

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TAIWAN SEMICONDUCTOR MANUFACTURING COMPANY LTD.,
Petitioner,

v.

MARLIN SEMICONDUCTOR LIMITED,
Patent Owner.

Case No. IPR2025-01265
U.S. Patent No. 8,993,384 B2

PATENT OWNER'S SUR-REPLY

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TABLE OF EXHIBITS

Exhibit	Description
2001	Declaration of Joseph McAlexander III
2002	Peter Van Zant, <i>Microchip Fabrication, A Practical Guide to Semiconductor Processing</i> , (4 th ed. 2000)
2003	<i>Curriculum Vitae</i> of Joseph C. McAlexander III
2004	Kintek, “What Is Step Coverage In PECVD, And Why Is It Important?” (https://kintekfurnace.com/faqs/what-is-step-coverage-in-pecvd-and-why-is-it-important)
2005	Transcript of February 26, 2026, Deposition of Jack Lee, Ph.D.
2006	Merriam-Webster Definition of “surround” (https://www.merriam-webster.com/dictionary/surround)
2007	Second Declaration of Joseph McAlexander III
2008-2100	<i>Reserved</i>
2101	Website: Foundries to Grow Faster than Integrated Circuits in 2016 (https://marketrealist.com/2015/12/foundries-grow-faster-integrated-circuits-2016/)
2102	Website: Ranked: Semiconductor Foundries by Revenue Share (www.visualcapitalist.com/ranked-semiconductor-foundries-by-revenue-share/)
2103	Website: US Patent No. 8,993,384 B2 – Semiconductor device and fabrication method thereof – Google Patents (https://patents.google.com/patent/US8993384B2/en?q=8993384#citedBy)
2104	Declaration of Paul Ahern Regarding Patent Owner’s Request for Discretionary Denial of Institution

I. INTRODUCTION

Petitioner's Reply misunderstands or mischaracterizes Marlin's positions and the evidentiary record and fails to substantively address Patent Owner's patentability arguments.

First, Petitioner's Reply relies on a meaning of the term "surround" that is inconsistent with both the plain meaning—"to enclose on all sides"—and the '384 Patent's specification and figures. Petitioner raises four flawed arguments to support its departure from the plain meaning, none of which withstands scrutiny. Moreover, applying the correct plain meaning of "surround," neither Xu nor Lin teaches or suggests an isolation structure that surrounds the fin structure as required by the challenged claims, because the isolation structures in those references cover only two sides of the fins. And even under Petitioner's flawed interpretation, Xu's isolation structure does not surround the entire "fin structure" as claimed, because Xu merges its fins into a single fin template that is not surrounded by the isolation structure.

Second, Petitioner misinterprets the claim language regarding the "recess" of elements 1[e] and 1[f]. The claimed recess must be formed "in the fin structure"—meaning it is defined by the etched-away portions of the fin, not by the isolation structure as Petitioner contends. In addition, forming the recess "at a side of the gate structure" requires a horizontal etch into the vertical wall of the gate, which neither

Xu nor Lin discloses. Because the recess in the asserted references is not formed in the manner required by the claims, the references fail to disclose “forming an epitaxial layer to fill up the recess” as claimed.

Third, Petitioner offers no valid reason to combine Xu’s two separate and incompatible embodiments—one in which the isolation structure is etched and another in which a recess is formed in the fin—because each of Xu’s two embodiments already independently achieves channel strain through different methods of controlling source and drain depth.

Fourth, regarding Claim 8, Petitioner’s bare assertion that conformal deposition techniques were known and conventional is insufficient to establish obviousness, particularly given the recognized downsides of conformal deposition such as slower deposition rates and decreased film quality.

Fifth, regarding Claim 9, Petitioner fails to provide any motivation for why a POSITA would have chosen to implement the specific gate-last process recited in Claim 9 in either Xu or Lin, and Petitioner’s own expert admitted that the steps of Claim 9 would not “ideally” be used in a gate-last process.

II. THE CHALLENGED CLAIMS ARE PATENTABLE

All challenged claims 1-9 should be upheld as patentable, because no prior art reference discloses or renders obvious: (1) “forming an isolation structure to surround the fin structure”, (2) “forming a recess in the fin structure at a side of the

gate structure”, and (3) “forming an epitaxial layer to fill up the recess.” At the very least, claims 8 and 9 are patentable, because no asserted ground discloses or renders obvious the specific combination of steps recited in those claims.

A. No Asserted Ground Discloses “Forming An Isolation Structure To Surround The Fin Structure” (Element 1[b])

1. The Plain Meaning Of “Surround” Within The Context Of The ’384 Patent Means Enclosed On All Sides

Petitioner conflates different uses of “surround” in entirely different contexts. The Reply clarifies that the parties agree that the meaning of “surround” depends on context. Reply, 4. However, the parties dispute the meaning of “surround” as used within the specific context of the ’384 Patent.

Petitioner has not proposed any specific claim construction for any claim term, including the term “surround.” Pet., 10. Instead, the Petition alleged that the prior art invalidated the challenged claims “under any reasonable construction, including their plain meaning.” *Id.*

It is well-established that when determining the plain meaning of a claim term, “the person or ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005); *see also Aylus v. Apple*, 856 F.3d 1353, 1358 (Fed. Cir. 2017) (“Properly viewed, the ‘ordinary meaning’ of a claim term is its

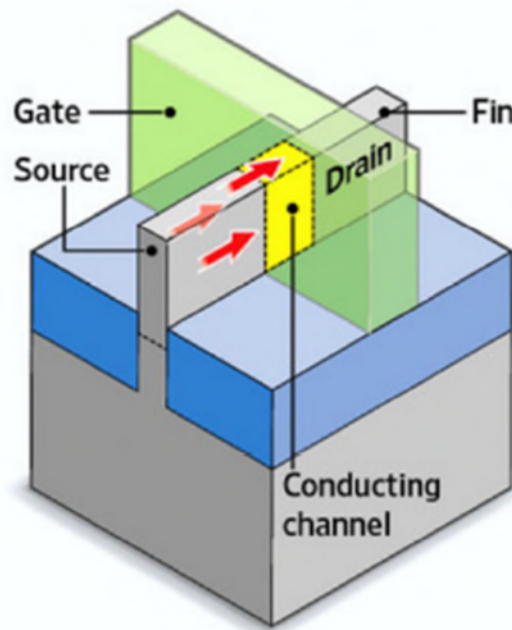
meaning to the ordinary artisan after reading the entire patent.”). As explained in Patent Owner’s Response (“POR”), the plain meaning of the term “surround”—as used in Claim 1—is to “enclose on all sides.” POR, 37 (citing EX2006, Merriam-Webster’s definition of “surround”). This plain meaning is consistent with and supported by the ’384 Patent’s specification, including its figures. POR, 25-26, 35-37.

