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Paper 38
Date: May 16, 2025

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INERGY TECHNOLOGY, INC.,
Petitioner,

v.

FORCE MOS TECHNOLOGY CO., LTD.,
Patent Owner.

IPR2024-00093
Patent 7,629,634 B2

Before GRACE KARAFFA OBERMANN, CHRISTOPHER L. OGDEN, and MARY C. HOFFMAN, *Administrative Patent Judges*.

OBERMANN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining No Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

Inergy Technology, Inc. ("Petitioner") filed a Petition (Paper 1, "Pet.") requesting *inter partes* review of claims 1–9 of U.S. Patent No. 7,629,634 (Ex. 1001, "the '634 patent"). Force MOS Technology Co., Ltd. ("Patent Owner") filed a Preliminary Response. Paper 7 ("Prelim. Resp."). Applying the standard in 35 U.S.C. § 314(a), we instituted review of all challenged claims on all grounds asserted in the Petition. Paper 13.

After we instituted review, Patent Owner filed a Response. Paper 25 ("PO Resp.") Petitioner filed a Reply to Patent Owner's Response. Paper 27 ("Reply"). Patent Owner filed a Sur-reply. Paper 28 ("Sur-reply").

We held an oral hearing on February 21, 2025, and entered a copy of the transcript into the record. Paper 32 ("Tr.").

We have jurisdiction pursuant to 35 U.S.C. § 6. This is a Final Written Decision under 35 U.S.C. § 318(a) (2018) and 37 C.F.R. § 42.73 (2020) as to the patentability of the claims on which we instituted trial. Petitioner bears the burden of proving unpatentability of the challenged claims. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). To prevail, Petitioner must prove unpatentability by a preponderance of the evidence. *See* 35 U.S.C. § 316(3); 37 C.F.R. § 42.1(d). For reasons that follow, we determine that Petitioner has not shown by a preponderance of the evidence that claims 1–9 of the '634 patent are unpatentable.

A. Real Parties in Interest

Petitioner identifies itself (Inergy Technology, Inc.), ASUSTek Computer, Inc. ("ASUS"), and Panjit International Inc. as real parties in interest. Pet. 1. Patent Owner identifies itself (Force MOS Technology Co., Ltd.) as the sole real party in interest. Paper 6, 2.

B. Related Matters

The parties identify *Force MOS Technology Co., Ltd. v. ASUSTek Computer, Inc.*, No. 2:22-cv-00460 (E.D. Tex.) ("the District Court action") and *Alpha and Omega Semiconductor, Ltd., et al. v. Force MOS Technology Co., Ltd.*, No. 4:22-cv-05448 (N.D. Ca.) as related matters. Pet. 1–2; Paper 6, 2.

Petitioner filed a petition in IPR2024-00094 ("IPR094") on the same day as the instant Petition. The petition in IPR094 challenges claims of U.S. Patent No. 7,812,409 B2, which is owned by Patent Owner. Final arguments were presented in a hearing consolidated with IPR094, although the proceedings are not consolidated or joined. *See* Tr. 1 (caption).

II. BACKGROUND

A. The '634 Patent (Ex. 1001)

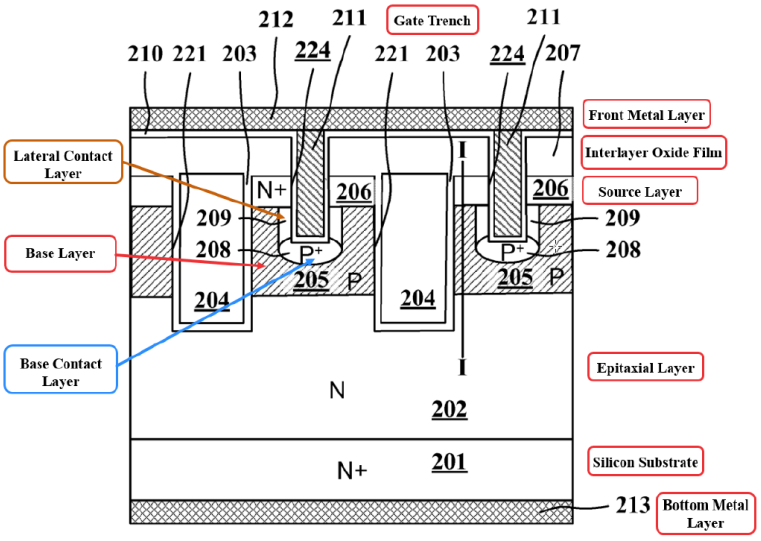
The '634 patent is titled "Trenched MOSFET with Trenched Source Contact." Ex. 1001, code (54). In the context of the disclosure of the '634 patent, a "MOSFET" refers to "a trench Metal-Oxide Semiconductor Field Effect Transistor,"[1] which is a "type of vertical transistor" that "allows high current to pass through" and for the channel to turn on or off using "a low voltage." *Id.* at 1:11–18. This type of "vertical transistor" includes a gate structure "formed in a trench on top of an epitaxial layer" and source/drain regions "formed on both sides of the gate." *Id.*

[1] The specification uses "trench" and "trenched" interchangeably to describe a MOSFET with a trenched source contact. Ex. 1001, 1:6–7, 1:11. The sole independent claim, however, specifies "[a] trenched MOSFET." *Id.* at 5:37.

According to the specification, the sidewall of the source contact in a traditional trenched MOSFET design has no ohmic contact with the contact metal plug, which results in poor ruggedness performance. *Id.* at 1:35–38. The specification further reports that, when P base resistance from the channel to the source contact is too high, the device may destruct. *Id.* at 1:38–42.

The specification describes an embodiment of the invention in which a P*-type lateral contact layer is implanted into parts of the sidewall of the source contact trench. *Id.* at 2:1–11. In such an embodiment, a P* base layer may have more doping than a P base layer, but less doping than a P+ base contact layer, which is located at the bottom of the source contact trench. *Id.* The specification further describes optimizing a P*-type lateral contact layer doping concentration to achieve ohmic contact between the P*-type layer and a contact metal plug without significantly increasing the threshold voltage of the device. *Id.*

We reproduce below Figure 2G from the '634 patent, as annotated by Petitioner.



