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Paper 23
Entered: August 8, 2025

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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MICRON TECHNOLOGY, INC.,
Petitioner,

v.

YANGTZE MEMORY TECHNOLOGIES CO., LTD.,
Patent Owner.

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IPR2025-00245
Patent 11,482,532 B2

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Before JO-ANNE M. KOKOSKI, KIMBERLY McGRAW, and MICHAEL T. CYGAN, *Administrative Patent Judges*.

CYGAN, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
*35 U.S.C. § 314*

## I. INTRODUCTION

Petitioner, Micron Technology, Inc., filed a petition for *inter partes* review of claims 1–3, 11, 13, 15–18, and 20 of U.S. Patent No. 11,482,532 B2 (Ex. 1001, "the '532 patent"). Paper 1 ("Pet." or "Petition"). Patent Owner, Yangtze Memory Technologies Co., Ltd., filed a Preliminary Response. Paper 13 ("Prelim. Resp.").

In the Preliminary Response, Patent Owner indicates that it filed a Statutory Disclaimer pursuant to 35 U.S.C. § 253 and 37 C.F.R. § 1.321(a), disclaiming claims 1–3, 18, and 20 of the '532 patent. Prelim. Resp. 6–7 (citing Ex. 2008 (Disclaimer)). Accordingly, only claims 11, 13, and 15–17 ("the challenged claims") are at issue. *See Vectra Fitness, Inc. v. TNWK Corp.*, 162 F.3d 1379, 1383 (Fed. Cir. 1998); *General Elec. Co. v. United Techs. Corp.*, IPR2017-00491, Paper 9 (PTAB July 6, 2017) (precedential).

The Director's delegee denied Patent Owner's request for discretionary denial. Paper 20.

Under the authority delegated to us by the Director under 37 C.F.R. § 42.4(a), we may only institute an *inter partes* review when "the information presented in the petition . . . and any response . . . shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." 35 U.S.C. § 314(a); *see also* 37 C.F.R. § 42.108(c). Based upon our review of the present record, Petitioner has not sufficiently shown a reasonable likelihood it will prevail with respect to at least one of the challenged claims. Accordingly, we do not institute *inter partes* review.

## II. BACKGROUND

### *A. Related Matters*

The parties identify *Yangtze Memory Technologies Company, Ltd. v. Micron Technology, Inc. and Micron Consumer Products Group*, No. 3:24-cv-04223 (N.D. Cal.), which was consolidated with *Yangtze Memory Technologies Company, Ltd. v. Micron Technology, Inc. and Micron Consumer Products Group, LLC*, No. 3:23-cv-05792-RFL (N.D. Cal.) as related matters. *See* Pet. 6; Paper 4 (Patent Owner's Mandatory Notices). Petitioner also identifies additional IPR proceedings that challenge patents that Patent Owner asserted in the District Court Litigation. Pet. 6–7.

### *B. Real Parties in Interest*

Petitioner identifies itself (Micron Technology, Inc.) "and its subsidiaries, including Micron Consumer Products Group LLC" as the real parties in interest. Pet. 6.

Patent Owner identifies itself (Yangtze Memory Technologies Co., Ltd.) as the real party in interest. Paper 6, 1.

### *C. The '532 Patent (Ex. 1001)*

The '532 patent, titled "Joint Opening Structures of Three-Dimensional Memory Devices and Methods for Forming the Same" is directed to methods for forming channel holes in 3D memory devices. *See* Ex. 1001, codes (10), (54), 57. The patent states that as semiconductor technology advances, it becomes difficult to use a single etching process to form the channel holes in the 3D memory devices that have a substantial depth. *See* Ex. 1001, 1:28–31. To address this problem, the '532 patent discloses methods to form a joint opening structure of a 3D memory device by combining two through hole formation processes. *See id.* at 1:41–2:7.

This process may allow the formed channel hole having the joint opening structure to have a large aspect ratio and a limited top-bottom aperture error, resulting in "an efficient process capability control, a simplified process complexity, and a reduced cost." *See id.* at 15:32–43.

*D. The Challenged Claims*

Subsequent to Patent Owner's disclaimer, the claims challenged by Petitioner are independent apparatus claim 11 and dependent claims 13 and 15–17 of the '532 patent. Pet. 9; Prelim. Resp. 6–7. Because Petitioner's arguments regarding apparatus claim 11 refer to method claim 1, both claims 1 and 11, with Petitioner's bracketed material added, are reproduced below. Limitation [1.F] is italicized to emphasize its relevance to the disputed issue in claim 11.