Despite this, Petitioner argues that “forming an isolation structure to surround the fin structure”—as recited in Claim 1—may be met by the fin structure being enclosed on only two sides by the isolation structure, as taught by Xu and Lin. See Reply, 3-5. Notably, Petitioner does not identify any portion of the ’384 patent supporting that “surround” would mean anything other than the plain meaning of “enclosed on all sides.” Instead, Petitioner employs several flawed arguments and analogies to allege that “surround” does not require enclosure on all sides within the relevant context.

First, Petitioner argues that Marlin is improperly reading the ’384 Patent figures into the claims. Reply, 3. Not so. The claims recite that the isolation structure is formed “to surround the fin structure.” The plain meaning of the term “surround” is to “enclose on all sides.” This meaning is further bolstered by the ’384

Patent's specification and figures. Patent Owner's analysis is entirely consistent with the framework set forth in *Phillips*.

Second, Petitioner argues that “Marlin and Mr. McAlexander repeatedly use ‘surround’ in a manner inconsistent with Marlin’s ‘all four sides’ definition. Reply, 4. But these examples are neither in the relevant context nor inconsistent with the plain meaning of the word “surround.” Petitioner’s first alleged example is a passage from the POR referring to a “gate [] wrapped over the fin surrounding the fin on the top and two sides,” as shown in the figure below:



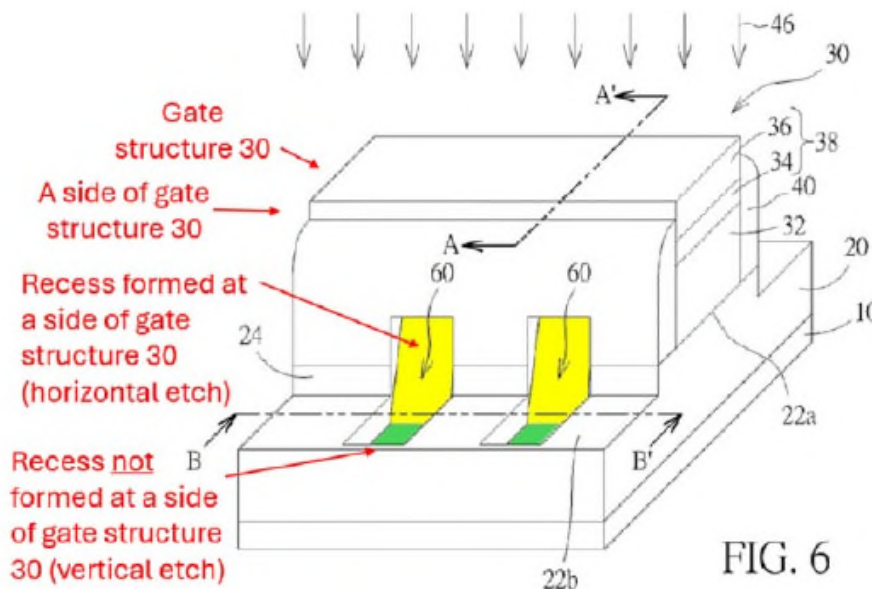
POR, 19; EX2007, ¶38. Importantly, the POR added the qualifier “on the top and two sides” to distinguish from the plain meaning of “surround”, which would indicate that the gate enclosed the fin on all sides. The challenged claims also recite

such a gate, and uses the language: “forming a gate structure, ***overlaying the top surface and the two side surfaces*** of a portion of the fin structure.” In contrast, the claim language describes the isolation structure as “***surround[ing]*** the fin structure” with no such qualifiers. Thus, the claim language expressly differentiates—by using different terminology—between a structure surrounding the fin structure, as opposed to covering less than all sides of the fin structure. Indeed, this highlights the problem with Petitioner’s proposed construction: Petitioner essentially argues that the qualifier “on two sides” should be imported into the claim language such that the claim language would be interpreted as “forming an isolation structure to surround the fin structure on two sides”. Such a limitation has no support in any part of the ’384 Patent, and Petitioner does not assert otherwise.

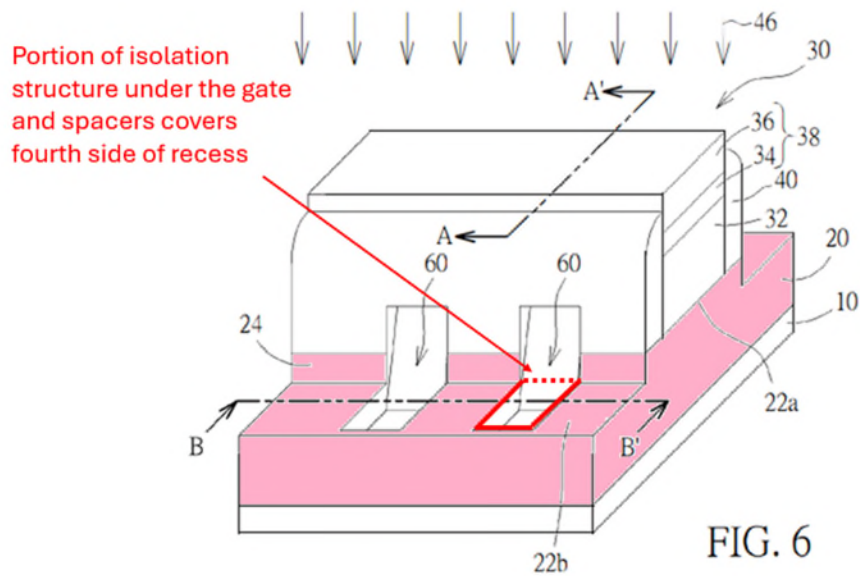
Petitioner’s second alleged example is a passage from Mr. McAlexander’s deposition in which he testified: “For instance, if I was giving a lecture and I had a semicircle of people that were in front of me that are surrounding me, that’s one thing.... I mean, there’s different contexts of what ‘surround’ might mean based on its application and its context.” EX1204, 33:3-10. Mr. McAlexander’s testimony is entirely consistent with the plain meaning of “surround,” because he was giving an example of a specific context—giving a lecture, where he would have a wall behind him—in which the meaning would depart from the plain meaning. But the ’384

Patent does not use “surround” in such a context. Within the context of the ’384 Patent, the meaning of “surround” is the plain meaning.