'634 Patent, Figure 2G (annotations added)

Pet. 8; Ex. 1001, Fig. 2G. Figure 2G is a sectional view of a vertical trenched MOSFET "for describing the processes in accordance with an embodiment of the present invention." Ex. 1001, 2:43–45.

Figure 2G is annotated by Petitioner to label structural features of a trenched MOSFET as described in the '634 patent. Among other features, Figure 2G illustrates a P+-type base contact layer (**208**) and P*-type lateral contact layer (**209**), which are formed, respectively, "at the bottom and sidewall of" source contact trenches (**224**). *Id*. at 5:9–12. Source contact trenches (**224**) are formed to reach P-type base layer (**205**). *Id*. at 4:60–61.

B. Challenged Claims

We reproduce below claim 1, the sole independent challenged claim.

1. A trenched MOSFET with trenched source contact, comprising:
   [a] a semiconductor region having a drain region, a body region and a source region, comprising, a silicon substrate, an epitaxial layer corresponding to said drain region disposed on the top of said silicon substrate, a base layer corresponding to said body region disposed on the top of said epitaxial layer, and a source layer corresponding to said source region disposed on the top of said base layer;
   [b] a front metal layer formed on the upper surface of said semiconductor region;
   [c] an interlayer oxide film formed between said source layer and said front metal layer.
   [d] a bottom metal layer formed on the lower surface of said semiconductor region;
   [e] a plurality of trenched gates covered by said interlayer oxide film are formed on top of said source layer extending downwardly through said base layer to a portion of said epitaxial layer; and
   [f] a plurality of source contact trenches formed on the top of said interlayer oxide film extending downwardly through said source layer to a portion of said base layer wherein the sidewalls of said trenches in said base layer are covered by ***the lateral contact***

> ***layer***, wherein the bottom base of said trenches in said base layer are covered by the base contact layer.

Ex. 1001, 5:37–6:17 (bracketed letters and emphasis added). The emphasized term is the sole reference in claim 1 to a "lateral contact layer." *Id*. at 6:15. We adopt the parties' convention and refer, for example, to the limitations of claim 1[a] and claim 1[f]. Pet. 23; PO Resp. 22.

Each of the other challenged claims, namely, claims 2–9, depends directly from claim 1. *Id.* at 6:18–6:45. Claims 2 and 6 add limitations pertaining to the "doping concentration" of "the lateral contact layer" in the trenched MOSFET of claim 1. *Id*. at 6:18–23, 6:32–37.

C. Asserted Grounds of Unpatentability

The Petition identifies five grounds of unpatentability:

Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1	1, 2, 6	102(b)[2]	Hirler[3]
2	3–5, 7–9	103(a)	Hirler, Kobayashi[4]
3	1, 2	102(b)	Shiraishi[5]
4	3–9	103(a)	Shiraishi, Kobayashi

[2] 35 U.S.C. §§ 102, 103 (2006), *amended by* Leahy-Smith America Invents Act ("AIA"), Pub. L. No. 112–29 §§ 102, 103, sec. (n)(1), 125 Stat. 284, 287, 293 (2011) (effective Mar. 16, 2013). The pre-AIA versions of Sections 102(b) and 103(a) apply because the '634 patent issued from a U.S. application filed on February 23, 2008, which is before the effective date of the AIA amendments. *See* Ex. 1001, code (22). Neither party indicates, however, that the result on institution would change under the AIA versions.

[3] Pub. No. DE 102004009083, published Sept. 22, 2005 (Ex. 1006) (certified translation, with no figures) and (Ex. 1005) (original version, with figures).

[4] US Pub. No. 2004/0021174, published Feb. 5, 2004 (Ex. 1008).

[5] US Pub. No. 2005/0029584, published Feb. 10, 2005 (Ex. 1009).

Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
5	1–9	103(a)	Kobayashi, Shiraishi

Pet. 4. The Petition is supported by a declaration of Dr. David Kuan-Yu Liu. Ex. 1003. The Response is supported by a declaration of Dr. Dean Neikirk. Ex. 2012. The record includes cross-examination testimony taken from both witnesses by deposition. Ex. 1018; Ex. 2014.

III. ANALYSIS

A. Level of Ordinary Skill in the Art

The level of ordinary skill in the art at the time of the invention is a factual determination that provides a primary guarantee of objectivity in an obviousness analysis. *Al-Site Corp. v. VSI Int'l Inc.*, 174 F.3d 1308, 1324 (Fed. Cir. 1999) (citing *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966); *Ryko Mfg. Co. v. Nu-Star, Inc.*, 950 F.2d 714, 718 (Fed. Cir. 1991)).

Petitioner defines a person of ordinary skill in the art as having "a Master's degree in electrical engineering, and at least two years of relevant work experience in the field of integrated circuit design and manufacturing." Pet. 13 (citing Ex. 1003 ¶¶ 32–37, 57). Patent Owner does not dispute Petitioner's definition. PO Resp. 6.

We adopt Petitioner's proposed definition of the level of ordinary skill in the art because it is supported by unopposed declaration testimony and appears to be consistent with the disclosures of the '634 patent and the asserted prior art references. *See* Ex. 1001, 1:6–2:33 (describing the invention and related art in terms of integrated circuit design and fabrication); *see also* Ex. 1006 ¶¶ 1–6 (Hirler); Ex. 1008 ¶¶ 1–37

(Kobayashi); Ex. 1009 ¶¶ 2–29 (Shiraishi). Neither party, moreover, indicates the overall result would change based on a different definition.

B. Claim Construction

In an *inter partes* review, the Board construes the terms of a patent claim "in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent." 37 C.F.R. § 42.100(b). Under that standard, claim terms generally are given their plain and ordinary meaning as would have been understood by an ordinarily skilled artisan at the time of the invention and within the context of the entire patent disclosure. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc).