> [1.PRE] A method of forming a joint opening structure in a three-dimensional (3D) memory device, comprising:
>
> [1.A] forming a first stacked layer on a substrate;
>
> [1.B] forming a first through hole penetrating the first stacked layer to expose the substrate;
>
> [1.C] forming a first channel structure at a bottom of the first through hole and in contact with the substrate;
>
> [1.D] forming a second channel structure in the first through hole and in contact with the first channel structure;
>
> [1.E] forming a third channel structure above the first through hole and in contact with the second channel structure, wherein a size of the third channel structure along a lateral direction is larger than a top aperture of the first through hole;
>
> *[1.F] forming a second stacked layer over the third channel structure*;
>
> [1.G] forming a second through hole penetrating the second stacked layer to expose the third channel structure;

> [1.H] forming a fourth channel structure in the second through hole and in contact with the third channel structure; and
>
> [1.I] forming a fifth channel structure above the second through hole and in contact with the fourth channel structure.

Ex. 1001, 43:33–56; Pet. ii.

> [11.PRE] A joint opening structure of a three-dimensional (3D) memory device, comprising:
>
> [11.A] a first through hole penetrating a first stacked layer along a vertical direction;
>
> [11.B] a first channel structure disposed at the bottom of the first through hole;
>
> [11.C] a second channel structure in contact with the first channel structure disposed in the first through hole;
>
> [11.D] a third channel structure in contact with the second channel structure disposed over the first through hole, wherein a size of the third channel structure along a lateral direction is larger than a top aperture of the first through hole;
>
> *[11.E] a second stacked layer disposed on the third channel structure*;
>
> [11.F] a second through hole penetrating the second stacked layer along the vertical direction;
>
> [11.G] a fourth channel structure in contact with the third channel structure disposed in the second through hole;
>
> [11.H] a fifth channel structure in contact with the fourth channel structure disposed over the second through hole.

Ex. 1001, 45:24–45 (contested limitation [1.E] is emphasized in italics); Pet. x–xi.

*E. Asserted Grounds of Unpatentability*

We address Petitioner's contention that claims 11, 13, and 15–17 are unpatentable on the following grounds.

| Claims Challenged | 35 U.S.C. §[1] | Reference(s)/Basis |
|---|---|---|
| 11, 13, 15–17 | 103 | Costa[2] |
| 11, 13, 15–17 | 103 | Costa, Oh[3] |

Pet. 10.

In support of its unpatentability arguments, Petitioner relies on the declaration of Sanjay K. Banerjee, Ph.D. (Ex. 1003). Patent Owner relies on the declaration of Sunil P. Khatri, Ph.D. (Ex. 2006).

## III. ANALYSIS

### *A. Level of Ordinary Skill in the Art*

In determining whether a claimed invention would have been obvious, we consider the level of ordinary skill at the time of filing. 35 U.S.C. § 103; *see also Graham v. John Deere Co*., 383 U.S. 1, 17 (1966) (discussing pre-AIA obviousness). Petitioner contends that a person of ordinary skill in the art ("POSITA") would have had "a bachelor's degree in electrical engineering or a similar discipline, along with 2–3 years of professional experience working with (e.g., researching, designing, or teaching) monolithic 3D structures and NAND memory devices, or an equivalent level of skill, knowledge, and experience (e.g., an advanced degree may replace

[1] The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) ("AIA"), amended 35 U.S.C. § 103. The earliest claimed priority date for the '241 patent is after the effective date of the applicable AIA amendment. *See* Ex. 1001, (63). Thus, we refer to the AIA version of 35 U.S.C. § 103.

[2] Costa, US 2018/001282771 (filed Feb. 28, 2017, published June 28, 2018) (Ex. 1005, "Costa").

[3] Oh, US 2017/0154892 A1 (filed June 10, 2016, published June 1, 2017) (Ex. 1006, "Oh").

some of the professional experience). Pet. 23–24. Petitioner also asserts that a POSITA "would have been aware of and generally knowledgeable about 3D NAND's structure, how it is manufactured, and its component parts." *Id.* (citing Ex. 1003 ¶¶ 36–40). Patent Owner does not take a position on the level of ordinary skill in the art. Prelim. Resp. 11; *see also* Ex. 2006 ¶ 34 (applying Petitioner's definition of a POSITA to the opinions set forth in the declaration but reserving the right to opine to an alternative level of a POSITA).

