

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MICRON TECHNOLOGY, INC.,
Petitioner
v.

YANGTZE MEMORY TECHNOLOGIES COMPANY, LTD.,
Patent Owner

Case No.: IPR2024-00788
U.S. Patent No. 10,658,378
Issue Date: May 19, 2020

Title: THROUGH ARRAY CONTACT (TAC) FOR
THREE-DIMENSIONAL MEMORY DEVICES

PETITIONER'S REPLY

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Exhibit	Description
1001	U.S. Patent No. 10,658,378 to Tao et al.
1002	File History of U.S. Patent No. 10,658,378 to Tao et al.
1003	Declaration of Dr. Jack C. Lee (“Lee”)
1004	<i>Curriculum Vitae</i> of Dr. Jack C. Lee
1005	U.S. Patent Publ. No. 2017/0179026 A1 (“Toyama”)
1006	U.S. Patent No. 10,354,980 (“Mushiga”)
1007	U.S. Patent No. 10,262,945 (“Makala”)
1008	Minute Order, Dkt. No. 42, dated February 22, 2024 in <i>Yangtze Memory Technologies Company, Ltd. v. Micron Technology, Inc. and Micron Consumer Products Group, LLC</i> , Case No. 3:23-cv-05792-RFL
1009	Combined Civil and Criminal Federal Court Management Statistics (December 31, 2023), available at https://www.uscourts.gov/sites/default/files/data_tables/fcms_na_distcomparison1231.2023.pdf
1010	Docket from <i>Yangtze Memory Technologies Company, Ltd. v. Micron Technology, Inc. and Micron Consumer Products Group, LLC</i> , Case No. 3:23-cv-05792-RFL
1011	CN109075169A Office Action, dated November 14, 2019
1012	Certified Translation of CN109075169A Office Action, dated November 14, 2019
1013	CN109075169A Reexamination Decision, dated November 25, 2021
1014	Certified Translation of CN109075169A Reexamination Decision, dated November 25, 2021

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1015	Michelsoni, “3D Flash Memories” (2016)
1016	Aritome, “NAND Flash Memory Technologies” (2016)
1017	U.S. Patent No. 9,620,512 to Nishikawa et al.
1018	U.S. Patent Publ. No. 2016/0056188 A1 to Lee et al.
1019	U.S. Patent No. 9,293,348 to Lai et al.
1020	U.S. Patent No. 10,103,169 to Ge et al.
1021	U.S. Patent No. 8,697,519 to Jee et al.
1022	Excerpts from “Merriam-Webster’s Collegiate Dictionary,” Eleventh Edition (2014)
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1031	<i>Intentionally Omitted</i>
1032	<i>Intentionally Omitted</i>

Exhibit	Description
1033	Complaint for Patent Infringement, Dkt. No. 1, filed Nov. 9, 2023, in <i>Yangtze Memory Technologies Company, Ltd. v. Micron Technology, Inc. and Micron Consumer Products Group, LLC</i> , Case No. 3:23-cv-05792-RFL
1034	First Amended Complaint for Patent Infringement, Dkt. No. 29, filed Feb. 2, 2024, in <i>Yangtze Memory Technologies Company, Ltd. v. Micron Technology, Inc. and Micron Consumer Products Group, LLC</i> , Case No. 3:23-cv-05792-RFL
1035	Plaintiff and Counterclaim Defendant Yangtze Memory Technologies Company, Ltd.’s Disclosure of Asserted Claims and Infringement Contentions, dated May 6, 2024, in <i>Yangtze Memory Technologies Company, Ltd. v. Micron Technology, Inc. and Micron Consumer Products Group, LLC</i> , Case No. 3:23-cv-05792-RFL
1036	Declaration of Jared Bobrow in Support of Petitioner’s Motion for Admission <i>Pro Hac Vice</i>
1037	Reply Declaration of Dr. Jack C. Lee (“Lee-Reply”)
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1039	Decision Granting Institution of <i>Inter Partes</i> Review, in <i>Micron Technology, Inc. v. Yangtze Memory Technologies Company, Ltd.</i> Case No. IPR2024-00909, Paper 12 (“378-2 ID”)
1040	Transcript of the deposition of Woodward Yang, dated April 22, 2025, in Case Nos. IPR2024-00788, -00909
1041	Woodward Yang, Deposition Exhibit 3, in Case Nos. IPR2024-00788, -00909
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1043	Woodward Yang, Deposition Exhibit 5, in Case Nos. IPR2024-00788, -00909
1044	Print out of https://boundarystones.org/

I. INTRODUCTION

The Institution Decision found that the Petition had established a reasonable likelihood of success on all three prior art embodiments raised. PO's response fails to rebut the Board's preliminary findings.

As to limitation [15.A] (all three grounds), PO relies on a claim construction that improperly replaces the claim term "with" with "part of." Moreover, the prior art renders the limitation obvious even under PO's erroneous construction.

As to limitation [15.C.i] (Toyama's Second Modification and Mushiga), PO's attack that Petitioner's mappings arbitrarily divide or combine elements cannot be squared with the specification's disclosure that its own "functional building blocks have been arbitrarily defined" and that "[a]lternate boundaries can be defined." '378, 22:65-23:5. Moreover, PO has not shown any error in the Board's conclusion that, even under PO's claim construction, a POSITA would have arrived at the limitation with nothing more than a simple substitution of known elements between Toyama's third exemplary structure and its Second Modification.

As to limitation [15.H] (Toyama's Second Modification), PO's single-dielectric-structure requirement relies on a construction contrary to the well-settled patent law principle that "a" ordinarily means "one or more," and that "the" refers back to the antecedent basis's numerosity (which, here, is "one or more"). PO also

fails to recognize that multiple noncontiguous elements (here, “insulating liners 674”) can combine to form a single structure.

As to claim 17 (Toyama’s Second Modification and Mushiga), PO’s argument regarding Toyama’s Second Modification relies on a construction that improperly requires the TAC region to be “within or defined by” the dielectric structure, even though that restriction only appears permissively in the specification (e.g., “in some embodiments”). Moreover, the Second Modification discloses claim 17’s TAC region even under PO’s erroneous construction. PO’s argument regarding Mushiga ignores the text of the Petition’s mapping for the claim, and instead relies on an inadvertently misannotated figure (which nevertheless illustrates how Mushiga discloses the claim).

The Board should hold all challenged claims unpatentable under each ground raised.

II. CLAIM CONSTRUCTION

A. “a substrate with an isolation structure” (claim 15)

Claim 15 recites “a substrate with an isolation structure.” The parties’ dispute regarding this term centers on PO’s improper attempt to narrow the meaning of “with” to “part of.” POR 19. The limitation encompasses an “isolation structure” that serves to isolate the conductive elements within it from

the “substrate” even if the “isolation structure” is not part of the “substrate.”¹ PO has not identified any basis for its narrow construction.

PO does not contend that the plain meaning of “with” is “part of,” nor could it; a first object can be “with” a second object even if the second object is not part of the first. Ex. 1038, 7 (definition of “with”). In the sentence “Alice went to school **with** Bob,” it would be nonsensical to interpret that to mean that Bob is **part of** Alice.

