMON INTERROGATORIES

Subject to the foregoing qualifications and General Objections and the specific objections made below, Samsung objects and responds to Elm's Third Set of Common Interrogatories as follows:

COMMON INTERROGATORY NO. 4:

For any Product made or sold by you that contains a semiconductor layer that is 50 microns or less, identify on a worldwide, product-by-product basis the monthly revenue and profit from 2008 through 2018.

OBJECTIONS AND RESPONSE TO COMMON INTERROGATORY NO. 4:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this interrogatory to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this interrogatory as premature and improperly compound, in an impermissible attempt to circumvent the number of interrogatories permitted under ¶ 7(e) of the Court's Scheduling Order (D.I. 176), to the extent that it seeks "monthly revenue and profit" information about products before the parties have resolved the preliminary issue of identifying products that contain a semiconductor layer that has a thickness of 50 microns or less. Samsung further objects to this interrogatory as overbroad and unduly burdensome to the extent that "identif[ication] on a worldwide, product-by-product basis [of] the monthly revenue and profit from 2008 through 2018" for "any Product made or sold by you that contains a semiconductor layer that is 50 microns or less" may encompass information that is not proportional to the needs of this case. Samsung further objects to this interrogatory on

the grounds that it is vague, ambiguous, and overbroad as to “made or sold by you,” “contains,” “a semiconductor layer that is 50 microns or less,” “identify,” “worldwide,” “product-by-product,” “basis,” “revenue,” and “profit.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this interrogatory as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to geography and not properly limited with respect to time. For example, it is ambiguous as to whether “any Product made or sold by you that contains a semiconductor layer that is 50 microns or less” is properly limited in scope with respect to time or geography, and the request for monthly revenue and profit on a “worldwide, product-by-product basis” is not properly limited in geography. Furthermore, because at least some patents-in-suit have expired prior to the end of 2018, Samsung objects to this interrogatory to the extent it seeks post-patent expiration data. Samsung further objects to this interrogatory as being premature because the Court has not yet construed the claims of the patents-in-suit. Samsung objects to this interrogatory to the extent it would require Samsung to draw a legal conclusion or contention to make a proper response. Samsung further objects to this interrogatory to the extent that it is duplicative and seeks information that can be derived or ascertained from documents and things that were produced in discovery and that are in Elm’s possession, custody, and control. Samsung further objects to this interrogatory to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this interrogatory to the extent it seeks information unrelated to the products that are properly accused in this case.

Subject to and without waiving the foregoing general and specific objections, Samsung is available to meet and confer with Elm regarding the proper timing and scope, if any, of this interrogatory.

COMMON INTERROGATORY NO. 5:

For any Product made or sold by you that contains a semiconductor layer that is 50 microns or less, identify on a product-by-product basis the monthly revenue and profit from 2008 through 2018 for Products manufactured, sold, offered for sale, or imported into the United States.

OBJECTIONS AND RESPONSE TO COMMON INTERROGATORY NO. 5:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this interrogatory to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this interrogatory as premature and improperly compound, in an impermissible attempt to circumvent the number of interrogatories permitted under ¶ 7(e) of the Court’s Scheduling Order (D.I. 176), to the extent that it seeks “monthly revenue and profit” information about products before the parties have resolved the preliminary issue of identifying products that contain a semiconductor layer that has a thickness of 50 microns or less. Samsung further objects to this interrogatory as overbroad and unduly burdensome to the extent that “identif[ication] on a product-by-product basis [of] the monthly revenue and profit from 2008 through 2018” for “any Product made or sold by you that contains a semiconductor layer that is 50 microns or less” and/or for “Products manufactured, sold, offered for sale, or imported into the United States” may encompass information that is not proportional to the needs of this case. Samsung further objects to this interrogatory on the grounds that it is vague, ambiguous, and overbroad as to “made or sold by you,” “contains,” “a semiconductor layer that is 50 microns or less,” “identify,” “product-by-product,” “basis,” “revenue,” “profit,” and “manufactured, sold, offered for sale, or imported into the United States.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this interrogatory as ambiguous and

overbroad, particularly to the extent that it is not properly limited with respect to time or geography. For example, it is ambiguous as to whether “any Product made or sold by you that contains a semiconductor layer that is 50 microns or less” is properly limited in scope with respect to time or geography. Furthermore, because at least some patents-in-suit have expired prior to the end of 2018, Samsung objects to this interrogatory to the extent it seeks post-patent expiration data. Samsung further objects to this interrogatory as being premature because the Court has not yet construed the claims of the patents-in-suit. Samsung objects to this interrogatory to the extent it would require Samsung to draw a legal conclusion or contention to make a proper response. Samsung further objects to this interrogatory to the extent that it is duplicative and seeks information that can be derived or ascertained from documents and things that were produced in discovery and that are in Elm’s possession, custody, and control. Samsung further objects to this interrogatory to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this interrogatory to the extent it seeks information unrelated to the products that are properly accused in this case. Samsung further objects to this interrogatory to the extent that it seeks information relating to products that are not made, sold, or offered for sale within the United States or not imported into the United States by any Samsung defendant.

Subject to and without waiving the foregoing general and specific objections, Samsung is available to meet and confer with Elm regarding the proper timing and scope, if any, of this interrogatory.

DATED: July 24, 2019

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CERTIFICATE OF SERVICE

I, Adam W. Poff, hereby certify that on July 24, 2019, I caused a true and correct copy of the foregoing document to be served on the following counsel of record in the manner indicated:

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Exhibit 52

**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE**

ELM 3DS INNOVATIONS, LLC,
Plaintiff,
v.
SAMSUNG ELECTRONICS CO., LTD., et al.,
Defendants.

C.A. No. 14-cv-1430-LPS

JURY TRIAL DEMANDED

**ELM'S FOURTH SET OF REQUESTS FOR PRODUCTION TO SAMSUNG
(NO. 66-141)**

Under Federal Rules of Procedure 26 and 34, Plaintiff Elm 3DS Innovations, LLC (“Elm 3DS”) requests that Defendants Samsung Electronics Co., Ltd., Samsung Semiconductor, Inc., Samsung Electronics America, Inc., and Samsung Austin Semiconductor, LLC (collectively “Samsung”), answer the following Requests for Production in writing under Rule 34 and serve a copy of your answers upon Bartlit Beck LLP, 1801 Wewatta Street, Suite 1200, Denver, CO 80202 within 30 days of service of these Requests for Production upon you. These Requests for Production are continuing in nature and responses thereto must be supplemented or corrected, or both, in a timely manner.

DEFINITIONS

1. The term “Product(s)” means any stacked semiconductor product that is sold by you, or incorporated into a product that is sold by you, that contains a semiconductor layer with a thickness of 50 microns or less. For the avoidance of doubt, “Product(s)” include all types of semiconductor products that meet the above definition, regardless of their function (e.g., memory, image sensor, control, etc.). In addition, although Elm expects that there may be Products that are not included in the following documents, the term Product(s) specifically includes each Product listed in, or included in other products listed in, the following documents: Samsung-Elm-000062357 – Samsung-Elm-000062367.

2. The term “Physical Dimensions” includes height, width, and thickness at the time that the relevant materials are initially deposited on or otherwise added to the Product, and as they appear in the final Product.

3. The term “Material Properties” means every known, estimated, or measured property of the material, including each of the following:

- i. Young’s modulus
- ii. Shear modulus
- iii. Poisson’s ratio
- iv. Coefficient of thermal expansion
- v. Density
- vi. Heat capacity
- vii. Thermal conductivity.

4. The term “assembly yield” means the number of Products that have successfully exited the assembly process divided by the number of Products that have started the assembly process. As used in this definition, assembly process does not include wafer fab operations; instead, it includes assembly operations such as wafer thinning, die attach, wirebonding, and molding. As used in these Requests, assembly yield relates only to parts that fail to meet functional requirements due to assembly-related process steps. Parts that fail to meet requirements due to part design, wafer fab, or chip electrical functionality issues should not be included in your assessment of assembly yield. For example, final electrical test yield loss should only be included in assembly yield if the electrical test yield loss can be attributed to the assembly process as opposed to the fabrication process or other processes. As used in these Requests, assembly yield relates only to Products that

have passed all qualification tests needed for release to manufacturing, and that have been in production for more than three (3) months.

5. “The term “Communication(s)” means the transmittal of information by any means, and includes any transfer of information, facts, ideas, opinions, inquiries, or thoughts by any means, written, oral or otherwise, at any time or place under any circumstances. The definition is not limited to transfers between persons but also includes other transfers, such as records and memoranda to file; any written letter, memorandum, e-mail, or other document which was sent by one or more individuals to another or others; any telephone call between one or more individuals and another or others, whether such call was by chance or prearranged, formal or informal; and any conversation or meeting between one or more individuals and another, whether such contact was by chance or prearranged, formal or informal. The definition includes without limitation e-mail, work spaces, One Notes, communications by instant messenger or text message, SharePoint, Box.net, DropBox, paper-based communications, or other electronic means.

6. The term “Document(s)” has the broadest meaning ascribed to it by Rule 34(a) of the Federal Rules of Civil Procedure and encompasses any writing of any kind, including originals and non-identical copies (whether different from the original by reason of any notation made on such copies or otherwise). The term “Document(s)” includes without limitation the following items, whether printed or reproduced by any process, or written or produced by hand or stored in computer memory, magnetic or hard disk, or other data storage medium, and whether or not claimed to be privileged, confidential, or otherwise excludable from discovery, including without limitation: patents, patent applications, articles, publications, presentations, posters, slides, electronic presentations, notes, letters, correspondence, communications, e-mail, telegrams, memoranda, summaries or records of telephone conversations, summaries or records of personal conversations

or meetings, diaries, reports, laboratory and research reports and notebooks, recorded experiments, charts, plans, drawings, diagrams, schematic diagrams, HDL, Verilog, source code or other computer code, illustrations, product descriptions, labels, product inserts, product analyses, requests for proposals, documents related to proposals or actual product improvements or changes, user manuals or guides, installation guides or manuals, technical descriptions or specifications, product repair manuals or guides, photographs, video images, software flow charts or descriptions or specifications, product functional descriptions or specifications, minutes or records of meetings, summaries of interviews, reports, or investigations, opinions or reports of consultants, reports of patent searches, patent appraisals, opinions of counsel, agreements, reports or summaries of negotiations, brochures, pamphlets, advertisements, circulars, trade letters, press releases, drafts of documents, and all other material fixed in a tangible medium of whatever kind.

7. The terms “you” and “your” mean the Defendants in above-captioned action, referring to Samsung Electronics Co., Ltd., Samsung Semiconductor, Inc., Samsung Electronics America, Inc., and Samsung Austin Semiconductor, LLC (individually or collectively), and their parents, subsidiaries, divisions, affiliates, predecessors, assigns, successors, and acquired assets of business units, and any of their present or former officers, directors, trustees, employees, agents, representatives, attorneys, patent agents, and all other persons acting on their behalf.

8. Where used in these Requests, the singular also encompasses the plural and vice versa, the words “and” and “or” shall be conjunctive and disjunctive, the words “all” or “any” shall mean “all and any,” and the word “including” means “including without limitation.”

9. The use and definition of any of these words or terms is not contingent on the capitalization or lack of capitalization of those terms as used below. Some terms may be capitalized,

including without limitation at the beginning of a sentence, or not capitalized—regardless, the above definitions should be considered to apply.

INSTRUCTIONS

1. Each requested document shall be produced in its entirety, including all attachments and enclosures. If a portion of a document is responsive to a request, produce the entire document, including all attachments, enclosures, “post-it”-type notes, and any other matter physically attached to the document. If a document responsive to any requests cannot be produced in full, it shall be produced to the extent possible with an explanation stating why production of the remainder is not possible.

2. Documents produced in response to these requests shall be produced in the same order as they are kept in the ordinary course of business and, where attached, shall not be separated or disassembled. If documents responsive to any request are normally kept in a file or folder, also produce that file or folder with any labels attached thereto, and indicate the company, division, department, and/or individual from whose files the document is being produced. If responsive documents are segregated or separated from other documents, whether by inclusion in binders, files, sub-files, or by use of dividers, tabs or any other method, produce such documents in that form.

3. Electronic and computerized information must be produced in an intelligible format or together with a description of the system format from which it was derived sufficient to permit rendering of the materials intelligible. If you contend that any documents or information is not reasonably accessible, identify the documents or information, their location, and state the basis for your contention.

4. For any document, communication, or thing that you contend is privileged or otherwise shielded from discovery, state the basis for the privilege claimed, the name and address of the author(s) and addressee(s), the date, the type of document, the subject matter of the document, and the name and address of every recipient of the original or any copy of the document and such other information needed to enable Elm 3DS to assess the claim.

5. These requests are continuing and require, to the extent authorized by the Federal Rules of Civil Procedure, production of additional responsive documents and things that may be located or acquired by you after the date of your original production.

6. All objections shall be made in writing and delivered to the offices of Bartlit Beck LLP, 1801 Wewatta Street, Suite 1200, Denver CO 80202.

REQUESTS FOR PRODUCTION

REQUEST FOR PRODUCTION NO. 66:

Ten (10) samples of each Product.

REQUEST FOR PRODUCTION NO. 67:

Ten (10) samples of each die with a thickness of 50 microns or less that is used in each Product. For the purposes of this Request, please produce unstacked die that have met all qualifications for packaging.

REQUEST FOR PRODUCTION NO. 68:

Three (3) samples of each wafer whose constituent die have been used to make any Product. For the purposes of this Request, please produce wafers that have met all qualifications for dicing, but have not yet been diced.

REQUEST FOR PRODUCTION NO. 69:

Every purchase agreement related to the Products that was signed in the United States.

REQUEST FOR PRODUCTION NO. 70:

Every purchase agreement related to the Products that was negotiated in the United States.

REQUEST FOR PRODUCTION NO. 71:

Every memorandum, email, or other Document memorializing, discussing, or relating to any discussion or meeting in the United States with any customer, or any affiliate of any customer, who has purchased a Product from you.

REQUEST FOR PRODUCTION NO. 72:

Every email sent to any customer, or any affiliate of any customer, in the United States that relates to any Product.

REQUEST FOR PRODUCTION NO. 73:

Every purchase agreement or purchase order signed in, negotiated in, or sent to the United States relating to equipment used to deposit or otherwise form dielectric used in any Product.

REQUEST FOR PRODUCTION NO. 74:

Documents sufficient to show your stress targets for each processing step for each Product.

REQUEST FOR PRODUCTION NO. 75:

Documents sufficient to show all stress measurements of wafers and/or die used in each Product.

REQUEST FOR PRODUCTION NO. 76:

Documents sufficient to show all warpage measurements of each Product, including without limitation warpage test method specification and test equipment identification.

REQUEST FOR PRODUCTION NO. 77:

Documents sufficient to show all warpage specifications and/or warpage targets of each Product.

REQUEST FOR PRODUCTION NO. 78:

Documents sufficient to show the assembly yield targets for each Product.

REQUEST FOR PRODUCTION NO. 79:

Documents sufficient to show the assembly yield for each Product.

REQUEST FOR PRODUCTION NO. 80:

Documents sufficient to show the packaging of the Products, including but not limited to the substrate(s), the constituent die, the adhesives, and the wiring components of said packaging, including how the associated die and assembly are interconnected to form said Products.

REQUEST FOR PRODUCTION NO. 81:

All Marketing Requirements Documents (MRDs) and Product Requirements Documents (PRDs) for the Products.

REQUEST FOR PRODUCTION NO. 82:

All bondpad and TSV diagrams, floorplans, RDL diagrams, and ballout package netlists for the Products.

REQUEST FOR PRODUCTION NO. 83:

Documents sufficient to show all specifications for the Products, including the layout of the Products, the Front-End-of-Line and Back-End-of-Line process steps and specifications for the Products, and all packaging specifications for the Products.

REQUEST FOR PRODUCTION NO. 84:

Documents sufficient to show all stress targets for the die incorporated into the Products.

REQUEST FOR PRODUCTION NO. 85:

Documents sufficient to show all stress testing of the die incorporated into the Products, and results of those tests.

REQUEST FOR PRODUCTION NO. 86:

Documents sufficient to show all stress testing of the wafers whose die are incorporated into the Products, and the results of those tests.

REQUEST FOR PRODUCTION NO. 87:

Documents sufficient to identify the process node(s) used to manufacture each of the Products, on a Product-by-Product basis.

REQUEST FOR PRODUCTION NO. 88:

Documents sufficient to show the grinding, thinning, and/or back-side processing of the wafers and/or die that are incorporated into the Products.

REQUEST FOR PRODUCTION NO. 89:

Documents sufficient to identify, for each of the Products, the equipment used to perform grinding, thinning, and/or back-side processing of the Product.

REQUEST FOR PRODUCTION NO. 90:

Documents sufficient to show, for each of the Products, all technical specifications and/or settings of the equipment used to perform grinding, thinning, and/or back-side processing of the Product.

REQUEST FOR PRODUCTION NO. 91:

Documents sufficient to show the number of die in each Product.

REQUEST FOR PRODUCTION NO. 92:

Documents sufficient to show each die in each Product, including the part number for each die, the location of each die within the stack, the type of die (e.g., DRAM, NAND, controller, image sensor, etc.) and quantity of each die in the Product.

REQUEST FOR PRODUCTION NO. 93:

Documents sufficient to show the Physical Dimensions of each die in each Product.

REQUEST FOR PRODUCTION NO. 94:

Documents sufficient to show the Physical Dimensions of each Product.

REQUEST FOR PRODUCTION NO. 95:

Documents sufficient to show the process node(s) used to make each die in each Product.

REQUEST FOR PRODUCTION NO. 96:

Documents sufficient to show the starting wafer diameter and thickness for each wafer used to make each die included in each Product.

REQUEST FOR PRODUCTION NO. 97:

Documents sufficient to show each dielectric used in each Product, including any passivation layer(s).

REQUEST FOR PRODUCTION NO. 98:

Documents sufficient to show the material composition of each dielectric in each Product, including any passivation layer(s).

REQUEST FOR PRODUCTION NO. 99:

Documents sufficient to show the Physical Dimensions of each dielectric in each Product, including any passivation layer(s).

REQUEST FOR PRODUCTION NO. 100:

Documents sufficient to show the Material Properties of each dielectric in each Product.

REQUEST FOR PRODUCTION NO. 101:

Documents sufficient to show each interconnect (metal) layer used in each Product, including any RDL layers.