Third, Petitioner argues that in the ’384 Patent’s Figure 6, the isolation structure does not surround the recess on all four sides:



Reply, 4-5. This is plainly incorrect. As shown below, the isolation structure 20 surrounds the recesses 60 on all sides:



Ex. 1001, Fig. 6 (annotated). It is unclear why Petitioner believes that “only three sides of the recess are surrounded.” Reply, 4.

Fourth, Petitioner argues that Marlin’s usage of the phrase “fully surrounds” suggests that the meaning of the word “surround” is different from “fully surrounds.” Reply, 5 (citing POR, 31). To be clear, that is incorrect. The POR merely included the word “fully” to make clear that the ’384 Patent’s usage of the term “surround” was consistent with the plain meaning of the term—to “enclose on all sides.” See POR, 31 (“[B]ecause the isolation structure 20 fully surrounds the fin structures on all four sides, when the fin structures are etched down to form recesses 60, the isolation structure 20 fully surrounds the recesses 60.”).

In short, the Petition grounds rely on a meaning of the term “surround” that is inconsistent with both the plain meaning and the ’384 Patent specification.

Moreover, Petitioner was obligated to raise such a claim construction issue in the Petition but chose not to. The Board should decline Petitioner's belated attempt to advocate for a construction that departs from the plain meaning of the term and is unsupported by the record.

2. The Asserted Prior Art Does Not Teach Or Suggest An Isolation Structure That Surrounds The Fin Structure Within The Context Of The '384 Patent

Under the plain meaning of “surround,” neither Xu nor Lin teach or suggest an isolation structure that surrounds the fin structure. As shown in the figures of Xu and Lin, the isolation structures in those references cover only two sides of the fins:

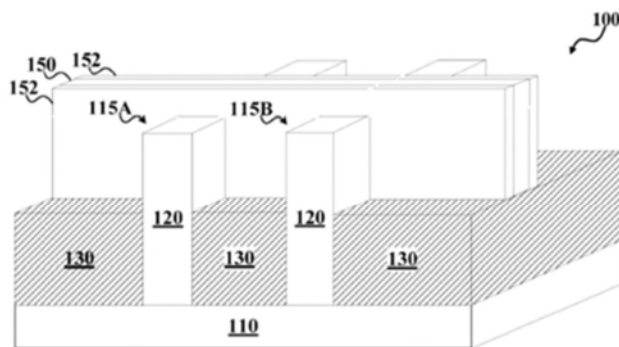


FIG. 2

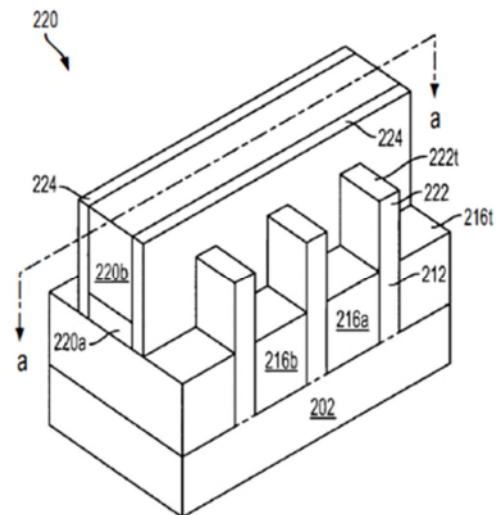


FIG. 7A

EX1004-Xu, Fig. 2 (left); EX1005-Lin, Fig. 7A (right).

Petitioner argues that these figures should be disregarded because they are “simplified.” Reply, 7, 9. Petitioner cites *In re Andersen*, 743 F.2d 1578, 1581 (Fed.

Cir. 1984), which explains that “ambiguity in this *simplified* drawing does not outweigh the consistent and unambiguous *detailed* teaching of the specification and mechanical drawings of the Winder patent.” That is, in *Andersen*, ambiguity in a single simplified drawings did not outweigh detailed teachings of the specification and other drawings. But *Andersen* is inapplicable here, because: (1) multiple figures in both Xu and Lin consistently and unambiguously illustrate that the isolation structures do not surround the fins; and (2) neither Xu nor Lin contain consistent, unambiguous, or detailed description contradicting the figures. Thus, it is entirely proper to reference the figures to determine what Xu and Lin would reasonably suggest to a POSITA. In fact, it is Petitioner that improperly attempts to use the “simplified” nature of the figures to infer additional disclosure (that the isolation structures surround the fin structures) beyond what Xu and Lin reasonably suggest.

a. Xu Fails To Disclose Or Render Obvious Element 1[b]

Although Xu states that its isolation features 130 “surround” the fins, this statement is ambiguous because, as agreed by both parties, the meaning of “surround” may differ in different contexts. Xu’s figures resolve this ambiguity by clearly depicting that the isolation features cover only two sides of the fins. Thus, Xu’s usage of the term “surround” in this context is inconsistent with the usage of “surround” in the challenged claims.