The intrinsic record provides no basis to depart from the ordinary meaning of “with,” as PO’s construction would require. Lee-Reply ¶¶10-17. The patent repeatedly describes the substrate as distinct from—not part of—the isolation structure. Figures 2 and 13, for example, label the substrate and isolation structure with separate numbers; 202 and 233, respectively. And when the patent describes the relationship between these elements, it explains that “STI structure 233 is formed **on** a top portion of the substrate 202.” ’378, 10:36-40, Figures 2, 13.² The

¹ PO’s assertion that “the alleged substrate is not divided into isolated portions” is therefore beside the point. POR 42.

² Indeed, POSITA would have understood that “STI structure 233” would typically be formed by starting with a substrate, removing a part of the substrate to create an opening, and “fill[ing it] with a dielectric material, such as for example SiO₂”—

patent further discloses that “[i]n some embodiments a method for forming [a] 3D memory device includes forming an isolation structure **on** [the] substrate.” ’378, 21:7-8. An “isolation structure” formed **on** a “substrate” is not **part of** the substrate just as a book placed **on** a table is not **part of** the table.³ PO’s construction would exclude these embodiments. Indeed, it makes little sense to argue the isolation structure must be part of the substrate, because the isolation structure is typically a dielectric material and thus not “part of” the substrate, which might be made of a semiconductor material. Lee-Reply ¶15.

The passages of the specification on which PO relies do not meet the “exacting” standard required to “depart from the plain meaning” of “with.” *Luminara Worldwide, LLC v. Liown Elecs. Co.*, 814 F.3d 1343, 1353 (Fed. Cir. 2016). The specification uses the phrase “an isolation region **of** the substrate.” But an isolation region **of** a substrate need not be **part of** the substrate just as a pencil **of** the artist is not **part of** the artist. Ex. 1039 (IPR2024-00909, Paper 12) (“’378-2 ID”), 15-16 (Board concluding same). Although the specification at times

exactly the same process that Toyama and Mushiga disclose. ’378, 12:66-13:3; Lee-Reply ¶14.

³ PO’s assertion that “nothing in the specification suggests that the STI structure is merely ‘on’ the substrate” is therefore nonsensical. POR 22.

describes a substrate that “includes” an isolation structure, ’378, 12:64-66, the specification’s varying description of the relationship between the “substrate” and the “isolation structure” is neither a “clearly express[ed] intent to redefine” the word “with” nor is it “clear and unmistakable” disavowal. *Luminara*, 814 F.3d at 1353.

Nor has PO identified anything about the ’378’s purported invention that would justify narrowing the meaning of “with” to “part of.” As Dr. Lee explained and PO does not dispute, the purpose of the isolation structure is to “electrically isolate[] conductors from each other and from electrical interference from the substrate.” Lee ¶ 102. Nothing about that purpose requires the isolation structure to be “part of” the substrate. Lee-Reply ¶17. On the contrary, an isolation structure can isolate conductors from each other and from electrical interference from the substrate even if the isolation structure is not part of the substrate. Indeed, the specification notes that “STI structure 233 is exemplary and is not limiting,” and that “other isolation structures can be used.” ’378, 10:33-35.

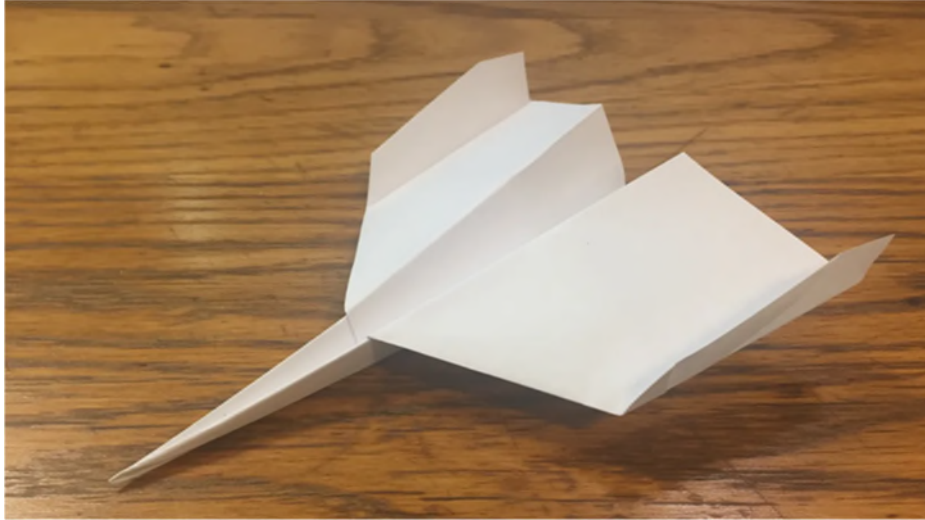
B. “a dielectric structure on the isolation structure” (claim 15)

PO asserts that the term “on” should be construed to mean “‘above’ in the z-direction (the vertical direction) when the substrate is positioned in the lowest plane of the semiconductor device in the z-direction.” POR 13. Petitioner does

not dispute this construction of “on.” The Grounds disclose or render obvious this limitation under PO’s construction, and PO does not assert otherwise.

PO errs, however, in asserting that the term “a dielectric structure on the isolation structure” “requires ... separate depositions for the isolation structure and the dielectric structure thereon.” POR 49 (quoting and disagreeing with the Institution Decision). On the contrary, the “dielectric structure” and the “isolation structure” may be formed simultaneously from a unitary material, or each structure may be composed of multiple components. Lee-Reply ¶¶20-25.

Indeed, the plain meaning of “structure” allows a unitary material to include multiple structures, just as the below paper airplane folded from a single piece of paper could be said to include a “nose structure,” a “wing structure,” and a “wing tip” structure, each with its own function:



Ex. 1041 (Yang Dep., Ex. 3), 7; Ex. 1040, 34:8-40:25 (agreeing that this paper airplane has multiple components with different functions); Ex. 1022, 5 (defining “structure” as “the arrangement of particles or parts in a substance or body”).

The ’378 patent admits that its own boundaries are “arbitrarily defined.”

The specification explains:

The boundaries of these functional building blocks have been ***arbitrarily defined*** herein for the convenience of the description. Alternate boundaries can be defined so long as the specified functions and relationships thereof are appropriately performed.

’378, 22:65-23:5 (emphasis added).

The Board correctly identified, in a related proceeding, three other aspects of the specification that support Petitioner’s construction. 378-2 ID 16-19; Lee-Reply ¶¶22-25. “First, the ’378 patent indicates that both the dielectric structure and the isolation structure may be the same material; i.e., SiO₂.” 378-2 ID 18 (citing ’378, 10:37-40, 10:46-47). “Second, the ’378 indicates that the dielectric structure may

be ‘aligned to’ and ‘in contact with’ the isolation structure,” such that the structures form “a single column, of the same material.” 378-2 ID 18 (’378, 10:30-36). “Third, the ’378 patent specification describes that the dielectric structure and a top portion of the isolation structure may be formed in the same deposition step,” which reflects the patent’s “indifference to the exact boundary” between the structures. 378-2 ID 18-19 (citing ’378, 15:12-20, 15:42-54).

C. “through array contacts (TACs) extending vertically through the dielectric and the isolation structures” (claim 15)

Petitioner agrees with PO that this term refers to the “dielectric” and “isolation” structures previously mentioned in the claim. The parties’ dispute centers on whether the device’s “through array contacts” may extend vertically through multiple dielectric structures (as Petitioner contends, Lee-Reply ¶26) or whether the claim requires that multiple “through array contacts” extend through a “single dielectric structure” (as PO contends). POR 26.