REQUEST FOR PRODUCTION NO. 102:

Documents sufficient to show the material composition of each interconnect (metal) layer in each Product, including any RDL layers.

REQUEST FOR PRODUCTION NO. 103:

Documents sufficient to show the Physical Dimensions of each interconnect (metal) layer in each Product, including any RDL layers.

REQUEST FOR PRODUCTION NO. 104:

Documents sufficient to show the Material Properties of each interconnect (metal) layer in each Product, including any RDL layers.

REQUEST FOR PRODUCTION NO. 105:

Documents sufficient to show each die attach used in each Product.

REQUEST FOR PRODUCTION NO. 106:

Documents sufficient to show the Physical Dimensions of each die attached used in each Product.

REQUEST FOR PRODUCTION NO. 107:

Documents sufficient to show the Material Properties of each die attach in each Product.

REQUEST FOR PRODUCTION NO. 108:

Documents sufficient to show the process parameters and equipment used for deposition of each dielectric layer, including each inter-layer dielectric, inter-metal dielectric, and passivation layer.

REQUEST FOR PRODUCTION NO. 109:

Documents sufficient to show all stress data for each dielectric layer, including all such data from ongoing process monitoring, quality control, and/or process qualification.

REQUEST FOR PRODUCTION NO. 110:

Documents sufficient to show the process parameters and equipment used for deposition of each metal layer in each Product.

REQUEST FOR PRODUCTION NO. 111:

Documents sufficient to show the CMP of each dielectric or metal layer in each Product.

REQUEST FOR PRODUCTION NO. 112:

Documents sufficient to show the annealing steps, and all parameters and equipment used in the annealing steps, occurring after deposition of each dielectric layer in each Product.

REQUEST FOR PRODUCTION NO. 113:

Documents sufficient to show every process to which each Product is subjected during wafer fabrication (manufacturing), and the order in which each such processes takes place.

REQUEST FOR PRODUCTION NO. 114:

Documents sufficient to identify the wafer fabrication location for each die used in each Product.

REQUEST FOR PRODUCTION NO. 115:

Documents sufficient to show all process steps, process parameters and equipment used for all package assembly processing, including wafer thinning/back grind, wafer polish, saw/clean, die-attach, wire bond, encapsulation, and additionally for TSV-based products: wafer bonding, TSV etching, and TSV conductive filling.

REQUEST FOR PRODUCTION NO. 116:

Documents sufficient to show the wirebonding for each Product.

REQUEST FOR PRODUCTION NO. 117:

For Products that include TSVs, documents sufficient to show topside and bottomside RDL or final metal layout per each unique die design, and TSV location layout.

REQUEST FOR PRODUCTION NO. 118:

Documents sufficient to show the package assembly location for each Product.

REQUEST FOR PRODUCTION NO. 119:

Documents sufficient to show the equipment used for dicing, sawing, and/or singulating wafers whose constituent die are used in the Products, and the settings and technical specifications for all such equipment.

REQUEST FOR PRODUCTION NO. 120:

All communications related to stress with third-parties who supply equipment or materials used to make, deposit, or otherwise form any dielectric used in the Products.

REQUEST FOR PRODUCTION NO. 121:

All presentations related to stress made to or by third-parties who supply equipment or materials used to make, deposit, or otherwise form any dielectric used in the Products.

REQUEST FOR PRODUCTION NO. 122:

Documents sufficient to show analysis of the composition of wafers, die, substrates, circuit layers, dielectric layers, and/or bonding layers in the Products, including all EDX, EDS, XEDS, EDXA, EDXMA, and SIMS.

REQUEST FOR PRODUCTION NO. 123:

Documents sufficient to show all X-ray, SEM, and/or TEM images of the Products, including such images of any wafer, die, or component thereof incorporated into the Products.

REQUEST FOR PRODUCTION NO. 124:

Documents sufficient to show every entity involved in the sale of each Product.

REQUEST FOR PRODUCTION NO. 125:

Documents sufficient to show every entity involved in the manufacturing of each Product, and the specific role of each such entity.

REQUEST FOR PRODUCTION NO. 126:

Documents sufficient to show every entity involved in marketing each Product.

REQUEST FOR PRODUCTION NO. 127:

All internal communications relating to stress in each Product, including but not limited to dielectric stress.

REQUEST FOR PRODUCTION NO. 128:

Documents sufficient to show your internal or expected rate of return for capital investments.

REQUEST FOR PRODUCTION NO. 129:

Documents sufficient to show the amount and form of consideration paid to or by you in exchange for intellectual property rights relating to the Products.

REQUEST FOR PRODUCTION NO. 130:

Documents sufficient to show your economic analysis of any acquisition or disposition of intellectual property rights relating to the Products.

REQUEST FOR PRODUCTION NO. 131:

Documents sufficient to identify any lawsuits relating to the Products.

REQUEST FOR PRODUCTION NO. 132:

Documents sufficient to identify the terms of any settlement agreement relating to any lawsuits that relate to the Products, including but not limited to all term sheet agreements and/or final settlement agreements relating to any such lawsuits.

REQUEST FOR PRODUCTION NO. 133:

All expert reports produced or exchanged in any lawsuit relating to the Products.

REQUEST FOR PRODUCTION NO. 134:

All of your discovery responses filed or exchanged in any lawsuit relating to the Products.

REQUEST FOR PRODUCTION NO. 135:

Every contract or other agreement in which you received a license or any other rights to a U.S. patent within any of the following United States Patent Classifications: 257/74; 257/685; 257/686; 257/723; 257/724; 257/777; 257/778; 257/E21.597; 257/E27.026; 257/E27.081; 257/E27.097; 365/200; 365/201; 365/230.6; 365/230.06; 438/17; 438/18; 438/107; 438/108; 438/123; 438/455; 438/459; 438/598; 438/977; 714/30; 714/718; and/or 714/719.

REQUEST FOR PRODUCTION NO. 136:

Every contract or other agreement in which you conveyed a license or any other rights to a U.S. patent within any of the following United States Patent Classifications: 257/74; 257/685; 257/686; 257/723; 257/724; 257/777; 257/778; 257/E21.597; 257/E27.026;

257/E27.081; 257/E27.097; 365/200; 365/201; 365/230.6; 365/230.06; 438/17; 438/18; 438/107; 438/108; 438/123; 438/455; 438/459; 438/598; 438/977; 714/30; 714/718; and/or 714/719.

REQUEST FOR PRODUCTION NO. 137:

Every contract or other agreement in which you received a license or any other rights to a U.S. patent within the following Cooperative Patent Classification (“CPC”) Subclasses: H01L and/or G11C.

REQUEST FOR PRODUCTION NO. 138:

Every contract or other agreement in which you conveyed a license or any other rights to a U.S. patent within the following Cooperative Patent Classification (“CPC”) Subclasses: H01L and/or G11C.

REQUEST FOR PRODUCTION NO. 139:

Every contract or other agreement in which you received a license or any other rights to a U.S. patent that relates to the Products.

REQUEST FOR PRODUCTION NO. 140:

Every contract or other agreement in which you received a license or any other rights to a U.S. patent that relates to semiconductor memory or image sensor products.

REQUEST FOR PRODUCTION NO. 141:

Every contract or other agreement in which you conveyed a license or any other rights to a U.S. patent that relates to semiconductor memory or image sensor products.

February 6, 2020

Respectfully submitted,

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Counsel for Plaintiff
ELM 3DS INNOVATIONS, LLC

CERTIFICATE OF SERVICE

I, Michael J. Farnan, hereby certify that on February 6, 2020, a copy of Elm's Fourth Set of Requests for Production was served on the following as indicated:

Via E-Mail
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/s/ Michael J. Farnan
Michael J. Farnan (Bar No. 5165)

Exhibit 53

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

ELM 3DS INNOVATIONS, LLC, a)
Delaware limited liability company,)

Plaintiff,)

v.)

SAMSUNG ELECTRONICS CO., LTD., a)
Korean business entity,)
SAMSUNG SEMICONDUCTOR, INC., a)
California corporation,)
SAMSUNG ELECTRONICS AMERICA,)
INC., a New York corporation, and)
SAMSUNG AUSTIN SEMICONDUCTOR,)
LLC, a Delaware limited liability company,)

Defendants.)

C.A. No. 14-1430-LPS

**SAMSUNG’S OBJECTIONS AND RESPONSES TO PLAINTIFF
ELM’S FOURTH SET OF REQUESTS FOR PRODUCTION**

Pursuant to Rules 26 and 34 of the Federal Rules of Civil Procedure, and the applicable Local Rules of the U.S. District Court for the District of Delaware, Defendants Samsung Electronics Co., Ltd., Samsung Semiconductor, Inc., Samsung Electronics America, Inc., and Samsung Austin Semiconductor, LLC (collectively, “Samsung”) object and respond to Plaintiff Elm 3DS Innovations, LLC’s (“Elm” or “Plaintiff”) Fourth Set of Requests for Production as follows:

GENERAL STATEMENTS

1. Samsung's investigation in this action is ongoing. The responses and objections set forth below constitute the best information presently available to and located by Samsung. These responses are based upon: (1) a reasonable search, given the time allotted to Samsung to respond to the Requests; and (2) inquiries of Samsung's employees and/or representatives who could reasonably be expected to possess responsive information. Samsung reserves the right to amend, supplement, or change the responses and objections made herein if and when additional, different, or more accurate information becomes available and/or additional facts are developed. Indeed, the coronavirus impact on Samsung's businesses and personnel presents an ongoing logistical and temporal problem with regard to Samsung's investigation, potentially necessitating supplementation once the coronavirus impact has subsided.

2. Samsung reserves the right to make any use of, or to introduce at any hearing and at trial, information and/or documents responsive to the Requests but discovered subsequent to the date of this response, including but not limited to any such information or documents obtained in discovery herein.

3. No incidental or implied admissions are intended by the responses herein. The fact that Samsung has answered or objected to any Request should not be taken as an admission that Samsung accepts or admits the existence of any "facts" set forth or assumed by such Request. The fact that Samsung has answered part or all of any Request is not intended to be, and shall not be construed to be, a waiver by Samsung of any part of any objection to any Request.

4. Samsung's responses to the Requests do not constitute an admission concerning the scope of the claims of any patent at issue nor the relation of any such claims to any product made, used, sold, or offered for sale by Samsung in this case.

5. To the extent Samsung responds to a Request by stating that Samsung will produce non-privileged documents or is searching for documents, Samsung does not represent that any such documents actually exist, but that Samsung will make a good faith search and attempt to ascertain whether documents responsive to the Request exist.

6. Samsung reserves all objections or other questions as to the competency, relevance, materiality, privilege, or admissibility as evidence, in any subsequent proceeding or trial of this or any other action for any purpose whatsoever, of its responses herein and any document or thing identified or produced in response to these Requests.

7. To the extent that Samsung provides information pursuant to these Requests, Samsung does not concede that the information provided is relevant to this action. Samsung expressly reserves the right to object to further discovery into the subject matter of such Requests and the introduction into evidence of any information, or portion thereof.

GENERAL OBJECTIONS

Samsung incorporates by reference the following General Objections within each response and objection to individual Requests, and all responses and objections to individual Requests, definitions, and instructions are made subject to and without waiving these objections.

1. Samsung objects to each Request, Definition, and Instruction to the extent that it is broader than, or purports to impose obligations upon Samsung beyond those required by, the Federal Rules of Civil Procedure and/or the local rules of this Court.

2. Samsung objects to each Request to the extent that it seeks information not relevant to any claim or defense, and not proportional to the needs of this case.

3. Samsung objects to each Request to the extent that it seeks information beyond what is available from a reasonable search of Samsung's files likely to contain relevant or

responsive information and a reasonable inquiry of Samsung's employees likely to have information relevant to a claim or defense of any party, or to the subject matter of this suit.

4. Samsung objects to each Request to the extent that it seeks information and documents not in Samsung's knowledge, possession, custody, or control, or refers to persons, entities, or events not known to Samsung, on the grounds that such instructions, definitions, and Requests seek to require more of Samsung than any obligation imposed by law, and would subject Samsung to unreasonable and undue annoyance, oppression, burden, and expense, and would seek to impose upon Samsung an obligation to investigate or discover information or materials from third parties or services who are equally accessible to Plaintiff.

5. Samsung objects to each Request to the extent it is overly broad, unreasonably burdensome, not proportional to the needs of this case, or otherwise beyond the scope of permissible discovery in this proceeding.

6. Samsung objects to each Request to the extent that it requires Samsung to produce information equally available to Plaintiff, in the public domain, and/or from sources other than Samsung, including but not limited to court filings and documents in official, local, state, or federal records, on the grounds that it is unduly burdensome and oppressive.

7. Samsung objects to each Request to the extent that it is duplicative of prior discovery requests and seeks production of documents previously requested and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control.

8. Samsung objects to each Request to the extent that it seeks information protected by the attorney-client privilege, common interest privilege, trial preparation privilege, work product immunity, and/or any other applicable privilege, immunity, or protection. Such

information shall not be provided in response to the Requests, and any inadvertent disclosure or production thereof shall not be deemed a waiver of any privilege with respect to such information or of any work product doctrine which may attach thereto.

9. Samsung objects to each Request to the extent that it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to or nondisclosure agreements with third parties, or pursuant to a privacy right of a third party.

10. Samsung objects to each Request as overly broad, unduly burdensome, and seeking information that is neither relevant, nor proportional to the needs of this case, to the extent it is not appropriately limited in time or scope.

11. Samsung objects to each Request to the extent that it seeks information already in the possession of Plaintiff or its counsel on the grounds that it is unnecessary, unduly burdensome, and oppressive.

12. Samsung objects to each Request to the extent that it: (i) is compound; (ii) is phrased disjunctively or conjunctively; (iii) includes subparts in such a manner that is unduly burdensome, confusing, or cannot be reasonably answered; or (iv) collectively exceeds the number of requests permitted by the applicable discovery order(s).

13. Samsung objects to each Request to the extent that it calls for a legal conclusion.

14. Samsung objects to each Request to the extent it incorporates argumentative and conclusory definitions. Samsung will respond to the Requests based on the definitions provided by Plaintiff without prejudice either to Samsung's position that such definitions may be incorrect or to any legal position Samsung may take during the course of this lawsuit.

15. Samsung objects to each Request to the extent it: (i) conflicts with any schedule entered by the Court; (ii) seeks information and/or responses that are dependent on the Court's

construction of any claims of the patent-in-suit; or (iii) is dependent on depositions and documents that have not been taken or produced.

16. Samsung objects to each Request to the extent it purports to require Samsung to identify all information related to a particular topic or issue, as such a Request is unduly burdensome and oppressive.

17. Samsung objects to each Request to the extent that it seeks information that is properly the subject of expert testimony, opinions, and/or reports.

18. Samsung objects to each Request to the extent it is vague and/or ambiguous.

19. Samsung objects to each Request to the extent it seeks communications and other related materials covered by the parties' agreement on custodial discovery.

20. Samsung objects to each Request to the extent it requires Samsung to identify oral communications, conversations, discussions, or meetings for which there is no readily accessible written record. Identifying such oral communications, conversations, discussions, or meetings would be unduly burdensome and oppressive.

21. Samsung objects to each Request to the extent it has not completed discovery and preparation for trial and thus has not yet identified all information and documents substantiating its contentions. To the extent Samsung responds to a Request with a statement that they have or will produce the information and/or documents requested, Samsung will supplement its response to the Request in accordance with Federal Rule of Civil Procedure 26(e).

22. Samsung objects to each Request to the extent that it seeks information regarding the identity of facts known by, or opinions held by, consultants or experts retained or specifically employed by Samsung in anticipation of litigation, but not expected to be called as witnesses at trial.

23. Samsung objects to each Request, and to each Definition and Instruction, to the extent it is premature at this stage of litigation or conflicts with any schedule entered by the Court. Samsung's responses to at least some of the Requests may first require claim construction by the Court. Samsung's responses to at least some of the Requests may also require discovery from Plaintiff and third parties.

24. Samsung objects to each Request as overly broad, and seeking information that is neither relevant to any issues in the case, nor proportional to the needs of this case, to the extent that the Request is not properly limited geographically to the United States, to the post-issuance time period of the patents-in-suit, to the pre-expiration time period of the patents-in-suit, or to the subject matter of the patents-in-suit.

25. Samsung objects to the production of documents, or the listing of documents on a withheld document list, to the extent that such documents were generated after Plaintiff's November 21, 2014 filing of its Complaint.

26. Samsung objects to each Request to the extent it uses words such as "each" or similar language in a manner that renders the Request overly broad, unduly burdensome, vague, or ambiguous, or requires Samsung to engage in speculation. Consistent with its obligations under the Federal Rules of Civil Procedure and subject to its objections, Samsung will identify responsive, non-privileged information, documents, or things to the extent they exist and are located after a reasonable search.

27. Samsung objects to Elm's definitions of "you" and "your" as overbroad, unduly burdensome, and oppressive to the extent that they include Samsung "and their parents, subsidiaries, divisions, affiliates, predecessors, assigns, successors, and acquired assets of business units, and any of their present or former officers, directors, trustees, employees, agents,

representatives, attorneys, patent agents, and all other persons acting on their behalf.” Samsung will respond, subject to and without waiving all other objections, only as to the following Samsung entities: Samsung Electronics Co., Ltd., Samsung Semiconductor, Inc., Samsung Electronics America, Inc., Samsung Austin Semiconductor, LLC, and Samsung Electronics LatinoAmerica Miami, Inc.

28. Samsung objects to Elm’s definition of “Product(s)” on the grounds that the definition is vague, ambiguous, overbroad, and unduly burdensome with respect to its scope and application, particularly to the extent that it seeks to include “any stacked semiconductor product that is sold by you, or incorporated into a product that is sold by you, that contains a semiconductor layer with a thickness of 50 microns or less” and “all types of semiconductor products that meet the above definition, regardless of their function (e.g., memory, image sensor, control, etc.).” Samsung further objects to the definition as not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to the definition as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this definition to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this definition on the grounds that it is vague, ambiguous, and overbroad as to “stacked semiconductor product,” “sold by you,” “incorporated into a product,” “contains,” “semiconductor layer with a thickness of 50 microns or less,” “types of semiconductor products,” “meet,” “function,” and “included in other products.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further

objects to the extent that the definition may include products that are not manufactured by a party to this case and/or products that are not imported, sold, or offered for sale in the United States by a party to this case. To the extent that Samsung provides discovery, Samsung does not concede that products potentially falling within the scope of the provided definition are relevant or properly included or subject to any remedies in this case.

