

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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TAIWAN SEMICONDUCTOR MANUFACTURING COMPANY, LTD.  
and GLOBALFOUNDRIES U.S. INC.,  
Petitioner,

v.

GODO KAISHA IP BRIDGE 1,  
Patent Owner.

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Case IPR2016-01377<sup>1</sup>  
Patent 6,197,696 B1

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Before JUSTIN T. ARBES, MICHAEL J. FITZPATRICK, and  
JENNIFER MEYER CHAGNON, *Administrative Patent Judges*.

CHAGNON, *Administrative Patent Judge*.

FINAL WRITTEN DECISION  
*Inter Partes* Review  
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

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<sup>1</sup> GlobalFoundries U.S. Inc.'s motion for joinder in Case IPR2017-00922 was granted.

## I. INTRODUCTION

We have jurisdiction to hear this *inter partes* review under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons discussed herein, we determine that Petitioner has shown, by a preponderance of the evidence, that claims 10–12 (“the challenged claims”) of U.S. Patent No. 6,197,696 B1 (Ex. 1001, “the ’696 patent”) are unpatentable.

### A. Procedural History

Taiwan Semiconductor Manufacturing Company, Ltd. (“Petitioner”)<sup>2</sup> filed a Petition for *inter partes* review of claims 10–12 of the ’696 patent. Paper 2 (“Pet.”). Petitioner provided a Declaration of Bruce W. Smith, Ph.D., (Ex. 1002) to support its positions. Godo Kaisha IP Bridge 1 (“Patent Owner”) filed a Preliminary Response to the Petition. Paper 6 (“Prelim. Resp.”). Pursuant to our authorization (Paper 7), Petitioner filed a Reply to the Preliminary Response (Paper 9) and Patent Owner filed a Sur-Reply (Paper 10).

Pursuant to 35 U.S.C. § 314(a), on January 18, 2017, we instituted *inter partes* review to determine whether claims 10–12 are unpatentable

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<sup>2</sup> On August 8, 2017, we granted a motion for joinder filed by GlobalFoundries U.S. Inc. (“GlobalFoundries”) in IPR2017-00922, and authorized GlobalFoundries to participate in this proceeding only on a limited basis. *See* Paper 29; Ex. 3003 (IPR2017-00922, Paper 10). Although the papers referenced herein were filed by Taiwan Semiconductor Manufacturing Company, Ltd., we refer to both entities as “Petitioner” throughout this Decision.

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under 35 U.S.C. § 103(a) as obvious in view of Grill<sup>3</sup> and Aoyama.<sup>4</sup> *See* Paper 11 (“Inst. Dec.”). Subsequent to institution, Patent Owner filed a Patent Owner Response (Paper 19, “PO Resp.”), along with a Declaration of Alexander Glew, Ph.D., (Ex. 2009) to support its positions. Petitioner filed a Reply (Paper 26, “Reply”) to the Patent Owner Response, along with a second Declaration of Dr. Smith (Ex. 1050) in support thereof.

Petitioner filed a Motion to Exclude (Paper 30, “Pet. Mot.”) certain evidence submitted by Patent Owner. Patent Owner filed an Opposition (Paper 37), and Petitioner filed a Reply (Paper 41). Patent Owner filed Observations on the cross-examination of Dr. Smith (Paper 34), and Petitioner filed a Response thereto (Paper 35). Pursuant to our authorization, Patent Owner also filed a listing of portions of Petitioner’s Reply that allegedly exceed the proper scope of a reply (Paper 36).

A combined oral hearing for IPR2016-01376, IPR2016-01377, IPR2016-01378, and IPR2016-01379 was held on September 12, 2017. A transcript of the hearing is included in the record. Paper 45 (“Tr.”).

#### *B. Related Proceedings*

The parties indicate that the ’696 patent has been asserted in *Godo Kaisha IP Bridge 1 v. Broadcom Ltd.*, No. 2-16-cv-00134 (E.D. Tex. 2016). Paper 4, 2; Pet. 84. Three additional *inter partes* reviews challenge claims of the ’696 patent. *See* Case IPR2016-01376; Case IPR2016-01378; Case IPR2016-01379; Pet. 82–83; Paper 4, 2–3.