At this stage of the proceeding, we adopt Petitioner's definition of a POSITA as it appears consistent with the level of ordinary skill in the art that is reflected by the prior art of record.

*B. Claim Construction*

We construe the '532 patent claims using the same claim construction standard that would be used to construe a claim in a civil action under 35 U.S.C. § 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent. 37 C.F.R. § 42.100(b); *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–14 (Fed. Cir. 2005) (en banc). Only terms that are in controversy need to be construed, and then only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

Petitioner states that none of the claims require express construction and the claims should receive their plain and ordinary meaning. Pet. 23. Patent Owner argues that no claim construction is necessary for the institution determination, and that the Petition "still fails if the claim term

'on' receives its plain and ordinary meaning -- e.g., physically in contact with or directly on top of with intervening objects therebetween." Prelim. Resp. 20 (citing Ex. 2006 ¶ 66). Although Patent Owner argues that Petitioner has construed "on" as including indirectly on; i.e., where there is no physical contact, the Petition addressed now-disclaimed claim 18, and the Petition does not advance any construction for the remaining claims. *See id.* at 16–17 (citing Pet. 92; Ex. 1003 ¶ 258). Consequently, we determine that no construction is required to resolve the issues for institution.

*C. Overview of Asserted Art*

*1. Costa (Ex. 1005)*

Costa is a US Patent Publication, titled "Three-Dimensional Memory Devices Containing Inter-Tier Dummy Memory Cells and Methods of Making the Same," that is directed to providing a reliable connection between vertically neighboring memory stack structures. Ex. 1005, codes (12), (54), ¶ 3. Costa describes "challenges for fabricating a multi-tier memory stack structure [as including] formation of memory openings having high aspect ratios and alleviation of effects of misalignment of tier-level memory openings formed in different tier structures." *Id.* ¶ 3.

*D. Legal Principles*

"In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")); *see also* 37 C.F.R. § 42.104(b) (requiring a petition for *inter partes* review to identify how the

challenged claim is to be construed and where each element of the claim is found in the prior art patents or printed publications relied upon).

A claim is unpatentable under 35 U.S.C. § 103 if "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the [relevant time frame] to a person having ordinary skill in the art to which said subject matter pertains." *KSR Int'l Co. v. Teleflex Inc*., 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) when in evidence[4], objective evidence of obviousness or nonobviousness, i.e., secondary considerations. *See Graham v. John Deere Co*., 383 U.S. 1, 17–18 (1966).

*E. Asserted Unpatentability of Claims 11, 13, and 15–17 over Costa*

Patent Owner argues that Petitioner has not shown the obviousness of limitation [11.E] because Petitioner has not shown that Costa teaches or suggests a "second stacked layer disposed on the third channel structure." Prelim. Resp. 20–21.

Regarding limitation [11.E], Petitioner refers back to its assertions for limitation [1.F], because both limitations are characterized by Petitioner as "substantively identical." Pet. 81. Limitation [1.F] recites the step of "forming a second stacked layer over the third channel structure." For

[4] The present record does not contain evidence of secondary considerations. *See* Pet. 97; *see generally* Prelim. Resp.

limitation [1.F], Petitioner asserts that Costa's "second alternating stack (232, 242) is formed 'on' doped semiconductor portion 173." Pet. 64–65; Ex. 1003 ¶¶ 171–175. Petitioner provides the following annotated Figure 21 of Costa:

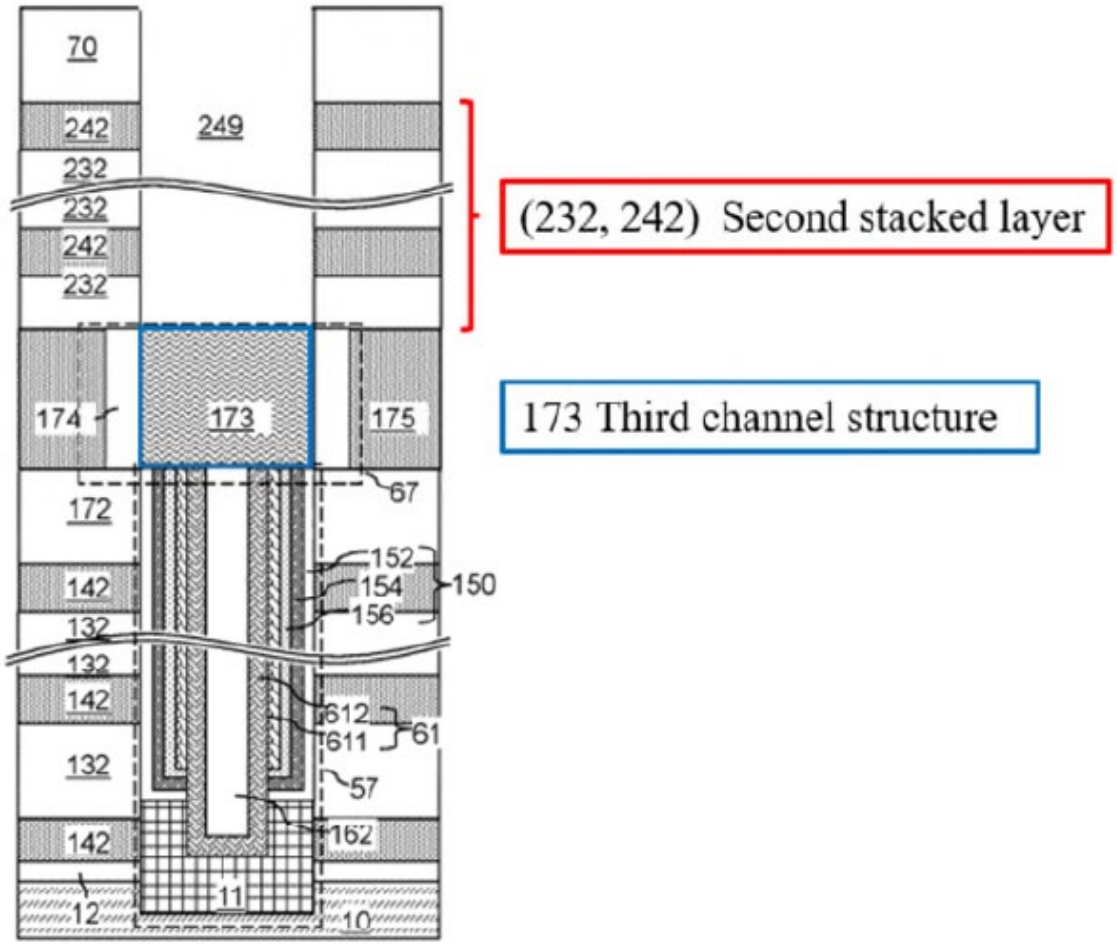



FIG. 21A

Annotated Figure 21A captions alternating layers 232 and 242 as the "second stacked layer" and layer 173 as the "third channel structure." Pet. 65. To support this assertion, Petitioner cites to Costa's description that the "second alternating stack (232, 242) of material layers is subsequently

formed on the top surface of the joint level material layers." Pet. 64 (citing Ex. 1005 ¶¶ 178, 270, 263; Ex. 1003 ¶ 175).