29. Samsung objects to Elm's definition of "Physical Dimensions" on the grounds that it is vague, ambiguous, and overbroad as to "height," "width," "thickness," "at the time," "relevant materials," "initially deposited on or otherwise added to," "as they appear in," and "final." These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to the definition as not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung incorporates by reference its objections to Elm's definition of "Product(s)" to the extent its definition of "Physical Dimensions" incorporates or references its definition of "Product(s)."

30. Samsung objects to Elm's definition of "Material Properties" on the grounds that it is vague, ambiguous, and overbroad as to "known," "estimated," "measured," "property," "material," "Young's modulus," "Shear modulus," "Poisson's ratio," "Coefficient of thermal expansion," "Density," "Heat capacity," and "Thermal conductivity." These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to the definition as not reasonably tied to Elm's infringement allegations

and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case.

31. Samsung objects to Elm's definition of "assembly yield" on the grounds that it is vague, ambiguous, and overbroad as to "successfully exited," "started," "assembly process," "wafer fab operations," "assembly operations," "wafer thinning," "die attach," "wirebonding," "molding," "relates only to," "parts," "fail to meet," "functional requirements," "due to," "assembly-related process steps," "requirements," "part design," "wafer fab," "chip electrical functionality," "issues," "assessment," "final electrical test yield loss," "electrical test yield loss," "attributed to," "fabrication process," "other processes," "passed," "qualification tests," "needed for," "release to manufacturing," and "in production." These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to the definition as not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung incorporates by reference its objections to Elm's definition of "Product(s)" to the extent its definition of "assembly yield" incorporates or references its definition of "Product(s)."

32. Samsung objects to Elm's definition of "Communication(s)" to the extent that this definition conflicts with the Federal Rules of Civil Procedure, any Local Rule or Court Order, or joint agreement. Samsung additionally objects to this definition to the extent it is vague, ambiguous, overbroad, unduly burdensome, seeks information that is not within the possession, custody, or control of Samsung, and seeks information that is neither relevant to any claim or defense in this case, nor proportional to the needs of this case.

33. Samsung objects to Elm’s definition of “Document(s)” to the extent that this definition conflicts with the Federal Rules of Civil Procedure, any Local Rule or Court Order, or joint agreement. Samsung additionally objects to this definition to the extent it is vague, ambiguous, overbroad, unduly burdensome, seeks information that is not within the possession, custody, or control of Samsung, and seeks information that is neither relevant to any claim or defense in this case, nor proportional to the needs of this case.

34. These General Objections apply to each of Samsung’s responses below. Specific objections provided in any response are made without waiver of or prejudice to any General Objection.

SPECIFIC OBJECTIONS AND RESPONSES TO PLAINTIFF’S REQUESTS FOR PRODUCTION

REQUEST FOR PRODUCTION NO. 66:

Ten (10) samples of each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 66:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent that it seeks “[t]en (10) samples of each Product,” and the number of products requested is unduly burdensome and unnecessarily cumulative, particularly in light of Samsung having already produced samples in response to prior RFPs. Samsung further objects to this request insofar as Products sold in the U.S. that purportedly incorporate “stacked semiconductor product ... that contains a semiconductor layer with a thickness of 50 microns or less” are or have been available for purchase directly by Elm from public sources during the pendency of this litigation. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[t]en (10) samples of each Product” is not proportional to the needs of this case. Elm has not explained why it requires a sample of each and

every Product, why it has not procured samples from commercially available products that might contain an accused product, nor explained why it requires a quantity of ten (10) samples for every Product for which samples are produced. This request is further overbroad and unduly burdensome insofar as it purports to require Samsung reverse engineer semiconductor products from third parties that are “incorporated into a product” sold by Samsung to determine whether they are “stacked” and contain “a semiconductor layer with a thickness of 60 microns or less,” and then provide sample(s) for each and every such third party semiconductor product. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “samples.” The term is undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified term, and therefore, what information or things are actually being requested. Samsung objects to this Request to the extent it is overly broad because the scope of discovery should be limited to the products specifically identified by Elm under the Default Discovery Rules. *See, e.g., Honeywell Intern. Inc. v. Audiovox Comm’n Corp.*, No. C-04-1337-KAJ, 2005 WL 3988905 at *1 n.2 (D. Del. Oct. 7, 2005). Samsung objects to this Request to the extent it seeks products available on the market because the burden of obtaining them is equal for both parties. To the extent Elm can provide a sufficient basis for why it cannot obtain the requested products on its own, Elm should offer to purchase them from Samsung at market or reasonable prices. *See, e.g., Itex, Inc. v. Westex, Inc.*, Nos. 05 CV 6110, 08 CV 1224, 2011 WL 856583, at *5 (N.D. Ill. Mar. 9, 2011); *Caliper Techs. Corp. v. Molecular Devices Corp.*, 213 F.R.D. 555, 558 (N.D. Cal. 2003). Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested products before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will search for and produce, to the extent they exist, a reasonable number of samples for one accused product within each representative product grouping, within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products and at Elm's own expense.

REQUEST FOR PRODUCTION NO. 67:

Ten (10) samples of each die with a thickness of 50 microns or less that is used in each Product. For the purposes of this Request, please produce unstacked die that have met all qualifications for packaging.

RESPONSE TO REQUEST FOR PRODUCTION NO. 67:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent that it seeks “[t]en (10) samples of each die with a thickness of 50 microns or less that is used in each Product,” which is unduly burdensome and unnecessarily cumulative. Samsung objects to this Request as overly broad, vague and ambiguous to the extent it seeks the production of “samples of each die with a thickness of 50 microns or less that is used in each Product” and “unstacked die that have met all qualifications for packaging.” Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[t]en (10) samples of each die with a thickness of 50 microns or less that is used in each Product” are not proportional to the needs of this case. Elm has not explained why it requires a sample of each and every “die with a thickness of 50 microns or less that is used in each Product,” why it has not procured samples from commercially available products that might

contain an accused product, nor explained why it requires a quantity of ten (10) samples for every such die for which samples are to be produced. [REDACTED]

[REDACTED], and it is unduly burdensome, not proportional to the needs of this case, and cumulative for Samsung to [REDACTED]

[REDACTED], at least some of which have already been produced in this case.

This request is further overbroad and unduly burdensome insofar as it purports to require Samsung to reverse engineer third party products that are “used in each Product” sold by Samsung to determine whether they were manufactured from a “die with a thickness of 50 microns or less,” and then obtain and provide sample(s) for each and every such die. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “samples,” “die with a thickness of 50 microns or less,” “used” “unstacked die,” “met,” and “qualifications for packaging.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information or things are actually being requested. Samsung objects to this Request to the extent it is overly broad because the scope of discovery should be limited to the products specifically identified by Elm under the Default Discovery Rules. *See, e.g., Honeywell Intern. Inc. v. Audiovox Comm’n Corp.*, No. C-04-1337-KAJ, 2005 WL 3988905 at *1 n.2 (D. Del. Oct. 7, 2005). Samsung objects to this Request to the extent it seeks products available on the market (or components thereof) because the burden of obtaining such products is equal for both parties. To the extent Elm can provide a sufficient basis for why Samsung should disturb its manufacturing processes and produce sample “die” that are available to Samsung, Elm should compensate Samsung for any and all expenses associated with disrupting the manufacturing process in addition to a reasonable price

for the actual dies produced. *See, e.g., Itex, Inc. v. Westex, Inc.*, Nos. 05 CV 6110, 08 CV 1224, 2011 WL 856583, at *5 (N.D. Ill. Mar. 9, 2011); *Caliper Techs. Corp. v. Molecular Devices Corp.*, 213 F.R.D. 555, 558 (N.D. Cal. 2003). Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested samples before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will not produce samples of each unstacked die with a thickness of 50 microns or less that is used in each Product based at least on the specific objections articulated in this response.

REQUEST FOR PRODUCTION NO. 68:

Three (3) samples of each wafer whose constituent die have been used to make any Product. For the purposes of this Request, please produce wafers that have met all qualifications for dicing, but have not yet been diced.

RESPONSE TO REQUEST FOR PRODUCTION NO. 68:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent that it seeks “[t]hree (3) samples of each wafer whose constituent die have been used to make any Product,” which is unduly burdensome and unnecessarily cumulative. Samsung objects to this Request as overly broad, vague and ambiguous to the extent it seeks the production of “samples of each wafer whose constituent die have been used to make any Product” and “wafers that have met all qualifications for dicing, but have not yet been diced.” Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[t]hree (3) samples of each wafer whose constituent die have been used to make any Product” are not proportional to the needs of this case. Elm has not explained why it requires a sample of each and every “wafer whose constituent die have been used to make

any Product,” nor explained why it requires a quantity of three (3) samples for every such wafer for which samples are to be produced. [REDACTED]

[REDACTED], and it is unduly burdensome, not proportional to the needs of this case, and cumulative for Samsung to [REDACTED]

[REDACTED], at least some of which have already been produced in this case. This request is further overbroad and unduly burdensome insofar as it purports to require Samsung to reverse engineer third party products that are “used to make any Product” sold by Samsung to determine the relevant wafer used to manufacture that Product, and then obtain and provide sample(s) for each and every such wafer. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “samples,” “wafer whose constituent die have been used to make any Product,” “met,” “qualifications for dicing,” and “have not yet been diced.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information or things are actually being requested. Samsung objects to this Request to the extent it is overly broad because the scope of discovery should be limited to the products specifically identified by Elm under the Default Discovery Rules. *See, e.g., Honeywell Intern. Inc. v. Audiovox Comm’n Corp.*, No. C-04-1337-KAJ, 2005 WL 3988905 at *1 n.2 (D. Del. Oct. 7, 2005). To the extent Elm can provide a sufficient basis for why Samsung should disturb its manufacturing processes and produce sample “wafers” that are available to Samsung, Elm should compensate Samsung for any and all expenses associated with disrupting the manufacturing process in addition to a reasonable price for the actual dies produced. *See, e.g., ITEX, Inc. v. Westex, Inc.*, Nos. 05 CV 6110, 08 CV 1224, 2011 WL 856583, at *5 (N.D. Ill. Mar. 9, 2011); *Caliper Techs. Corp. v. Molecular*

Devices Corp., 213 F.R.D. 555, 558 (N.D. Cal. 2003). Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested samples before the parties have agreed on the proper scope of Product(s), and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will not produce samples of each wafer whose constituent die has been used to make any Product based at least on the specific objections articulated in this response.

REQUEST FOR PRODUCTION NO. 69:

Every purchase agreement related to the Products that was signed in the United States.

RESPONSE TO REQUEST FOR PRODUCTION NO. 69:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[e]very purchase agreement related to the Products that was signed in the United States” is not proportional to the needs of this case. This includes, but is not limited to, agreements with third parties (e.g., wireless carriers and retailers of consumer electronics devices) that purchase Products sold by Samsung in the U.S. that incorporate a stacked semiconductor product that contain a die with a thickness of 50 microns or less. This further includes, but is not limited to, requiring Samsung produce “every purchase agreement” with any third party that has ever purchased a stacked semiconductor product that contains a semiconductor layer with a thickness of 50 microns or less. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “purchase agreement,” “related to,” and “signed in.” These terms are undefined and capable of different interpretations.

It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung's confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 43, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will search for and produce, to the extent they exist, at least one relevant, non-privileged, and responsive purchase agreement related to the sale of accused semiconductor products from November 2008 through January 2020 for its top 5 customers of stacked semiconductor products that contain a die with a thickness of 50 microns or less within each representative product grouping, within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court’s local rules, to the extent not already produced—once the parties agree on a set of representative products. Samsung will not produce every purchase agreement related to Products that was signed in the United States based at least on the specific objections articulated in this response.

REQUEST FOR PRODUCTION NO. 70:

Every purchase agreement related to the Products that was negotiated in the United States.

RESPONSE TO REQUEST FOR PRODUCTION NO. 70:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[e]very purchase agreement related to the Products that was negotiated in the United States” is not proportional to the needs of this case. This includes, but is not limited to, agreements with third parties (e.g., wireless carriers and retailers of consumer electronics devices) that purchase Products sold by Samsung in the U.S. that incorporate a stacked semiconductor product that contain a die with a thickness of 50 microns or

less. This further includes, but is not limited to, requiring Samsung produce “every purchase agreement” with any third party that has ever purchased a stacked semiconductor product that contains a semiconductor layer with a thickness of 50 microns or less. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “purchase agreement,” “related to,” and “negotiated in.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior

requests for production, including but not limited to Request for Production No. 43, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will search for and produce, to the extent they exist, at least one relevant, non-privileged, and responsive purchase agreement related to the sale of accused semiconductor products from November 2008 through January 2020 for its top 5 customers of stacked semiconductor product that contain a die with a thickness of 50 microns or less within each representative product grouping, within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products. Samsung will not produce every purchase agreement related to Products that was negotiated in the United States based at least on the specific objections articulated in this response.

REQUEST FOR PRODUCTION NO. 71:

Every memorandum, email, or other Document memorializing, discussing, or relating to any discussion or meeting in the United States with any customer, or any affiliate of any customer, who has purchased a Product from you.

RESPONSE TO REQUEST FOR PRODUCTION NO. 71:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[e]very memorandum, email, or other Document memorializing, discussing, or relating to any discussion or meeting in the United States with any customer, or any affiliate of any customer, who has purchased a Product from you” is not proportional to the needs of this case. This includes, but is not limited to, agreements with third parties (e.g. wireless carriers and retailers of consumer electronics devices) that purchase Products sold by Samsung in the U.S. that incorporate a stacked semiconductor product that contain a die with a thickness of 50 microns or less. This further includes, but is not limited to, requiring Samsung produce “every purchase agreement” with any third party that has ever purchased a stacked semiconductor product that contains a semiconductor layer with a thickness of 50 microns or less. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “memorializing,” “discussing,” “relating to,” “discussion,” “meeting” “customer,” “affiliate” “purchased,” and “from you.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks

information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery, including to the extent it seeks communications and other related materials covered by the parties' agreement on custodial discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 43, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will search for and produce, to the extent they exist, at least one relevant, non-privileged, and responsive meeting minute or similar meeting memorialization memorandum related to any meetings related to the sale of accused semiconductor products from November 2008 through January 2020 to one of Samsung's top 5 customers of stacked semiconductor products that contain

a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court’s local rules, to the extent not already produced—once the parties agree on a set of representative products. Samsung will not produce every memorandum, email, or other Document memorializing, discussing, or relating to any discussion or meeting in the United States with any customer, or any affiliate of any customer, who has purchased a Product from Samsung based at least on the specific objections articulated in this response.

Subject to and without waiving the foregoing general and specific objections, Samsung will produce only those communications subject to and in accordance with the parties’ agreement on custodial discovery.

REQUEST FOR PRODUCTION NO. 72:

Every email sent to any customer, or any affiliate of any customer, in the United States that relates to any Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 72:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[e]very email sent to any customer, or any affiliate of any customer, in the United States that relates to any Product” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague,

ambiguous, and overbroad as to “customer,” “affiliate” “in the United States,” and “relates to.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time and unclear as to what the phrase “in the United States” modifies. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery, including to the extent it seeks communications and other related materials covered by the parties’ agreement on custodial discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production and/or seeks information that can be derived or ascertained from documents that were

or will be produced in discovery and that are or will be in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will produce only those communications subject to and in accordance with the parties' agreement on custodial discovery.

REQUEST FOR PRODUCTION NO. 73:

Every purchase agreement or purchase order signed in, negotiated in, or sent to the United States relating to equipment used to deposit or otherwise form dielectric used in any Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 73:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that "[e]very purchase agreement or purchase order signed in, negotiated in, or sent to the United States relating to equipment used to deposit or otherwise form dielectric used in any Product" is not proportional to the needs of this case. For example, Elm's infringement contentions do not accuse "equipment used to deposit or otherwise form dielectric" of infringement. Nor does Elm otherwise explain how purchase agreements or purchase orders related to such equipment otherwise relate to a disputed issue in this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to "purchase agreement," "purchase order," "signed in, negotiated in, or sent to the United

States,” “relating to,” “equipment,” “used,” and “deposit or otherwise form dielectric.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or not sufficiently limited with respect to geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 9 and 30, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm’s possession, custody, and control.

Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will not produce documents responsive to this request based at least on the specific objections articulated in this response.

REQUEST FOR PRODUCTION NO. 74:

Documents sufficient to show your stress targets for each processing step for each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 74:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “your stress targets for each processing step for each Product” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “stress targets,” and “processing step.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential

information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 32 and Common Request for Production Nos. 1 and 2, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request, and will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of

Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 75:

Documents sufficient to show all stress measurements of wafers and/or die used in each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 75:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “all stress measurements of wafers and/or die used in each Product” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “stress measurements of wafers and/or die,” and “used.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung's trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive

inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 19, 20, 22, 28, and 32 and Common Request for Production Nos. 1 and 2, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request, and will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 76:

Documents sufficient to show all warpage measurements of each Product, including without limitation warpage test method specification and test equipment identification.

RESPONSE TO REQUEST FOR PRODUCTION NO. 76:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “all warpage measurements of each Product, including without limitation warpage test method specification and test equipment identification” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “warpage measurements,” and “warpage test method specification and test equipment identification.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through

other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 9, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request, and will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 77:

Documents sufficient to show all warpage specifications and/or warpage targets of each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 77:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “all warpage specifications and/or warpage targets of each Product” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “warpage specifications,” and “warpage targets.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not

permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 9, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request, and will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 78:

Documents sufficient to show the assembly yield targets for each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 78:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “assembly yield targets for each Product” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show” and “assembly yield targets.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it

seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will not produce documents showing the assembly yield targets for each Product based at least on the specific objections articulated in this response.

REQUEST FOR PRODUCTION NO. 79:

Documents sufficient to show the assembly yield for each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 79:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that "assembly yield for each Product" is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to "sufficient to show" and "assembly yield for each Product." These terms are undefined and/or capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what

information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung's trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will not produce documents showing the assembly yields for each Product based at least on the specific objections articulated in this response.

REQUEST FOR PRODUCTION NO. 80:

Documents sufficient to show the packaging of the Products, including but not limited to the substrate(s), the constituent die, the adhesives, and the wiring components of said packaging, including how the associated die and assembly are interconnected to form said Products.