First, PO has not rebutted the Institution Decision’s reasoning in rejecting PO’s position. The Board explained that “[b]eing plural, the phrase ‘the dielectric and the isolation structures’ ... may include multiple dielectric structures and/or multiple isolation structures.” Paper 13 (“ID”) 23. Indeed, the specification expressly discloses an embodiment in which each of the device’s dielectric structures includes only one TAC, such that a device with multiple TACs (as is claimed) would necessarily have multiple dielectric structures. ID 23; ’378, 21:7-

25. PO's construction would improperly exclude this embodiment. Lee-Reply ¶27.

Second, PO's construction runs afoul of the "general rule of claim construction" that "a" means "one or more." *KCJ Corp. v. Kinetic Concepts, Inc.*, 223 F.3d 1351, 1357 (Fed. Cir. 2000). Although a departure from the rule requires that "the patentee evinces a clear intent to so limit the article," PO does not even attempt to surmount this high bar. *Id.* at 1356. Nor can it.

The specification expressly provides that "terms, such as 'a,' 'an,' or 'the,' ... may be understood to convey a singular usage or to convey a plural usage, depending at least in part upon context." '378, 4:17-19. Thus, the specification's definition "reinforces ... the applicability here of the 'one or more' general rule concerning 'a' or 'an.'" *ABS Glob., Inc. v. Cytonome/St, LLC*, 84 F.4th 1034, 1040-41 (Fed. Cir. 2023). "It also brings into play the lexicography principle—that, with narrow exceptions, '[w]here the specification instructs as to the meaning of a claim term, the inventor's lexicography governs.'" *Id.*; Lee-Reply ¶¶28-33.

PO's attempt to distinguish *KCJ* lacks merit. PO acknowledges that the claimed device may include multiple dielectric structures. POR 59-60. PO asserts, however, that the limitation "through array contacts ... extending vertically through **the** dielectric ... structure[]" means that multiple TACs must extend through a single dielectric structure. *Id.* (emphasis added). But "because the initial

indefinite article (‘a’) carries either a single or plural meaning, any later reference to that same claim element merely reflects the same potential plurality.” *Baldwin Graphic Sys., Inc. v. Siebert, Inc.*, 512 F.3d 1338, 1343 (Fed. Cir. 2008). In other words, “the reference-back ‘the’ takes its meaning from the meaning of the antecedent, so if [‘a dielectric structure’] has a plural-allowing meaning, so does the reference-back [‘the dielectric structure’] phrase.” *ABS Glob.*, 84 F.4th at 1040.

The Federal Circuit’s decision in *Baldwin* illustrates why PO’s singular-mandating interpretation of “the dielectric ... structures” is flawed. In *Baldwin*, the claim at issue recited “a pre-soaked fabric roll ..., said fabric roll having a sealed sleeve.” 512 F.3d at 1340. The district court held that “the use of ‘said fabric roll’ implies that the prior reference to ‘a fabric roll’ should be read as a single roll,” and therefore held that an accused product with multiple fabric rolls having one, shared sealed sleeve did not infringe the asserted patent. *Id.* at 1343. The Federal Circuit reversed, explaining that “[i]n grammatical terms, the instances of ‘said fabric roll’ in the claim are anaphoric phrases, referring to the initial antecedent phrase. Because the initial phrase”—that is, “a fabric roll”—“carries no definitive numerosity, the anaphoric phrases do not alter that meaning in the slightest.” *Id.* Thus, just as the district court in *Baldwin* erred by holding that “said fabric roll” required a single fabric roll, PO errs by arguing that “the dielectric and the isolation structures” requires a single dielectric structure.

PO's reliance on *Finjan* misses the mark. *Finjan* involved a claim that recited method steps including, for example, "receiving, by a computer," "determining, by the computer," and "identifying, by the computer." *Finjan LLC v. SonicWall, Inc.*, 84 F.4th 963, 966-67 (Fed. Cir. 2023). The Court held that the claim was not infringed when in the accused system some of the recited method steps were performed by one computer, and other method steps were performed by a "separate, remote computer[]." *Id.* at 974. But *Finjan* did not involve a situation, as here, where the specification expressly states that the word "a" may be used "to convey a plural usage." '378, 4:17-19. Nor did *Finjan* involve a situation, analogous to here, where multiple computers each perform each "subsequent claim limitation[]." *Finjan*, 84 F.4th at 975. Indeed, the Court recognized that the claim in *Finjan* could have been met so long as "**at least one** ... computer[] perform[s] all [of] the [claimed] functions." *Id.* (emphasis added). In other words, the claim at issue in *Finjan* could have been met by multiple computers working together.

There is nothing inconsistent between *Finjan*'s holding and Petitioner's construction. Applied here, *Finjan* merely stands for the proposition that the "**same** 'one or more'" dielectric structures must satisfy all of the limitations reciting "the dielectric structure." *Id.* at 974 (emphasis added). Petitioner's Grounds meet that requirement. §III.C.1.a.

D. “the dielectric structure comprises a through array contact region of the 3D memory device” (claim 17)

The parties’ dispute regarding this term centers on whether, as PO contends, the *TAC region* must be “within or defined by” the *dielectric structure*. POR 27. That requirement has no basis. Petitioner submits that *through array contact region* should be given its plain and ordinary meaning, that is, a region that includes at least one through array contact. Lee-Reply ¶¶34-40.

As an initial matter, the specification repeatedly and consistently uses the formulation “[component] region” to describe an area that includes more than just that component. Lee-Reply ¶36. For example, the patent’s “NAND string region 110” includes “NAND strings 112,” “slit structures 114,” and may also include “dummy channel structures 122.” ’378, Figure 1B; *see also* Ex. 1040, 69:16-20 (agreeing that NAND string region 110 includes more than just NAND strings). Similarly, “staircase region 130” includes not just “TSG contacts 132,” but also “slit structures 114.” *Id.*, Figure 1A.

The specification’s use of the phrase “TAC region” further confirms that it is not intended to exclude other components. The specification explains that “TAC region 102 includes NAND string regions 110, a TAC region 120, and top selective gate (TSG) staircase regions 130,” each of which includes multiple elements. ’378, 5:63-67.