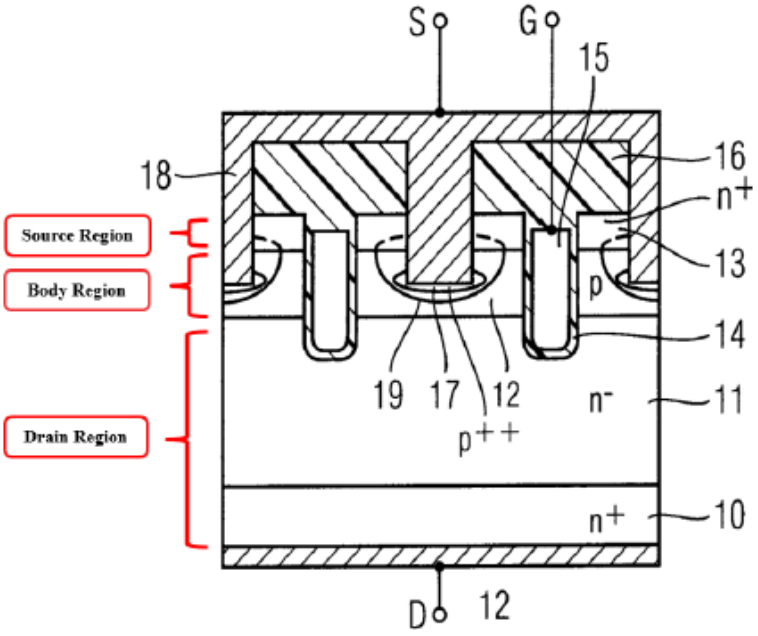
Petitioner argues that "the sidewalls of said trenches in said base layer are covered" should be construed to mean that "the entire sidewalls of" those trenches are covered. Pet. 18–19. We refer to this as "the sidewall limitation." Petitioner shows persuasively that the disclosure and file history of the '634 patent support its position on the sidewall limitation. *Id*.

Patent Owner, for its part, observes that, after the filing of the Petition. two District Courts adopted the construction proposed by Petitioner." PO Resp. 21 (citing Ex. 2010, 6–9; Ex. 2011, 23). Patent Owner also agrees to apply Petitioner's construction for purposes of this proceeding. *Id*. We agree with Patent Owner that an express construction of the sidewall limitation is necessary to this Decision, *id*., and adopt Petitioner's undisputed definition because it is supported by the record. No other claim term requires express construction for purposes of this Decision.

C. Grounds That Assert Hirler

Petitioner raises two grounds that assert Hirler — one anticipation ground (Ground 1) and one obviousness ground (Ground 2). Pet. 4 (grounds chart). Both depend on a finding that Hirler discloses "an epitaxial layer" on top of" a "silicon substrate" with "a base layer" on top of the epitaxial layer. Ex. 1001, 5:42–45 (claim 1, the sole independent challenged claim).

"An epitaxial layer is a semiconductor layer created via the process of epitaxy." PO Resp. 22; Ex. 2012 ¶ 109; Ex. 2016 ¶ 85. Petitioner does not dispute that definition. *See generally* Reply. Petitioner, however, relies on the following annotated version of Hirler's Figure 2F to show that Hirler discloses an epitaxial layer as specified in claim 1[a].



Id. at 24. Figure 2F illustrates Hirler's transistor arrangement, including semiconductor substrate 10, drift zone 11, body zone area 12, and source zone area 13. Ex. 1006 ¶¶ 18, 22, 33. Petitioner annotates Figure 2F to label a source region, a body region, and a drain region. In Petitioner's view, "drift zone 11" corresponds to the "epitaxial layer" of claim 1[a]. Pet. 23.

The Petition reflects an assumption that Hirler's drift layer 11 is "an epitaxial layer," but directs us to no evidence that suggests how the layer is created, much less proof that this layer is created by an "epitaxial" process Pet. 23 (citing Ex. 1005, Figs. 1, 2F; Ex. 1006 ¶ 18); *see* Ex. 1003 ¶ 66 (Petitioner's witness, Dr. Liu, parroting the same conclusory assertion, set forth in the Petition, that Hirler's drift layer 11 is an "epitaxial layer").

Patent Owner discusses that deficiency at length, pointing out that Hirler "does not use the word 'epitaxial' or any variation of that word." PO Resp. 22. We agree with Patent Owner that neither Petitioner, in the Petition, nor Dr. Liu, in the declaration supporting the Petition, provides "any explanation for *why* they believe that Hirler discloses an *epitaxial* layer" either expressly or inherently. *Id.* at 22–23. Indeed, the anticipation ground fails at the outset because the Petition is devoid of any analysis sufficient to demonstrate how or why Hirler teaches an "epitaxial layer" either expressly or inherently. Pet. 23–24.

The obviousness ground fares no better. Pet. 29–36. In the Petition, Petitioner presents no argument, separate from its anticipation assessment, that an epitaxial layer is obvious from Hirler's disclosure, therefore, this ground suffers the same deficiency as the anticipation ground. *Id.*

Alternative reasons fully support our conclusions above. Patent Owner describes how, during cross-examination, Dr. Liu for the first time "argued that an epitaxial layer is obvious" from Hirler's disclosure, then "attempted to advance an inherency argument for this limitation." *Id.* at 24 (citing Ex. 2014, 47:8–48:12, 164:16–165:20). We agree with Patent Owner that Dr. Liu's opinions, expressed for the first time during cross-examination, come too late, as they are necessary to support the challenges

but are not "clearly disclosed in the Petition" or in Dr. Liu's supporting declaration. *Id*. (and authority cited therein).

Alternatively, even if we set aside that timing issue, Dr. Liu's bare opinion, advanced for the first time during cross-examination, that an epitaxial layer is "obvious" from Hirler's disclosure is inadequate to support the challenges. *Id*. at 24–25. We accord little weight to Dr. Liu's opinion because it is conclusory. *See Xerox Corp. v. Bytemark, Inc.*, IPR2022-00624, Paper 9 at 15 (PTAB Aug. 24, 2022) (precedential).

In any event, Petitioner does not meet, on this record, the "high standard" required to establish an inherent disclosure of an epitaxial layer in Hirler. PO Resp. 24.[6] Dr. Liu opined for the first time during cross-examination "that it would have been impossible to create Hirler's more lightly doped n- drift zone layer on top of its more heavily doped n+ substrate layer other than via epitaxy." *Id*. at 25 (citing Ex. 2014, 164:16–165:20). But Patent Owner effectively refutes that proposition with evidence that such a layer "could be created by counter-doping," even if, as Dr. Liu contends, counter-doping may have been less ideal due to "disadvantageous mobility." *Id*. (citing Ex. 2012 ¶ 133; Ex. 2014, 166:15–167:8).