RESPONSE TO REQUEST FOR PRODUCTION NO. 80:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “packaging of the Products, including but not limited to the substrate(s), the constituent die, the adhesives, and the wiring components of said packaging, including how the associated die and assembly are interconnected to form said Products” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “packaging,” “substrate(s), the constituent die, the adhesives, and the wiring components of said packaging,” “associated die,” “assembly,” and “interconnected to form said Products.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung

objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung's trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 9 and 10, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information can be discerned, or such samples are publicly available to Elm. Samsung will continue to search

for and produce, to the extent they exist, relevant, non-privileged, and responsive documents within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court’s local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 81:

All Marketing Requirements Documents (MRDs) and Product Requirements Documents (PRDs) for the Products.

RESPONSE TO REQUEST FOR PRODUCTION NO. 81:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[a]ll Marketing Requirements Documents (MRDs) and Product Requirements Documents (PRDs) for the Products” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “Marketing Requirements Documents (MRDs)” and “Product Requirements Documents (PRDs).” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung

further objects to this Request to the extent it seeks Samsung's trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 12, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will not produce documents responsive to this request based at least on the specific objections articulated in this response.

REQUEST FOR PRODUCTION NO. 82:

All bondpad and TSV diagrams, floorplans, RDL diagrams, and ballout package netlists for the Products.

RESPONSE TO REQUEST FOR PRODUCTION NO. 82:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[a]ll bondpad and TSV diagrams, floorplans, RDL diagrams, and ballout package netlists for the Products” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “bondpad and TSV diagrams,” “floorplans,” “RDL diagrams,” and “ballout package netlists.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to

the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 13, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information can be discerned, or such samples are publicly available to Elm. Samsung will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 83:

Documents sufficient to show all specifications for the Products, including the layout of the Products, the Front-End-of Line and Back-End-of-Line process steps and specifications for the Products, and all packaging specifications for the Products.

RESPONSE TO REQUEST FOR PRODUCTION NO. 83:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “all specifications for the Products, including the layout of the Products, the Front-End-of Line and Back-End-of-Line process steps and specifications for the Products, and all packaging specifications for the Products” is not proportional to the needs of this case. By way of example, Elm has not explained how “specifications” “including the layout” of Products that incorporate a stacked semiconductor product that contains a layer with a thickness of 50 microns or less is relevant to any issue in dispute in this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “specifications,” “layout,” “Front-End-of Line and Back-End-of-Line process steps and specifications,” and “packaging specifications.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of

post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung's trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 9, 14, 16, 27, 31, 32, and 39, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information can be discerned, or such samples are publicly available to Elm. Samsung will continue to search

for and produce, to the extent they exist, relevant, non-privileged, and responsive documents within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 84:

Documents sufficient to show all stress targets for the die incorporated into the Products.

RESPONSE TO REQUEST FOR PRODUCTION NO. 84:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “all stress targets for the die incorporated into the Products” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “stress targets,” and “die incorporated into the Products.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung's trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent

it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 32 and Common Request for Production Nos. 1 and 2, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request, and will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of

Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 85:

Documents sufficient to show all stress testing of the die incorporated into the Products, and results of those tests.

RESPONSE TO REQUEST FOR PRODUCTION NO. 85:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “all stress testing of the die incorporated into the Products, and results of those tests” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “stress testing,” “die incorporated into the Products,” and “results.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung's trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly

burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 19 and 32, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request, and will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 86:

Documents sufficient to show all stress testing of the wafers whose die are incorporated into the Products, and the results of those tests.

RESPONSE TO REQUEST FOR PRODUCTION NO. 86:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “all stress testing of the wafers whose die are incorporated into the Products, and the results of those tests” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “stress testing,” “wafers whose die are incorporated into the Products,” and “results.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to

this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 19 and 32, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request, and will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 87:

Documents sufficient to identify the process node(s) used to manufacture each of the Products, on a Product-by-Product basis.

RESPONSE TO REQUEST FOR PRODUCTION NO. 87:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “identif[ication of] the process node(s) used to manufacture each of the Products, on a Product-by-Product basis” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to identify,” “process node(s) used to manufacture each of the Products,” and “Product-by-Product basis.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery.

Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request, and will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 88:

Documents sufficient to show the grinding, thinning, and/or back-side processing of the wafers and/or die that are incorporated into the Products.

RESPONSE TO REQUEST FOR PRODUCTION NO. 88:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “grinding, thinning, and/or back-side processing of the wafers and/or die that are incorporated into the Products” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “grinding, thinning, and/or back-side processing,” and “wafers and/or die that are incorporated into the Products.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through

other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 9, 16, 17, 20, 21, 54, and 56 and Common Request for Production Nos. 21 and 22, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request, and will continue search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 89:

Documents sufficient to identify, for each of the Products, the equipment used to perform grinding, thinning, and/or back-side processing of the Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 89:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “identif[ication of], for each of the Products, the equipment used to perform grinding, thinning, and/or back-side processing of the Product” is not proportional to the needs of this case. For example, Elm’s infringement contentions do not accuse “equipment used to perform grinding, thinning, and/or back-side processing” of infringement. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to identify,” “equipment,” “used,” and “perform grinding, thinning, and/or back-side processing of the Product.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to

this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 17 and 18, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will not produce documents responsive to this request based at least on the specific objections articulated in this response.

REQUEST FOR PRODUCTION NO. 90:

Documents sufficient to show, for each of the Products, all technical specifications and/or settings of the equipment used to perform grinding, thinning, and/or back-side processing of the Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 90:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “for each of the Products, all technical specifications and/or settings of the equipment used to perform grinding, thinning, and/or back-side processing of the Product” is not proportional to the needs of this case. For example, Elm’s infringement contentions do not accuse “equipment used to perform grinding, thinning, and/or back-side processing” of infringement. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “technical specifications and/or settings,” “equipment,” “used,” and “perform grinding, thinning, and/or back-side processing of the Product.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to

this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 17 and 18, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will not produce documents responsive to this request based at least on the specific objections articulated in this response.

REQUEST FOR PRODUCTION NO. 91:

Documents sufficient to show the number of die in each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 91:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other

applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “number of die in each Product” is not proportional to the needs of this case. Elm has not explained why it cannot derive the information it requests from commercially available products that might contain an accused product. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show” and “number of die in each Product.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any

production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information can be discerned, or such samples are publicly available to Elm. Samsung will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the number of die in each stacked semiconductor product that contain a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 92:

Documents sufficient to show each die in each Product, including the part number for each die, the location of each die within the stack, the type of die (e.g., DRAM, NAND, controller, image sensor, etc.) and quantity of each die in the Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 92:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[d]ocuments sufficient to show each die in each Product, including the part number for each die, the location of each die within the stack, the type of die (e.g., DRAM, NAND, controller, image sensor, etc.) and quantity of each die in the Product” is not proportional to the needs of this case. Elm has not explained why it cannot derive the information it requests from commercially available products that might contain an accused product. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “each die in each Product,” “part number for each die,” “location of each die within the stack,” “type of die (e.g., DRAM, NAND, controller, image sensor, etc.),” and “quantity of each die in the Product.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery.

Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 11 and 35, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information can be discerned, or such samples are publicly available to Elm. Samsung will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the listed characteristics of each die in each stacked semiconductor product that contain a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the

Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 93:

Documents sufficient to show the Physical Dimensions of each die in each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 93:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “Physical Dimensions of each die in each Product” is not proportional to the needs of this case. Elm has not explained why it cannot derive the information it requests from commercially available products that might contain an accused product. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show” and “each die in each Product.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “Physical Dimensions of each die in each Product” wherein Elm’s definition of “Physical Dimensions” includes “height, width, and thickness at the time that the relevant materials are initially deposited on or otherwise added to the Product, and as they appear in the final Product” because the Request in view of the definition does not clarify what “the relevant materials” are. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit

have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung's trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Common Request for Production Nos. 9 and 10, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information

can be discerned, or such samples are publicly available to Elm. Samsung will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the size of each die in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping, within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 94:

Documents sufficient to show the Physical Dimensions of each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 94:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “Physical Dimensions of each Product” is not proportional to the needs of this case. As an example, Elm has not explained how the Physical Dimensions of a Product that incorporates a stacked semiconductor product that contains a semiconductor layer with a thickness of 50 microns or less is relevant to a disputed issue in this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show.” These term is undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified term, and therefore, what information is actually being requested. Samsung further objects to this

Request on the grounds that it is vague, ambiguous, and overbroad as to “Physical Dimensions of each Product” wherein Elm’s definition of “Physical Dimensions” includes “height, width, and thickness at the time that the relevant materials are initially deposited on or otherwise added to the Product, and as they appear in the final Product” because the Request in view of the definition does not clarify what “the relevant materials” are. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it would impose a duty on Samsung to undertake a search for or an evaluation of information, documents, or things for which Elm is equally able to search for and evaluate. Samsung further objects to this Request to the extent that it is duplicative and seeks

production of documents requested in prior requests for production and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information can be discerned, or such samples are publicly available to Elm. Samsung will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the size of one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping, within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 95:

Documents sufficient to show the process node(s) used to make each die in each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 95:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “process node(s) used to make each die in

each Product” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show” and “process node(s) used to make each die in each Product.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production and/or seeks information that can be derived or ascertained from documents that were produced in discovery

and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request, and will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the process node used to make each die in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 96:

Documents sufficient to show the starting wafer diameter and thickness for each wafer used to make each die included in each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 96:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “starting wafer diameter and thickness for each wafer used to make each die included in each Product” is not proportional to the needs of this

case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “starting wafer diameter and thickness,” and “wafer used to make each die included in each Product.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 19 and 20, and/or seeks information that can be derived or ascertained from

documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the starting wafer diameter and thickness of each die in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 97:

Documents sufficient to show each dielectric used in each Product, including any passivation layer(s).

RESPONSE TO REQUEST FOR PRODUCTION NO. 97:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[d]ocuments sufficient to show each dielectric used in each Product, including any passivation layer(s)” is not proportional to the needs of this case. Elm has not explained why it cannot derive the information it requests from

commercially available products that might contain an accused product. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “each dielectric used in each Product,” and “passivation layer(s).” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 9, 27, 28, and 32-34, and/or seeks information that can be

derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information can be discerned, or such samples are publicly available to Elm. Samsung will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show each dielectric in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 98:

Documents sufficient to show the material composition of each dielectric in each Product, including any passivation layer(s).

RESPONSE TO REQUEST FOR PRODUCTION NO. 98:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “material composition of each dielectric in

each Product, including any passivation layer(s)” is not proportional to the needs of this case. Elm has not explained why it cannot derive the information it requests from commercially available products that might contain an accused product. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “material composition,” “each dielectric in each Product,” and “passivation layer(s)” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to

the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 9, 27, 28, and 34, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information can be discerned, or such samples are publicly available to Elm. Samsung will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the material composition of each dielectric in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 99:

Documents sufficient to show the Physical Dimensions of each dielectric in each Product, including any passivation layer(s).

RESPONSE TO REQUEST FOR PRODUCTION NO. 99:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from

discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “Physical Dimensions of each dielectric in each Product, including any passivation layer(s)” is not proportional to the needs of this case. Elm has not explained why it cannot derive the information it requests from commercially available products that might contain an accused product. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “each dielectric in each Product,” and “passivation layer(s).” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further

objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 9, 27, 28, 32, and 33, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information can be discerned, or such samples are publicly available to Elm. Samsung will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the size of each dielectric in one stacked semiconductor product that contains a die with a thickness of 50 microns or less, within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 100:

Documents sufficient to show the Material Properties of each dielectric in each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 100:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from

discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[d]ocuments sufficient to show Material Properties of each dielectric in each Product” is not proportional to the needs of this case. Elm has not explained why it cannot derive the information it requests from commercially available products that might contain an accused product. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show” and “each dielectric in each Product.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to

the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 9, 27, 28, and 34, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information can be discerned, or such samples are publicly available to Elm. Samsung will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the material properties of each dielectric in one stacked semiconductor product that contains a die with a thickness of 50 microns or less, within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 101:

Documents sufficient to show each interconnect (metal) layer used in each Product, including any RDL layers.

RESPONSE TO REQUEST FOR PRODUCTION NO. 101:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[d]ocuments sufficient to show each interconnect (metal) layer used in each Product, including any RDL layers” is not proportional to the needs of this case. Elm has not explained why it cannot derive the information it requests from commercially available products that might contain an accused product. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “each interconnect (metal) layer used in each Product,” and “RDL layers.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or

nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 10, 13, 54, and 56 and Common Request for Production Nos. 25-27, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information can be discerned, or such samples are publicly available to Elm. Samsung will continue search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show each metal interconnect layer in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 102:

Documents sufficient to show the material composition of each interconnect (metal) layer in each Product, including any RDL layers.

RESPONSE TO REQUEST FOR PRODUCTION NO. 102:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “material composition of each interconnect (metal) layer in each Product, including any RDL layers” is not proportional to the needs of this case. Elm has not explained why it cannot derive the information it requests from commercially available products that might contain an accused product. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “material composition,” “each interconnect (metal) layer in each Product,” and “RDL layers.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly

burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 13, 54, and 56 and Common Request for Production Nos. 25-27, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information can be discerned, or such samples are publicly available to Elm. Samsung will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the material composition of each metal interconnect layer in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to

identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 103:

Documents sufficient to show the Physical Dimensions of each interconnect (metal) layer in each Product, including any RDL layers.

RESPONSE TO REQUEST FOR PRODUCTION NO. 103:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “Physical Dimensions of each interconnect (metal) layer in each Product, including any RDL layers” is not proportional to the needs of this case. Elm has not explained why it cannot derive the information it requests from commercially available products that might contain an accused product. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “each interconnect (metal) layer in each Product,” and “RDL layers.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung's trade secret

and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 13, 54, and 56 and Common Request for Production Nos. 25-27, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information can be discerned, or such samples are publicly available to Elm. Samsung will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents

sufficient to show the size of each metal interconnect layer in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court’s local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 104:

Documents sufficient to show the Material Properties of each interconnect (metal) layer in each Product, including any RDL layers.

RESPONSE TO REQUEST FOR PRODUCTION NO. 104:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[d]ocuments sufficient to show the Material Properties of each interconnect (metal) layer in each Product, including any RDL layers” is not proportional to the needs of this case. Elm has not explained why it cannot derive the information it requests from commercially available products that might contain an accused product. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “each interconnect (metal) layer in each Product,” and “RDL layers.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to

the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung's trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 13, 54, and 56 and Common Request for Production Nos. 25-27, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information can be discerned, or such samples are publicly available to Elm. Samsung will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the material properties of each metal interconnect layer in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court’s local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 105:

Documents sufficient to show each die attach used in each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 105:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[d]ocuments sufficient to show each die attach used in each Product” is not proportional to the needs of this case. Elm has not explained why it cannot derive the information it requests from commercially available products that might contain an accused product. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show” and “each die attach used in each Product.” These terms are undefined and capable of different interpretations. It therefore requires Samsung

to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung's trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 9, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information can be discerned, or such samples are publicly available to Elm. Samsung will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show each die attach in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 106:

Documents sufficient to show the Physical Dimensions of each die attached used in each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 106:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “Physical Dimensions of each die attached used in each Product” is not proportional to the needs of this case. Elm has not explained why it cannot derive the information it requests from commercially available products that might contain an accused product. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show” and “each die attached used in each Product.”

These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung's trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 9, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that

it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information can be discerned, or such samples are publicly available to Elm. Samsung will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the size of each die attach in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 107:

Documents sufficient to show the Material Properties of each die attach in each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 107:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[d]ocuments sufficient to show the Material Properties of each die attach in each Product” is not proportional to the needs of this case. Elm has not explained why it cannot derive the information it requests from commercially available products that might contain an accused product. Samsung further objects to this Request on the

grounds that it is vague, ambiguous, and overbroad as to “sufficient to show” and “each die attach in each Product.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 9, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm’s possession, custody, and control. Samsung further objects to the Request to

the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information can be discerned, or such samples are publicly available to Elm. Samsung will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the material properties of each die attach in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 108:

Documents sufficient to show the process parameters and equipment used for deposition of each dielectric layer, including each inter-layer dielectric, inter-metal dielectric, and passivation layer.

RESPONSE TO REQUEST FOR PRODUCTION NO. 108:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[d]ocuments sufficient to show the process

parameters and equipment used for deposition of each dielectric layer, including each inter-layer dielectric, inter-metal dielectric, and passivation layer” is not proportional to the needs of this case. For example, Elm’s infringement contentions do not accuse “equipment used for deposition of each dielectric layer, including each inter-layer dielectric, inter-metal dielectric, and passivation layer” of infringement. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “process parameters,” “equipment,” “used,” “deposition of each dielectric layer,” “inter-layer dielectric,” “inter-metal dielectric,” and “passivation layer.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further

objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it would impose a duty on Samsung to undertake a search for or an evaluation of information, documents, or things for which Elm is equally able to search for and evaluate. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 9, 29, 30, 32, and 33, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control.

Subject to and without waiving the foregoing general and specific objections, Samsung will not produce documents responsive to this request based at least on the specific objections articulated in this response.

REQUEST FOR PRODUCTION NO. 109:

Documents sufficient to show all stress data for each dielectric layer, including all such data from ongoing process monitoring, quality control, and/or process qualification.

RESPONSE TO REQUEST FOR PRODUCTION NO. 109:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that "all stress data for each dielectric layer, including all such data from ongoing process monitoring, quality control, and/or process qualification" is not proportional to the needs of this case. Samsung further objects to this Request

on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “stress data,” “dielectric layer,” “ongoing process monitoring,” “quality control,” and “process qualification.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it would impose a duty on Samsung to undertake a search for or an evaluation of information, documents, or things for which Elm is equally able to search for and evaluate. Samsung further objects to this Request to the extent that it is duplicative and seeks production of

documents requested in prior requests for production, including but not limited to Request for Production Nos. 28, 32, 54, and 56 and Common Request for Production Nos. 1 and 2, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control.

Subject to and without waiving the foregoing general and specific objections, as noted above, Samsung will not produce any documents responsive to this request that are unrelated to the products accused of infringement in this case. Samsung has produced documents responsive to this request, and will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the stress data for each dielectric layer in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 110:

Documents sufficient to show the process parameters and equipment used for deposition of each metal layer in each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 110:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[d]ocuments sufficient to show the process

parameters and equipment used for deposition of each metal layer in each Product” is not proportional to the needs of this case. For example, Elm’s infringement contentions do not accuse “equipment used for deposition of each metal layer” of infringement. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “process parameters,” “equipment,” “used,” and “deposition of each metal layer in each Product.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to

the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 9, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will not produce documents responsive to this request based at least on the specific objections articulated in this response.