Moreover, even if Xu's isolation structure could be said to surround the fins, the isolation undoubtedly does not surround the entire "fin **structure**," as claimed. Unlike the '384 Patent, Xu's device merges its fins together into a single, merged "fin structure," which is not surrounded by the alleged isolation structure. EX2007-McAlexander-Decl, ¶72. Specifically, Xu explains that a "fin template 135 is formed by merging together the fins 120 of the FinFET device 100." EX1004-Xu at 5:2-4. A "semiconductor material is epitaxially grown by an epi process until the fins 120 of the fin structures 115A and 115B are merged together to form the fin template 135." *Id.* at 5:8-10. That the fin template is a part of what would correspond to the claimed "fin structure" is apparent from Xu's Figure 4, which labels "fin structures 115A and 115B" as including "fin template 135":

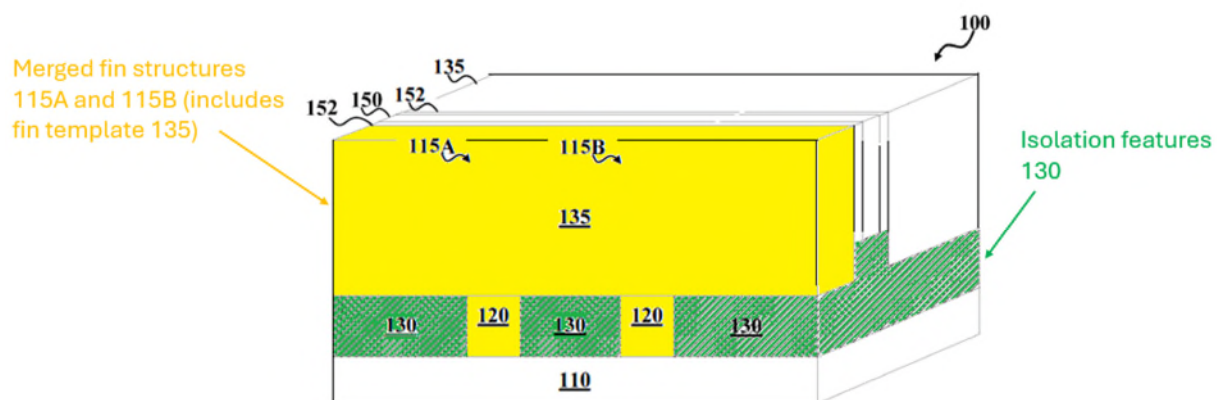


FIG. 4

Id., Fig. 4 (annotated). That is, there is a single merged “fin structure,” which includes the fin template 135, and which is not surrounded by the isolation structure.

Petitioner argues that Xu states that “it is understood that ‘fin template’ can refer to the newly grown epi semiconductor material alone.” Reply, 8. But that is irrelevant—the challenged claims recite a “fin structure,” not a “fin template.” Thus, whether the “fin template” can refer to the newly grown material alone makes no difference. What would correspond to the “fin structure” of the challenged claims includes both the fin template and the initial fins, because they are merged into one unit.

b. Lin Fails To Disclose Or Render Obvious Element 1[b]

As explained in the POR, Lin’s insulation regions 216 cover only two sides of the fins. This is apparent from the figures, as well as Lin’s description of the insulation regions, which describes “a fin 212 ***between the first and second insulation regions 216a, 216b.***” EX1005-Lin, ¶[0026] (emphasis added). That is, as illustrated in Lin’s Figs. 6A and 6B, the insulation regions 216a and 216b only cover two sides of each of the fins 212.

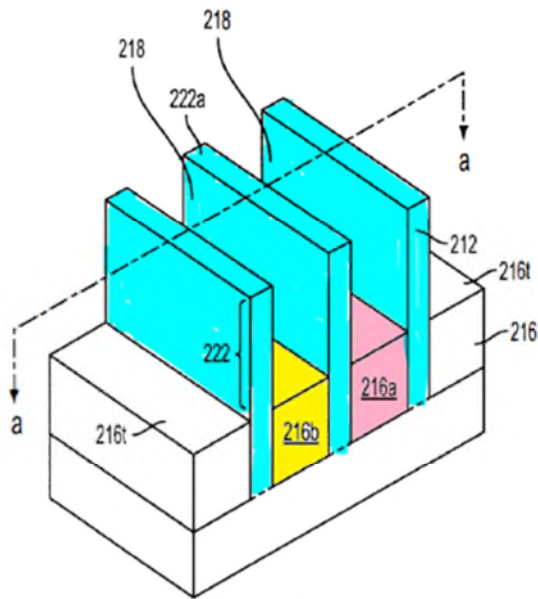


FIG. 6A

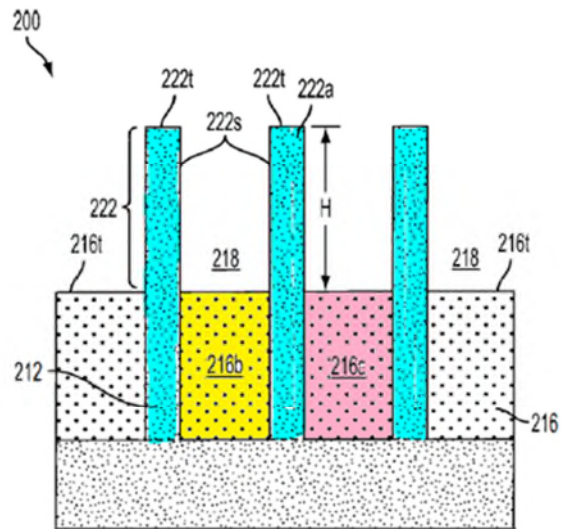


FIG. 6B

Id., Figs. 6A and 6B (annotated); EX2007-McAlexander-Decl, ¶113.

