

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.: IPR2024-00909
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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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
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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
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1046	Patent Owner’s Response in <i>Micron Technology, Inc. v. Yangtze Memory Technologies Company, Ltd.</i> Case No. IPR2024-00788, Paper 17 (“378-1 POR”)
1047	Declaration of Dr. Jack C. Lee in <i>Micron Technology, Inc. v. Yangtze Memory Technologies Company, Ltd.</i> Case No. IPR2024-00791, Ex. 1003 (“806-1 Lee Decl.”)

LISTING OF CLAIMS

Claim 1	
[1.PRE]	A three-dimensional (3D) memory device, comprising:
[1.A]	a semiconductor substrate;
[1.B]	an alternating layer stack disposed on the semiconductor substrate;
[1.C.i]	a dielectric structure
[1.C.ii]	on an isolation region of the substrate and
[1.C.iii]	extending vertically through the alternating layer stack,
[1.C.iv]	wherein the alternating layer stack abuts a sidewall surface of the dielectric structure and
[1.C.v]	the dielectric structure is formed of a dielectric material
[1.D]	one or more through array contacts (TACs) extending vertically through the dielectric structure and the isolation region;
[1.E]	one or more channel structures extending vertically through the alternating layer stack;
[1.F]	an epitaxial layer between the one or more channel structures and the semiconductor substrate;
[1.G]	an etch stop plug on each of the one or more channel structures;
[1.H]	a staircase structure in the alternating layer;
[1.I]	slit structures extending vertically in the alternating layer stack; and
[1.j]	one or more contact layers on the one or more TACs, the one or more channel structures, and the slit structures.
Claim 2	
[2]	The 3D memory device of claim 1, wherein the dielectric structure abuts a sidewall surface of the TACs.
Claim 3	

[3]	The 3D memory device claim 1, wherein the 3D memory device is a NAND 3D memory device.
Claim 4	
[4]	The 3D memory device of claim 1, wherein the alternating layer stack comprises alternating pairs of a dielectric and a conductor layer.
Claim 5	
[5]	The 3D memory device of claim 1, wherein the dielectric material is silicon oxide.
Claim 6	
[6]	The 3D memory device of claim 1, wherein the dielectric structure comprises an oxide.
Claim 7	
[7]	The 3D memory device of claim 1, wherein the dielectric structure defines a through array contact region within the 3D memory device.
Claim 15	
[15.PRE]	A three-dimensional (3D) memory device, comprising:
[15.A]	a substrate with an isolation structure;
[15.B]	an alternating conductor/dielectric layer stack disposed on the substrate;
[15.C.i]	a dielectric structure on the isolation structure
[15.C.ii]	extending vertically through the alternating conductor/dielectric layer stack
[15.C.iii]	wherein the alternating conductor/dielectric layer stack abuts a sidewall surface of the dielectric structure and
[15.C.iv]	the dielectric structure is formed of a dielectric material
[15.D]	channel structures and slit structures extending vertically through the alternating conductor/dielectric layer stack;

[15.E]	a staircase structure disposed in the alternating conductor/dielectric layer stack, wherein the staircase structure comprises levels with each level having a conductor layer thereon;
[15.F]	a word line contact disposed on the conductor layer of the each level;
[15.G]	local contacts disposed on the channel structures and the slit structures; and
[15.H]	through array contacts (TACs) extending vertically through the dielectric and the isolation structures.
Claim 18	
[18.PRE]	The 3D memory device of claim 15, further comprising:
[18.A]	an etch stop plug interposed between each local contact of the local contacts and each channel structure of the channel structures; and
[18.B]	an epitaxial layer disposed between the channel structures and the substrate.

I. INTRODUCTION

This proceeding relates to claims 1-7 and 18 of U.S. Pat. No 10,658,378 (“’378”). Petitioner challenged claim 15 of the ’378 in IPR2024-00788 (“the -788 Proceeding”) on the same Ground as here (and one other ground). Claim 1 (upon which claims 2-7 depend) recites limitations similar to those of claim 15. Claim 18 depends upon claim 15. PO challenges the Ground’s sufficiency as to various limitations of claims 1 and 15 based on the same arguments as it made in the -788 Proceeding. PO also disputes claim 7 on essentially the same basis as it disputed claim 17 in the -788 Proceeding. This Reply responds to these arguments in substantially the same way as the Reply in the -788 Proceeding.

In this Proceeding, PO further argues that the Ground does not disclose claim 18’s “etch stop plug” limitation. As this Reply explains, PO’s argument is premised on a nonsensical claim construction, which a related Institution Decision (Ex. 1045) already considered and rejected, and which would exclude every ’378 embodiment. And even if PO’s construction were adopted, by PO’s own logic the prior art discloses the limitation in exactly the same way as does the ’378.

The Board should hold all Challenged Claims unpatentable.

II. CLAIM CONSTRUCTION

A. “an isolation region of the substrate” (claim 1) and “a substrate with an isolation structure” (claim 15)

1. An Isolation Region/Structure Need Not Be “Part of” the Substrate

Claim 1 recites “an isolation region of the substrate.” 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” and “of” to “part of.” POR 14. Both limitations encompass an “isolation structure”¹ that serves to isolate the conductive elements within it from the “substrate” even if the “isolation structure” is not part of the “substrate.”² PO has not identified any basis for its unduly narrow construction, which the Board’s Institution Decision correctly rejected. Institution Decision, (Paper 12) (“ID”), at 14-16.

PO does not contend that the plain meaning of “with” or “of” is “part of,” nor could it; a first object can be “with” or “of” a second object even if the second

¹ PO does not argue that the phrase “isolation region” has a materially distinct meaning from “isolation structure.” Petitioner’s discussion of an “isolation structure” should be understood to apply equally to an “isolation region.”