REQUEST FOR PRODUCTION NO. 111:

Documents sufficient to show the CMP of each dielectric or metal layer in each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 111:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[d]ocuments sufficient to show the CMP of each dielectric or metal layer in each Product” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “CMP,” and “each dielectric or metal layer in each Product.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to

the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung's trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 9, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request, and will continue to search for and produce, to the

extent they exist, relevant, non-privileged, and responsive documents sufficient to show the CMP of each dielectric or metal layer in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 112:

Documents sufficient to show the annealing steps, and all parameters and equipment used in the annealing steps, occurring after deposition of each dielectric layer in each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 112:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[d]ocuments sufficient to show the annealing steps, and all parameters and equipment used in the annealing steps, occurring after deposition of each dielectric layer in each Product” is not proportional to the needs of this case. For example, Elm’s infringement contentions do not accuse “equipment used in the annealing steps, occurring after deposition of each dielectric layer” of infringement. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “annealing steps,” “parameters,” “equipment,” “used,” “occurring,” “after,” and “deposition of each dielectric layer in each Product.” These terms are undefined and capable of different interpretations. It

therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung's trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 9, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce

the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request, and will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the annealing steps, and all parameters and equipment used in the annealing steps, occurring after deposition of each dielectric layer in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 113:

Documents sufficient to show every process to which each Product is subjected during wafer fabrication (manufacturing), and the order in which each such processes takes place.

RESPONSE TO REQUEST FOR PRODUCTION NO. 113:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “every process to which each Product is subjected during wafer fabrication (manufacturing), and the order in which each such processes takes place” is not proportional to the needs of this case. Samsung further objects to this Request

on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “process,” “subjected,” “during,” “wafer fabrication (manufacturing),” and “order in which each such processes takes place.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 9, 16, and 31, and/or seeks information that can be derived or ascertained from

documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request, and will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the manufacturing process in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 114:

Documents sufficient to identify the wafer fabrication location for each die used in each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 114:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[d]ocuments sufficient to identify the wafer fabrication location for each die used in each Product” is not proportional to the needs of this case.

Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to identify,” “wafer fabrication location,” and “each die used in each Product.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 46 and 48, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm’s possession,

custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the wafer fabrication location for each die in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 115:

Documents sufficient to show all process steps, process parameters and equipment used for all package assembly processing, including wafer thinning/back grind, wafer polish, saw/clean, die-attach, wire bond, encapsulation, and additionally for TSV-based products: wafer bonding, TSV etching, and TSV conductive filling.

RESPONSE TO REQUEST FOR PRODUCTION NO. 115:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “all process steps, process parameters and equipment used for all package assembly processing, including wafer thinning/back grind, wafer

polish, saw/clean, die-attach, wire bond, encapsulation, and additionally for TSV-based products: wafer bonding, TSV etching, and TSV conductive filling” is not proportional to the needs of this case. For example, Elm’s infringement contentions do not accuse “equipment used for all package assembly processing, including wafer thinning/back grind, wafer polish, saw/clean, die-attach, wire bond, encapsulation, and additionally for TSV-based products: wafer bonding, TSV etching, and TSV conductive filling” of infringement. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “process steps,” “process parameters,” “equipment,” “used,” “package assembly processing,” “wafer thinning/back grind,” “wafer polish,” “saw/clean,” “die-attach,” “wire bond,” “encapsulation,” “TSV-based products,” “wafer bonding,” “TSV etching,” and “TSV conductive filling.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party.

Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it would impose a duty on Samsung to undertake a search for or an evaluation of information, documents, or things for which Elm is equally able to search for and evaluate. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 9, 16-18, 21, 26, and 31, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control.

Subject to and without waiving the foregoing general and specific objections, as noted above, Samsung will not produce any documents responsive to this request that are unrelated to the products accused of infringement in this case. Samsung has produced documents responsive to this request, and will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the packaging process in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 116:

Documents sufficient to show the wirebonding for each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 116:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[d]ocuments sufficient to show the wirebonding for each Product” is not proportional to the needs of this case. Elm has not explained why it cannot derive the information it requests from commercially available products that might contain an accused product. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show” and “wirebonding.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information

that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 9, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information can be discerned, or such samples are publicly available to Elm. Samsung will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the wirebonding in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 117:

For Products that include TSVs, documents sufficient to show topside and bottomside RDL or final metal layout per each unique die design, and TSV location layout.

RESPONSE TO REQUEST FOR PRODUCTION NO. 117:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “documents sufficient to show topside and bottomside RDL or final metal layout per each unique die design, and TSV location layout” “[f]or Products that include TSVs” is not proportional to the needs of this case. Elm has not explained why it cannot derive the information it requests from commercially available products that might contain an accused product. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “documents,” “include TSVs,” “sufficient to show,” “topside and bottomside RDL or final metal layout,” “unique die design,” and “TSV location layout.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession,

custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 9 and 13, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request and/or samples from which responsive information can be discerned, or such samples are publicly available to Elm. Samsung will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the layout and location of TSVs in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping

within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court’s local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 118:

Documents sufficient to show the package assembly location for each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 118:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[d]ocuments sufficient to show the package assembly location for each Product” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show” and “package assembly location.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the

ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 46 and 48, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the package assembly location of one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period

consistent with the Federal Rules of Civil Procedure and this Court’s local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 119:

Documents sufficient to show the equipment used for dicing, sawing, and/or singulating wafers whose constituent die are used in the Products, and the settings and technical specifications for all such equipment.

RESPONSE TO REQUEST FOR PRODUCTION NO. 119:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[d]ocuments sufficient to show the equipment used for dicing, sawing, and/or singulating wafers whose constituent die are used in the Products, and the settings and technical specifications for all such equipment” is not proportional to the needs of this case. For example, Elm’s infringement contentions do not accuse “equipment used for dicing, sawing, and/or singulating wafers” of infringement. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “equipment,” “used,” “dicing, sawing, and/or singulating wafers,” “constituent die,” “settings,” and “technical specifications.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this

Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung's trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 23 and 24, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will not produce documents responsive to this request based at least on the specific objections articulated in this response.

REQUEST FOR PRODUCTION NO. 120:

All communications related to stress with third-parties who supply equipment or materials used to make, deposit, or otherwise form any dielectric used in the Products.

RESPONSE TO REQUEST FOR PRODUCTION NO. 120:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[a]ll communications related to stress with third-parties who supply equipment or materials used to make, deposit, or otherwise form any dielectric used in the Products” is not proportional to the needs of this case. For example, Elm’s infringement contentions do not accuse “equipment . . . used to make, deposit, or otherwise form any dielectric” of infringement. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “communications,” “related to,” “stress,” “third-parties,” “supply,” “equipment,” “materials,” “used,” “make,” “deposit,” “form,” and “dielectric.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession,

custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery, including to the extent it seeks communications and other related materials covered by the parties' agreement on custodial discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections and to the extent not already produced, Samsung will only produce those additional communications subject to and in accordance with the parties' agreement on custodial discovery.

REQUEST FOR PRODUCTION NO. 121:

All presentations related to stress made to or by third-parties who supply equipment or materials used to make, deposit, or otherwise form any dielectric used in the Products.

RESPONSE TO REQUEST FOR PRODUCTION NO. 121:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[a]ll presentations related to stress made to or by third-parties who supply equipment or materials used to make, deposit, or otherwise form any dielectric used in the Products” is not proportional to the needs of this case. For example, Elm’s infringement contentions do not accuse “equipment . . . used to make, deposit, or otherwise form any dielectric” of infringement. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “presentations,” “related to,” “stress,” “made to or by,” “third-parties,” “supply,” “equipment,” “materials,” “used,” “make,” “deposit,” “form,” and “dielectric.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to

the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request, and will continue to search for and produce, to the extent they exist, at least one relevant, non-privileged, and responsive stress presentation for one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 122:

Documents sufficient to show analysis of the composition of wafers, die, substrates, circuit layers, dielectric layers, and/or bonding layers in the Products, including all EDX, EDS, XEDS, EDXA, EDXMA, and SIMS.

RESPONSE TO REQUEST FOR PRODUCTION NO. 122:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “analysis of the composition of wafers, die, substrates, circuit layers, dielectric layers, and/or bonding layers in the Products, including all EDX, EDS, XEDS, EDXA, EDXMA, and SIMS” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “analysis,” “composition,” “wafers,” “die,” “substrates,” “circuit layers,” “dielectric layers,” “bonding layers,” “EDX,” “EDS,” “XEDS,” “EDXA,” “EDXMA,” and “SIMS.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in

Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 34, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control, including Elm's ability to independently obtain analyses of the composition of wafers, die, substrates, circuit layers, dielectric layers, and/or bonding layers in the Products, including all EDX, EDS, XEDS, EDXA, EDXMA, and SIMS for which Samsung has provided samples and/or were available for purchase by Elm during the pendency of this litigation. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung has produced documents responsive to this request, and will continue to search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the

analysis of the composition of wafers, die, substrates, circuit layers, dielectric layers, and/or bonding layers in one stacked semiconductor product that contains a die with a thickness of 50 microns or less within each representative product grouping within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products.

REQUEST FOR PRODUCTION NO. 123:

Documents sufficient to show all X-ray, SEM, and/or TEM images of the Products, including such images of any wafer, die, or component thereof incorporated into the Products.

RESPONSE TO REQUEST FOR PRODUCTION NO. 123:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “all X-ray, SEM, and/or TEM images of the Products, including such images of any wafer, die, or component thereof incorporated into the Products” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “X-ray, SEM, and/or TEM images of the Products,” “wafer,” “die,” “component,” and “incorporated into.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly

to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung's trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 35, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control, including Elm's ability to independently obtain X-ray, SEM and/or TEM images of Products for which Samsung has provided samples and/or were available for purchase by Elm during the pendency of this litigation. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested

documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will not produce documents responsive to this request based at least on the specific objections articulated in this response. Elm can conduct its own imaging of the Products to the extent it wishes to collect that information.

REQUEST FOR PRODUCTION NO. 124:

Documents sufficient to show every entity involved in the sale of each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 124:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[d]ocuments sufficient to show every entity involved in the sale of each Product” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “entity,” “involved,” and “sale.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession,

custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 45 and 48-50, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the key entities directly involved in the sale from November 2008 to January 2020 of Products in the U.S. as well as those directly involved in the sale of representative products and/or the accused semiconductor products to Samsung's top 5 customers of the accused semiconductor products, within its possession, custody, or control, and that it is able to identify

through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court’s local rules—once the parties agree on a set of representative products. Samsung will not produce documents related to every entity involved in the sale of each Product based at least on the specific objections articulated in this response, to the extent not already produced.

REQUEST FOR PRODUCTION NO. 125:

Documents sufficient to show every entity involved in the manufacturing of each Product, and the specific role of each such entity.

RESPONSE TO REQUEST FOR PRODUCTION NO. 125:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[d]ocuments sufficient to show every entity involved in the manufacturing of each Product, and the specific role of each such entity” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “entity,” “involved,” “manufacturing,” and “specific role.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung

further objects to this Request to the extent it seeks Samsung's trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 46, 48, and 49, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the key entities, and their roles, directly involved in the manufacturing of representative products and/or the top 5 accused semiconductor products with

the highest sales from November 2008 through January 2020 within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products. Samsung will not produce documents related to every entity involved in the manufacture of each Product based at least on the specific objections articulated in this response.

REQUEST FOR PRODUCTION NO. 126:

Documents sufficient to show every entity involved in marketing each Product.

RESPONSE TO REQUEST FOR PRODUCTION NO. 126:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[d]ocuments sufficient to show every entity involved in marketing each Product” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “entity,” “involved,” and “marketing.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or

information. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 47-49, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to show the key entities directly involved in U.S. marketing of the accused semiconductor products from November 2008 to January 2020 within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a

rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products. Samsung will not produce documents related to every entity involved in marketing each Product based at least on the specific objections articulated in this response.

REQUEST FOR PRODUCTION NO. 127:

All internal communications relating to stress in each Product, including but not limited to dielectric stress.

RESPONSE TO REQUEST FOR PRODUCTION NO. 127:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[a]ll internal communications relating to stress in each Product, including but not limited to dielectric stress” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “internal,” “communications,” “relating to,” “stress,” and “dielectric.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung's trade secret and/or confidential information that is unrelated to this dispute. Samsung

further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery, including to the extent it seeks communications and other related materials covered by the parties' agreement on custodial discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Common Request for Production Nos. 2, 3, 5, and 7, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will produce only those communications subject to and in accordance with the parties' agreement on custodial discovery.

REQUEST FOR PRODUCTION NO. 128:

Documents sufficient to show your internal or expected rate of return for capital investments.

RESPONSE TO REQUEST FOR PRODUCTION NO. 128:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “your internal or expected rate of return for capital investments” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show” and “internal or expected rate of return for capital investments.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant

to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 58 and 59, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control.

Subject to and without waiving the foregoing general and specific objections, Samsung will not produce documents responsive to this request based at least on the specific objections articulated in this response.

REQUEST FOR PRODUCTION NO. 129:

Documents sufficient to show the amount and form of consideration paid to or by you in exchange for intellectual property rights relating to the Products.

RESPONSE TO REQUEST FOR PRODUCTION NO. 129:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that "amount and form of consideration paid to or by you in exchange for intellectual property rights relating to the Products" is not proportional to

the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “amount and form of consideration,” “paid to or by you,” “in exchange,” “intellectual property rights,” and “relating to.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in other and/or prior requests for production, including but not limited to Request for Production Nos. 60 61, 139, and 140, and/or seeks

information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will search for and produce, to the extent they exist, relevant, non-privileged, and responsive patent acquisitions and licenses in which Samsung received rights from an entity similarly situated to Elm that potentially cover semiconductor memory devices or image sensor devices that contain a die with a thickness of 50 microns or less, dated November 2008 to present within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules.

REQUEST FOR PRODUCTION NO. 130:

Documents sufficient to show your economic analysis of any acquisition or disposition of intellectual property rights relating to the Products.

RESPONSE TO REQUEST FOR PRODUCTION NO. 130:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that "your economic analysis of any acquisition or disposition of intellectual property rights relating to the Products" is not proportional to the

needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to show,” “economic analysis,” “acquisition or disposition of intellectual property rights,” and “relating to.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production Nos. 62 and 63, and/or seeks information that can be derived or

ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections and based on Samsung's reasonable investigation to date, Samsung has not uncovered any non-privileged documents responsive to this request.

REQUEST FOR PRODUCTION NO. 131:

Documents sufficient to identify any lawsuits relating to the Products.

RESPONSE TO REQUEST FOR PRODUCTION NO. 131:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that "[d]ocuments sufficient to identify any lawsuits relating to the Products" is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to "sufficient to identify," "lawsuits," and "relating to." These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung

further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it would impose a duty on Samsung to undertake a search for or an evaluation of information, documents, or things for which Elm is equally able to search for and evaluate. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will search for and produce, to the extent they exist, relevant, non-privileged, and responsive documents sufficient to identify any patent infringement lawsuits asserting infringement by the accused semiconductor devices that contain a die with a thickness of 50 microns or less from

November 2008 to January 2020 that cover semiconductor memory devices or image sensor devices within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules, to the extent not already produced—once the parties agree on a set of representative products. Samsung will not otherwise produce documents that identify all lawsuits relating to the Products based at least on the specific objections articulated in this response.

REQUEST FOR PRODUCTION NO. 132:

Documents sufficient to identify the terms of any settlement agreement relating to any lawsuits that relate to the Products, including but not limited to all term sheet agreements and/or final settlement agreements relating to any such lawsuits.

RESPONSE TO REQUEST FOR PRODUCTION NO. 132:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “terms of any settlement agreement relating to any lawsuits that relate to the Products, including but not limited to all term sheet agreements and/or final settlement agreements relating to any such lawsuits” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “sufficient to identify,” “terms of any settlement agreement,” “relating to,” “lawsuits,” “term sheet agreements,” and “final settlement agreements.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to

what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung's trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will search for and produce, to the extent they exist, relevant, non-privileged, and responsive patent licenses in which Samsung received rights from an entity similarly situated to Elm that potentially cover semiconductor memory devices or image sensor devices that contain a die with a thickness of 50 microns or less, dated November 2008 to present within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules.

REQUEST FOR PRODUCTION NO. 133:

All expert reports produced or exchanged in any lawsuit relating to the Products.

RESPONSE TO REQUEST FOR PRODUCTION NO. 133:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under a protective order governing proceedings in which such information was produced, the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[a]ll expert reports produced or exchanged in any lawsuit relating to the Products” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “expert reports,” “produced,” “exchanged,” “lawsuit,” and “relating to.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited

with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung's trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will not produce documents responsive to this request based at least on the specific objections articulated in this response.

REQUEST FOR PRODUCTION NO. 134:

All of your discovery responses filed or exchanged in any lawsuit relating to the Products.

RESPONSE TO REQUEST FOR PRODUCTION NO. 134:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under a protective order governing proceedings in which such information was produced, the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[a]ll of your discovery responses filed or exchanged in any lawsuit relating to the Products” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “discovery responses,” “filed,” “exchanged,” “lawsuit,” and “relating to.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s trade secret and/or confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control.

Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will not produce documents responsive to this request based at least on the specific objections articulated in this response. Nonetheless, Samsung may be willing to produce responsive documents from any lawsuit that Elm specifically identifies and which it has a reasonable basis to believe is relevant to the issues raised in this case.

REQUEST FOR PRODUCTION NO. 135:

Every contract or other agreement in which you received a license or any other rights to a U.S. patent within any of the following United States Patent Classifications: 257/74; 257/685; 257/686; 257/723; 257/724; 257/777; 257/778; 257/E21.597; 257/E27.026; 257/E27.081; 257/E27.097; 365/200; 365/201; 365/230.6; 365/230.06; 438/17; 438/18; 438/107; 438/108; 438/123; 438/455; 438/459; 438/598; 438/977; 714/30; 714/718; and/or 714/719.