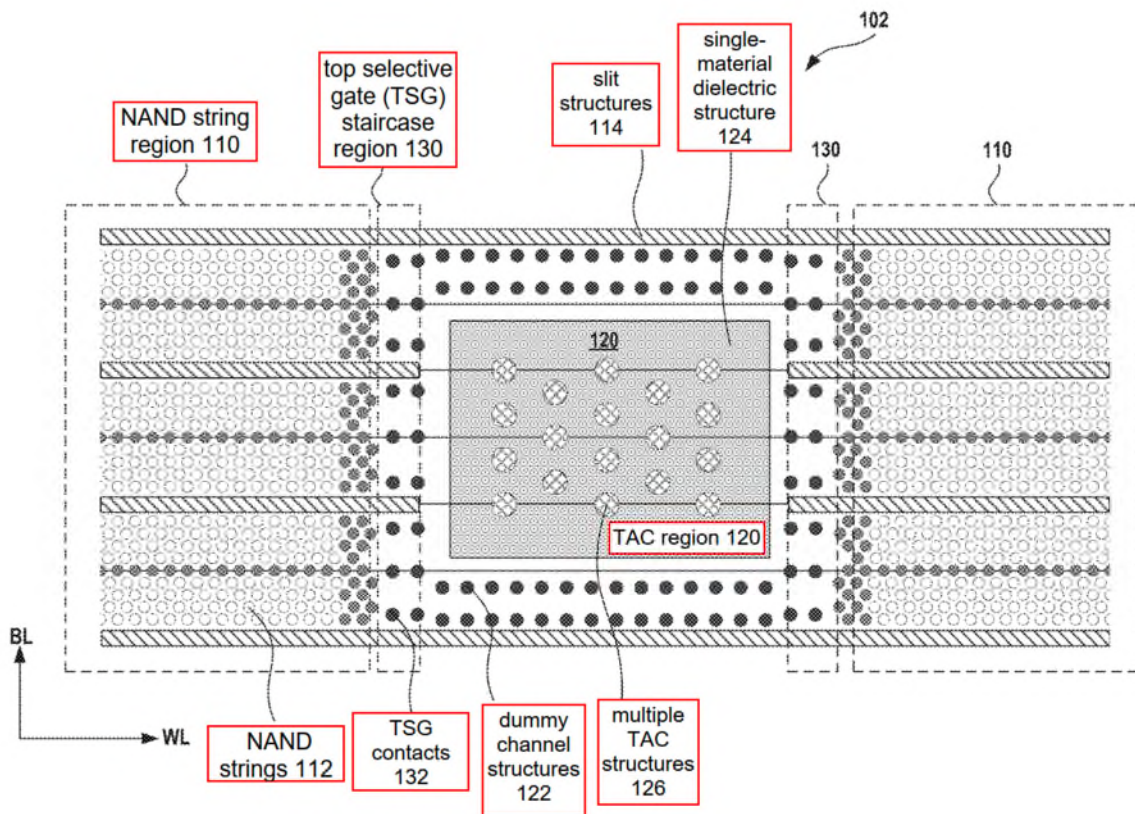


FIG. 1A

'378, Figure 1A (annotated). Thus, a “TAC region” includes elements other than a “dielectric structure” (124) and TACs (126). Indeed, a TAC region (102) can include **another** TAC region (120). And a “TAC region” can include “NAND string region 110.” As Figure 2 shows and both parties’ experts agree, “NAND string region 110” includes an alternating conductor/dielectric layer stack. Lee-Reply ¶37. Ex. 1040, 69:11-13. Figures 1B-C disclose TAC regions 104 and 106, which similarly include other elements such as an alternating conductor/dielectric layer stack. Lee-Reply ¶37. Moreover, the passages on which PO relies are neither disclaimer nor lexicography because they are phrased permissively (e.g.,

“TAC region 120 *can be* defined by a ... dielectric structure” and “[i]n some *embodiments*, dielectric structure 232 defines the boundaries ... of TAC region 120”). POR 28-29 (emphasis added). The specification, therefore, contradicts PO’s assertions that “in all [of the specification’s embodiments] the TAC region is within or defined by the dielectric structure,” and that a TAC region “cannot include the alternating conductor/dielectric layer stack.” POR 27.

Nor does the claim language support PO’s construction. PO asserts that because the dielectric structure “comprises” a TAC region, “the TAC region is nested within the dielectric structure, or is at most coextensive with the dielectric structure.” POR 27-28. But PO’s assertion is contrary to the specification’s repeated use of the term “TAC region” to describe regions that are not nested or coextensive within a dielectric structure. ’378, Figures 1A-C (TAC regions 102, 104, 106). And PO’s argument is contrary to the plain meaning of “comprises.” A fish in the ocean comprises water (like all other living things), but that doesn’t mean that water can’t exist outside of the fish. Similarly, a dielectric structure may comprise (i.e., include) a TAC region, but that doesn’t prevent the TAC region from also existing outside of the dielectric structure.

PO’s assertion that its construction “is the only one that gives meaning to the term ‘through array contact region’” lacks merit. POR 28. Consistent with the plain meaning of “region,” the claim limits the location of the “TAC region” (that

is, the region of the device that includes at least one TAC) such that the “dielectric structure” must comprise at least part of it. And even if claim 17 didn’t limit claim 15, “[t]he preference for giving meaning to all terms ... is not an inflexible rule that supersedes all other principles of claim construction.” *SimpleAir, Inc. v. Sony Ericsson Mobile Commc’ns AB*, 820 F.3d 419, 429 (Fed. Cir. 2016). This case is analogous to *VLSI*, which reversed the district court’s construction of another “region”—“force region”—for adding requirements not specified in the claim. *VLSI Tech. LLC v. Intel Corp.*, 53 F.4th 646, 653 (Fed. Cir. 2022).

III. GROUND 1: TOYAMA RENDERS THE CHALLENGED CLAIMS OBVIOUS

A. Limitation [15.A]: “a substrate with an isolation structure”

1. PO Does Not Dispute That Under Petitioner’s Construction, Toyama Renders Limitation [15.A] Obvious

PO does not dispute that if the *isolation structure* need not be *part of* the *substrate* (as the limitation should be interpreted, §III.A, ID 15), Toyama’s first exemplary structure and Second Modification disclose a *substrate with an isolation structure* for the reasons explained in the Petition. Pet. 28-36.

2. Limitation [15.A] Would Have Been Obvious Even Under PO’s Erroneous Construction

Even accepting PO’s erroneous requirement that the limitation requires the *isolation structure* to be “part of” the *substrate*, Toyama’s first exemplary structure and Second Modification each disclose the limitation because those embodiments

are materially the same as the '378.⁴ In other words, whatever faulty logic that would compel adoption of PO's position that the '378's isolation structure is part of its substrate would similarly compel a finding that Toyama's isolation structures are part of its substrates. Lee-Reply ¶42.

The '378 defines "substrate" as "a material onto which subsequent material layers are added, or otherwise 'disposed.'" '378, 4:41-43. PO apparently contends that the '378's combination of its "STI structure 233" and its "substrate 202" meet this definition. But, if that were true, then in Toyama's first exemplary structure, "planar semiconductor material layer 10" and the lower part of "dielectric fill material portion 430" are collectively a *substrate*:

⁴ "Where," as here, "a patent owner in an IPR first proposes a claim construction in a patent owner response, a petitioner must be given the opportunity in its reply to argue and present evidence of anticipation or obviousness under the new construction, at least where," as here, "it relies on the same embodiments for each invalidity ground as were relied on in the petition." *Apple Inc. v. Omni MedSci, Inc.*, No. 2023-1034, 2024 WL 3084509, at *5 (Fed. Cir. June 21, 2024).