² PO’s assertion that “the alleged substrate is not divided into isolated portions” is therefore beside the point. POR 43.

object is not part of the first. Ex. 1038, 8 (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. And when someone says, “a friend **of** mine,” that does not imply that the speaker is **part of** the friend. Ex. 1038, 6 (Merriam-Webster’s definition of “of”).

The intrinsic record provides no basis to depart from the ordinary meaning of “with” and “of,” as PO’s construction would require. Lee-Reply ¶¶10-18. 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, 13.³ The patent further discloses that “[i]n some embodiments a method for forming [a] 3D memory device includes forming an isolation structure **on** [the]

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

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. PO’s construction would exclude these embodiments. Moreover, 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 ¶16.

Thus, the specification does not meet the “exacting” standard required to “depart from the plain meaning” of “with” and “of.” *Luminara Worldwide, LLC v. Liown Elecs. Co.*, 814 F.3d 1343, 1353 (Fed. Cir. 2016); ID 15-16 (Board concluding same). Although the specification at times 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 words “with” or “of” 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” or “of” 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 ¶130. Nothing about that purpose requires the isolation structure to be “part of” the substrate. Lee-Reply ¶18. 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.

2. PO’s Section on the Construction of “on” Is Improper and Beside the Point

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 17-22. PO’s assertion is improper because the word “on” does not appear in either of the terms at issue. PO’s construction is beside the point because it is premised on PO’s erroneous attempt to import a “part of” requirement into the limitations at issue.

B. “through array contacts (TACs) extending vertically through the dielectric and the isolation structures”⁴ (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 ¶¶ 19-26)

⁴ Although PO only seeks construction of the shorter phrase “the dielectric and the isolation structures,” Petitioner proposes the full limitation for construction because it includes context necessary to resolve the parties’ dispute.

or whether the claim requires that multiple “through array contacts” extend through a “single ‘dielectric structure’” (as PO contends). POR 27. PO has not shown error in the Institution Decision, which rejected PO’s construction. ID 21.

First, PO has not rebutted a related Institution Decision’s reasoning that rejected PO’s position. There, 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.” Ex. 1039, (Institution Decision, IPR2024-00788, Paper 13) (“378-1 ID”) at 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.*, ’378, 21:7-25. PO’s construction would improperly exclude this embodiment. Lee-Reply ¶20. Even accepting PO’s incorrect argument that the specification only includes embodiments with multiple TACs extending through each dielectric structure (POR 25-26), “the claims should not be confined to the disclosed embodiments.” *Woods v. DeAngelo Marine Exhaust, Inc.*, 692 F.3d 1272, 1283 (Fed. Cir. 2012).

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 ¶¶21-26.

PO’s attempt to distinguish *KCJ* lacks merit. PO acknowledges that the claimed device may include multiple dielectric structures. POR 24. 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 by the accused system in which 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).

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.

C. “an etch stop plug interposed between each local contact of the local contacts, and each channel structure of the channel structures”⁵ (claim 18)

The parties’ dispute with respect to this limitation is whether the term “each local contact” refers to local contacts on the channel structures (Petitioner’s position, Lee-Reply ¶¶27-36) or refers to local contacts on the channel structures *and* on the slit structures (PO’s position). PO’s construction, which reads out every embodiment of the specification, cannot be correct. Indeed, a related Institution Decision correctly resolved this dispute in Petitioner’s favor. Ex. 1045 (Institution Decision, IPR2024-00911, Paper 12) (“806-2 ID”), at 37-40. PO provides no basis to disturb the Board’s preliminary holding.

First, not a single embodiment of the ’378 meets PO’s construction. The ’378 repeatedly, consistently, and exclusively describes “NAND string contacts” (236) as the “local contacts” for the “channel structures” (216),⁶ and “slit

⁵ Although PO only seeks construction of the shorter phrase “each local contact of the local contacts,” Petitioner proposes the full limitation for construction because it includes context necessary to resolve the parties’ dispute.

⁶ More specifically, the “lower end of NAND string contact 236” is “in contact with the etch stop plug 224.” ’378, 11:34-38. “Etch stop plug 224” is, in turn,” is