RESPONSE TO REQUEST FOR PRODUCTION NO. 135:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[e]very contract or other agreement in which you received a license or any other rights to a U.S. patent within any of the [] United States Patent Classifications” identified in the Request is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “contract,” “other agreement,” “received,” “license,” “other rights,” and “within.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or not sufficiently limited with respect to geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s confidential information that is

unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 60, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control.

Subject to and without waiving the foregoing general and specific objections, Samsung will search for and produce, to the extent they exist, relevant, non-privileged, and responsive patent licenses in which Samsung received rights from an entity similarly situated to Elm that potentially cover semiconductor memory devices or image sensor devices that contain a die with a thickness of 50 microns or less, dated November 2008 to present within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules.

REQUEST FOR PRODUCTION NO. 136:

Every contract or other agreement in which you conveyed a license or any other rights to a U.S. patent within any of the following United States Patent Classifications: 257/74; 257/685; 257/686; 257/723; 257/724; 257/777; 257/778; 257/E21.597; 257/E27.026; 257/E27.081; 257/E27.097; 365/200; 365/201; 365/230.6; 365/230.06; 438/17; 438/18; 438/107; 438/108; 438/123; 438/455; 438/459; 438/598; 438/977; 714/30; 714/718; and/or 714/719.

RESPONSE TO REQUEST FOR PRODUCTION NO. 136:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[e]very contract or other agreement in which you conveyed a license or any other rights to a U.S. patent within any of the [] United States Patent Classifications” identified in the Request is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “contract,” “other agreement,” “conveyed,” “license,” “other rights,” and “within.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or not sufficiently limited with respect to geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s confidential information that is

unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung's possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 60, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control.

Subject to and without waiving the foregoing general and specific objections, Samsung's reasonable investigation has not uncovered any sales of Samsung patents, licenses of Samsung patents, or similar agreements in which Samsung conveyed rights to an entity similarly situated to Elm within its possession, custody, or control that fall within any of the following United States Patent Classifications: 257/74; 257/685; 257/686; 257/723; 257/724; 257/777; 257/778; 257/E21.597; 257/E27.026; 257/E27.081; 257/E27.097; 365/200; 365/201; 365/230.6; 365/230.06; 438/17; 438/18; 438/107; 438/108; 438/123; 438/455; 438/459; 438/598; 438/977; 714/30; 714/718; and/or 714/719.

REQUEST FOR PRODUCTION NO. 137:

Every contract or other agreement in which you received a license or any other rights to a U.S. patent within the following Cooperative Patent Classification (“CPC”) Subclasses: H01L and/or G11C.

RESPONSE TO REQUEST FOR PRODUCTION NO. 137:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[e]very contract or other agreement in which you received a license or any other rights to a U.S. patent within the [] Cooperative Patent Classification (“CPC”) Subclasses” identified in the Request is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “contract,” “other agreement,” “received,” “license,” “other rights,” and “within.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or not sufficiently limited with respect to geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the

ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 60, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control.

Subject to and without waiving the foregoing general and specific objections, Samsung will search for and produce, to the extent they exist, relevant, non-privileged, and responsive patent licenses in which Samsung received rights from an entity similarly situated to Elm that potentially cover semiconductor memory devices or image sensor devices that contain a die with a thickness of 50 microns or less, dated November 2008 to present within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules.

REQUEST FOR PRODUCTION NO. 138:

Every contract or other agreement in which you conveyed a license or any other rights to a U.S. patent within the following Cooperative Patent Classification (“CPC”) Subclasses: H01L and/or G11C.

RESPONSE TO REQUEST FOR PRODUCTION NO. 138:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[e]very contract or other agreement in which you conveyed a license or any other rights to a U.S. patent within the [] Cooperative Patent Classification (“CPC”) Subclasses” identified in the Request is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “contract,” “other agreement,” “conveyed,” “license,” “other rights,” and “within.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or not sufficiently limited with respect to geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the

ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in prior requests for production, including but not limited to Request for Production No. 60, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control.

Subject to and without waiving the foregoing general and specific objections, Samsung's reasonable investigation has not uncovered any sales of Samsung patents, licenses of Samsung patents, or similar agreements in which Samsung conveyed rights to an entity similarly situated to Elm within its possession, custody, or control that fall within the following Cooperative Patent Classification Subclasses: H01L and/or G11C.

REQUEST FOR PRODUCTION NO. 139:

Every contract or other agreement in which you received a license or any other rights to a U.S. patent that relates to the Products.

RESPONSE TO REQUEST FOR PRODUCTION NO. 139:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[e]very contract or other agreement in which you received a license or any other rights to a U.S. patent that relates to the Products” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “contract,” “other agreement,” “received,” “license,” “other rights,” and “relates to.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or not sufficiently limited with respect to geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not

relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in other and/or prior requests for production, including but not limited to Request for Production Nos. 60, 61, 129, and 140, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to the Request to the extent that it is premature and unduly burdensome to produce the requested documents or things before the parties have agreed on the proper scope of Product(s) and/or representative products.

Subject to and without waiving the foregoing general and specific objections, Samsung will search for and produce, to the extent they exist, relevant, non-privileged, and responsive patent licenses in which Samsung received rights from an entity similarly situated to Elm that potentially cover semiconductor memory devices or image sensor devices that contain a die with a thickness of 50 microns or less, dated November 2008 to present within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules.

REQUEST FOR PRODUCTION NO. 140:

Every contract or other agreement in which you received a license or any other rights to a U.S. patent that relates to semiconductor memory or image sensor products.

RESPONSE TO REQUEST FOR PRODUCTION NO. 140:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[e]very contract or other agreement in which you received a license or any other rights to a U.S. patent that relates to semiconductor memory or image sensor products” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “contract,” “other agreement,” “received,” “license,” “other rights,” “relates to,” and “semiconductor memory or image sensor products.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or not sufficiently limited with respect to geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent

it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in other and/or prior requests for production, including but not limited to Request for Production Nos. 60, 61, 129, and 139, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control.

Subject to and without waiving the foregoing general and specific objections, Samsung will search for and produce, to the extent they exist, relevant, non-privileged, and responsive patent licenses in which Samsung received rights from an entity similarly situated to Elm that potentially cover semiconductor memory devices or image sensor devices that contain a die with a thickness of 50 microns or less, dated November 2008 to present within its possession, custody, or control, and that it is able to identify through a reasonable search, investigation, and inquiry, on a rolling basis within a reasonable time period consistent with the Federal Rules of Civil Procedure and this Court's local rules.

REQUEST FOR PRODUCTION NO. 141:

Every contract or other agreement in which you conveyed a license or any other rights to a U.S. patent that relates to semiconductor memory or image sensor products.

RESPONSE TO REQUEST FOR PRODUCTION NO. 141:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this Request to the extent it calls for information protected from

discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this Request as overbroad and unduly burdensome to the extent that “[e]very contract or other agreement in which you conveyed a license or any other rights to a U.S. patent that relates to semiconductor memory or image sensor products” is not proportional to the needs of this case. Samsung further objects to this Request on the grounds that it is vague, ambiguous, and overbroad as to “contract,” “other agreement,” “conveyed,” “license,” “other rights,” “relates to,” and “semiconductor memory or image sensor products.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this Request as ambiguous and overbroad, particularly to the extent that it is unlimited with respect to time or not sufficiently limited with respect to geography. In particular, because the patents-in-suit have expired, Samsung objects to this Request to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this Request to the extent it seeks Samsung’s confidential information that is unrelated to this dispute. Samsung further objects to this Request to the extent it seeks information not in Samsung’s possession, custody, or control. Samsung further objects to this Request on the ground that it is unduly burdensome and oppressive inasmuch as it calls for information more properly obtained through other forms of discovery. Samsung further objects to this Request to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this Request to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung

further objects to this Request to the extent it seeks information unrelated to the accused stacked semiconductor products. Samsung therefore has limited and will limit any production accordingly. Samsung further objects to this Request to the extent that it is duplicative and seeks production of documents requested in other and/or prior requests for production, including but not limited to Request for Production Nos. 60, 61, and 129, and/or seeks information that can be derived or ascertained from documents that were produced in discovery and that are in Elm's possession, custody, and control.

Subject to and without waiving the foregoing general and specific objections, Samsung's reasonable investigation has not uncovered any sales of Samsung patents, licenses of Samsung patents, or similar agreements in which Samsung conveyed rights to an entity similarly situated to Elm within its possession, custody, or control that include a U.S. patent that relates to semiconductor memory or image sensor products.

DATED: March 18, 2020

OF COUNSEL:

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Samsung Electronics America, Inc., and
Samsung Austin Semiconductor, LLC*

CERTIFICATE OF SERVICE

I, Adam W. Poff, hereby certify that on March 18, 2020, I caused a true and correct copy of the foregoing document to be served on the following counsel of record in the manner indicated:

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Attorneys for Defendants

Exhibit 54

**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE**

ELM 3DS INNOVATIONS, LLC,
Plaintiff,
v.
SAMSUNG ELECTRONICS CO., LTD., et al.,
Defendants.

C.A. No. 14-cv-1430-LPS-CJB

JURY TRIAL DEMANDED

PLAINTIFF ELM 3DS'S FIFTH SET OF INTERROGATORIES TO SAMSUNG

Under Federal Rules of Civil Procedure 26 and 33, Plaintiff Elm 3DS Innovations, LLC (“Elm 3DS”) requests that Defendants Samsung Electronics Co., Ltd., Samsung Semiconductor, Inc., Samsung Electronics America, Inc. and Samsung Austin Semiconductor, LLC (collectively “Samsung”), answer the following interrogatories in writing, under oath, and serve a copy of the answers upon Bartlit Beck LLP, 1801 Wewatta Street, Suite 1200, Denver, CO 80202 within 30 days of service of these interrogatories. These interrogatories are continuing in nature and must be supplemented or corrected, or both, in a timely manner.

DEFINITIONS

1. The term “Elm 3DS” refers to the Plaintiff in these actions and all parents, subsidiaries, affiliates, assignees, predecessors, employees, and agents thereof.
2. The term “Elm 3DS Patents” refers to the asserted patents in these actions.
3. The terms “You” and “Your” mean the Samsung Defendants in these actions and their parents, subsidiaries, divisions, affiliates, predecessors, assignees, successors, and acquired assets of business units, and any of their present or former officers, directors, trustees, employees, agents, representatives, attorneys, patent agents, and all other persons acting on their behalf.
4. The term “Product(s)” means any stacked semiconductor product that is sold by you, or incorporated into a product that is sold by you, that contains a semiconductor layer with a thickness of 50 microns or less. For the avoidance of doubt, “Product(s)” include all types of semiconductor

products that meet the above definition, regardless of their function (e.g., memory, image sensor, control, etc.). In addition, although Elm expects that there may be Products that are not included in the following documents, the term Product(s) specifically includes each Product listed in, or included in other products listed in, the following documents: Samsung-Elm-000062357 – Samsung-Elm-000062374.

5. The term “Physical Dimensions” includes height, width, and thickness.

6. The term “Relevant Die” means any die with a thickness of 50 microns or less. For the avoidance of doubt, this thickness measurement refers only to the semiconductor die itself, and not to the dielectric, metal, or other material that may be deposited on the die.

7. The term “Material Properties” means every known, estimated, or measured property of the material, including each of the following:

- a. Young’s modulus
- b. Shear modulus
- c. Poisson’s ratio
- d. Coefficient of thermal expansion
- e. Density
- f. Heat capacity
- g. Thermal conductivity.

8. The term “Stress Target” means a desired level or range of stress for a given entity, such as a die or a dielectric layer within a die.

9. The term “Stress Measurement” means any determination or estimation of stress that involves the use of physical measurements.

10. The term “Stress Simulation” means any determination or estimation of stress that involves the use of modeling or simulation techniques.

11. The term “Rigid Carrier” means a carrier that is used to facilitate processing of a die or wafer through one or more manufacturing process steps, but that ultimately does not become part of the product or remain with the die.

INSTRUCTIONS

1. *Lost or Destroyed Documents:* If any document or tangible thing for which identification is requested was formerly in existence or in your possession but no longer exists, or no longer is within your possession, custody or control, your response should state, for each such document or thing: (a) an identification of the document or thing and, if a document, its author and addressee; (b) the date and circumstances of such loss or destruction; and (c) the reason or justification for such loss or destruction.

2. *Documents for Which a Privilege Is Claimed:* To the extent of any claim that any information or document is privileged or in any other way free from discovery under the Federal Rules of Civil Procedure, you are requested, in lieu of producing said information or document, to produce a description of the information or document sufficient to allow Elm 3DS a specific understanding of the nature of the objection; and if a document, the identification of the author, the date of the document, the addressee(s), the person(s) who received copies of the document, and the general subject matter of the document.

3. *Ongoing Duty to Supplement:* Pursuant to Federal Rule of Civil Procedure 26(e), you are required to supplement your response to include further information that may become available after the date of your response to these interrogatories.

INTERROGATORIES

6. Separately for each stacked semiconductor product that constitutes, or is included in, a Product, identify the die included in the Product, including the following data:

- a. Identifier(s) of each die in the stack (e.g. part number);

- b. The Physical Dimensions of each die in the stack;
- c. The type of die (e.g., DRAM, NAND, controller, etc.);
- d. The process node used to make the die; and
- e. The quantity of each type of die in the packaged product.

7. Separately for each Relevant Die in each stacked semiconductor product that constitutes, or is included in, a Product, identify each dielectric, including without limitation each pre-metal dielectric, inter-layer dielectric, inter-metal dielectric, and passivation layer(s) that is deposited on the die, including the following information about each dielectric:

- a. Any identifiers You use to describe or identify the dielectric;
- b. Material composition of the dielectric;
- c. Material Properties of the dielectric; and
- d. All process parameters and equipment used for deposition of the dielectric.

8. For each dielectric identified in response to Interrogatory Number 7, identify all stress data, whether from ongoing process monitoring, quality control, simulation, or process qualification, including the following:

- a. All Stress Targets for the dielectric;
- b. All Stress Measurements of the dielectric; and
- c. All Stress Simulations of the dielectric.

9. Separately for each Relevant Die in each stacked semiconductor product that constitutes, or is included in, a Product, identify when in the manufacturing process the die is thinned to 50 microns (or less), including the following:

- a. Whether it is thinned to 50 microns (or less) before or after it is stacked with another die; and

- b. Whether at any point in time after the die is thinned to 50 microns (or less) and before the die is stacked with another die, the die is detached from any Rigid Carrier.
10. Identify every agreement in which you received a license to intellectual property that relates to any Product, including without limitation the following types of licenses:
- a. Licenses to intellectual property that is used or incorporated in any Product;
 - b. Licenses to intellectual property that is used or incorporated in the manufacture of any Product; and
 - c. Licenses to intellectual property that is used by Your customers when they use any Product.

April 24, 2020

Respectfully submitted,

/s/ Michael J. Farnan

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Counsel for Plaintiff
ELM 3DS INNOVATIONS, LLC

CERTIFICATE OF SERVICE

I hereby certify that on December April 24, 2020, a copy of Elm's Fifth Set of Interrogatories to Samsung was served on the following as indicated:

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/s/ Michael J. Farnan
Michael Farnan

Exhibit 55

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

)	
)	
ELM 3DS INNOVATIONS, LLC, a Delaware)	
limited liability company,)	
)	
Plaintiff,	)	C.A. No. 14-cv-1430-LPS
)	
v.)	
)	
SAMSUNG ELECTRONICS CO., LTD., a)	
Korean business entity,)	
SAMSUNG SEMICONDUCTOR, INC., a)	
California Corporation,)	
SAMSUNG ELECTRONICS AMERICA,)	
INC., a New York corporation, and)	
SAMSUNG AUSTIN SEMICONDUCTOR,)	
LLC, a Delaware limited liability company,)	
)	
Defendants.)	

SAMSUNG’S OBJECTIONS AND RESPONSES TO ELM’S FIFTH SET OF INTERROGATORIES TO SAMSUNG

Pursuant to Rules 26 and 33 of the Federal Rules of Civil Procedure, defendants Samsung Electronics Co., Ltd., Samsung Semiconductor, Inc., Samsung Electronics America, Inc., and Samsung Austin Semiconductor, LLC (collectively “Samsung”) hereby object and respond to Plaintiff ELM 3DS Innovations, LLC’s (“Elm”) Fifth Set of Interrogatories, dated April 22, 2020.

GENERAL OBJECTIONS

Samsung makes the following general responses and objections (“General Objections”) to each “Definition,” “Instruction,” and “Interrogatory” propounded in Elm’s Fifth Set of

Interrogatories to Samsung. These General Objections are hereby incorporated into each specific response. The assertion of the same, similar or additional objections or partial responses to individual interrogatories does not waive any of Samsung's General Objections.

1. Samsung objects to Elm's definition of "Elm" and "Elm 3DS" as vague, ambiguous, overbroad, and unduly burdensome to the extent that they include "all parents, subsidiaries, affiliates, assignees, predecessors, employees, and agents thereof." Samsung further objects to the definition as not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to the extent that these terms may include persons or entities that are not parties to this action.

2. Samsung objects to Elm's definitions of "you" and "your" as overbroad, unduly burdensome, and oppressive to the extent that they include Samsung "and their parents, subsidiaries, divisions, affiliates, predecessors, assigns, successors, and acquired assets of business units, and any of their present or former officers, directors, trustees, employees, agents, representatives, attorneys, patent agents, and all other persons acting on their behalf." Samsung will respond, subject to and without waiving all other objections, only as to the named Samsung Defendants: Samsung Electronics Co., Ltd., Samsung Semiconductor, Inc., Samsung Electronics America, Inc., and Samsung Austin Semiconductor, LLC.

3. Samsung objects to Elm's Instruction No. 1 because it purports to impose requirements and obligations on Samsung other than as set forth in the Federal Rules of Civil Procedure.

4. Samsung provides these objections and responses to the best of its current knowledge. Discovery or further investigation may reveal additional or different information

warranting amendment of these objections and responses. Samsung reserves the right to produce at trial and make reference to any evidence, facts, documents, or information not discovered at this time, omitted through good-faith error, mistake, or oversight, or the relevance of which Samsung has not presently identified.

5. By responding to these interrogatories, Samsung does not concede the relevance or materiality of any of the interrogatories or of the subjects to which it refers. Samsung's responses are made subject to, and without waiving any objections as to the competency, relevancy, materiality, privilege, or admissibility of any of the responses, or of the subject matter to which they concern, in any proceeding in this action or in any other proceeding.