Patent Owner also comes forward with additional evidence that "one could create Hirler's n− and n+ layers by starting with an n-doped substrate and creating the more heavily doped n+ portion of that substrate via back-side doping." *Id*. (citing Ex. 2012 ¶ 114). "Dr. Liu could not articulate any

[6] It is axiomatic that a party asserting inherency bears the burden of showing that "the limitation at issue necessarily must be present, or the natural result of the combination of elements explicitly disclosed by the prior art." PO Resp. 24–25 (quoting *Par Pharmaceutical, Inc. v. TWI Pharmaceuticals, Inc*., 773 F.2d 1186, 1195–1196 (Fed. Cir. 2014)).

reason why back-side doping could not have created Hirler's arrangement of an n− layer on top of an n+ layer." *Id.* (citing Ex. 2014, 167:24–169:15).

Petitioner responds in the Reply with a two-fold counterargument. First, Petitioner points out that language in claim 1 of Hirler describes drift zone 11, body zone 12, and source zone 13 as "successively provided on" semiconductor substrate 10. Reply 10 (quoting Ex. 1006, claim 1); *see supra* 9 (reproducing Figure 2F, which illustrates these elements in Hirler's transistor). That counterargument is untimely in the Reply. Petitioner did not cite this disclosure in Hirler or present this argument in the Petition, therefore, the argument comes too late in the Reply as a means for making out a *prima facie* case that Hirler teaches an epitaxial layer. Sur-reply 8.

Here again, even if we set aside that timing issue, an alternative rationale supports our conclusion that Petitioner has not proven by a preponderance of the evidence that any claim is unpatentable based on any ground that asserts Hirler. That is because we agree with Patent Owner that Petitioner's argument rests on a conclusory (and unpersuasive) assumption that the cited language in Hirler's claim 1 describes "epitaxis, a specific process where a thin layer of single crystal material is deposited on a single-crystal substrate," as opposed to simply describing the sequential layering of drift zone 11, body zone 12, and source zone 13 on a substrate. *Id.* at 9.

To be clear, we find meritless Petitioner's view that Hirler's disclosure of providing three layers (drift layer 11, a body zone 12, and source layer 13) "successively" on substrate 10 somehow suggests that Hirler creates drift layer 11 by a process of epitaxis. *Id.* at 9. "[T]here is no reason to believe that the language 'successively provided' in Hirler's claim 1 provides any indication as to how" drift layer 11 in Hirler's transistor "was made." *Id.*

That language "simply describes a vertical ordering of the zones as arranged in the final product (substrate on bottom, drift zone on top of substrate, body zone on top of drift zone, and source zone on top of body zone)." *Id.* It does *not* suggest that one of those layers (drift layer 11) is created via epitaxis.

Second, Petitioner argues that Patent Owner's own expert testified that "counter-doping and back-side doping are both processes that introduce dopants into a substrate." Reply 11. Petitioner then points out that Hirler's drift layer 11, body zone 12, and source zone 13 "are disposed on top of each other in a specific order." *Id.* From there, Petitioner asserts, without citing any evidence, that "[t]he only way to provide Hirler's drift zone on the substrate is via epitaxial growth." *Id.* That assertion is both conjectural and untimely. As Patent Owner points out, that assertion is "unsupported by expert analysis (or any other factual basis)" and, moreover, it "is an inherency argument that should have appeared in the Petition." Sur-reply 10.

Against that backdrop, in connection with the obviousness ground, we take care here to avoid "the distortion caused by hindsight bias and" are "cautious of arguments reliant upon *ex post* reasoning." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007). We reject Petitioner's and Dr. Liu's efforts to backfill the total absence of evidence in the Petition, on how or why Hirler's drift layer 11 is created via epitaxis, by raising new arguments during the trial. We detect here a classic example of impermissible hindsight reconstruction, driven not by any disclosure in Hirler, but by guidance gleaned from the '634 patent; namely, the claim 1[a] instruction to use an "epitaxial layer" as a "drain region." Ex. 1001, 5:42–43.

For the above reasons, Petitioner fails to demonstrate by a preponderance of the evidence that Hirler anticipates or renders obvious the

"epitaxial layer" specified in claim 1[a]. Because the other challenged claims inherit that limitation through dependence on claim 1, we find Petitioner has proven no claim unpatentable based on the grounds that assert Hirler.

D. The Shiraishi Grounds

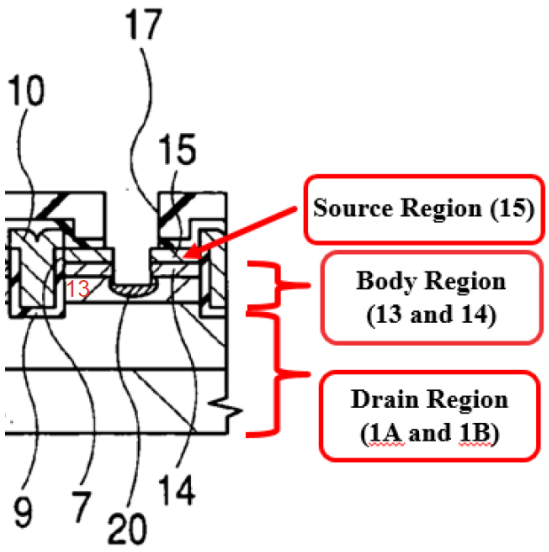
Petitioner raises three grounds that assert Shiraishi — one anticipation ground (Ground 3) and two obviousness grounds (Grounds 4 and 5). Pet. 4 (grounds chart). All three grounds fail because Petitioner does not advance evidence sufficient to establish that Shiraishi teaches or suggests the "base layer" of claim 1[a] or the sidewall limitation of claim 1[g].

1. Ground 3: Alleged Anticipation by Shiraishi

Petitioner argues that claims 1 and 2 are anticipated by Shiraishi. *Id.* This challenge is deficient for reasons explained below.

Petitioner's Reliance on Annotated Figure 8

We begin by providing an overview of the configuration of Shiraishi's semiconductor, which Petitioner relies upon to make out anticipation by reference to the following annotated version of Shiraishi's Figure 8.



Pet. 38 (reproducing Ex. 1009, Fig. 8) (cropped, zoomed, and annotated by Board and Petitioner). Figure 8 is a sectional view that illustrates a step in the manufacture of Shiraishi's semiconductor. Ex. 1009 ¶ 38. Petitioner adds annotations mapping a "Source Region (15)," a "Body Region (13 and 14)," and a "Drain Region (1A and 1B)" to the figure. Additionally, we have marked layer 13 with a red "13" annotation.