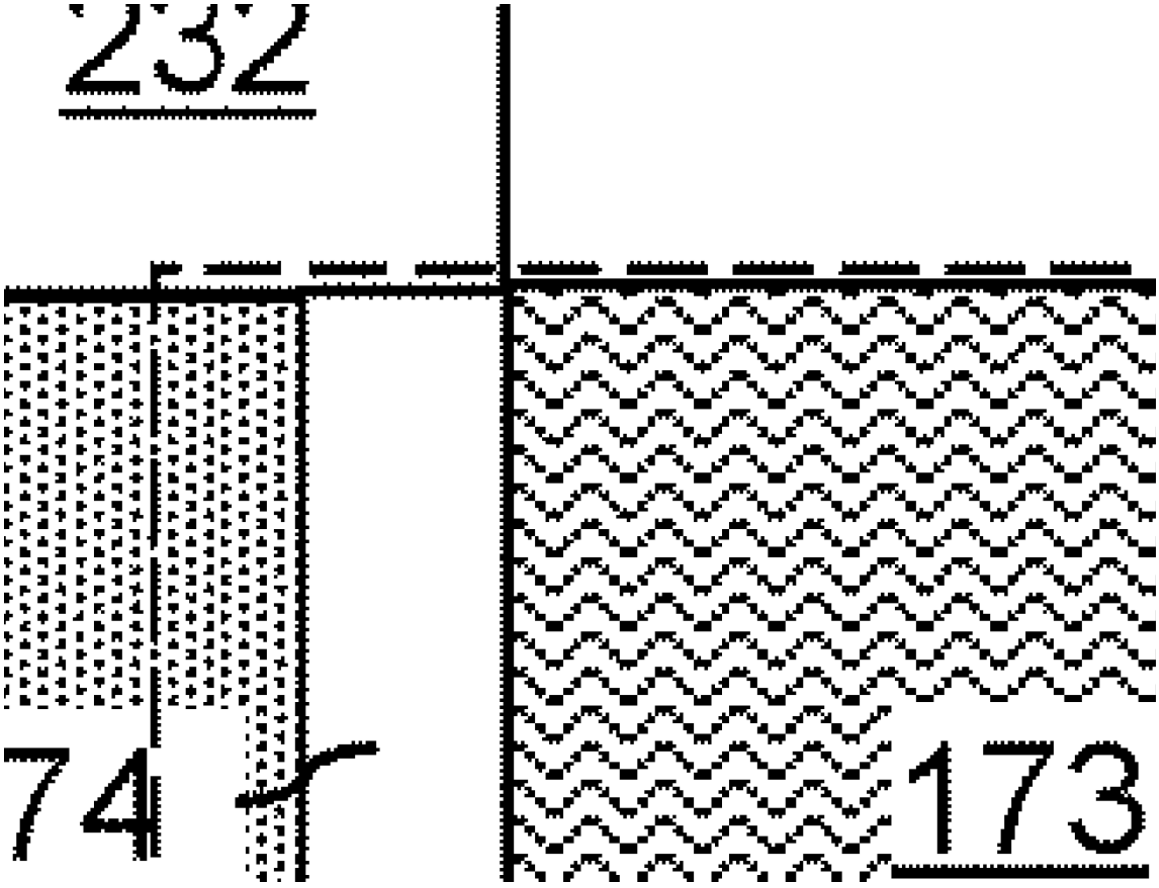
Patent Owner argues that Petitioner does not even assert that Costa's second stacked layer (232, 242) is *disposed on* third channel structure 173 and, indeed cannot, because Costa's second stacked layer does not laterally overlap with semiconductor portion 173. Prelim. Resp. 5–6 (citing Pet. 63–65, 81; Ex. 1005, Fig. 21A).

We agree with Patent Owner that the Petition fails to sufficiently show that Costa teaches a "second stacked layer *disposed on the third channel structure"* as required by apparatus claim element [11.E].

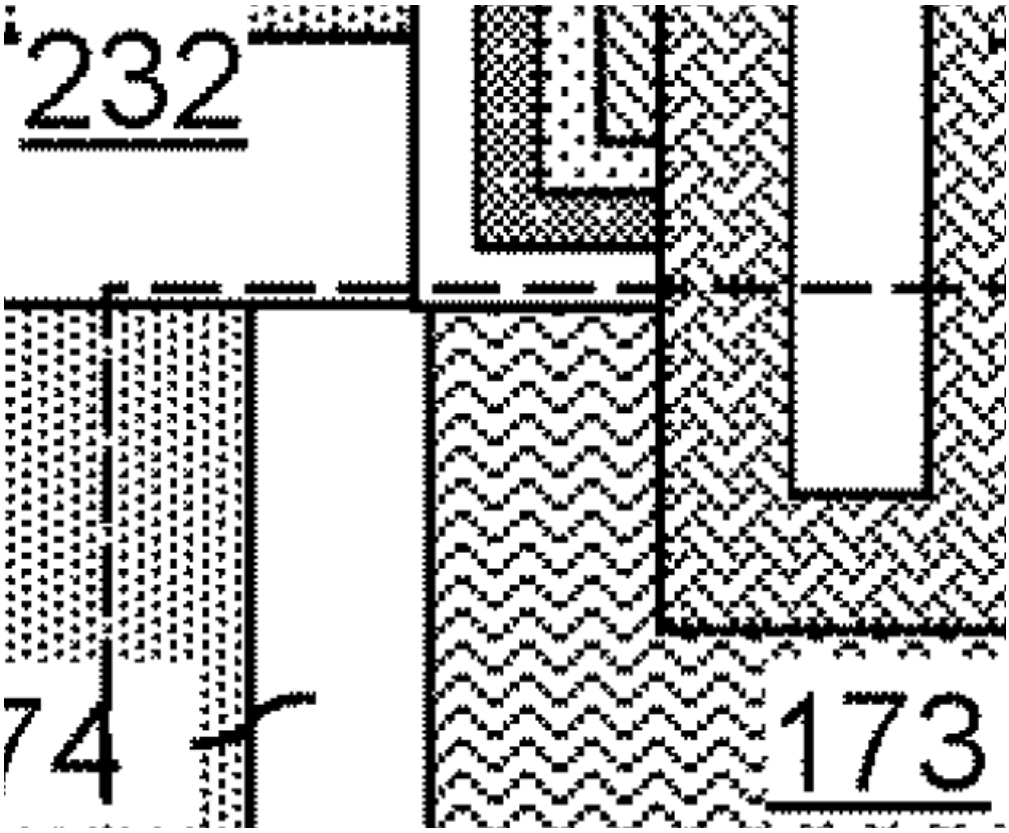
The Petition asserts that Costa's second alternating stack 232, 242 is formed "on the top surface of joint-level material layers." Pet. 64. However, Costa refers to the term "joint-level material layers" as representing layers 175–177, not the asserted third channel structure 173. Ex. 1005 ¶¶ 166, 178, 184–85; *see* Ex. 2006 ¶ 77. Thus, under Petitioner's characterization, which is consistent with Costa, Costa's second alternating stack is not formed on the third channel structure, but instead, "on the top surface of the joint level material layers" that surround the third channel structure. Because Petitioner has not explained how a second alternating stack on the surface of the joint material layers teaches a second alternating stack disposed on the third channel structure, Petitioner has not met its obviousness burden for limitation [11.E].