Petitioner argues that the '384 Patent also uses the word “between” to describe the location of the isolation structure. Reply 9. But Petitioner conveniently omits that the next sentence in the specification states that “[t]he isolation structure 20 may have the configuration shown in FIG. 2.” EX1001, 3:60-61. Figure 2 clearly shows that the isolation structure encloses the fins on all four sides:

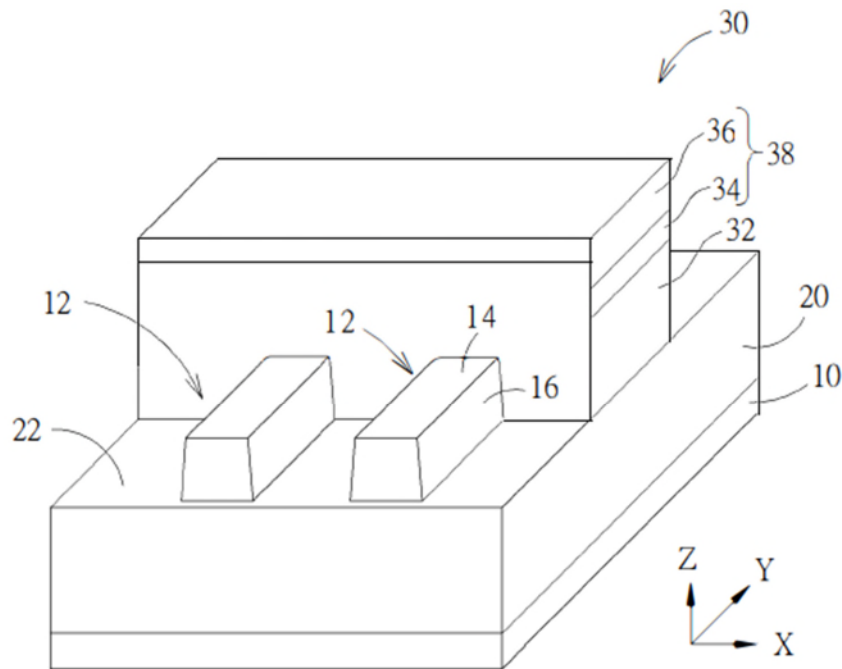


FIG. 2

EX1001, Fig. 2.

B. No Asserted Ground Discloses “Forming A Recess In The Fin Structure At A Side Of The Gate Structure” (Element 1[e]) And “Forming An Epitaxial Layer To Fill Up The Recess” (Element 1[f])

Regarding elements 1[e] and 1[f], Petitioner misinterprets both the claim language and Patent Owner’s positions. Specifically, Petitioner fails to recognize two critical aspects of the claimed “recess”: (1) it is formed “in the fin structure” and (2) “at a side of the gate structure.”

1. The Claimed “Recess” Must Be “In The Fin Structure”

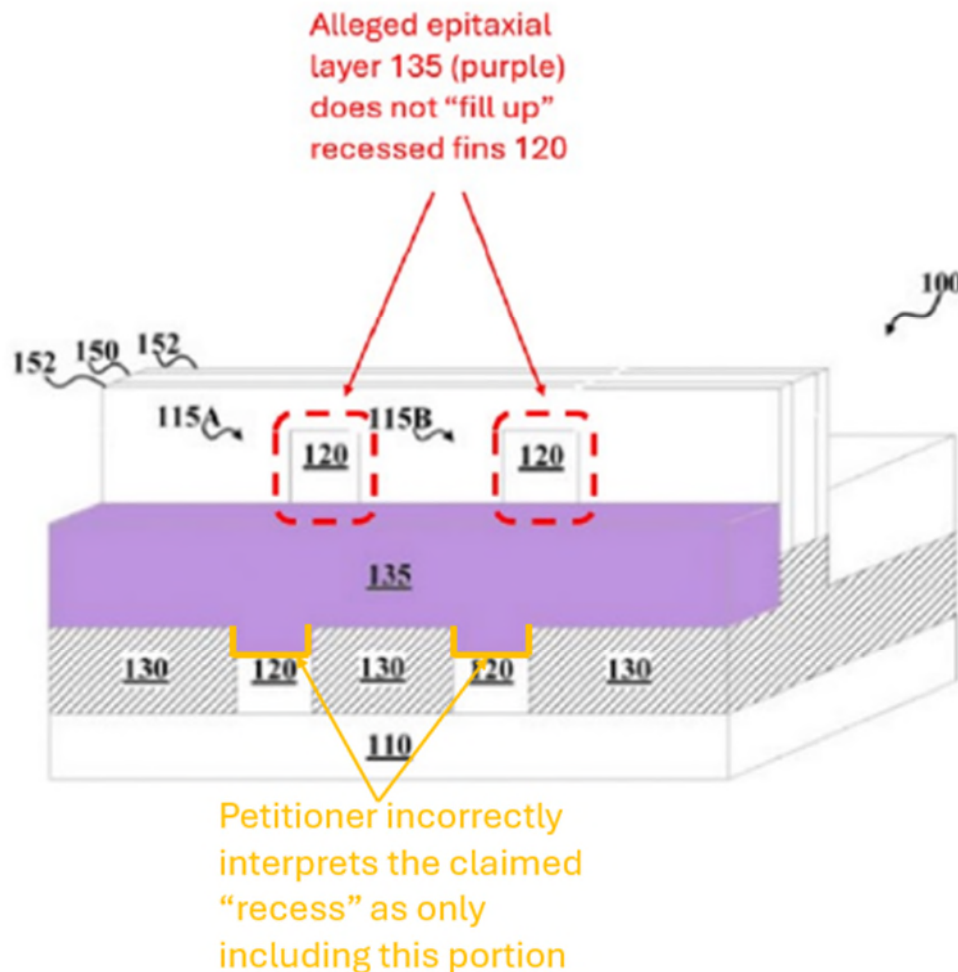
Element 1[e] recites: “forming a recess *in the fin structure at a side of the gate structure.*” The ’384 specification explains that this recess is formed by etching the fin structures:

As shown in FIG. 6 to FIG. 8, a second etching process 46 is carried out to etch the fin structures 12 under the gate structure 30 and the spacers 40. After the etching process, a recess 60 may be formed in each fin structure 12 at at least one side of the gate structure 30. Furthermore, according to this embodiment, the ends of the fin structures 12 at two sides of the gate structure 30 may respectively have a recess 60, and a bottom surface 68 of the recess 60 is preferably shallower than a bottom surface 26 of the isolation structure 20.

EX1001, 5:56-64. That is, the claimed “recess” is defined by the portion of the fin structure that is etched away.