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<sup>3</sup> U.S. Patent No. 6,140,226, filed July 30, 1998, issued Oct. 31, 2000 (Ex. 1005).

<sup>4</sup> U.S. Patent No. 5,592,024, issued Jan. 7, 1997 (Ex. 1018).

*C. The '696 Patent*

The '696 patent relates to a “method for forming an interconnection structure in a semiconductor integrated circuit.” Ex. 1001, 1:5–7.

According to the '696 patent, “[a]n object of the present invention is providing a method for forming an interconnection structure in which an insulating film with a low dielectric constant can be formed by an ordinary resist application process.” *Id.* at 3:2–5.

The '696 patent describes various embodiments of methods of forming an interconnection structure. *Id.* at [57]. The manufacturing process for a modified example of the fifth embodiment is depicted in Figures 24(a)–(c), 25(a)–(c), and 26(a)–(d). *Id.* at 24:52–27:60.

Figure 24(a) of the '696 patent is reproduced below.

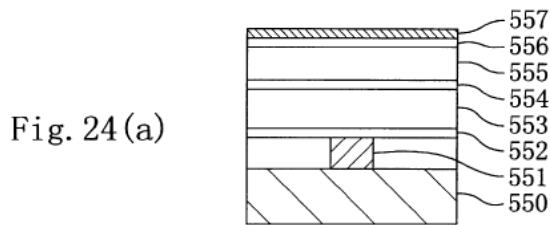


Figure 24(a), reproduced above, is a cross-sectional view of a partially formed interconnection structure during a process step for forming the same. Ex. 1001, 9:28–31. As seen in Figure 24(a), silicon nitride film 552 is formed over first metal interconnects 551 (only one shown in Figure 24(a)), which are formed on semiconductor substrate 550. *Id.* at 24:60–62. First organic film 553, first silicon dioxide film 554, second organic film 555, second silicon dioxide film 556, and titanium nitride film 557 are deposited sequentially. *Id.* at 24:65–25:11.

Figure 24(b) of the '696 patent, illustrating a subsequent step in the method of this embodiment, is reproduced below.

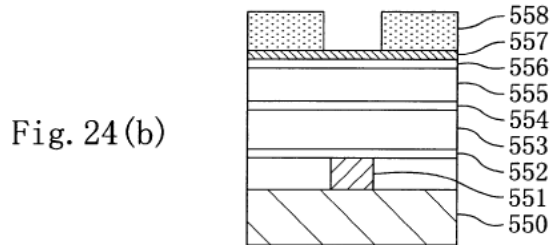


Figure 24(b), reproduced above, is a cross-sectional view of a partially formed interconnection structure during a process step for forming the same. *Id.* at 9:28–31. In this step, first resist pattern 558 is formed on titanium nitride film 557. *Id.* at 25:19–21. First resist pattern 558 includes openings for forming wiring grooves of the interconnection structure. *Id.*

Figure 24(c) of the '696 patent, illustrating a subsequent step in the method of this embodiment, is reproduced below.

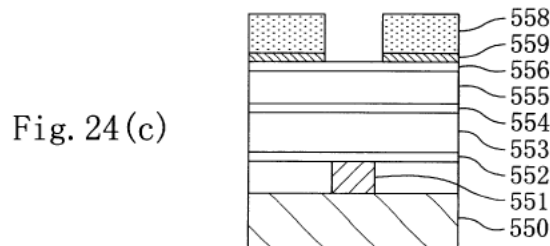


Figure 24(c), reproduced above, is a cross-sectional view of a partially formed interconnection structure during a process step for forming the same. Ex. 1001, 9:28–31. In this step, titanium nitride film 557 is dry-etched using first resist pattern 558 as a mask, thereby forming mask pattern 559. *Id.* at 25:21–23.

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