Nor does Petitioner's bare reference to Costa's Figure 21A sufficiently explain how the second stacked layer is asserted to be on the third channel structure. Petitioner does not provide any explanation how Figure 21A shows limitation [11.E]. Figure 21A depicts Costa's second stacked layer

232, 242 and third channel structure (173) having edges that appear to be in close proximity to each other:




The above illustration is a magnification of Figure 21A depicting the upper left edge of third channel structure 173 and lower right edge of second stacked layer member 232 in Costa. Another figure representing the same region at a slightly later stage of processing, Costa's Figure 21C, shows a clear gap between items 173 and 232:




The above illustration is a magnification of Figure 21C depicting the upper left edge of third channel structure 173 and lower right edge of second stacked layer member 232 in Costa.

Patent figures may not be relied upon for their depicted proportions where, as here, they are not expressly stated to have been drawn to scale or represent specific dimensions. *See Hockerson-Halberstadt, Inc. v. Avia Group Int'l*, 222 F.3d 951, 956 (Fed. Cir. 2000). Costa's Figures 21A–D are not so clear that Petitioner's mere inclusion of the drawing sufficiently shows that the second stacked layer touches or abuts the third channel structure, rather than representing an artifact of the draftsman. *See* Pet. 65. The only explicit description of dimensions noted by Petitioner regarding the second stacked layer and third channel structure in Costa indicates that the

third channel structure is smaller in diameter than the gap in the second stacked layer. *See* Pet. 44–45 ("portion 173 can be smaller than that of the first memory opening 149") (referring to the first embodiment); Ex. 1005 ¶ 194 (the width of opening 249 in the third channel structure is "comparable to the lateral dimensions of the first-tier opening[ ]149").

Although Petitioner's assertions for limitation [1.E] argue that channel structure 173 is "wider than the underlying fill structure 57," Petitioner does not present any obviousness theory for limitation [11.E] or limitation [1.F] on which it relies. Pet. 63–65, 81. Petitioner relies solely on Costa's third embodiment for limitations [1.F] and [11.E]. Pet. 45–46, 63–65 (citing the third embodiment to teach limitation [1.F]), 81 ("Costa discloses it for the same reasons" as [1.F]). Petitioner's explanation of why such a combination would be obvious for the relative dimensions of third channel structure 173 and *fill structure 57* which it covers for limitation [1.E] does not explain how such a change in the dimensions of the third channel structure would affect (or not) the dimensions of the *second stacked layer* for limitation [11.E]. *See* Pet. 46–63. Consequently, to the extent that Petitioner's discussion of limitation [1.E] may bear on its assertions for limitation [1.F],[5] Petitioner has not provided a reasoned explanation of how a wider third channel structure 173 would teach limitations [1.F] or [11.E].