Failure to Identify in the Petition Any Structure in Shiraishi That Corresponds to the "Base Layer" Recited in Claim 1[a]

Claim 1[a] requires "a semiconductor region having a body region" in which "*a base layer corresponding to said body region*" is disposed on top of an epitaxial layer, "and a source layer corresponding to" a "*source region*" is "disposed *on top of the said base layer*." Ex. 1001, 5:39–47 (emphasis added); Pet. 37–38.

Referring to its own annotations in Figure 8 (in the version of Figure 8 reproduced above), Petitioner contends that Shiraishi's device "has a drain region, a body region, and a source region." Pet. 37 (citing Ex. 1009 ¶¶ 12, 67, 72, 73, Fig. 8, Fig. 35). "Moreover, the drain region is oriented at the bottom of the figure with a silicon substrate (1A), an epitaxial layer (1B), a body layer (13), and a source layer (15)." *Id.* (citing Ex. 1009 ¶ 67, Fig. 8, Fig. 35, Claim 22; Ex. 1003 ¶ 98.

From the outset, Petitioner's mapping of structures in Shiraishi to regions and layers specified in claim 1[a] are minimal and confusing. Pet. 37–38 (entirety of analysis in the Petition relating to this limitation); s*ee* Sur-reply 15–18 (Patent Owner's assessment of the minimal and confusing analysis set forth in the Petition). Indeed, as Patent Owner correctly observes, "the entirety of the Petition's analysis of limitation 1[a] against

Shiraishi contains no identification of the claimed 'base layer.'" Sur-reply 16 (citing Pet. 37–38).

Petitioner's failure to identify, in the Petition, any structure in Shiraishi that teaches or suggests the "base layer" of claim 1[a], standing alone, fully supports our holding that the anticipation ground is deficient. *Id.* The Petition lacks an essential "statement of material fact" (namely, a clear statement that Shiraishi teaches the "base layer" of claim 1[a]) and "specific citations to the portions of the record that support that fact." 37 C.F.R. § 42.22. Stated somewhat differently, Petitioner fails to point out with "particularity" why Shiraishi anticipates claim 1 or claim 2, which depends from claim 1. 35 U.S.C. § 312(a)(3).

Petitioner's Confusing Identifications of Shiraishi's Layers 13 and 14

Petitioner contends in the Petition that Shiraishi's layer 13 corresponds to a "body layer," a structure not recited in claim 1. Pet. 38 (citing Ex. 1003 ¶ 98); PO Resp. 38 (pointing out this problem). Though not stated in the Petition, Petitioner's witness, Dr. Liu, asserts elsewhere that layer 13 corresponds to a "base layer," a structure that is recited in claim 1. Ex. 1003 ¶ 100; PO Resp. 38.

Importantly, neither in the Petition nor in Dr. Liu's supporting declaration, can we find any persuasive evidence that Shiraishi's layers 14 and 13 together teach a "body region," which is another structure required by claim 1[a]. Ex. 1001, 5:40–41. At best, from the Petition, we can glean a mere conclusory argument to that effect from Petitioner's annotations to Figure 8. *See* Pet. 37–38 (citing Ex. 1003 ¶¶ 97–101). Actual argument to that effect appears only in Petitioner's Reply (Reply 17–18). Adding to the confusion, in the Petition, Petitioner identifies layer 14 (separately) as "the

lateral contact layer" that covers "the sidewalls" of "the trenches in" the "base layer" as specified in claim 1[g]. Pet. 40.

On this record, the Petition lacks a clear statement of which features of claim 1 are met by Shiraishi's layers 13 and 14 and lacks "specific citations to the portions of the record that support that fact." 37 C.F.R. § 42.22. Here again, the anticipation challenge fails to satisfy the "particularity" requirement that applies in our forum. 35 U.S.C. § 312(a)(3).

Petitioner's Post-Institution Attempt to Re-write the Petition by Mapping Shiraishi's Layers 13 and 14 to the Specified "Base Layer"

Patent Owner persuasively addresses the confusion surrounding Petitioner's claim mapping for the "base layer" limitation of claim 1[a]:

> Confusingly, Petitioner's annotation of Shiraishi's Fig. 8 identifies both layers 13 and 14 as the "body region," despite the claim reciting a "base layer corresponding to said body region," and despite Petitioner not identifying Shiraishi's layer 14 as part of the claimed base layer. Pet., 38; Ex. 1003 ¶98. Because the claim recites the "base layer corresponding to said body region," it is inconsistent with the claim's text to identify both layers 13 and 14 of Shiraishi as the body region but to identify layer 13 alone as the "base layer." Ex. 2012 ¶137.
>
> . . . .
>
> Thus, because Shiraishi's layer 14 is disposed underneath the source layer, Shiraishi fails to disclose the specific structure of limitation 1[a], which requires "a source layer corresponding to said source region disposed on top of the said base layer."

PO Resp. 39–40 (citing Ex. 2012 ¶¶ 137–138).

Petitioner, for its part, responds by arguing that Patent Owner misinterprets how the Petition maps Shiraishi to claim 1[a]. Reply 16–17. Petitioner, in the Reply, for the first time presents clear argument

that Shiraishi's layers 13 and 14 together form a "body region." Reply 16 (citing Pet. 37–38). But Petitioner goes further, stating for the first time that layers 13 and 14 together comprise the "base layer":

> Consistent with Shiraishi's description of region 14 as part of region 13, *Petitioner identified region 13 (which includes region 14) as a body or base layer* that corresponds to the body region. Shiraishi further discloses region 15, which forms a source layer corresponding to a source region, disposed on top of region 14, which is a part of region 13 that forms the base layer corresponding to the body region. Accordingly, Shiraishi teaches a source layer (15) that corresponds to a source region and is disposed on the top of *a base layer (13) and (14)* that corresponds to a body region.

Reply 17–18 (emphasis added).

Patent Owner asserts that this part of the Reply introduces new arguments that we should reject as inconsistent with the Petition or as not meeting the particularity requirements of 35 U.S.C. § 312(a)(3). Sur-reply 15–16. Patent Owner further contends that Petitioner, improperly for the first time in the Reply, asserts that Shiraishi's layers 13 and 14 together correspond to the specified "base layer":

> Moreover, although the Petition's annotated version of Shiraishi's Fig. 8 does mention "body region (13 and 14)," the entirety of the Petition's analysis of limitation 1[a] against Shiraishi contains no identification of the claimed "base layer." Pet., 37-38. However, Petitioner is now trying to rewrite "body layer (13)" (in the Petition) and "base layer (13)" (in its expert declaration) to "base layer (13 and 14)." This is plainly improper.