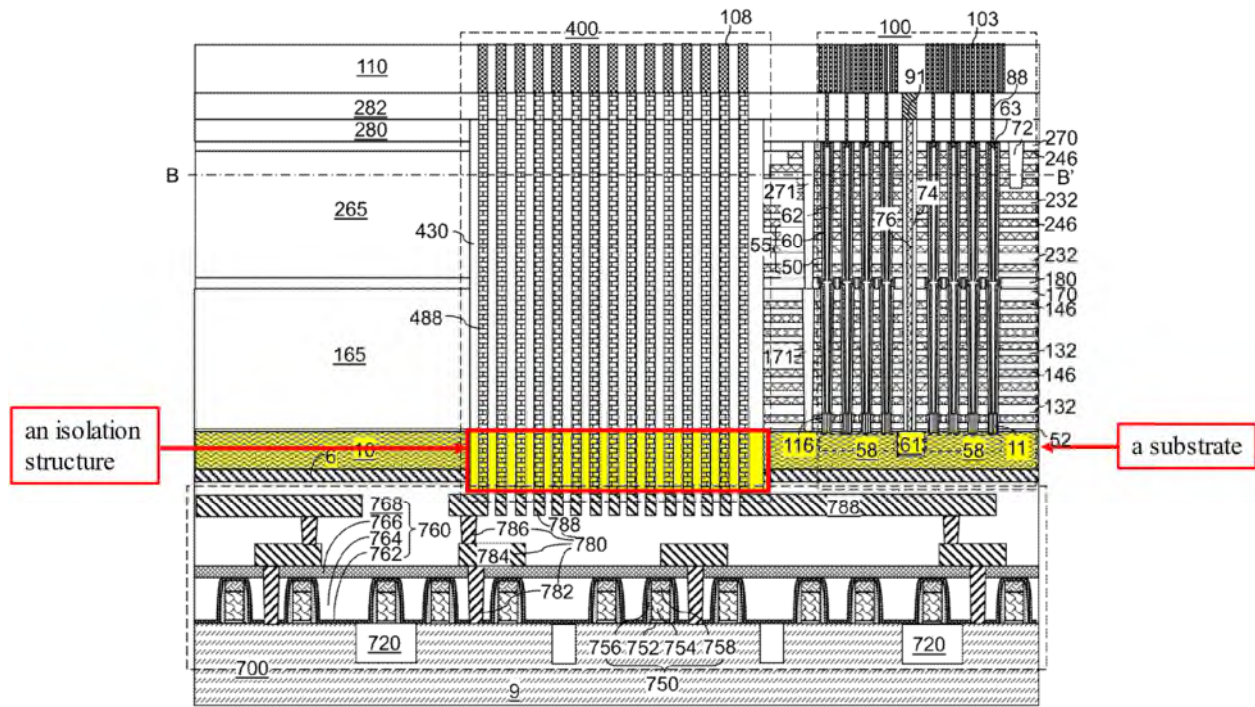


FIG. 17A

Toyama, Figure 17A (annotated); Lee-Reply ¶43. Similarly, based on PO’s logic, in Toyama’s Second Modification, the “planar semiconductor material layer 10” and the insulating material layer that fills “opening 151” (on the top) are collectively a *substrate*:

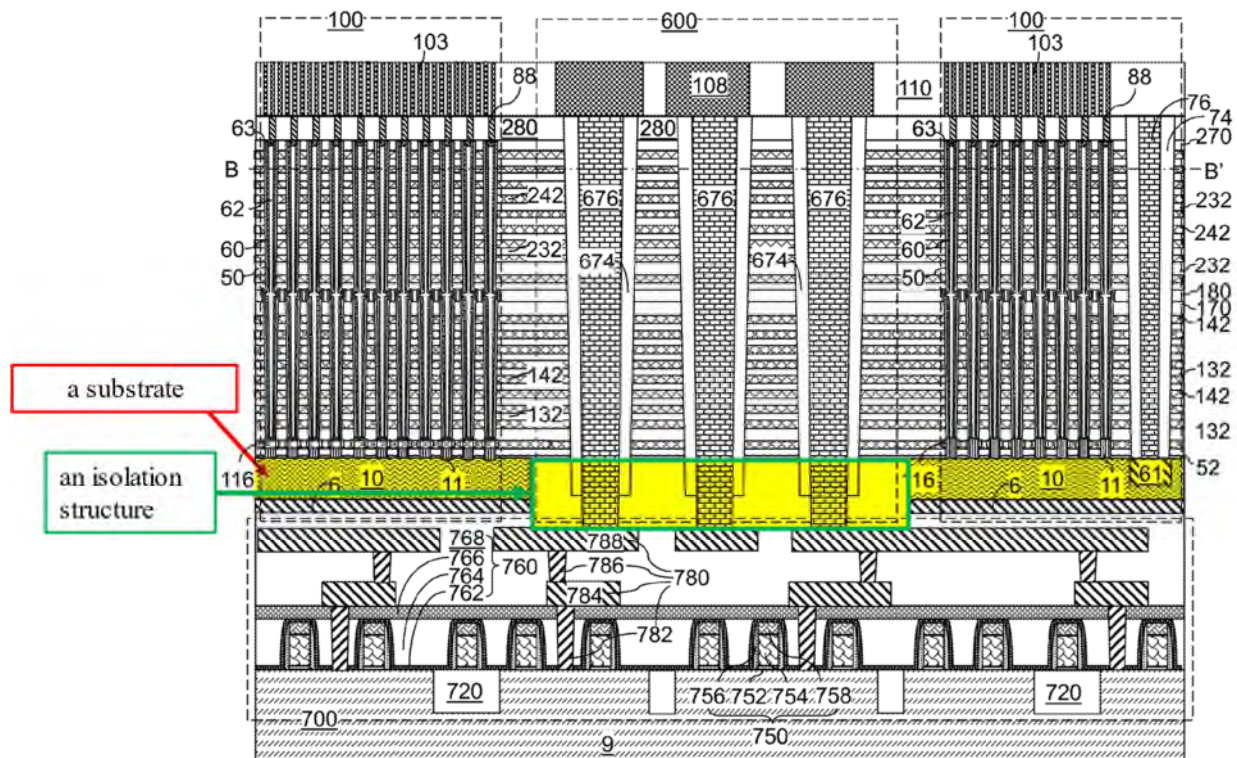


FIG. 49

Toyama, Figure 49 (annotated); Lee-Reply ¶43. Under this mapping, the *isolation structure* in both Toyama’s first exemplary structure and its Second Modification is *part of* the *substrate*. Pet. 28-36. To paraphrase the Board in a related proceeding, “Toyama’s dielectric-filled substrate cavity and the dielectric-filled structure of [the] Figure 2 of the ’378 patent have the same structure except that Toyama’s dielectric extends completely through the substrate whereas the dielectric of the ’378 patent extends only partway through the substrate.” ID 15. But “this distinction is not determinative because the claim,” even under PO’s interpretation, “does not restrict the region from extending through the substrate.” *Id.*

B. Limitation [15.C.i]: “a dielectric structure on the isolation structure”

1. First Exemplary Structure

a. PO Does Not Dispute That Under Petitioner’s Construction, Limitation [15.C.i] Would Have Been Obvious

PO does not and cannot dispute the Board’s preliminary finding that the identified parts of the “dielectric fill material portion 430 perform[] the isolation functions of both the isolation structure and the dielectric structure.” ID 20; Pet. 46-47; Lee-Reply ¶. It is therefore undisputed that under Petitioner’s construction, Toyama’s first exemplary structure discloses this limitation.

b. Limitation [15.C.i] Would Have Been Obvious Even under PO’s Erroneous Construction

Even under PO’s (incorrect) construction requiring the *dielectric structure* to be formed separately from the *isolation structure*, Toyama nevertheless renders the limitation obvious. Lee-Reply ¶¶45-48.