6. Samsung objects to any interrogatory to the extent that it seeks information that is protected from disclosure by the attorney-client privilege, the attorney work product doctrine, the joint defense or common interest privilege, or any other applicable privilege, doctrine, or discovery immunity. The inadvertent production by Samsung of information protected from disclosure by any such privilege, doctrine, or immunity shall not be deemed a waiver by Samsung of such privileges or protections.

7. Samsung objects generally to the interrogatories to the extent they seek confidential, proprietary, or trade secret information of third parties. Samsung will endeavor to work with third parties in order to obtain their consent, if necessary, before providing such information. To the extent an interrogatory seeks information of a confidential or proprietary nature to Samsung, or to others to whom Samsung is under an obligation of confidentiality, Samsung will respond pursuant to the terms of the protective order entered in this case and subject to notice to third parties, as necessary.

8. Samsung objects to each interrogatory and to Elm's "Definitions" and "Instructions" to the extent they are vague, ambiguous, overbroad, unduly burdensome, are not proportional to the needs of this case, or purport to impose upon Samsung any duty or obligation that is inconsistent with or in excess of those obligations that are imposed by the Federal Rules of Civil Procedure, the Civil Local Rules and/or the Patent Local Rules of this Court, or any other applicable rule.

9. Samsung objects to any interrogatory to the extent it seeks irrelevant information about Samsung's products or business operations, or is not otherwise proportional to the needs of this case. Such requests are overbroad and unduly burdensome. Samsung will only produce information that is relevant to the patents-in-suit, or that is otherwise related to the claims or defenses asserted by the parties in this litigation.

10. Samsung objects to each interrogatory to the extent that it would impose a duty on Samsung to undertake a search for or an evaluation of information, documents, or things for which Elm is equally able to search for and evaluate and/or is not proportional to the needs of this case. In particular, Samsung objects to each interrogatory to the extent that it seeks information or documents that are publicly available.

11. Samsung objects to each interrogatory to the extent that it seeks information that can be derived or ascertained from documents that will be produced in discovery, is not otherwise proportional to the needs of this case, or that is uniquely in Elm's possession, custody, and control.

12. Samsung objects to each interrogatory to the extent it would require Samsung to draw a legal conclusion or contention to make a proper response.

13. Samsung objects to each interrogatory to the extent that it purports to define words or phrases to have a meaning different from their commonly understood meaning, or to include more than their commonly understood definitions.

14. In Samsung's objections, the terms "and" and "or" are intended to be construed conjunctively or disjunctively as necessary to make the objections inclusive rather than exclusive.

15. Samsung objects to each interrogatory to the extent it purports to require Samsung to identify or describe or identify "every," "each," "any," or other similarly expansive, infinite, or all-inclusive terms as overbroad and unduly burdensome.

16. Samsung objects to Elm's "Instructions" and the interrogatories to the extent they seek information that is not in the possession, custody, or control of Samsung, purport to require Samsung to speculate about the identity of persons who might have responsive documents, and/or purport to call for any description of documents that Samsung no longer possesses and/or was under no obligation to maintain.

17. Samsung objects to each interrogatory to the extent it is not limited in time and seeks information for periods of time that is not relevant to any claim or defense and is not otherwise proportional to the needs of this case.

18. Samsung objects to the interrogatories as a whole, and to each interrogatory contained therein, to the extent they are overbroad, unreasonably burdensome, and/or not proportional to the needs of this case. In particular, Samsung objects to the interrogatories as a whole, and to each interrogatory contained therein, to the extent they seek irrelevant information about accused products. By answering, objecting, and otherwise responding to the

interrogatories, Samsung does not concede relevance or admissibility, both of which Samsung reserves the right to challenge.

19. Samsung objects to the interrogatories as a whole, and to each interrogatory contained therein, to the extent they are premature and/or to the extent they: (a) conflict with any schedule entered by the Court; (b) seek information that is the subject of expert testimony; (c) seek information and/or responses that are dependent on the Court's construction of the asserted claims of the patents-in-suit; or (d) are dependent on depositions and documents that have not been taken or produced.

20. Samsung's objections as set forth herein are made without prejudice to Samsung's right to assert any additional or supplemental objections pursuant to Rule 26(e).

21. Samsung will make, and has made, reasonable efforts to respond to Elm's Fifth Set of Interrogatories to Samsung, to the extent that no objection is made, as Samsung reasonably understands and interprets each Interrogatory. If Elm subsequently asserts any interpretation of any interrogatory that differs from the interpretation of Samsung, then Samsung reserves the right to supplement and amend its objections and responses.

OBJECTIONS AND RESPONSES TO INTERROGATORIES

Subject to the foregoing qualifications and General Objections and the specific objections made below, Samsung objects and responds to Elm's Fifth Set of Interrogatories to Samsung as follows:

INTERROGATORY NO. 6:

Separately for each stacked semiconductor product that constitutes, or is included in, a Product, identify the die included in the Product, including the following data:

- a. Identifier(s) of each die in the stack (e.g. part number);
- b. The Physical Dimensions of each die in the stack;
- c. The type of die (e.g., DRAM, NAND, controller, etc.);
- d. The process node used to make the die; and
- e. The quantity of each type of die in the packaged product.

OBJECTIONS AND RESPONSE TO INTERROGATORY NO. 6:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this interrogatory to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this interrogatory to the extent that it seeks private, privileged, and confidential commercial, financial, and/or proprietary business information. Samsung further objects to this interrogatory on the grounds that it is improperly compound. Elm’s reference to this as a singular interrogatory is an impermissible attempt to circumvent the number of interrogatories permitted to be served by Elm pursuant to ¶ 7(e) of the Court’s Scheduling Order. (D.I. 111). Samsung further objects to this interrogatory on the grounds that it is vague, ambiguous, and overbroad as to “semiconductor product,” “identifier,” “part number” and “type.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this interrogatory as ambiguous and overbroad to the extent that it is unlimited with respect to time and seeks information for periods of time that are not relevant to any claim or defense and is not otherwise proportional to the needs of this case. In particular, because the patents-in-suit have expired, Samsung objects to this interrogatory to the extent it seeks

production of post-patent expiration data or information. Samsung further objects to this interrogatory to the extent it would require Samsung to draw a legal conclusion or contention to make a proper response. Samsung further objects to this interrogatory to the extent that it is duplicative and seeks information that can be derived or ascertained from documents and things that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to this interrogatory to the extent it seeks information not in Samsung's possession, custody, or control. For example, a "Product . . . that contains a semiconductor layer that is 50 microns or less," under Elm's definition of "Product," may encompass a product of a third party whose information is not in Samsung's possession, custody, or control. Samsung further objects to this interrogatory to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this interrogatory to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this interrogatory to the extent it seeks information unrelated to the products or components that are properly accused in this case or are in the proper scope of this case. Samsung further objects to this interrogatory as overbroad and unduly burdensome to the extent it seeks information that Samsung does not maintain in its ordinary course of business.

Subject to and without in any way waiving the foregoing objections, and to the extent it understands this interrogatory, Samsung responds as follows:

Pursuant to Federal Rule of Civil Procedure 33(d), Samsung refers Elm to the documents bearing bates numbers SAMSUNG-ELM-000058542; SAMSUNG-ELM-000062356; SAMSUNG-ELM-000127642 – SAMSUNG-ELM-000127658; SAMSUNG-ELM-000127928 – SAMSUNG-ELM-000127950; SAMSUNG-ELM-000128100 – SAMSUNG-ELM-000128122; SAMSUNG-ELM-000128198 – SAMSUNG-ELM-000128208; SAMSUNG-ELM-000128451 –

SAMSUNG-ELM-000128463; SAMSUNG-ELM-000128539 – SAMSUNG-ELM-000128560; SAMSUNG-ELM-000129037 – SAMSUNG-ELM-000129050; SAMSUNG-ELM-000129088 – SAMSUNG-ELM-000129100; SAMSUNG-ELM-000129190 – SAMSUNG-ELM-000129204; SAMSUNG-ELM-000129254 – SAMSUNG-ELM-000129274, wherein additional information responsive to this interrogatory may be found.

Samsung expressly reserves the right to supplement this response following further investigation and/or discovery.

INTERROGATORY NO. 7:

Separately for each Relevant Die in each stacked semiconductor product that constitutes, or is included in, a Product, identify each dielectric, including without limitation each pre-metal dielectric, inter-layer dielectric, inter-metal dielectric, and passivation layer(s) that is deposited on the die, including the following information about each dielectric:

- a. Any identifiers You use to describe or identify the dielectric;
- b. Material composition of the dielectric;
- c. Material Properties of the dielectric; and
- d. All process parameters and equipment used for deposition of the dielectric.

OBJECTIONS AND RESPONSE TO INTERROGATORY NO. 7:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this interrogatory to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this interrogatory to the extent that it seeks private, privileged, and confidential commercial, financial, and/or proprietary business information. Samsung further objects to this interrogatory on the grounds that it is improperly compound. Elm's reference to this as a singular interrogatory is an impermissible attempt to circumvent the number of interrogatories permitted to be served by Elm

pursuant to ¶ 7(e) of the Court’s Scheduling Order. (D.I. 111). Samsung further objects to this interrogatory on the grounds that it is vague, ambiguous, and overbroad as to “semiconductor product,” “dielectric,” “passivation,” “identifiers,” “process,” “parameters” and “equipment.” These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this interrogatory as ambiguous and overbroad to the extent that it is unlimited with respect to time and seeks information for periods of time that are not relevant to any claim or defense and is not otherwise proportional to the needs of this case. In particular, because the patents-in-suit have expired, Samsung further objects to this interrogatory to the extent it seeks production of post-patent expiration data or information. Samsung objects to this interrogatory to the extent it would require Samsung to draw a legal conclusion or contention to make a proper response. Samsung further objects to this interrogatory to the extent that it is duplicative and seeks information that can be derived or ascertained from documents and things that were produced in discovery and that are in Elm’s possession, custody, and control. Samsung further objects to this interrogatory to the extent it seeks information not in Samsung’s possession, custody, or control. For example, a “Product . . . that contains a semiconductor layer that is 50 microns or less,” under Elm’s definition of “Product,” may encompass a product of a third party whose information is not in Samsung’s possession, custody, or control. Samsung further objects to this interrogatory to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this interrogatory to the extent it is not reasonably tied to Elm’s infringement allegations and potentially seeking information not relevant to any party’s claim or defense and not proportional to the needs of this case. Samsung further objects to this interrogatory to the extent it seeks information unrelated to the products or components that are properly accused in this case or are in the proper scope of this case. Samsung further objects to

this interrogatory as overbroad and unduly burdensome to the extent it seeks information that Samsung does not maintain in its ordinary course of business.

Subject to and without in any way waiving the foregoing objections, and to the extent it understands this interrogatory, Samsung responds as follows: pursuant to Federal Rule of Civil Procedure 33(d), Samsung refers Elm to the documents bearing bates numbers SAMSUNG-ELM-000000022 – SAMSUNG-ELM-000000249; SAMSUNG-ELM-000000291 – SAMSUNG-ELM-000000301; SAMSUNG-ELM-000000388 – SAMSUNG-ELM-000000722; SAMSUNG-ELM-000000916 – SAMSUNG-ELM-000001249; SAMSUNG-ELM-000044571 – SAMSUNG-ELM-000045238; SAMSUNG-ELM-000054900 – SAMSUNG-ELM-000054961; SAMSUNG-ELM-000055208 – SAMSUNG-ELM-000056061; SAMSUNG-ELM-000056211 – SAMSUNG-ELM-000056782; SAMSUNG-ELM-000056797 – SAMSUNG-ELM-000057122; SAMSUNG-ELM-000057184 – SAMSUNG-ELM-000057212; SAMSUNG-ELM-000057217 – SAMSUNG-ELM-000057277; SAMSUNG-ELM-000057280 – SAMSUNG-ELM-000057284; SAMSUNG-ELM-000057287; SAMSUNG-ELM-000058255 – SAMSUNG-ELM-000058275; SAMSUNG-ELM-000220168 – SAMSUNG-ELM-000220170; SAMSUNG-ELM-000220226; SAMSUNG-ELM-000220236 – SAMSUNG-ELM-000220239; SAMSUNG-ELM-000220262; SAMSUNG-ELM-000220263 – SAMSUNG-ELM-000220266; SAMSUNG-ELM-000220273 – SAMSUNG-ELM-000220353; SAMSUNG-ELM-000220354 – SAMSUNG-ELM-000220356, wherein information responsive to this interrogatory may be found.

Documents responsive to this interrogatory are also available for inspection on a stand-alone computer according to the parties' December 17, 2015, joint letter to the Court and the Protective Order entered by the Court.

Samsung expressly reserves the right to supplement this response following further investigation and/or discovery.

INTERROGATORY NO. 8:

For each dielectric identified in response to Interrogatory Number 7, identify all stress data, whether from ongoing process monitoring, quality control, simulation, or process qualification, including the following:

- a. All Stress Targets for the dielectric;
- b. All Stress Measurements of the dielectric; and
- c. All Stress Simulations of the dielectric.

OBJECTIONS AND RESPONSE TO INTERROGATORY NO. 8:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this interrogatory to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this interrogatory to the extent that it seeks private, privileged, and confidential commercial, financial, and/or proprietary business information. Samsung further objects to this interrogatory on the grounds that it is improperly compound. Elm's reference to this as a singular interrogatory is an impermissible attempt to circumvent the number of interrogatories permitted to be served by Elm pursuant to ¶ 7(e) of the Court's Scheduling Order. (D.I. 111). Samsung further objects to this interrogatory on the grounds that it is vague, ambiguous, and overbroad as to "dielectric," "stress data," "process," "monitoring," "quality control," and "qualification." These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this interrogatory as ambiguous and overbroad to the extent that it is unlimited with respect to time and seeks information for periods of time that are not relevant to any claim or defense and is not otherwise proportional to the needs of this case. In particular, because the patents-in-suit have expired, Samsung further objects to this interrogatory to the extent it seeks production of post-patent expiration data or information.

Samsung objects to this interrogatory to the extent it would require Samsung to draw a legal conclusion or contention to make a proper response. Samsung further objects to this interrogatory to the extent that it is duplicative and seeks information that can be derived or ascertained from documents and things that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to this interrogatory to the extent it seeks information not in Samsung's possession, custody, or control. For example, a "Product . . . that contains a semiconductor layer that is 50 microns or less," under Elm's definition of "Product," may encompass a product of a third party whose information is not in Samsung's possession, custody, or control. Samsung further objects to this interrogatory to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this interrogatory to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this interrogatory to the extent it seeks information unrelated to the products or components that are properly accused in this case or are in the proper scope of this case. Samsung further objects to this interrogatory as overbroad and unduly burdensome to the extent it seeks information that Samsung does not maintain in its ordinary course of business.

Subject to and without in any way waiving the foregoing objections, and to the extent it understands this interrogatory, Samsung responds as follows: pursuant to Federal Rule of Civil Procedure 33(d), Samsung refers Elm to the documents bearing bates numbers SAMSUNG-ELM-000044571 – SAMSUNG-ELM-000045238; SAMSUNG-ELM-000055208 – SAMSUNG-ELM-000056061; SAMSUNG-ELM-000056211 – SAMSUNG-ELM-000056782; SAMSUNG-ELM-000056797 – SAMSUNG-ELM-000057122; SAMSUNG-ELM-000057184 – SAMSUNG-ELM-000057212; SAMSUNG-ELM-000057217 – SAMSUNG-ELM-000057277; SAMSUNG-ELM-000057280 – SAMSUNG-ELM-000057284; SAMSUNG-ELM-000057287;

SAMSUNG-ELM-000058255 – SAMSUNG-ELM-000058275; SAMSUNG-ELM-000220262; SAMSUNG-ELM-000220273 – SAMSUNG-ELM-000220353, wherein information responsive to this interrogatory may be found.

Samsung expressly reserves the right to supplement this response following further investigation and/or discovery.

INTERROGATORY NO. 9:

Separately for each Relevant Die in each stacked semiconductor product that constitutes, or is included in, a Product, identify when in the manufacturing process the die is thinned to 50 microns (or less), including the following:

- a. Whether it is thinned to 50 microns (or less) before or after it is stacked with another die; and
- b. Whether at any point in time after the die is thinned to 50 microns (or less) and before the die is stacked with another die, the die is detached from any Rigid Carrier.

OBJECTIONS AND RESPONSE TO INTERROGATORY NO. 9:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this interrogatory to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this interrogatory to the extent that it seeks private, privileged, and confidential commercial, financial, and/or proprietary business information. Samsung further objects to this interrogatory on the grounds that it is improperly compound. Elm's reference to this as a singular interrogatory is an impermissible attempt to circumvent the number of interrogatories permitted to be served by Elm pursuant to ¶ 7(e) of the Court's Scheduling Order. (D.I. 111). Samsung further objects to this interrogatory on the grounds that it is vague, ambiguous, and overbroad as to "semiconductor product," "process" and "detached." These terms are undefined and capable of different

interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this interrogatory as ambiguous and overbroad to the extent that it is unlimited with respect to time and seeks information for periods of time that are not relevant to any claim or defense and is not otherwise proportional to the needs of this case. In particular, because the patents-in-suit have expired, Samsung objects to this interrogatory to the extent it seeks production of post-patent expiration data or information. Samsung further objects to this interrogatory to the extent it would require Samsung to draw a legal conclusion or contention to make a proper response. Samsung further objects to this interrogatory to the extent that it is duplicative and seeks information that can be derived or ascertained from documents and things that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to this interrogatory to the extent it seeks information not in Samsung's possession, custody, or control. For example, a "Product . . . that contains a semiconductor layer that is 50 microns or less," under Elm's definition of "Product," may encompass a product of a third party whose information is not in Samsung's possession, custody, or control. Samsung further objects to this interrogatory to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this interrogatory to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this interrogatory to the extent it seeks information unrelated to the products or components that are properly accused in this case or are in the proper scope of this case. Samsung further objects to this interrogatory as overbroad and unduly burdensome to the extent it seeks information that Samsung does not maintain in its ordinary course of business.