Sur-reply 16.

We agree with Patent Owner. Our rules of practice provide: "A reply may only respond to arguments raised in the corresponding opposition, patent owner preliminary response, patent owner response, or decision on

institution." 37 C.F.R. § 42.23(b). This regulation means that a "petitioner may not raise in reply 'an entirely new rationale,'" *Henny Penny*, 938 F.3d at 1330–31 (quoting *Intelligent Bio-Systems, Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1370 (Fed. Cir. 2016)), not "raised in its petition" or "responsive to arguments raised in the patent owner's response brief," *Apple Inc. v. Andrea Electronics Corp., 949 F.3d 697, 706* (Fed. Cir. 2020).

The regulation "reflects . . . efficiency and fairness interests," *Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1368 (Fed. Cir. 2015), and flows from the statutory "requirement that the initial petition identify 'with particularity' . . . 'the grounds for the challenge to each claim,'" *Intelligent Bio-Systems*, 821 F.3d at 1369 (quoting 35 U.S.C. § 312(a)(3)). Ultimately, the Board "must make [the] judgment[ ] about . . . when a [r]eply contention crosses the line from the responsive to the new." *Ariosa Diagnostics*, 805 F.3d at 1368.

We hold that the Petition fails to identify structure in Shiraishi that corresponds to the "base layer" limitation of claim 1[a], such that the Reply crosses the line from responsive to new. Reading the entirety of the Petition's analysis for claim 1[a] (Pet. 37–38), along with the entirety of Dr. Liu's declaration testimony advanced in support of that analysis (Ex. 1003 ¶¶ 97–101), we underscore that the Petition itself does not explicitly identify or discuss the specified "base layer." *See* Pet. 37–38. The closest the Petition comes to doing so is in its identification of layer 13 as simultaneously a "body layer" and a "body region." Pet. 38. One must look to Dr. Liu's supporting declaration to find an assertion that layer 13 (alone) corresponds to the "base layer." Ex. 1003 ¶ 100. However, the Reply — which contrasts with both the Petition and Dr. Liu's declaration — states

that Shiraishi's layers 13 and 14 (together) correspond to the specified "base layer." Reply 17. Petitioner's arguments are moving targets on this record.

We decline to consider the Reply arguments because they are untimely. Alternatively, Petitioner violates our rule against incorporation by reference by advancing a Petition that does not address an essential element of its challenges (precisely, how any structure in Shiraishi corresponds to the 'base layer" of claim 1[a]) but cites to a declaration that arguably does so. Pet. 38 (citing Ex. 1003 ¶ 100); *see* 37 C.F.R. § 42.6(a)(3) (rule prohibiting incorporation by reference). In addition, as explained in more detail in the next section, even when we take account of the new arguments raised in Petitioner's Reply, the ground based on anticipation by Shiraishi is deficient.

Reply Arguments About Figure 8
Do Not Cure the Deficiencies in the Petition

In the Reply, Petitioner attempts to backfill gaps in the Petition with post-institution arguments about its annotations to Figure 8. Pet. 38. Specifically, in the Reply, Petitioner asserts that the Petition, in fact, "identified region 13 (which includes region 14) as a body or base layer that corresponds to the body region" of claim 1[a]. Reply 17. We find no such reference in the Petition to layer 14 in connection with the "base layer" limitation. Pet. 37–38.

Notably, on that point, the Petition's analysis contains only two pieces of information relating to Shiraishi's layer 14 as it relates to claim 1[a]. *Id.* First, the Petition includes an annotated version of Shiraishi's Figure 8 (previously reproduced above) that labels layers 13 and 14 (together) as the specified "body region." *Id.* at 38.

Second, the Petition string cites twice to paragraph 73 in Shiraishi, which is a paragraph that discloses layer 14 as being "inside" of layer 13. *Id.*

But the Petition cites paragraph 73 for reasons unrelated to layer 14 and fails to mention, much less analyze, any part of paragraph 73 that relates to layer 14. *See id*. The confusion surrounding Petitioner's views on layer 14 is compounded thereafter, when the Petition identifies Shiraishi's layer 14 (separately) as "the lateral contact layer" that covers "the sidewalls" of "the trenches in" the "base layer" as required by claim 1[g], which only further muddies the waters. *Id*. at 40.

Dr. Liu's declaration provides little clarity. There we find an opinion that an ordinarily skilled artisan "would understand that channel layer (13) corresponds to a body region or base layer." Ex. 1003 ¶ 100. Petitioner's witness had the opportunity here to explain why layer 13 should be viewed as a feature "which includes layer 14" (Reply 17) and, therefore, layers 13 and 14 together correspond to the specified "body region" (as indicated in Petitioner's annotations to Figure 8 (Pet. 38)) or even analyze Shiraishi's paragraph 73. Petitioner's witness did none of that and, moreover, did not even identify layer 14 in his supporting declaration when discussing the limitations of claim 1[a]. *See* Ex. 1003 ¶¶ 97–101.

In light of the above, Petitioner's Reply argument that Shiraishi's layers 13 and 14 (together) represent the specified "body region," combined with Petitioner's further attestation that layer "13 (which includes region 14)" represents "a body or base layer that corresponds to the body region," is unsupported and, thus, unpersuasive. Reply 17. Petitioner, in the Reply, cites a portion of Shiraishi indicating that "region 14 may be implemented in the p-type semiconductor region," and refers us back to page 38 of the Petition. Reply 17 (citing Pet. 38). But that page of the Petition does not cite this disclosure in Shiraishi or include any other discussion of layer 14. Pet. 38.

On this record, we view the new Reply arguments (*see* Reply 16–18) as an ineffective attempt "to rewrite 'body layer (13) (in the Petition) and 'base layer (13)'" in Dr. Liu's "declaration to 'base layer (13 and 14).'" (Sur-reply 16). Petitioner's annotation to Figure 8, identifying "Body Region (13 and 14)," is too slender a reed to sustain the anticipation ground based on Shiraishi, even when we take account of the Reply arguments.