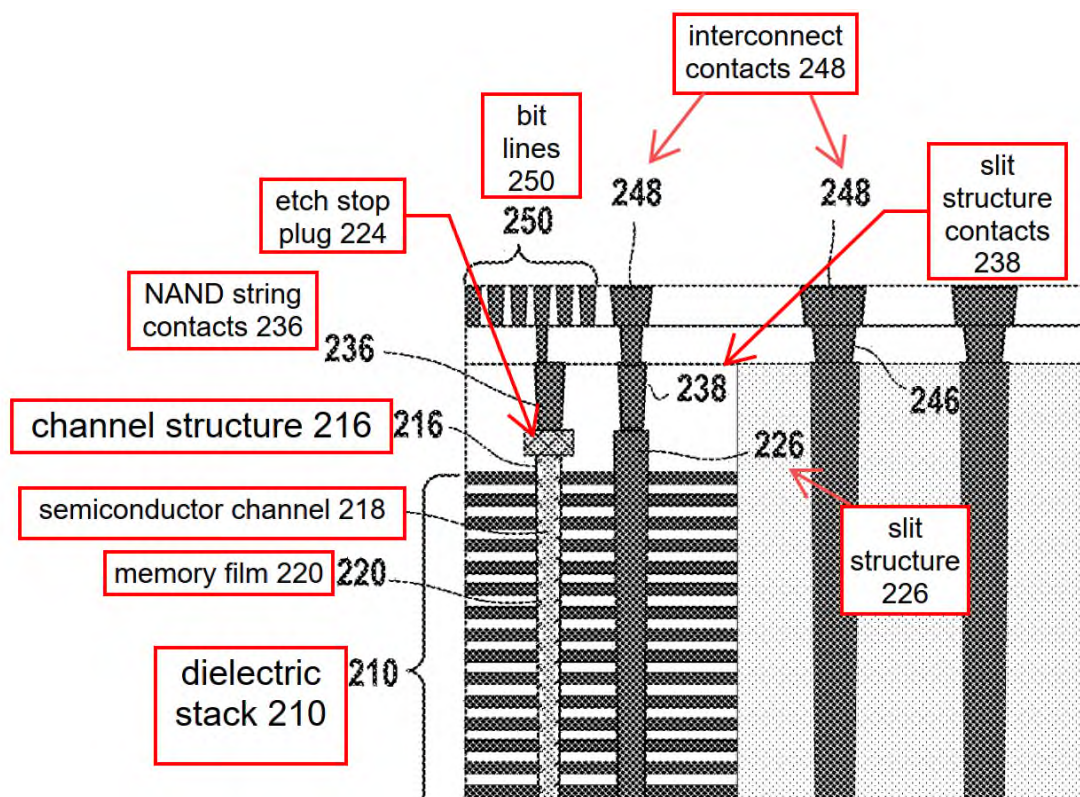
structure contacts” (238) as the “local contacts” for the “slit structures” (226). ’378, 11:24-26, 11:35-40. The ’378’s “etch stop plugs” (224) are *always* described as being between the channel structure local contacts (236) and the channel structures (216). ’378, 11:37-39. Indeed, the point of an “etch stop” is to protect *channel* structures; both parties’ experts agree that an etch stop plug on a *slit* structure is unnecessary because “the material composition of [slit structure] 226 in and of itself can actually stop the etch that’s required for the formation of [slit structure contacts] 238.” Ex. 1040 (4/22/25 Yang Dep.) 121:14-16; ’378, 9:44-46; Lee-Reply ¶31. It is thus no surprise that the ’378 *never* identifies any “etch stop plugs” that are interposed between slit structure local contacts (238) and channel structures (216). PO’s construction cannot be correct.

Second, PO’s attempt to concoct a ’378 embodiment meeting its construction is meritless. PO’s argument is premised on its nonsensical assertion that “bit lines 250” are “local contacts disposed on ... the slit structures.” POR 31-33.

As an initial matter, “bit lines 250” are not “local” contacts. Lee-Reply ¶¶33-36. Consistent with a POSITA’s general understanding, the ’378 explains

in contact with the top of “channel structure 216.” ’378, Figure 2, 9:1-3, 9:31-37, 15:61-62.

that “local contacts” are “in physical and electrical contact with the various memory array structures disclosed herein, such as ... slit structures 226.” ’378, 11:16-20. Thus, “the lower end of slit structure contact[s] 238 [*i.e.*, the slit structure local contacts] can be in contact with the upper end of slit structure[s] 226.” ’378, 11:35-40. But, as Figure 2 shows, “bit lines 250” are not in **physical** contact with “slit structures 226”:



’378, Figure 2 (cropped, annotated). Nor are “bit lines 250” in **electrical** contact with slit structures 226; instead, they are in (indirect) electrical contact with channel structure 216. ’378, 12:4-7. That “bit lines 250” are not “local” contacts is confirmed by the ’378’s description of them as “interconnect contacts.” ’378,

12:4-7. The patent describes “local contacts” as distinct from “interconnect contacts.” ’378, 11:56-59. Indeed, bit lines are the very opposite of local to the slit structures: they are “in the top interconnect layer.” ’378, 5:40-45.⁷

Third, the plain claim language undermines PO’s interpretation.

Independent claim 15 requires two sets of local contacts: (1) local contacts on channel structures, and (2) local contacts on slit structures. Dependent claim 18 then recites that there is “an etch stop plug interposed between each local contact of the local contacts and each channel structure.” Plainly, dependent claim 18 refers to the local contacts on the channel structures, not those on the slit structures, because it positions the etch stop above the channel structure and beneath the local contact (by its use of “interposed between”). PO’s reading of the term-at-issue “divorced from the surrounding limitations” and ignoring “the context of the ... specification” “lead [its] construction astray.” *Secure Web Conf. Corp. v. Microsoft Corp.*, 640 F. App’x 910, 915 (Fed. Cir. 2016); *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc).

⁷ Dr. Lee’s deposition testimony is not to the contrary; he did not purport to define the term “local contact.” Instead, he merely provided a broad answer regarding the “function of the local contact recited in line 15 of the ’378 patent.” Ex. 2007, 66:1-14; Lee-Reply ¶¶34-35.

III. GROUND 1: TOYAMA RENDERS THE CHALLENGED CLAIMS OBVIOUS

A. Limitations [1.C.ii], [15.A]: “an isolation region of the substrate” and “a substrate with an isolation structure”

1. PO Does Not Dispute That Under Petitioner’s Construction, Toyama Renders These Limitations Obvious

PO does not dispute that if the *isolation structure* need not be *part of* the *substrate* (as the limitations should be interpreted, §II.A, 378-1 ID 15; ID 14-16), Toyama’s first exemplary structure and Second Modification disclose *an isolation region of the substrate* and *substrate with an isolation structure* for the reasons explained in the Petition. Pet. 42-44, 93.