Subject to and without in any way waiving the foregoing objections, and to the extent it understands this interrogatory, Samsung responds as follows:

[REDACTED]

[REDACTED]

Further, pursuant to Federal Rule of Civil Procedure 33(d), Samsung refers Elm to the documents bearing bates numbers SAMSUNG-ELM-000000022 – SAMSUNG-ELM-000000249; SAMSUNG-ELM-000000291 – SAMSUNG-ELM-000000301; SAMSUNG-ELM-000000388 – SAMSUNG-ELM-000000722; SAMSUNG-ELM-000000916 – SAMSUNG-ELM-000001249; SAMSUNG-ELM-000054900 – SAMSUNG-ELM-000054961; SAMSUNG-ELM-000220168 – SAMSUNG-ELM-000220170; SAMSUNG-ELM-000220226; SAMSUNG-ELM-000220236 – SAMSUNG-ELM-000220239; SAMSUNG-ELM-000220263 – SAMSUNG-ELM-000220266; SAMSUNG-ELM-000220354 – SAMSUNG-ELM-000220356, wherein information responsive to this interrogatory may be found.

Documents responsive to this interrogatory are also available for inspection on a stand-alone computer according to the parties' December 17, 2015, joint letter to the Court and the Protective Order entered by the Court.

Samsung expressly reserves the right to supplement this response following further investigation and/or discovery.

INTERROGATORY NO. 10:

Identify every agreement in which you received a license to intellectual property that relates to any Product, including without limitation the following types of licenses:

- a. Licenses to intellectual property that is used or incorporated in any Product;
- b. Licenses to intellectual property that is used or incorporated in the manufacture of any Product; and
- c. Licenses to intellectual property that is used by Your customers when they use any Product.

OBJECTIONS AND RESPONSE TO INTERROGATORY NO. 10:

Samsung incorporates by reference the General Objections as if fully set forth herein. In addition, Samsung objects to this interrogatory to the extent it calls for information protected from discovery under the attorney-client privilege, the attorney work product doctrine, and other applicable privileges or restrictions on discovery. Samsung further objects to this interrogatory to the extent that it seeks private, privileged, and confidential commercial, financial, and/or proprietary business information. Samsung further objects to this interrogatory on the grounds that it is improperly compound. Elm's reference to this as a singular interrogatory is an impermissible attempt to circumvent the number of interrogatories permitted to be served by Elm pursuant to ¶ 7(e) of the Court's Scheduling Order. (D.I. 111). Samsung further objects to this interrogatory on the grounds that it is vague, ambiguous, and overbroad as to "intellectual property," "incorporated," "manufacture," and "customers." These terms are undefined and capable of different interpretations. It therefore requires Samsung to guess as to what Elm meant by the identified terms, and therefore, what information is actually being requested. Samsung further objects to this interrogatory as ambiguous and overbroad to the extent that it is unlimited with respect to time and seeks information for periods of time that are not relevant to any claim or defense and is not otherwise proportional to the needs of this case. In particular, because the patents-in-suit have expired, Samsung further objects to this interrogatory to the extent it seeks production of post-patent expiration data or information. Samsung objects to this interrogatory to the extent it would require Samsung to draw a legal conclusion or contention to make a proper response. Samsung further objects to this interrogatory to the extent that it is duplicative and seeks information that can be derived or ascertained from documents and things that were produced in discovery and that are in Elm's possession, custody, and control. Samsung further objects to this interrogatory to the extent it seeks information that Samsung is not permitted to disclose pursuant to confidentiality obligations to, or nondisclosure agreements with, third parties, or pursuant to a privacy right of a third party. Samsung further objects to this

interrogatory to the extent it is not reasonably tied to Elm's infringement allegations and potentially seeking information not relevant to any party's claim or defense and not proportional to the needs of this case. Samsung further objects to this interrogatory to the extent it seeks information unrelated to the products or components that are properly accused in this case or are in the proper scope of this case. In particular, Samsung further objects to this interrogatory for being unduly burdensome because it seeks license agreements regardless of their relation to the accused stacked semiconductor products or technology at issue in this case. Samsung therefore has limited and will limit any response accordingly.

Subject to and without waiver of the foregoing specific and general objections, Samsung will meet and confer with Elm to determine the proper scope, if any, for a search of relevant, non-privileged and discoverable documents responsive to this interrogatory.

DATED: May 26, 2020

OF COUNSEL:

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Naveen Modi
Phillip W. Citroën
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*ServicePHSamsung-
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*Attorneys for Defendants Samsung Electronics
Co., Ltd., Samsung Semiconductor, Inc.,
Samsung Electronics America, Inc., and
Samsung Austin Semiconductor, LLC*

YOUNG CONAWAY STARGATT &
TAYLOR, LLP

/s/ Adam W. Poff

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Pilar G. Kraman (No. 5199)
Rodney Square
1000 North King Street
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*apoff@ycst.com
pkraman@ycst.com*

*Attorneys for Defendants Samsung Electronics Co.,
Ltd., Samsung Semiconductor, Inc., Samsung
Electronics America, Inc., and Samsung Austin
Semiconductor, LLC*

CERTIFICATE OF SERVICE

I, Adam W. Poff, hereby certify that on May 26, 2020, I caused a true and correct copy of the foregoing document to be served on the following counsel of record in the manner indicated:

BY E-MAIL

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Attorneys for Plaintiff

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& TAYLOR, LLP

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Wilmington, Delaware 19801

(302) 571-6600

apoff@ycst.com

pkraman@ycst.com

Attorneys for Defendants

Exhibit 56

Kidokoro, Koichiro

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Monday, July 29, 2019 4:56 PM
To: Jung, Soyoung; Meehan, Maura; Mailing List - Leedy; Farnan, Brian; Farnan, Joseph J., Jr.; Farnan, Michael; Matthew Ford; Kat Hacker; John Hughes; Adam Mortara
Cc: Poff, Adam; Kraman, Pilar; ServicePH Samsung-ELM 3DS
Subject: [EXT] RE: Elm 3DS Innovations, LLC v. Samsung Electronics Co., Ltd., et al., C.A. No. 14-1430-LPS

Soyoung,

Considering the number and magnitude of questions for which Samsung owes us answers, your insistence that we immediately answer questions first posed this past Friday is ridiculous. As just one example, I asked you on May 22 when Samsung will produce communications with its dielectric suppliers. We have heard nothing in response.

As another example, I sent you a list of the Samsung products we're aware of that contain at least one die at 50µm or less more than a month ago. We asked you to confirm that this list was complete or to provide a complete list, but you have failed to do so.

As another example, we are still waiting for Samsung to propose a path forward on the products [REDACTED]. You have failed to provide a single proposal for how to address those products.

In this context, it is difficult to take seriously Samsung's insistence on immediate answers to its questions. Unless, of course, you plan to send us your answers to those, and all other outstanding questions to Samsung, by COB today.

Nonetheless, here are a few thoughts on the issues you've raised:

1. Worldwide sales data: Samsung's worldwide sales data is relevant to a number of issues in this case. Among other things, Elm needs this information because of Samsung's failure to provide detailed geographic information about its sales. In response to an interrogatory seeking detailed information about how Samsung tracks the geographic location of its sales, Samsung merely stated that [REDACTED]. Given your failure to provide more detailed geographic data, we plan to use your worldwide sales data as a starting point for reconstructing the actual extent to which Samsung is selling products into the United States.

2. Sales data for products regarding [REDACTED] is necessary for at least two reasons:

- a. As we've noted in the past, Elm may request an adverse inference instruction for these products. In that event, the jury may need sales data for those products in order to award damages.
- b. Sales data for these products will likely help guide how the parties address these products. For example, if it turns out that a relatively small number of those products account for a large portion of the sales for those products, the parties may be able to significantly narrow the scope of this issue. Thus narrowed, this issue may be a lot more straightforward to address.

We will circulate a dial-in for 3:30pmMT tomorrow, and look forward to discussing these issues with you then.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Monday, July 29, 2019 1:25 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; Meehan, Maura <mmeehan@ycst.com>; Mailing List - Leedy <leedy@bartlit-beck.com>; Farnan, Brian <bfarnan@farnanlaw.com>; Farnan, Joseph J., Jr. <farnan@farnanlaw.com>; Farnan, Michael <mfarnan@farnanlaw.com>; Matthew Ford <matthew.ford@bartlitbeck.com>; Kat Hacker <kat.hacker@bartlitbeck.com>; John Hughes <john.hughes@bartlitbeck.com>; Adam Mortara <adam.mortara@bartlitbeck.com>

Cc: Poff, Adam <APOFF@ycst.com>; Kraman, Pilar <PKraman@ycst.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Subject: RE: Elm 3DS Innovations, LLC v. Samsung Electronics Co., Ltd., et al., C.A. No. 14-1430-LPS

Nosson,

Your email provides no answers to our questions. We are available to participate in a meet and confer at the time you proposed, but on the condition that you explain to us why worldwide financials are relevant, and why Samsung should produce financials for hundreds of products that are ambiguously defined in the interrogatories and before they are accused by Elm. Please provide your responses by COB today so that we can consider your positions before the call. Otherwise, we don't see how the meet and confer will be productive.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>

Sent: Saturday, July 27, 2019 7:23 AM

To: Jung, Soyoung <soyoungjung@paulhastings.com>; Meehan, Maura <mmeehan@ycst.com>; Mailing List - Leedy <leedy@bartlit-beck.com>; Farnan, Brian <bfarnan@farnanlaw.com>; Farnan, Joseph J., Jr. <farnan@farnanlaw.com>; Farnan, Michael <mfarnan@farnanlaw.com>; Matthew Ford <matthew.ford@bartlitbeck.com>; Kat Hacker <kat.hacker@bartlitbeck.com>; John Hughes <john.hughes@bartlitbeck.com>; Adam Mortara <adam.mortara@bartlitbeck.com>

Cc: Poff, Adam <APOFF@ycst.com>; Kraman, Pilar <PKraman@ycst.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Subject: [EXT] RE: Elm 3DS Innovations, LLC v. Samsung Electronics Co., Ltd., et al., C.A. No. 14-1430-LPS

Soyoung,

In light of Samsung's failure to provide **any** information in response to our latest requests, we believe we have no choice but to move to compel.

We are available Tuesday at 3:30 or 4pm MT to discuss further. Please confirm that you and your local counsel are available to talk then, and we'll circulate a dial-in.

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

This message may contain confidential and privileged information. If it has been sent to you in error, please reply to advise the sender of the error and then immediately delete this message.

From: Jung, Soyoung <soyoungjung@paulhastings.com>

Sent: Friday, July 26, 2019 8:59 PM

To: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; Meehan, Maura <mmeehan@ycst.com>; Mailing List - Leedy <leedy@bartlit-beck.com>; Farnan, Brian <bfarnan@farnanlaw.com>; Farnan, Joseph J., Jr. <farnan@farnanlaw.com>; Farnan, Michael <mfarnan@farnanlaw.com>; Matthew Ford <matthew.ford@bartlitbeck.com>; Kat Hacker <kat.hacker@bartlitbeck.com>; John Hughes <john.hughes@bartlitbeck.com>; Adam Mortara <adam.mortara@bartlitbeck.com>

Cc: Poff, Adam <APOFF@ycst.com>; Kraman, Pilar <PKraman@ycst.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>

Subject: RE: Elm 3DS Innovations, LLC v. Samsung Electronics Co., Ltd., et al., C.A. No. 14-1430-LPS

Nosson,

We disagree that Elm is in a position to move to compel on these interrogatories immediately. First, how do you justify requiring Samsung to undergo the extraordinary burden of producing "worldwide" revenue and profits?

Second, the parties have not yet resolved the preliminary issue of characterizing products with a semiconductor layer of 50 microns or less [REDACTED]. In addition, it appears that Elm now seeks to significantly expand

the list of accused products, which we disagree with and will respond to separately. We do not believe it would be efficient to start compiling financial data on a list of accused products that is still very fluid and changing.

To be clear, Samsung has not refused to produce responsive, appropriately tailored information at the appropriate time. If you would like to further discuss, please propose some times next week.

Regards,
Soyoung

From: Nosson Knobloch <nosson.knobloch@bartlitbeck.com>
Sent: Thursday, July 25, 2019 9:15 AM
To: Meehan, Maura <mmeehan@ycst.com>; Mailing List - Leedy <leedy@bartlit-beck.com>; Farnan, Brian <bfarnan@farnanlaw.com>; Farnan, Joseph J., Jr. <farnan@farnanlaw.com>; Farnan, Michael <mfarnan@farnanlaw.com>; Matthew Ford <matthew.ford@bartlitbeck.com>; Kat Hacker <kat.hacker@bartlitbeck.com>; John Hughes <john.hughes@bartlitbeck.com>; Adam Mortara <adam.mortara@bartlitbeck.com>
Cc: Poff, Adam <APOFF@ycst.com>; Kraman, Pilar <PKraman@ycst.com>; ServicePH Samsung-ELM 3DS <ServicePHSamsung-ELM3DS@paulhastings.com>
Subject: [EXT] RE: Elm 3DS Innovations, LLC v. Samsung Electronics Co., Ltd., et al., C.A. No. 14-1430-LPS

Counsel,

You have failed to respond to our latest discovery requests. We intend to move to compel on this right away. When are you available to meet and confer so that we can raise this with the Court?

Thanks,

-Nosson

BartlitBeck LLP

Nosson D. Knobloch | p: 303.592.3122 | c: 773.301.2851 | Nosson.Knobloch@BartlitBeck.com | 1801 Wewatta Street, 12th Floor, Denver, CO 80202

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From: Meehan, Maura <mmeehan@ycst.com>
Sent: Wednesday, July 24, 2019 3:34 PM
To: Mailing List - Leedy <leedy@bartlit-beck.com>; Farnan, Brian <bfarnan@farnanlaw.com>; Farnan, Joseph J., Jr. <farnan@farnanlaw.com>; Farnan, Michael <mfarnan@farnanlaw.com>; Matthew Ford <matthew.ford@bartlitbeck.com>; Kat Hacker <kat.hacker@bartlitbeck.com>; John Hughes <john.hughes@bartlitbeck.com>; Nosson Knobloch <nosson.knobloch@bartlitbeck.com>; Adam Mortara <adam.mortara@bartlitbeck.com>
Cc: Poff, Adam <APOFF@ycst.com>; Kraman, Pilar <PKraman@ycst.com>
Subject: Elm 3DS Innovations, LLC v. Samsung Electronics Co., Ltd., et al., C.A. No. 14-1430-LPS

Attached please find your service copy of *Samsung's Objections and Responses to Elm 3DS's Third Set of Common Interrogatories*.

Thank you.



Maura C. Meehan, Paralegal

YOUNG CONAWAY STARGATT & TAYLOR, LLP

Rodney Square, 1000 North King Street

Wilmington, DE 19801

P 302.571.5739 F 302.576.3507

mmeehan@ycst.com | www.youngconaway.com

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Exhibit 57

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United States District Court
Northern District of California

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN JOSE DIVISION

VOIP-PAL.COM, INC.,
Plaintiff,

v.

APPLE INC,
Defendant.

Case No. 18-CV-06217-LHK
CASE MANAGEMENT ORDER

VOIP-PAL.COM, INC.,
Plaintiff,

v.

AT&T CORP,
Defendant.

Case No. 18-CV-06177-LHK

VOIP-PAL.COM, INC.,
Plaintiff,

v.

TWITTER INC.,
Defendant.

Case No. 18-CV-04523-LHK

United States District Court
Northern District of California

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VOIP-PAL.COM, INC.,
Plaintiff,
v.
VERIZON WIRELESS SERVICES, LLC,
et al.,
Defendant.

Case No. 18-CV-06054-LHK

Plaintiff’s Attorney: Kevin Malek
Apple Inc.’s Attorneys: John Desmarais and Peter Magic
AT&T Corp.’s Attorney: Wayne Stacy
Twitter, Inc.’s Attorneys: Gene Lee and Sarah Stahnke
Verizon Wireless Services, LLC’s Attorney: William Hector

A case management conference was held on January 16, 2019. A further case management conference is set for May 22, 2019, at 2:00 p.m. The parties shall file their joint case management statement by May 15, 2019.

Because 4 or 5 Defendants are filing 1 consolidated claim construction response brief, their brief shall limited to 30 pages in length.

30 days following issuance of the Court’s claim construction order, the parties shall reduce the number of asserted claims to 16, the number of accused products to 9 per defendant, and the number of prior art references to 40 (to be served 14 days after Plaintiff’s election of asserted claims, with no more than 20 references against each patent).

30 days following the close of fact discovery, the parties shall reduce the number of asserted claims to 14, the number of accused products to 8, and the number of prior art references to 30 (to be served 14 days after Plaintiff’s election of asserted claims, with no more than 15 references against each patent).

21 days before filing any motion for summary judgment, the parties shall reduce the number of asserted claims to 5, the number of accused products to 5 per defendant, and the number of prior art references to 12.

30 days before the pretrial conference, the parties shall further reduce the number of asserted claims to 3, the number of accused products to 4 per defendant, and the number of prior art references to 10. These same limits apply at trial.

The discovery rules in the Federal Rules of Civil Procedure shall govern the case.

The Court will address limits on the number of summary judgment and Daubert motions at a later time.

United States District Court
Northern District of California

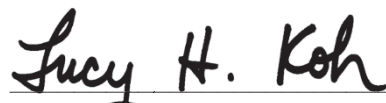
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The Court set the following case schedule:

Scheduled Event	Date
Disclosure of Asserted Claims and Infringement Contentions	January 30, 2019
Last Day to Amend the Pleadings/Add Parties	February 13, 2019
Invalidity Contentions	March 18, 2019
Exchange of Proposed Terms for Construction	April 1, 2019
Exchange of Preliminary Claim Constructions and Extrinsic Evidence	April 22, 2019
Damages Contentions	May 7, 2019
Joint Claim Construction and Prehearing Statement	May 17, 2019
Further Case Management Conference	May 22, 2019, at 2:00 p.m.
Responsive Damages Contentions	June 13, 2019
Close of Claim Construction Discovery	June 17, 2019
Opening Claim Construction Brief	July 1, 2019
Responsive Claim Construction Brief	July 19, 2019
Reply Claim Construction Brief	July 26, 2019
Claim Construction Hearing	August 15, 2019, at 1:30 p.m.
Close of Fact Discovery	November 15, 2019
Opening Expert Reports	January 6, 2020
Rebuttal Expert Reports	February 3, 2020
Close of Expert Discovery	March 2, 2020
Last Day to File Dispositive Motions and Daubert Motions	April 2, 2020
Hearing on Dispositive Motions and Daubert Motions	May 14, 2020, at 1:30 p.m.

IT IS SO ORDERED.

Dated: January 16, 2019



LUCY H. KOH
United States District Judge