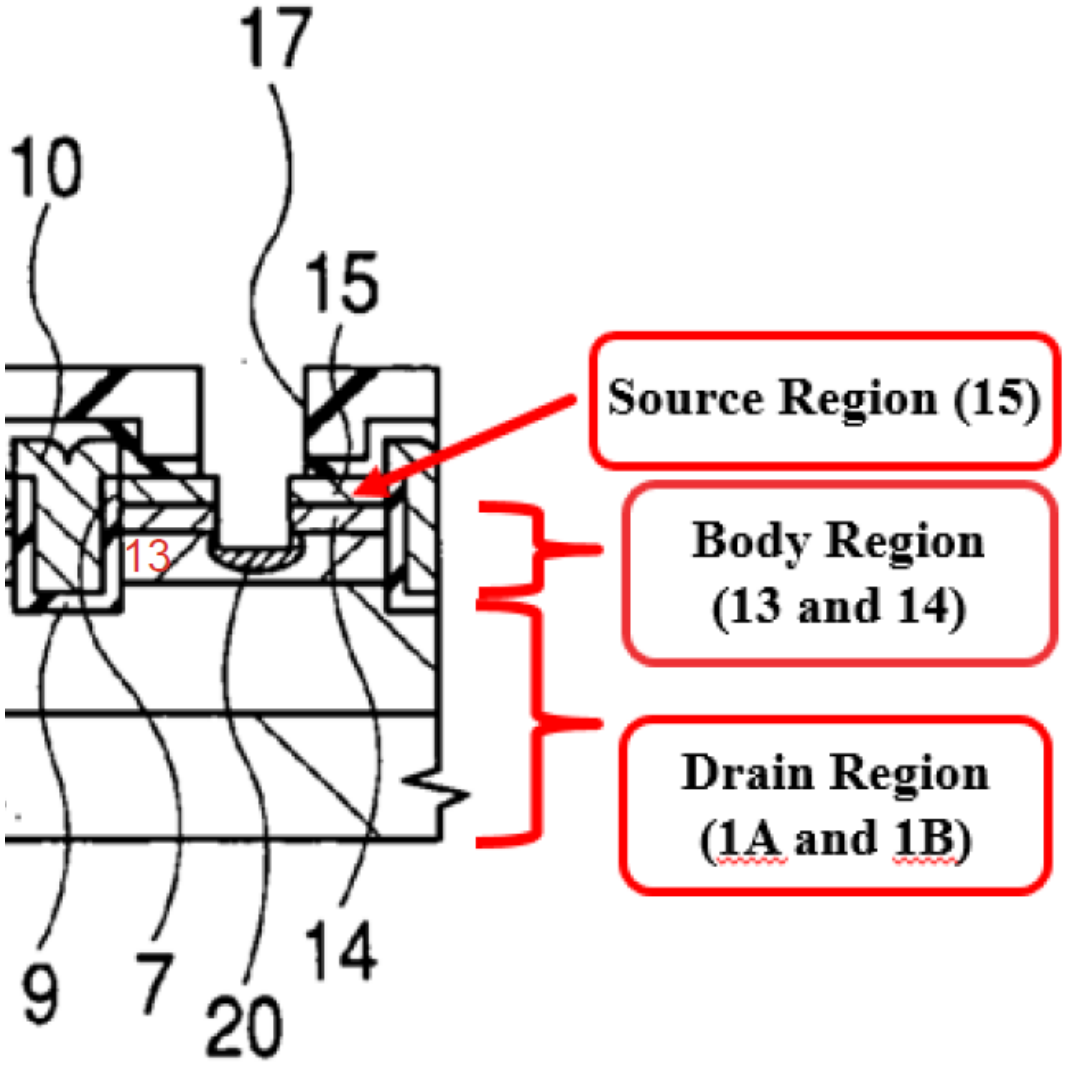
Layer 14 Cannot be Part of the "Base Layer"

Claim 1[a] recites, in part, "a semiconductor region having . . . a source layer corresponding to said source region *disposed on top* of the said base layer." Ex. 1001, 5:39–47 (emphasis added). Petitioner contends that Shiraishi's layer 15 corresponds to the claimed "source layer" and that layer 13 corresponds to a "body layer," which is not an element recited in claim 1. Pet. 38 (citing Ex. 1003 ¶ 98); PO Resp. 38. Although not argued in the Petition, Petitioner's witness, Dr. Liu, opines in his supporting declaration that layer 13 is a "base layer." Ex. 1003 ¶ 100; PO Resp. 38.

Even if we accept Dr. Liu's view that layer 13 corresponds to the "base layer" recited in this limitation, and even if we overlook that this view is not clearly articulated in the Petition or the Reply, the challenge based on anticipation by Shiraishi is deficient.

As Patent Owner correctly points out, if layer 13 is the "base layer," Shiraishi does not include a "source layer corresponding to said source region *disposed on the top* of said base layer" as recited in limitation 1[a]. PO Resp. 38–40 (emphasis added) (citing Ex. 2012 ¶¶ 136–139). That is because Petitioner's annotated Figure 8 (cropped, magnified, and reproduced below) shows layer 14 *interposed* between layer 13 (the asserted base layer) and source layer 15 (the asserted source layer), and Petitioner provides no

analysis in support of a finding that layer 13 is "disposed on top of" layer 15 as required by claim 1[a]. PO Resp. 38–39 (citing Ex. 2012 ¶ 138).



This figure is a sectional view illustrating a step of manufacturing Shiraishi's semiconductor. Ex. 1009 ¶ 38. Layers 13, 14 and 15 are depicted as being stacked on top of each other. Petitioner adds annotations mapping a "Source Region (15)," a "Body Region (13 and 14)," and a "Drain Region (1A and

1B)" to the figure. Pet. 38 (citing Ex. 1003 ¶ 98). Additionally, we have marked layer 13 with a red "13" annotation.

Patent Owner's witness, Dr. Neikirk, persuasively explains why layer 14 is not part of the "base layer" and interposes layers 13 and 15:

> By contrast, layer 14 is identified in Shiraishi as a "punch-through stopper layer," not a base layer, body region, or channel region. *Id*. at [0073], [0081]. This indicates that layer 14 of Shiraishi is not part of the body region or base layer. Indeed, Dr. Liu provides no analysis to the contrary. However, layer 14 of Shiraishi is interposed between the source layer (15) and the base layer (13), which is inconsistent with the specific structure of limitation 1[a].