2. These Limitations 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 ’378.⁸ Lee-Reply ¶38.

⁸ “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

and the insulating material layer that fills “opening 151” (on the top) are collectively a *substrate*:

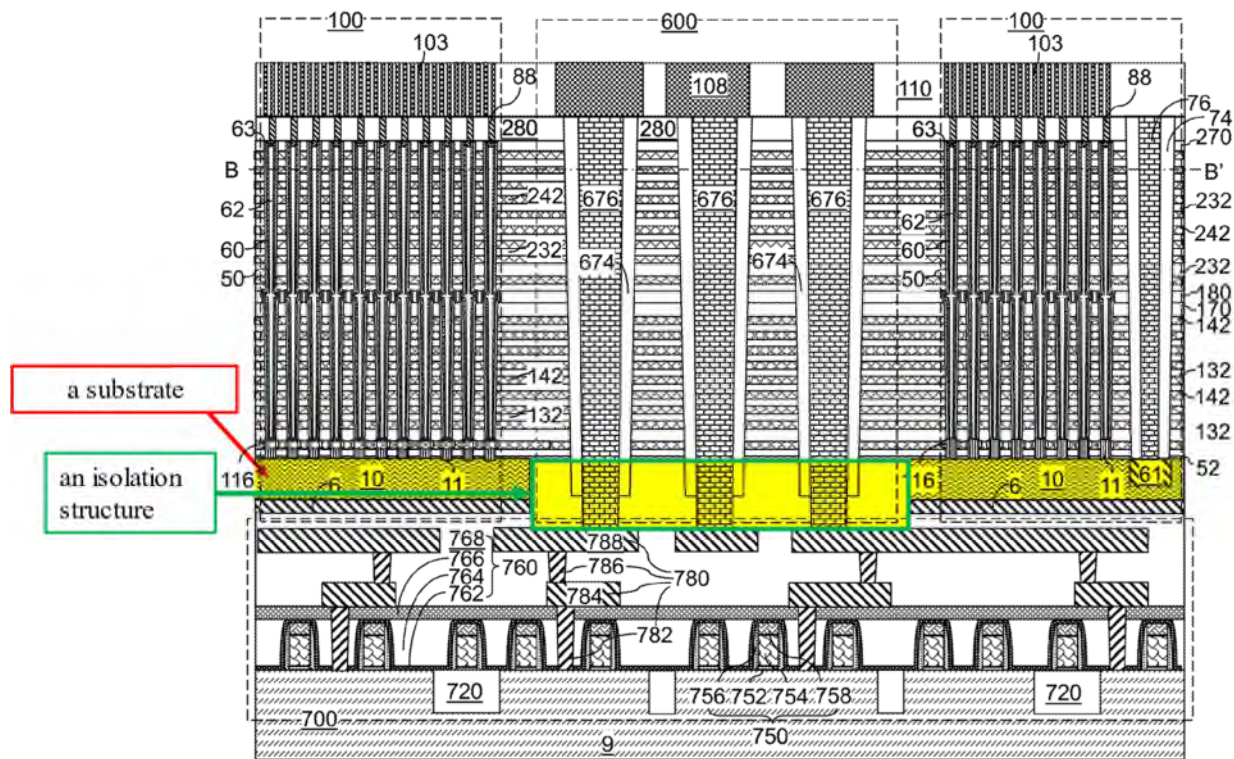


FIG. 49

Toyama, Figure 49 (annotated); Lee-Reply ¶39. Under this mapping, the *isolation structure* in both Toyama’s first exemplary structure and its Second Modification is *part of* the *substrate*. Pet. 42-44, 93. To paraphrase the Board, “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.*

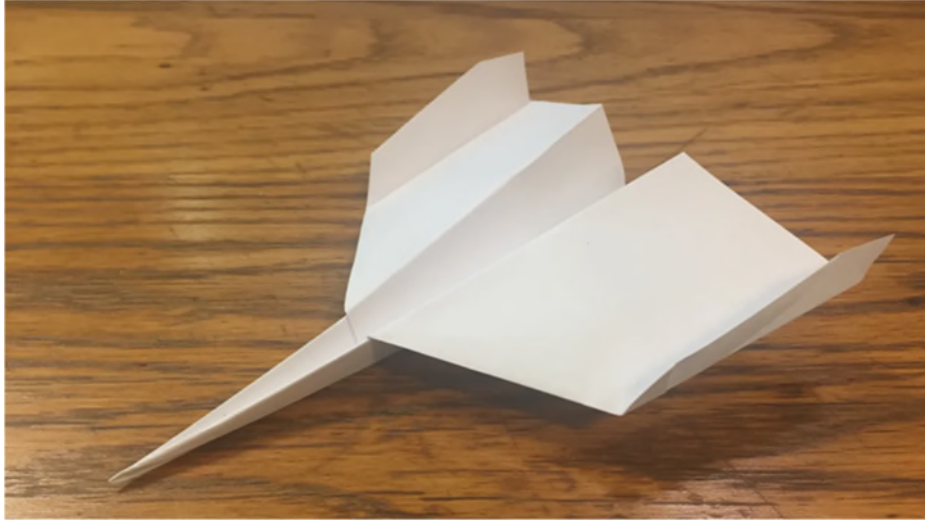
B. Limitations [1.C.i-ii], [15.C.i]: “a dielectric structure on an isolation region” and “a dielectric structure on the isolation structure”

1. First Exemplary Structure

a. PO’s Erroneous Requirement That The Structures Be Separately Formed Has No Basis

PO’s argument with respect to this limitation boils down to its erroneous assertion that the *dielectric structure* and *isolation structure/region* must be “formed at different steps.” POR 51. On the contrary, the *dielectric structure* and the *isolation structure/region* may be formed simultaneously from a unitary material. Lee-Reply ¶¶40-46.

Indeed, the plain meaning of “structure” allows a unitary material to include multiple structures, just as the paper airplane (pictured below) 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”). Similarly, the plain meaning of “region” as “an indefinite area” allows different parts of the same block of material to be different regions. Ex. 1038, 7.

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). 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 common to both the isolation structure and the dielectric structure.” ID 19; Pet. 51-52; Lee-Reply ¶¶42, 47.