Nor does Petitioner assert that Costa's stacked layer is not touching but is in a relation that meets Patent Owner's construction of "on." Patent Owner expands the construction of "on" to include "directly on or on with

[5] For example, that portion 173 should be wider to prevent etching of portion 174 during etching of alternating stack layers 232, 242. Pet. 55.

an intermediate feature or a layer therebetween," citing similar use in the Petition. Prelim. Resp. 17–18 (citing Pet. 92). The Petition applies that definition for a different limitation (limitation [18.B], now disclaimed), and does not provide any configuration in Costa that would meet this definition for limitation [11.E]. Consequently, Petitioner has not provided assertions that would show obviousness under Patent Owner's construction.

Further, we agree with Patent Owner's argument that Petitioner has not sufficiently alleged that the structures formed during fabrication remain after fabrication is complete. Costa shows that during fabrication, layer 242 in the second stack layer (which Petitioner asserts comprises layers 232 and 242) is removed and replaced with layer 246. Ex. 1005, Fig. 21G, ¶¶ 217–19, 280; annotated Fig 21G reproduced below (Pet. 28).

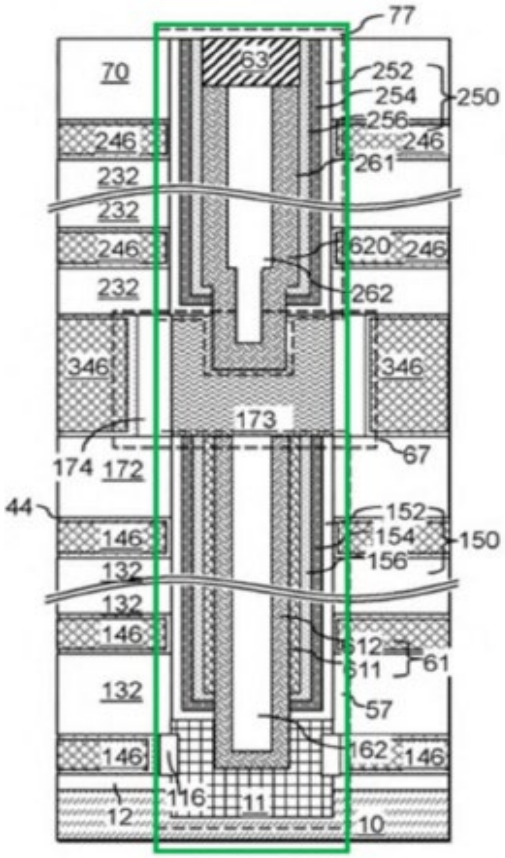



FIG. 21G

Thus, based on the present record, including figures provided by Petitioner, the Costa apparatus, after fabrication, does not contain layer 242, which Petitioner relies upon for disclosing the second stack structure. *See* Pet. 23–24, 64.

Consequently, Petitioner has failed to demonstrate a likelihood that the subject matter of claim 11 would have been obvious over Costa. Because Petitioner's assertions for claims 13 and 15–17 rely on its assertions for claim 11, Petitioner has also failed to demonstrate a reasonable likelihood that the subject matter of claims 13 and 15–17 would have been obvious over Costa.

*F. Asserted Unpatentability of claims 11, 13, and 15–17 over Costa and Oh*

With respect to limitation [11.E], Petitioner "relies upon the same claim mapping" as for its assertions against Costa alone. Pet. 94. Oh is relied upon solely to "expressly combine Costa with a secondary reference" to teach that Costa's third channel structure is wider than the underlying hole. *Id.* at 95. As in its Costa-only assertions, Petitioner focuses on the relative dimensions of the third channel structure and its underlying hole, and not on the obviousness of the relative dimensions of the third channel structure and the second stacked structure. *Id.* at 94–97. Consequently, Petitioner has not shown any teaching in Oh to cure the above-discussed defects of its Costa-only assertions. Thus, Petitioner has failed to demonstrate a reasonable likelihood that the subject matter of claims 13 and 15–17 would have been obvious over Costa and Oh.

## IV. CONCLUSION

For the foregoing reasons, we determine that Petitioner has not demonstrated a reasonable likelihood of prevailing with respect to at least one challenged claim of the '532 patent. Accordingly, we do not institute inter partes review.

## V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that the Petition is denied as to all challenged claims of U.S. Patent No. 11,482,532 B2, and no trial is instituted.

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