Petitioner fails to recognize this aspect of the claimed “recess,” instead arguing that the recess is defined by the isolation structure. That is, Petitioner argues that only the portion of the recess that is below the isolation structure is the “recess.” Reply at 23-24 (“[T]he epitaxial layer need not cover exposed fin portions under the gate to ‘fill up’ Xu’s recess, which is defined by the isolation structures.”). To

illustrate, Petitioner incorrectly interprets the claimed “recess” as only including the portion defined by the isolation structure (outlined in orange below):



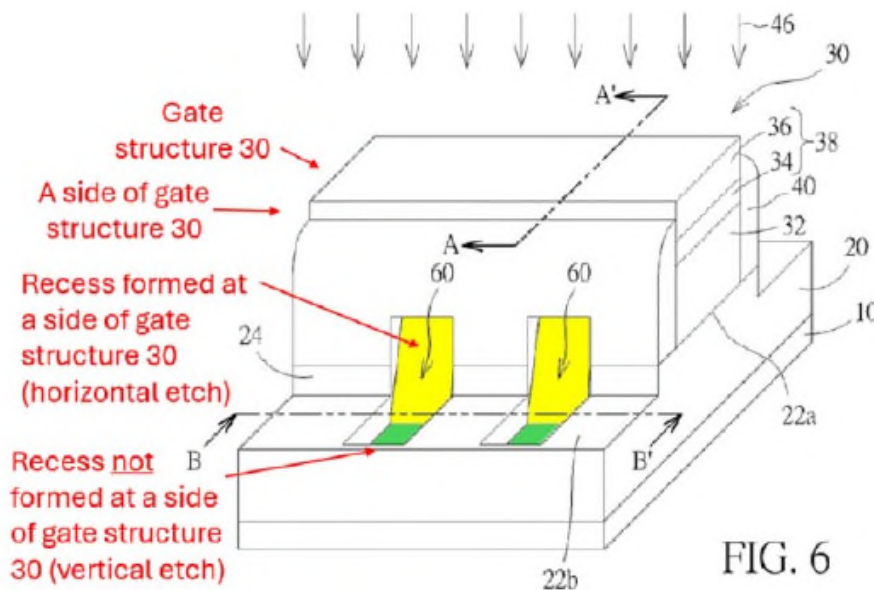
Reply, 23 (annotated further). But this interpretation does not comport with the ’384 Patent’s claim language, which recites that the “recess” is “formed . . . *in the fin structure.*” That is, the claimed recess is defined by the portion of the fin that is etched away to form the recess. Thus, under the claim language, the epitaxial layer must “fill up”—or extend to the top of—the recessed fins.

Contrary to Petitioner’s arguments, Mr. McAlexander did not concede that the claimed recess is defined by the “where the top surface of 120 is lower than the top surface of 130.” Reply, 24. Indeed, Mr. McAlexander affirmed that the recess is the part of the fin 120 that is etched away. Ex. 1204, 51:5-22.

Petitioner argues that in **Xu**, the recess sidewalls are “defined by... isolation features 240.” Reply, 23-24 (citing EX1004-Xu, 10:52-53, EX1204, 48:21-50:4, 52:20-53:5 (discussing Xu’s recess)). But whether **Xu’s** recess is defined by its isolation features cannot alter the claimed characteristics of the **’384 Patent’s** recess. Petitioner essentially attempts to read Xu’s disclosure into the challenged claims. That is backwards and illogical.

2. The Claimed Recess Must Be Formed “At A Side Of The Gate Structure” And It Is Not In Xu Or Lin

The claimed recess must be formed at a side of the gate. As explained in the POR, because the side of the gate is a vertical wall, forming the recess at the side of the gate requires a horizontal etch. POR, 28-30. The parties agree that the claimed recess is formed by etching. When one etches **at** a location, the etchant removes material at that location. Thus, in order to etch and form a recess “at a side of the gate structure,” which is a vertical wall, the recess must extend horizontally to etch into the gate structure. This maps exactly to Figure 6 of the specification, showing such an etch, having the yellow portion being an etch into the gate structure:



Ex. 1001, Fig. 6 (annotated). It also maps precisely to the specification's description that the claimed "etching process 46 is carried out to etch the fin structure 12 **under** the gate structure 30 and the spacers 40." Ex. 1001, 5:55-64.

Petitioner argues that despite Figure 6 and the quotation explaining the etching process, Ex. 1001, 5:55-64, when the '384 patent specification says to etch "under the gate structure 30 and the spacers 40," it does not mean that, but instead means to etch alongside those structures, vertically downward. Reply, 12. But such an etch is not "under," but rather "beside," which does not satisfy the claim language.

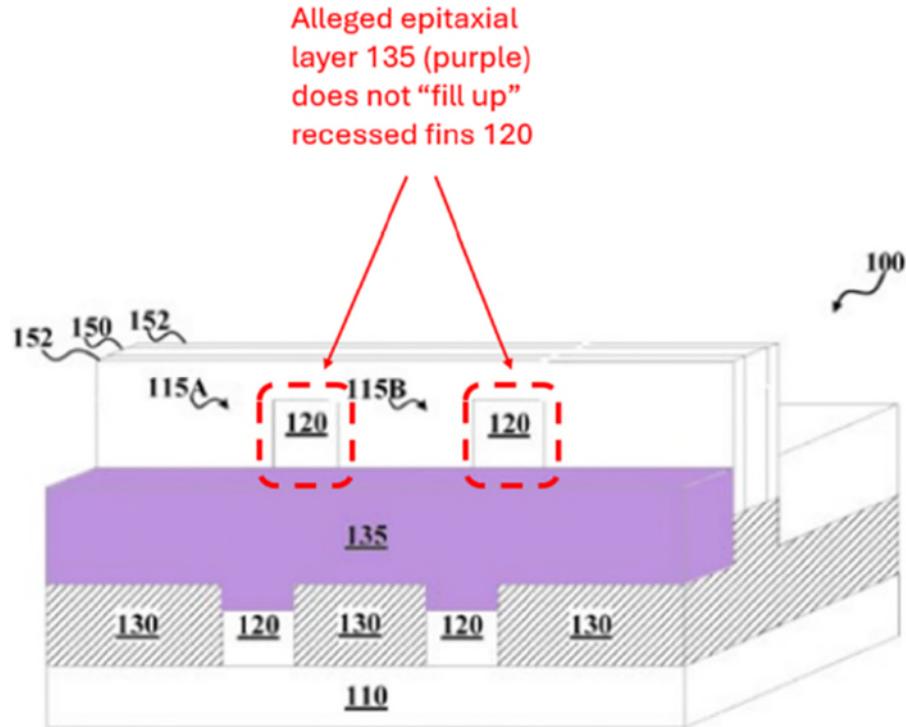
Petitioner also argues that "a side of the gate" refers to "the broader source/drain region of the transistor." Reply, 13. Petitioner points to the description of "the top surfaces 22b of the isolation structure at two sides of the gate structure." *Id* (citing EX1001, 7:7-8). This portion of the specification is referring to the portion

of the isolation structure that is beside the gate rather than under the gate. And so that does not change the fact that the claim language recites “forming a recess at a side of the gate structure.” The side of the gate structure is a vertical wall. Thus, forming the recess at the side of the gate requires a horizontal etch.