The Institution Decision correctly rejected PO’s position, and PO’s attempt to rebut the Board’s reasoning falls flat. ID 16-19. PO’s attempt (POR 51) to fault the Board for not finding an express disclosure that *dielectric* and *isolation structures* “may be formed as a single integral structure” misses the forest for the trees. The passages that the Board and Petitioner cite confirm that “neither the claims nor the specification ... indicate[s] that the dielectric structure and [the] isolation structure need be separately formed structures.” ID 18 (citing ’378, 10:30-40, 10:46-47, 15:12-20, 15:42-54); Lee-Reply ¶¶40-46. In light of these disclosures, PO has failed to demonstrate the “clarity required to exclude” a unitary dielectric material from the claims. *Retractable Techs., Inc. v. Becton, Dickinson & Co.*, 653 F.3d 1296, 1304 (Fed. Cir. 2011).

b. PO Has Not Rebutted Petitioner’s Obviousness Theory

PO’s argument must separately fail because PO has not rebutted the Petition’s showing, credited by the Board, that Toyama renders the limitation obvious even if it requires separately formed structures. Pet. 53-54; ID 19-20; Lee-Reply ¶¶48-51.

Contrary to PO’s contention (POR 54), the Petition did articulate a motivation to combine: “electrically isolat[ing] the conductors embedded within” the isolation structure, Pet. 54. 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 54) is similarly meritless because PO does not challenge Dr. Lee’s testimony (credited by the Board) that a POSITA could make this substitution because “[u]sing isolation structures on a substrate to electrically isolate components was well-known.” Lee ¶229; ID 20; Pet. 53-54; Lee-Reply ¶51.

2. Second Modification

PO’s argument regarding these limitations must fail because it is based solely on PO’s earlier, meritless argument that the Second Modification does not render an *isolation region/structure* obvious. POR 65; §III.A (limitations [1.C.ii], [15.A]).

- C. **Limitations [1.D], [15.H]: “one or more through array contacts (TACs) extending vertically through the dielectric structure and the isolation region” and “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, 378-1 ID 23; §II.B), then Toyama’s Second Modification discloses limitation [15.H]. Pet. 44-45, 94-95.

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]); (2) *extend[] vertically through*

the alternating conductor/dielectric layer stack ([15.C.ii]); (3) *abut[] a sidewall surface of the dielectric structure* ([15.C.iii]); (4) are *formed of a dielectric material* ([15.C.iv]); and (5) include the through array contacts (TACs) ([15.H]). Pet. 94-95 ([15.C.i-iv]), 101-102 ([15.H]). 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*.⁹ Pet. 101-102; Lee-Reply ¶¶54-56.

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

⁹ 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.

“something arranged in a definite pattern of organization.” Ex. 1022, 5.¹⁰ Thus, as 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”). Similarly, the staircase below is a structure even though the stairs do not contact each other:

¹⁰ 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.



Ex. 1043 (Yang Dep., Ex. 5).

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

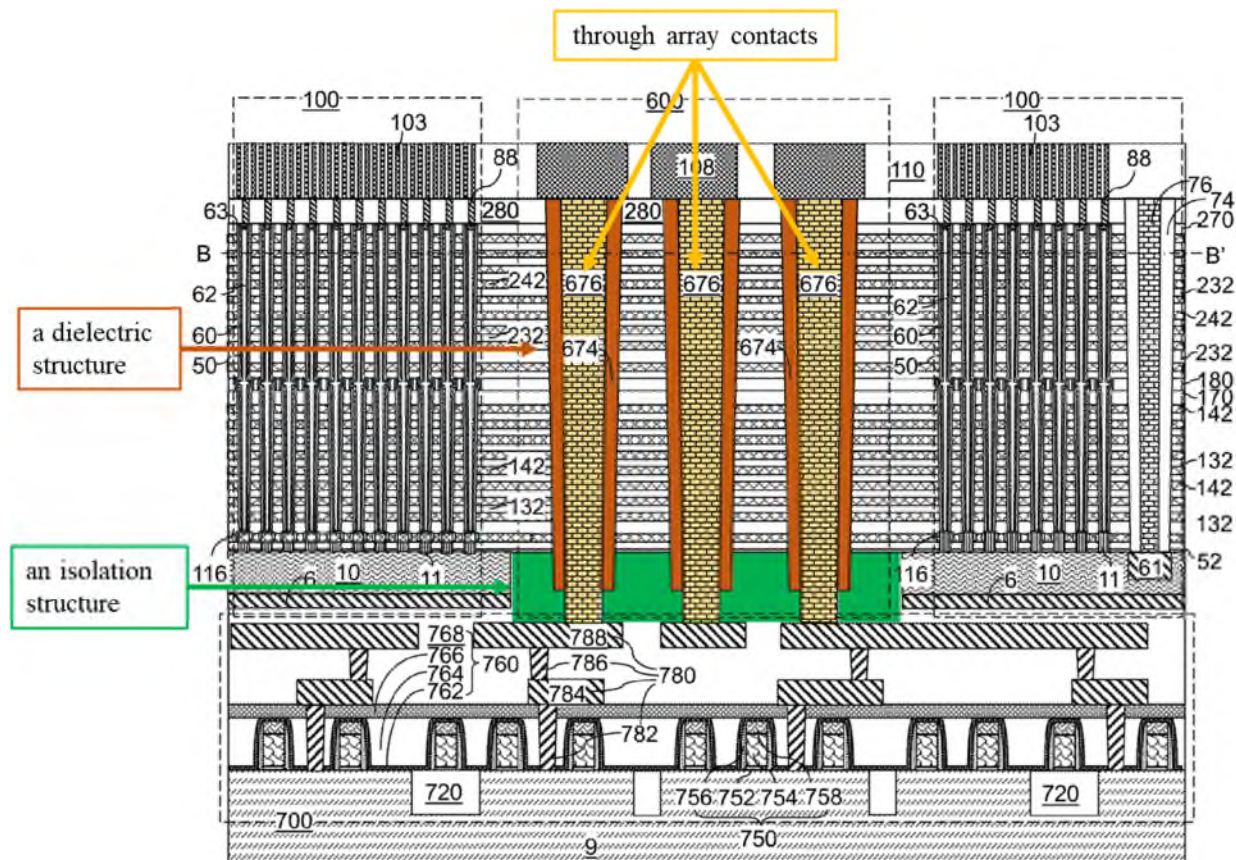


FIG. 49

Toyama, Figure 49 (annotated); Pet. 39-46. 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*.