As the Petition explained and the ID credited, “forming the isolation structure and the dielectric structure separately would be no more than the mere substitution of a known process ... for another process ... to obtain predictable results.” Pet. 47-48; ID 21. PO does not dispute that separately formed dielectric and isolation structures were known (and, indeed, disclosed in Toyama’s third

exemplary structure). POR 51. Nor does PO dispute that, if implemented, the proposed substitution would render limitation [15.C.i] obvious. *Id.*

PO contends that “Petitioner has not identified a motivation for making the proposed changes,” *id.*, but the Petition did articulate a motivation: “electrically isolating the conductors embedded within” the isolation structure, Pet. 47-48. Moreover, such “simple substitution[s] of one known element for another” are obvious even absent some express “teaching, suggestion, or motivation” to do so. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 401-02 (2007).

PO’s contention that the proposed modification “changes First Exemplary Structure’s processing steps” (POR 51) is similarly meritless because PO does not challenge Dr. Lee’s testimony (credited by the Board) that a POSITA could make this substitution because “using isolation structures on a substrate to electrically isolate components was well-known.” Lee ¶121; 378-2 ID 20; Pet. 47-48; Lee-Reply ¶48.

2. Second Modification

PO’s argument regarding limitation [15.C.i] must fail because it is based solely on PO’s earlier, meritless argument that the Second Modification does not render limitation [15.A] obvious. POR 56; §III.A (limitation [15.A]).

C. **Limitation [15.H]: “through array contacts (TACs) extending vertically through the dielectric and the isolation structures”**

1. **Second Modification**

a. **PO Does Not Dispute That under Petitioner’s Construction Limitation [15.H] Would Have Been Obvious**

PO does not dispute that if limitation [15.H] permits the *through array contacts* to extend through multiple *dielectric structures* (as the limitation should be interpreted, ID 23; §III.C), then Toyama’s Second Modification discloses limitation [15.H]. Pet. 66-68.

Specifically, PO’s analogy to *Finjan* falls flat because Toyama’s “insulating liners 674” satisfy every requirement of the claimed *dielectric structure*. In *Finjan*, the claim at issue recited a first “receiving” step performed “by a computer,” and then a number of successive steps (e.g., “determining,” and “instantiating,”) performed “by the computer.” *Finjan*, 84 F.4th at 966-67. The Court held that the claim required the “same ‘one **or more** computers’” “perform each of several subsequent claim limitations.” *Id.* at 974-75 (emphasis added). But, here, PO does not dispute that the same one **or more** *dielectric structures* (“insulating liners 674”) satisfy all claim limitations. The **same** “insulating liners 674” are (1) *on the isolation structure* (15.C.i, Pet. 39-42); (2) *extend[] vertically through the alternating conductor/dielectric layer stack* ([15.C.ii], Pet. 42-43); (3) *abut[] a sidewall surface of the dielectric structure* ([15.C.iii], Pet. 43-44); (4) are

formed of a dielectric material ([15.C.iv], Pet. 44); and (5) include the through array contacts (TACs) ([15.H], Pet. 67-70). Here, unlike in *Finjan*, the *same* “insulating liners 674” are “tied to all [of the (five) claimed] functions.” 84 F.4th at 974.

b. Limitation [15.H] Would Have Been Obvious Even under PO’s Erroneous Construction

Toyama’s Second Modification renders limitation [15.H] obvious even accepting PO’s construction because the combination of Toyama’s “insulating liners 674” are collectively a single *dielectric structure*.⁵ POR 60; Pet. 41; Lee-Reply ¶¶51-53.

As an initial matter, the term “structure” does not require all elements of the structure to be contiguous. Merriam-Webster’s defines a structure, for example, as “something arranged in a definite pattern of organization.” Ex. 1022, 5.⁶ Thus, as

⁵ Petitioner’s position here is consistent with its position that each of the “insulating liners 674” is individually a structure because “a structure ... can be composed of other structures.” Ex. 1040, 43:23-44:3; Lee-Reply ¶51 n.3.

⁶ Although the Petition (at 41) focused on a different Merriam-Webster definition (“something (such as a building) that is constructed”), Petitioner recognizes from the POR that this definition may not be sufficient to resolve the parties’ dispute.

PO's expert agreed, the wall pictured below is a structure even though its components are not all touching each other:



Ex. 1042 (Yang Dep., Ex. 4); Ex. 1040, 45:3-4, 47:3-6 (identifying the “wooden posts” as a “wall structure”); Lee-Reply ¶52. Similarly, the staircase below is a structure even though the stairs do not contact each other:



Ex. 1043 (Yang Dep., Ex. 5); Lee-Reply ¶52.

As the Petition explained, “insulating liners 674” of Toyama’s Second Modification to be “individually and *collectively*” a dielectric structure:

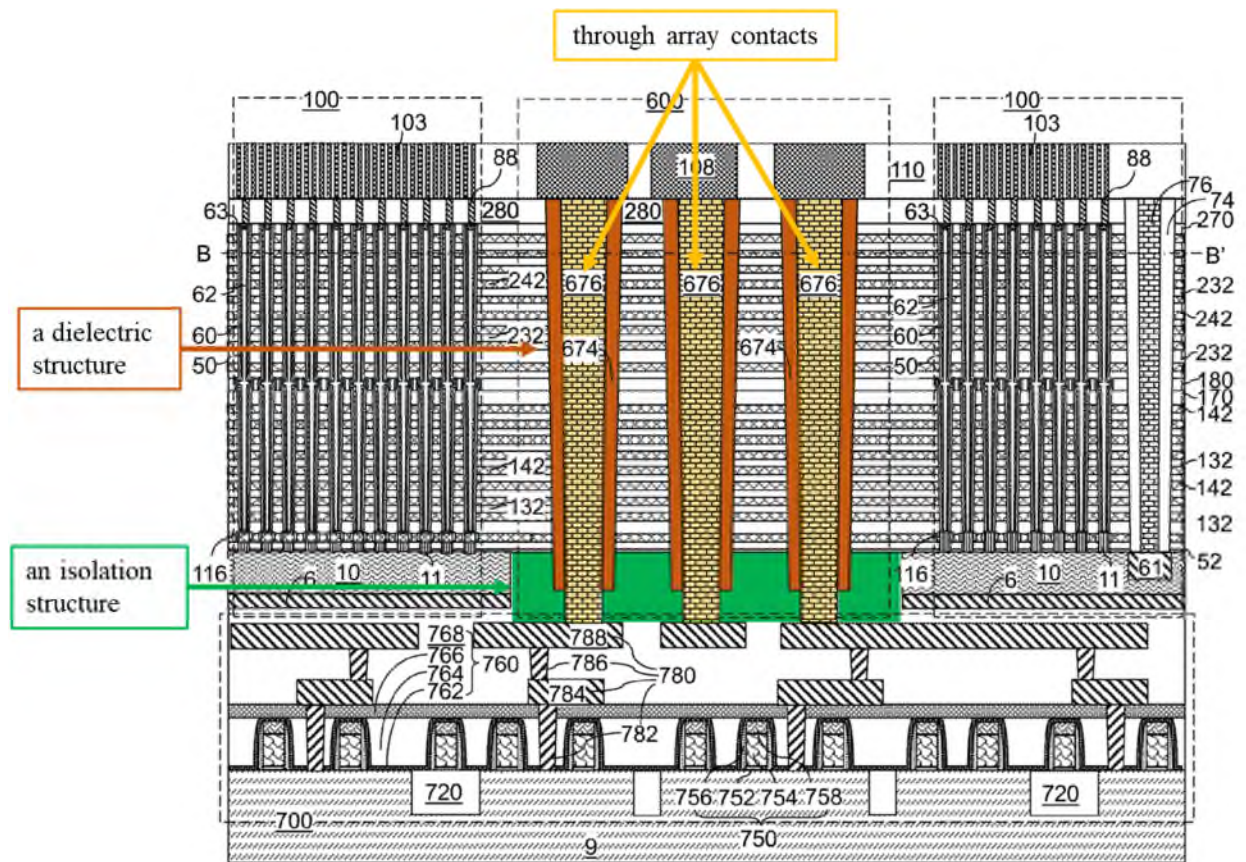


FIG. 49

Toyama, Figure 49 (annotated); Pet. 39-44. Like the wall posts and stairs above, each of “insulating liners 674” is arranged in a “definite pattern of organization.” Ex. 1022, 5. Indeed, the liners all have the same function: insulating the *TACs* as they pass through the *alternating ... layer stack*. Pet. 41. Thus, “insulating liners 674” are collectively a (single) *dielectric structure*. Lee-Reply ¶53.