Because forming a recess in the fin structure at a side of the gate structure requires a horizontal etch, neither Xu nor Lin disclose or render obvious element 1[e].

**3. Xu Does Not Disclose Or Render Obvious Element 1[f],
“Forming An Epitaxial Layer To Fill Up The Recess.”**

Element 1[f] recites “forming an epitaxial layer to fill up the recess.” Because the claimed recess is defined by the etched-away portions of the fin structure, the claimed epitaxial layer must fill up the etched-away portions of the fin structure. Xu fails to disclose such an epitaxial layer. Xu’s epitaxial layer does not fill up the recesses, as the alleged epitaxial layer 135 does not extend to the top of the etched-away portions of the fins 120:



Pet., 28 (showing annotated and modified figure, further annotated here).

C. No Reason Exists To Combine Xu's Two Separate Embodiments

As the Petition concedes, there is no disclosure in Xu of a process, embodiment, or structure created by both "etching the isolation structure" and "forming a recess in the fin structure," which are both requirements of all claims. Pet., 20-26; EX2007-McAlexander-Decl, ¶79. Rather, Xu discloses one embodiment in which the isolation structure is etched, and a separate, incompatible embodiment in which a recess is formed. In its Reply, Petitioner asserts that Xu describes that its embodiments are used together. Reply, 21 (citing Pet., 24-26, EX1003-Lee-Decl, ¶¶91, 95). That is plainly incorrect. Pages 24 -26 of the Petition

refer to a passage in Xu that summarizes the different embodiments. Pet., 24 (citing EX1004-Xu, 16:5-17:10). At no point does Xu suggest that the two embodiments are combined, much less explain how the two incompatible embodiments would be combined.

Moreover, Petitioner’s alleged motivation to combine the two embodiments is that the second embodiment (in which a recess is formed) can achieve and optimize channel strain. Reply, 20. According to Petitioner, in the second embodiment, strain is “optimized by controlling source and drain depth.” Reply, 21. But Petitioner ignores that in Xu’s first embodiment (in which the isolation structure is etched), channel strain is already optimized by controlling source and drain depth. Regarding the first embodiment, Xu explains that “[r]eferring to FIG. 5, a process is performed to recess the fin template 135”:

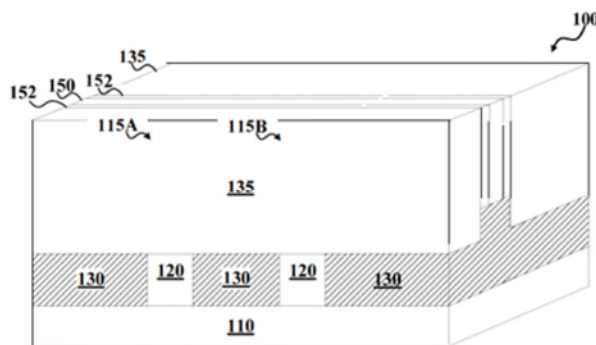


FIG. 4

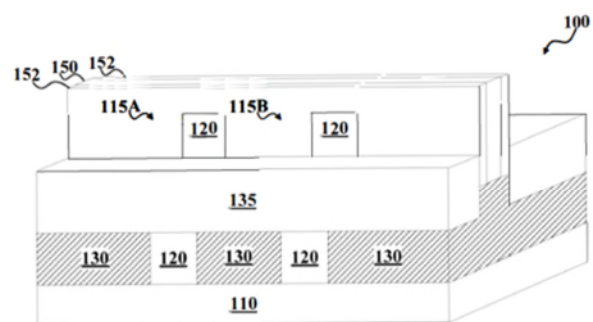


FIG. 5

EX1004-Xu, 5:34-36, Figs. 4 and 5. “The fin template 135 is etched back sufficiently to expose the channels of the fin structure 115A and 115B as illustrated

in FIG. 5. This ensures that later-formed raised source and drain features (semiconductor material 160) can effectively introduce strain into the channels of the fin structures 115A and 115B.” *Id.*, 5:43-48.

Thus, in the first embodiment, the source and drain depth is controlled by etching the isolation structure and fin template to a certain depth, which allows for effective introduction of channel strain. In contrast, in the second embodiment, the source and drain depth is controlled by forming a recess in the fins. *Id.*, 15:56-16:2. A POSITA would therefore have no reason to combine the two embodiments, as each embodiment provides different methods to control the source and drain depth to achieve effective channel strain. Petitioner’s assertion to the contrary is merely a post-hoc rationalization to justify combining two distinct embodiments of Xu.

D. Xu Fails To Disclose Or Render Obvious Claim 8

Regarding Claim 8, Petitioner’s Reply essentially repeats the Petition’s arguments that conformal deposition techniques were known and conventional prior to the ’384 Patent. Reply, 26-27. Petitioner argues that Xu’s statement that “spacers 152 may be formed by depositing a silicon nitride layer and then dry etching the layer to form the spacers 152” discloses or renders obvious conformal deposition. *Id.* (citing EX1004-Xu, 4:47-49).