c. PO Has Not Rebutted Petitioner’s Showing for Limitation [1.D]

PO has not rebutted the petition’s showing for limitation [1.D] for the same reasons as discussed above: (1) the term “the dielectric structure” may encompass

one or more dielectric structures (§§II.B, III.C.1.a); and (2) multiple “liners 674” are collectively a single dielectric structure (§III.C.1.b). And, even under PO’s position that a single “liner 674” is a dielectric structure, the plain language of limitation [1.D] encompasses **one** or more **through array contacts** (one “structure 676”) **extending vertically through the dielectric structure** (one “liner 674”).

2. First Exemplary Structure

PO’s argument regarding these limitations must fail because it is based solely on PO’s earlier, meritless arguments that Toyama’s first exemplary structure does not teach **a dielectric structure on an isolation region/structure**. POR 54-55; §§III.A (limitations [1.C.ii], [15.A]), III.B (limitations [1.C.i-ii], [15.C.i]).

D. Claim 7: “wherein the dielectric structure defines a through array contact region within the 3D memory device”

1. Second Modification

Contrary to PO’s assertions (POR 69-71), Toyama’s Second Modification’s discloses a **dielectric structure** that **defines a through array contact** (“TAC”) **region within the 3D memory device**:

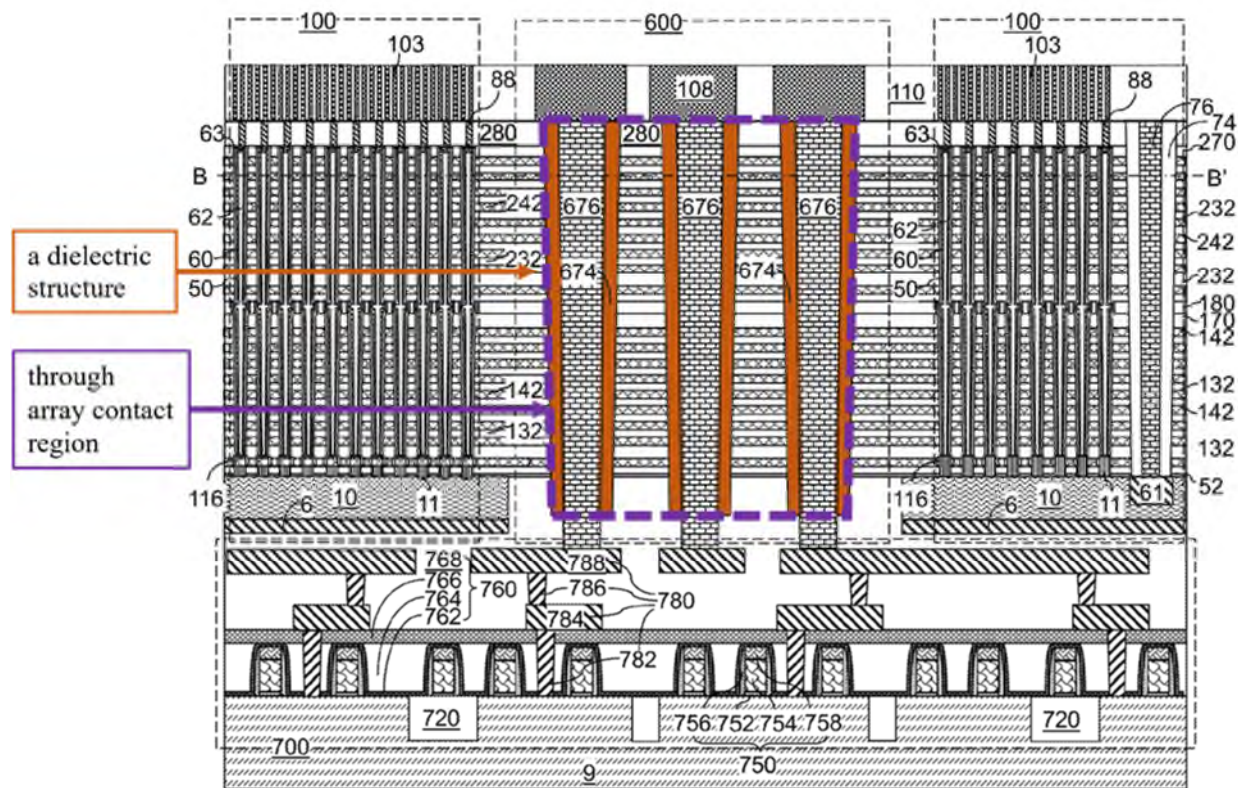


FIG. 49

Toyama, Figure 49 (annotated); Pet. 90-92; Lee-Reply ¶¶59-64. Indeed, the borders of the *TAC region* above are defined by the borders of the Second Modification's *dielectric structure* ("insulating liners 674").¹¹ That the borders of

¹¹ Either the TAC region's borders are defined by a single dielectric structure that includes all of the "insulating liners 674" (§III.C.1.b) or the TAC region's borders are defined by a collection of dielectric structures, each comprising a single "liner 674" (§III.C.1.a).

the *TAC region* are defined by the borders of the *dielectric structure* is also evident from a top view:

