

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

v.

GODO KAISHA IP BRIDGE 1,
Patent Owner.

Case IPR2016-01376¹
Patent 6,197,696 B1

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

¹ GlobalFoundries U.S. Inc.'s motion for joinder in Case IPR2017-00921 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 13 and 15 (“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”)² filed a Petition for *inter partes* review of claims 13 and 15 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 13 and 15 are unpatentable

² On August 8, 2017, we granted a motion for joinder filed by GlobalFoundries U.S. Inc. (“GlobalFoundries”) in IPR2017-00921, and authorized GlobalFoundries to participate in this proceeding only on a limited basis. *See* Paper 29; Ex. 3003 (IPR2017-00921, 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.

IPR2016-01376
Patent 6,197,696 B1

under 35 U.S.C. § 103(a) as obvious in view of Grill³ and Aoyama.⁴ 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. 1049) 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. 76. Three additional *inter partes* reviews challenge claims of the ’696 patent. See Case IPR2016-01377; Case IPR2016-01378; Case IPR2016-01379; Pet. 74–75; Paper 4, 2–3.

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

⁴ 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 sixth embodiment is depicted in Figures 33(a)–(c), 34(a)–(c), and 35(a)–(c). *Id.* at 29:62–32:9.

Figure 33(a) of the '696 patent is reproduced below.

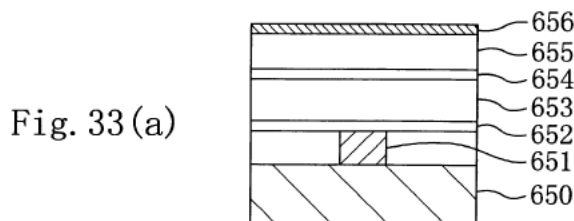


Figure 33(a), reproduced above, is a cross-sectional view of a partially formed interconnection structure during a process step for forming the same. Ex. 1001, 9:60–63. As seen in Figure 33(a), silicon nitride film 652 is formed over first metal interconnects 651 (only one shown in Figure 33(a)), which are formed on semiconductor substrate 650. *Id.* at 30:1–3. First organic film 653, silicon dioxide film 654, second organic film 655, and titanium nitride film 656 are deposited sequentially. *Id.* at 30:6–16.

Figure 33(b) of the '696 patent, illustrating a subsequent step in the method of this embodiment, is reproduced below.

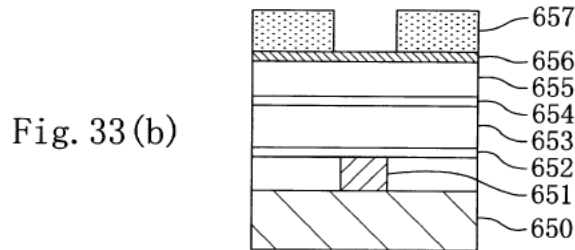


Figure 33(b), reproduced above, is a cross-sectional view of a partially formed interconnection structure during a process step for forming the same. *Id.* at 9:60–63. In this step, first resist pattern 657 is formed on titanium nitride film 656. *Id.* at 30:36–37. First resist pattern 657 includes openings for forming wiring grooves of the interconnection structure. *Id.*

Figure 33(c) of the '696 patent, illustrating a subsequent step in the method of this embodiment, is reproduced below.

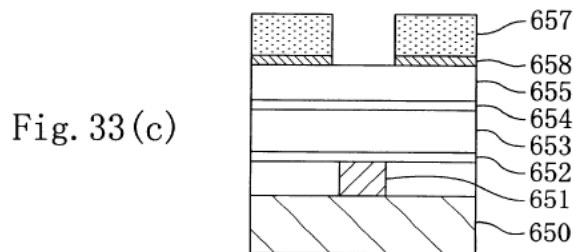


Figure 33(c), reproduced above, is a cross-sectional view of a partially formed interconnection structure during a process step for forming the same. *Ex.* 1001, 9:60–63. In this step, titanium nitride film 656 is dry-etched using first resist pattern 657 as a mask, thereby forming mask pattern 658. *Id.* at 30:38–40.

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