Petitioner misses the point. Nothing in Xu suggests the *manner* in which the silicon nitride layer is deposited. Yet Petitioner argues that a POSITA would have

understood Xu’s bare disclosure of depositing a silicon nitride layer as inherently disclosing that the deposition was conformal. Reply, 26-27. As explained in the POR, its argument fails to rise to the level of obviousness. *See, e.g. Apple Inc. v. MPH Techs. Oy*, 28 F.4th 254, 262-263 (Fed. Cir. 2022) (expert used the phrases “would naturally have included,” “it would be logical,” and “could be, and most logically would be.”). Petitioner’s assertion that a conformal deposition technique **could** have been used and concluding that the combination would therefore be obvious is inadequate to support an obviousness determination. *Apple*, 28 F.4th at 262-263; *TQ Delta, LLC v. CISCO Sys., Inc.*, 942 F.3d 1352, 1359 (Fed. Cir. 2019).

Petitioner’s cited cases are inapposite. In *Allied Erecting and Dismantling Co., Inc. v. Genesis Attachments, LLC*, 825 F.3d 1373, 1381 (Fed. Cir. 2016), the Federal Circuit explained that “a given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine.” But here, Petitioner has failed to offer any motivation to combine other than that conformal deposition was conventional and known. Similarly, in *Novartis Pharms. Corp. v. West-Ward Pharms. Int’l Ltd.*, 923 F.3d 1051, 1059 (Fed. Cir. 2019), the Federal Circuit explained that there is no requirement “that a particular combination must be the preferred, or the most desirable, combination described in the prior art in order to provide motivation for the current invention.” But here,

Petitioner has not set forth any prior art combination, preferred or otherwise. Rather, Petitioner simply asserts that it would have been obvious to use a conformal deposition technique to form the spacers in Xu’s fabrication method because conformal deposition was known. This is insufficient to support an obviousness determination.

Moreover, there are significant downsides to the allegedly obvious approach. A POSITA would have understood that depositing a material conformally comes at a cost. EX2007-McAlexander-Decl, ¶98; EX2004 at 4. For example, “[t]he process conditions that favor excellent step coverage—such as high pressure and low power—often result in a slower deposition rate.” EX2004 at 4. Indeed, Petitioner’s expert agreed that conformal deposition methods have slower deposition rates and decreased film quality. EX2005-Lee-Dep at 62:17-63:18.

E. No Asserted Ground Discloses Or Renders Obvious Claim 9

Regarding Claim 9, Petitioner’s Reply re-asserts the Petition’s arguments that gate-last processes were known prior to the ’384 Patent. Reply, 14-15. As an initial matter, Petitioner is incorrect that the ’384 Patent admits that Claim 9 is obvious. Moreover, as explained above with respect to Claim 8, merely asserting that a particular process was known is insufficient to establish obviousness. This is especially so in semiconductor manufacturing—even the most complex fabrication

processes are composed of four basic operations: layering, patterning, doping, and heat treatments. EX2007-McAlexander-Decl, ¶45 (citing EX2002 at 29-31, 71).

Petitioner's assertion that "these steps... are specifically known as steps of Xu's 'gate last' process and would have been obvious to a POSITA as described in the Petition" is specious. Dr. Lee specifically admitted that "ideally" a gate-last process would not use the steps recited in Claim 9. EX2005-Lee-Dep, 72:6-12; *see also id.*, 72:16-73:18. Thus, the mere fact that Xu contains the words "gate-last process" can not reasonably suggest performing the specific steps recited in Claim 9. Thus, Ground 1A fails to disclose or render obvious Claim 9.

Regarding Grounds 1B and 1C, the POR explained that these grounds failed to provide a motivation to combine Brask with either Xu or Lin. POR, 61-64, 68-73. The Petition did not provide any rationale for why a POSITA would want to implement the specific process disclosed in Brask, instead only stating certain benefits that would apply to any gate-last process. *See* Pet., 48-49 (stating benefits associated with a gate-last process in general). For example, the Petition alleges that a gate-last process enables tuning of gate electrode work functions, but this alleged benefit only applies to replacing a gate electrode, not a gate dielectric layer, as required by element 9[c]. EX2007-McAlexander-Decl, ¶110. In its Reply, without support, Petitioner attempts to shoehorn this work function benefit as also applying

to replacing a gate dielectric layer. Reply, 18. But as Mr. McAlexander explained during his deposition, work function tuneability is “the reason that you usually put the gate dielectric down early at a higher temperature so that it’s more conformal and it’s very dense.” EX1204-McAlexander-Dep, 68:3-16. Thus, Petitioner’s alleged work function benefit would in fact motivate “put[ting] the gate dielectric down early” rather than replacing the gate dielectric layer, as required by element 9[c]. Thus, the Petition fails to set forth any rationale for why a POSITA would have chosen to implement the specific gate-last process recited in Claim 9 in Xu or Lin.

Regarding the combination of Lin and Brask, the flaw in Petitioner’s argument is even more apparent. The Petition admits that “Lin discloses a ‘gate-first’ fabrication process where the operative metal gate is formed before the source and drain regions of the transistor.” Pet., 79. Despite this, the Petition argues that a POSITA would have been motivated to modify Lin’s gate-first process to instead use the opposite gate-last process. Pet., 79-80. Petitioner’s allegation that a POSITA would elect to contradict Lin’s express disclosure of using a gate-first process is speculative at best and should be rejected. Moreover, as explained above, even if a POSITA would have been motivated to modify Lin to use a gate-last process instead of a gate-first process, the Petition does not provide any rationale for why a POSITA would have chosen the specific gate-last process recited in Claim 9.

Thus, Grounds 1B and 1C similarly fail to disclose or render obvious Claim 9.

III. CONCLUSION

For at least the reasons discussed above, the challenged claims of the '384 Patent should be upheld as patentable.

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Respectfully submitted,

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CERTIFICATE OF WORD COUNT

The undersigned certifies that the portions of the above-captioned PATENT OWNER'S SUR-REPLY specified in 37 C.F.R. § 42.24(a)(1) have 4,766 words, in compliance with the 5,600 word limit set forth in 37 C.F.R. § 42.24(c)(4). This word count was prepared by the word-processing program used to prepare this paper (Microsoft Word).

Dated: July 9, 2026

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CERTIFICATE OF SERVICE

I certify that a copy of this PATENT OWNER’S SUR-REPLY is being served
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