2. First Exemplary Structure

PO’s argument regarding limitation [15.H] must fail because it is based solely on PO’s earlier, meritless arguments that Toyama’s first exemplary structure

does not render limitations [15.A] and [15.C.i] obvious. POR 56; §§III.A (limitation [15.A]), III.B (limitation [15.C.i]).

D. Claim 17: “the dielectric structure comprises a through array contact region of the 3D memory device”

1. Second Modification

a. PO Does Not Dispute That Under Petitioner’s Construction, Claim 17 Would Have Been Obvious

PO does not dispute that if TAC region merely means “a region that includes at least one TAC” (as under Petitioner’s construction), Toyama’s Second Modification renders claim 17 obvious. §III.D; Pet. 72-74.

b. Claim 17 Would Have Been Obvious Even Under PO’s Erroneous Construction

Even if the Board were to adopt PO’s construction of *TAC region*, Toyama’s Second Modification nevertheless renders claim 17 obvious because the *TAC region* that the Petition identified (reproduced below) meets all requirements of PO’s construction:

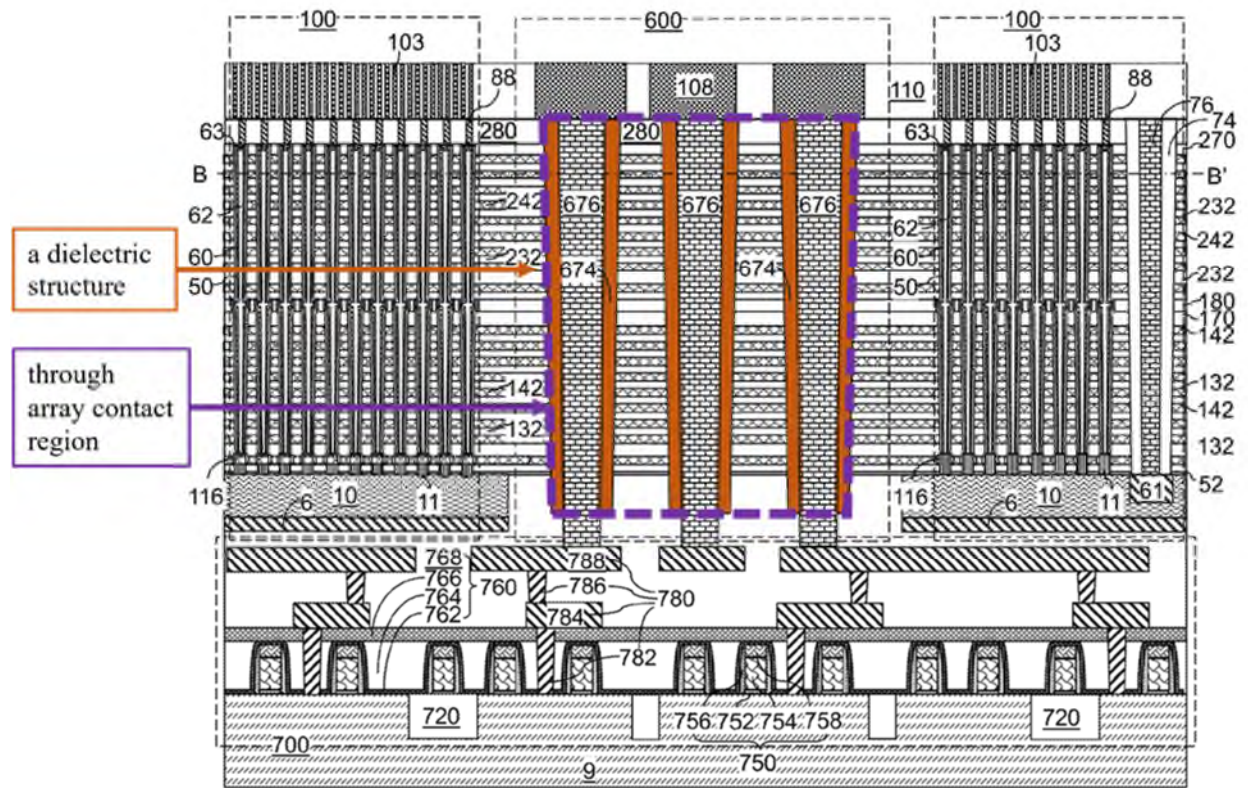


FIG. 49

Toyama, Figure 49 (annotated); Pet. 73-74; Lee-Reply ¶¶56-58. **First**, it is “a region.” POR 29; Ex. 1038, 6 (definition of “region” as “an indefinite area of the world or universe”); Lee-Reply ¶56. **Second**, it is “within or defined by the dielectric structure.” *Id.* Indeed, the borders of the *TAC region* above are defined by the borders of the Second Modification’s *dielectric structure* (“insulating liners

674”).⁷ That the borders of the *TAC region* are defined by the borders of the *dielectric structure* is also evident from a top view:

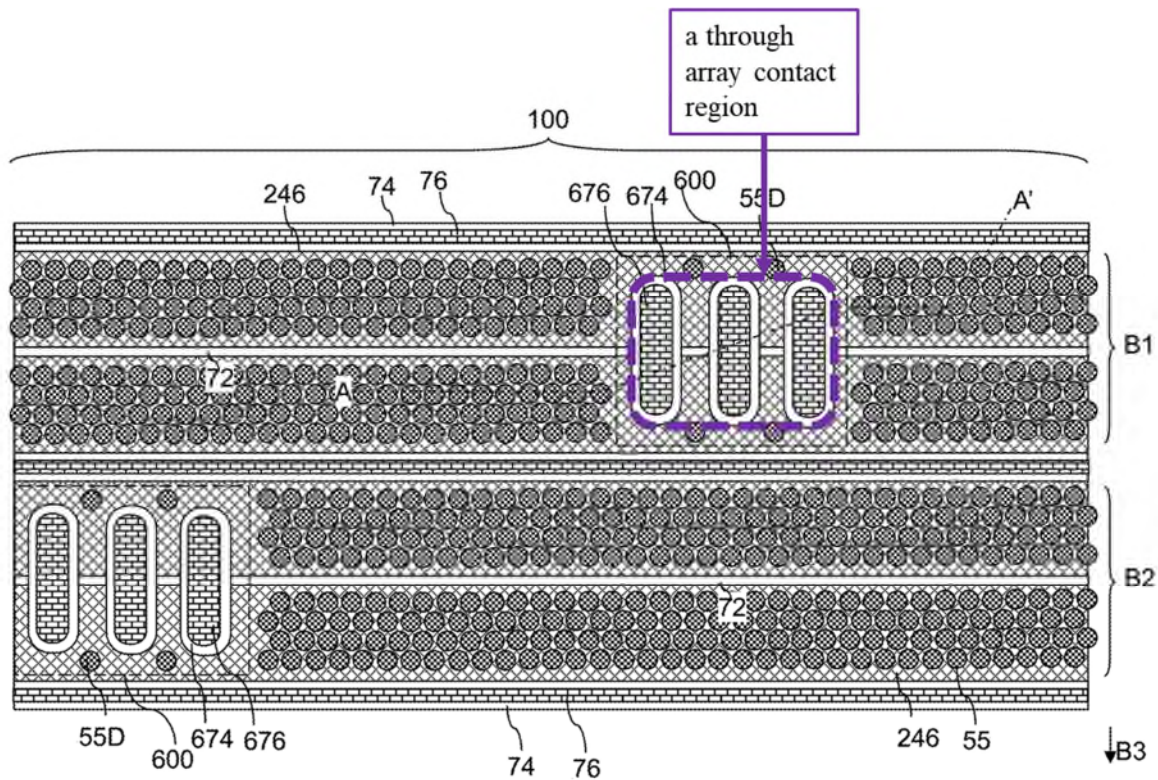


FIG. 48B

Toyama, Figure 48B (annotated). **Third**, as the above figures show, the Second Modification’s *TAC region* includes “through array contacts extending through the

⁷ Either the TAC region’s borders are defined by a single dielectric structure that includes all of the “insulating liners 674” (§III.B.1.b) or the TAC region’s borders are defined by a collection of dielectric structures, each comprising a single “liner 674” (§III.B.1.a).

dielectric structure.” Lee-Reply ¶56. Thus, the Second Modification discloses a *TAC region* even under PO’s construction.

Although PO asserts that the *TAC region* must be “coextensive” with the *dielectric structure*, that is inconsistent with PO’s own construction, which only requires that the TAC region be “within or defined by” the dielectric structure. POR 28-29. The plain meaning of “define” includes “to fix or mark the limits of.” Ex. 1038, 3 (definition of “define”). For example, the original borders of Washington, DC were defined by a number of “boundary stones” placed by surveyors, but clearly the District of Columbia was not *coextensive* with the small footprint of the stones themselves. Ex. 1044 (<https://boundarystones.org/>). Similarly, a POSITA would have understood that the *TAC region* may be defined by the *dielectric structure* even if the *TAC region* does not share the exact same spatial scope as the *dielectric structure*. Lee-Reply ¶57.

PO’s assertion that the *TAC region* “cannot include the alternating conductor/dielectric layer stack” is inconsistent with PO’s construction for the same reason; just as Washington, DC can include objects besides the boundary stones that define it, so too can a *TAC region* under PO’s construction include elements (e.g., an alternating stack) besides the *dielectric structure* that defines it. Lee-Reply ¶58.

2. First Exemplary Structure

PO's argument regarding claim 17 must fail because it is based solely on PO's earlier, meritless argument that Toyama's first exemplary structure does not render limitation [15.C.i] obvious. POR 56; §III.B (limitation [15.C.i]).

IV. GROUND 2: MUSHIGA RENDERS THE CHALLENGED CLAIMS OBVIOUS

A. Limitation [15.A]

PO's argument regarding Mushiga's disclosure of [15.A] merely rehashes the argument PO made regarding Toyama's disclosure of [15.A], and fails for similar reasons.⁸ §III.A.

First, PO does not dispute that if the *isolation structure* need not be **part of** the *substrate* (as under Petitioner's construction), then Mushiga discloses this limitation for the reasons explained above. §§II.A,III.A.1; Pet. 78-80; Lee-Reply ¶61.

Second, Mushiga renders limitation [15.A] obvious even under PO's construction. Under that (erroneous) construction, Mushiga nevertheless discloses

⁸ Petitioner understands that PO has "set[] aside" any argument that elements "cannot be combined" to form an isolation structure. POR 65-66. But, if PO is making such an argument, it is meritless for the same reasons as PO's position that multiple elements cannot be combined to form a dielectric structure. §IV.B.

standing alone. POR 69-70. PO then proceeds to argue that “insulating spacer 586,” by itself, fails to meet the requirements of limitations [15.C.i] and [15.H]. POR 70-80.

PO’s argument is based on an unspoken premise: that a single *dielectric structure* may not include multiple components. That premise is false. Although further supported in this Reply’s claim construction section, it scarcely needs to be said that a single structure can comprise multiple components. Ex. 1022, 5 (defining “structure” as “the arrangement of particles or parts in a substance or body”); §II.B; Lee-Reply ¶64. Indeed, PO’s expert repeatedly identified multi-component structures at his deposition. Ex. 1040, 43:23. This conclusion is further bolstered by the specification, which defines the related term “layer” to “include one or more layers therein,” which may be “inhomogeneous,” and recognizes that the boundaries that it uses are “arbitrarily defined.” ’378, 4:51-5:10, 22:65-23:5; ID 29; Lee-Reply ¶64. And PO’s assertion regarding Mushiga’s manufacturing process is both incorrect (because ’378’s devices are manufactured in the same way) and beside the point (because the Challenged Claims are apparatus claims). POR 66.

As the Board correctly held in its Institution Decision, “we do not discern any requirement in the claims or the disclosure of the ’378 patent that would prevent the claimed dielectric structure from being taught by multiple elements

having different purposes.” ID 29-30; Lee-Reply ¶65.⁹ And PO does not dispute that if the proper *dielectric structure* (elements 760, 165, 180, 265, and 568) is considered, Mushiga renders the claim obvious. Pet. 81-86.

C. Claim 17

The Petition explained that “Mushiga’s *dielectric structure* (elements 760, 165, 180, 265, 586) *comprises a through array contact region of the 3D memory device* because that is the area through which part of each *TAC* (“through-memory-level via structure 588”) extends through the dielectric structure.” Pet. 100. Instead of addressing Petitioner’s theory head-on, PO attacks an annotated figure that inadvertently included parts of elements 94 and 296 in the *TAC region*. POR 80-82.

PO should have understood that these elements were not intended to be included from the text of the Petition, which does not even mention these elements. Moreover, PO does not dispute that the *TAC region* described in the Petition’s text (at 100) satisfies claim 17.

⁹ As the Board also recognized, PO’s argument that Petitioner’s grouping “has no discernible logic” must fail because each of the dielectric structure’s components “possess a dielectric quality.” ID 29-30; Lee-Reply ¶65 n.6.

Regardless, even the *TAC region* in the misannotated figure satisfies claim 17 because, as explained in the claim construction section, the *TAC region* may include elements other than the *dielectric structure*. §II.D; Lee-Reply ¶¶66-68.

V. CONCLUSION

The Board should hold all challenged claims unpatentable.

Respectfully submitted,

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Dated: May 14, 2025

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CERTIFICATE OF COMPLIANCE

The undersigned certifies that the foregoing Petitioner's Reply complies with the type volume limitation in 37 C.F.R. § 42.24. According to the utilized word-processing system's word count, the petition—excluding the caption, table of contents, table of exhibits, mandatory notices, certificate of word count, and certificate of service—contains 5,597 words.

Dated: May 14, 2025

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CERTIFICATE OF SERVICE

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