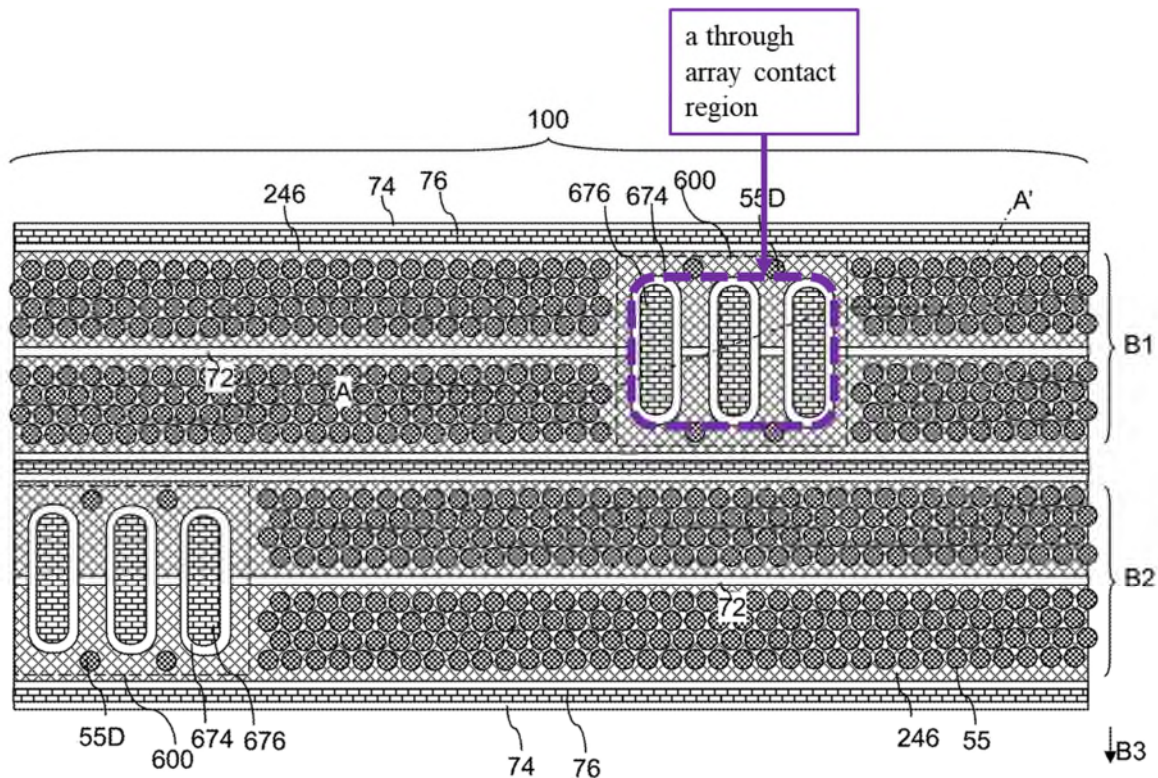


FIG. 48B

Toyama, Figure 48B (annotated).

PO in effect argues, as it did in a related case, that the TAC region must be “nested within ...or [is] at most coextensive with” the “dielectric structure.” Ex. 1046, (Patent Owner’s Response, IPR2024-00788, Paper 13) (“378-1 POR”) at 27-28. PO’s position is contrary to the plain meaning of “define,” which is “to fix or mark the limits of.” Ex. 1038, 3 (defining “define”). For example, the original borders of Washington, DC were defined by a number of “boundary stones” placed at the perimeter of the District by surveyors. Ex. 1044

(<https://boundarystones.org/>). But clearly the District of Columbia was not coextensive with the area under the stones themselves. 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 ¶60.

PO's assertion that the *TAC region* "cannot include the alternating conductor/dielectric layer stack" is similarly meritless. **First**, PO's assertion is contrary to the plain language of the claim, which nowhere precludes part of the alternating layer stack from being between *dielectric structures* or elements of a single *dielectric structure*. Just as Washington, DC can include objects besides the boundary stones that define it, so too can a *TAC region* include elements (e.g., an alternating stack) besides the *dielectric structure* that defines it. Lee-Reply ¶60.

Second, PO's assertion is contrary to the specification's description of a "TAC region." 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.

2. First Exemplary Structure

PO's argument regarding claim 7 must fail because it is based solely on PO's earlier, meritless argument that Toyama's first exemplary structure does not render obvious the claimed *dielectric structure*. POR 55; §III.B (limitations [1.C.i-ii], [15.C.i]).

E. Limitation [18.A]: “an etch stop plug interposed between each local contact of the local contacts and each channel structure of the channel structures”

1. PO Does Not Dispute That under Petitioner's Construction, Claim 18 Would Have Been Obvious

PO does not dispute that if claim 18 does not require etch stop plugs interposed between “local contacts disposed on a slit structure” and “channel structures” (as the limitation should be interpreted, 806-2 ID 39; §II.C), then Toyama's First Exemplary Structure and Second Modification discloses claim 18. Pet. 102-103.

2. Claim 18 Would Have Been Obvious Even under PO's Erroneous Construction¹²

Toyama's First Exemplary Structure and Second Modification render the claim 18 obvious even accepting PO's construction because Toyama discloses the

¹² *Apple*, 2024 WL 3084509, at *5 (Petitioner permitted to respond to new arguments).

claim in exactly the same way that, under PO's erroneous theory, the '378 discloses it. Lee-Reply ¶¶67-73. PO asserts that the '378's "bit lines 250" are *local contacts disposed on the channel structures and the slit structures* (limitation [15.G]), such that the '378 discloses *an etch stop plug* ("etch stop plug 224") *interposed between each local contact of the local contacts* ("bit lines 250") *and each channel structure of the channel structures* ("channel structure 216"). POR 31-32. PO annotates Figure 1A with its apparent theory:

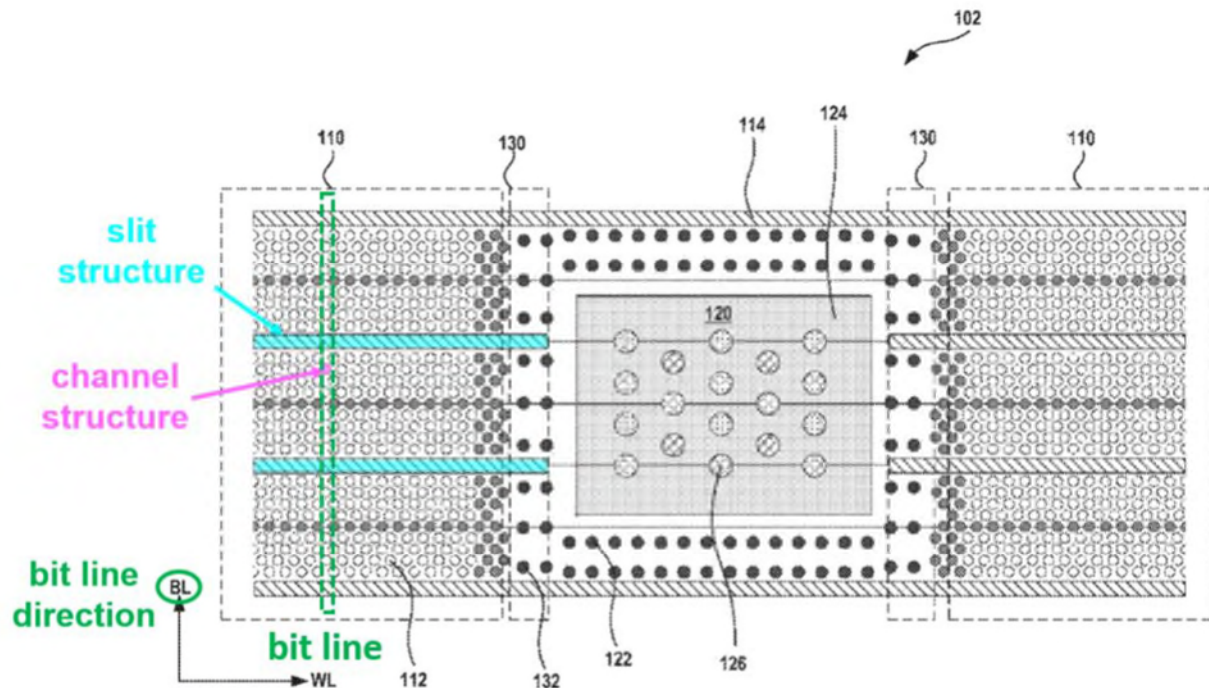


FIG. 1A

POR 32 (annotating '378, Figure 1A).

“bit lines 103” (in purple) are above “memory stack structures 55” (in red), and Toyama explains that in between “memory stack structures 55” and “bit lines 103” are “drain regions 63.” Toyama, [0251]; Lee-Reply ¶¶69-70.

Figure 48B similarly depicts this disclosure in Toyama’s Second Modification:

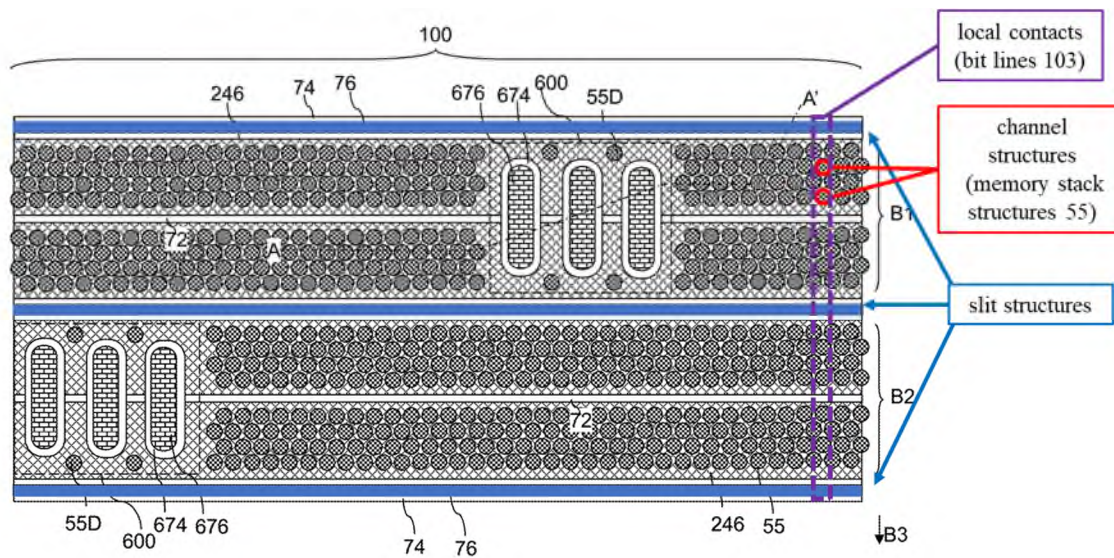


FIG. 48B

Toyama, Figure 48B (annotated), [0342] (“bit lines 103 ... extend along the second horizontal direction”), [0331] (“laterally-elongated contact via structures 76 extend[] along the first horizontal direction hd1”), [0251] (“drain regions 63” between “bit lines 103” and “memory stack structures 55”); Lee-Reply ¶¶71-73.

IV. CONCLUSION

The Board should hold all challenged claims unpatentable.

Respectfully submitted,

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Dated: June 25, 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 5,499 words.

Dated: June 25, 2025

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CERTIFICATE OF SERVICE

The undersigned hereby confirms that the foregoing paper was caused to be served on June 25, 2025 via electronic mail, upon the following attorneys of record for the Patent Owner:

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