Ex. 2012 ¶ 138.

It is worth repeating here that neither Petitioner, in the Petition, nor Dr. Liu, in his supporting declaration, discuss how layer 14 interacts with the claimed "base layer." *See* Pet. 37–38 (citing Ex. 1003 ¶¶ 97–101). Nor does Petitioner contest Dr. Niekirk's opinion on this point. *See* Reply 16–18. Given the total lack of countervailing evidence on point, we credit Dr. Neikirk's testimony, which is supported by Shiraishi's disclosure.

We agree with Patent Owner and Dr. Neikirk that Shiraishi's layer 14 interposes alleged base layer 13 and source layer 15. The Petition, thus, fails to show that Shiraishi's device includes a source layer "disposed on top of said base layer" as recited in claim 1[a]. That deficiency undermines the challenge based on anticipation by Shiraishi.

Petitioner's Own Arguments Defeat its Position as to Claim 1[g]

Even if we ignore all the above-discussed deficiencies and accept the argument, first raised by Petitioner in the Reply, that layers 13 and 14 in Shiraishi together represent a "base layer" within the scope of claim 1[a],

that creates another, independent deficiency pertaining to claim 1[g]. Sur-reply 18–22 (citing Ex. 2012).

Claim 1[g] recites, "wherein the *sidewalls* of said trenches in said base layer *are covered by the lateral contact layer*." Ex. 1001, 6:14–15 (emphasis added). The Petition offers only two sentences of argument to support that Shiraishi discloses this feature: "Element 1[g] is disclosed by Shiraishi. Specifically, as shown in Figure 8, Shiraishi discloses an additional semiconductor layer (14) along the sidewalls of the contact trench. Ex. 1009 at Fig. 8, [0073], [0080], [0084]–[0085]." Pet. 40 (citing Ex. 1003 ¶ 107).

Patent Owner responds that, "because Shiraishi's layer 14 is located *above* the base layer (layer 13), layer 14 cannot cover the sidewalls *in the base layer*." PO Resp. 41–42. Patent Owner then predicts, correctly, that Petitioner will counterargue in the Reply that Shiraishi's layer 14 is part of the claimed "base layer" together with layer 13. PO Resp. 42; *see* Reply 17 (arguing, for the first time, that "region 14" in Shiraishi is "***part of*** region 13" and the "base layer") (Petitioner's emphasis).

Anticipating that Reply argument, Patent Owner presents a thorough analysis, supported by Shiraishi's disclosure and Dr. Neikirk's testimony, explaining why treating layers 13 and 14 as the claimed "base layer" would fail to satisfy limitation 1[g]. PO Resp. 42–44 (citing Ex. 2012 ¶¶ 142–143).

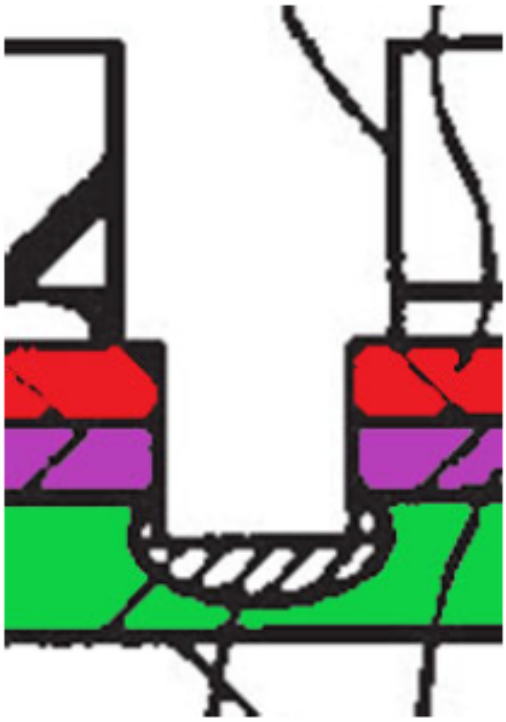
For example, Patent Owner persuasively argues, and we agree, that if layers 13 and 14 are the specified "base layer," then layer 14 does *not* cover the *entire* sidewalls of the source contact trench in the base layer as required by Petitioner's own construction of claim 1[g]. PO Resp. 42 (citing Pet. 19). By way of support, Patent Owner reproduces a cropped, magnified, and annotated version of Shiraishi Figure 8, which we reproduce below.



PO Resp. 43 (citing Ex. 2012 ¶ 142; reproducing Ex. 1009, Fig. 8; cropped, magnified, and annotated by Patent Owner). Shiraishi's Figure 8 is a sectional view illustrating a step of manufacturing the claimed semiconductor. Ex. 1009 ¶ 38. Patent Owner has added color highlights to identify layer 13 (green), layer 14 (purple), and layer 15 (red). PO Resp. 43. Additionally, Patent Owner has added two large red arrows to the figure.

Patent Owner contends that the above figure shows that Petitioner's mapping of the claimed "lateral contact layer" (purple, layer 14) does not cover the entirety of the sidewalls in the base layer (namely, that part of the base layer represented in green, layer 13, marked by red arrows).

In its Reply, Petitioner argues that Patent Owner's above figure is "misleading." Reply 18. Petitioner provides its own version of the figure, which we reproduce below.



Petitioner's magnified and cropped version of Fig. 8 (Ex. 1009)

Id. at 19 (reproducing Ex. 1009, Fig. 8; cropped, magnified, and annotated by Petitioner). Shiraishi's Figure 8 is a sectional view illustrating a step of manufacturing the claimed semiconductor. Ex. 1009 ¶ 38. Petitioner has added color highlights to identify layer 13 (green), layer 14 (purple), and layer 15 (red).

Petitioner asserts that its revised figure "clearly shows region 14 [(purple)] corresponding to the 'lateral contact layer' covering the entire sidewalls of the source contact trench in the base layer between the source layer 15 [(red)] and the base contact layer 20 [(uncolored and hatched area within the green layer)]." Reply 19. Petitioner further asserts that Shiraishi

Figure 8 is "very similar to the '634 Patent and its depiction of the lateral contact layer 209 covering the entire sidewalls of the trench 224 in the base layer 205 between the source layer 206 and the base contact layer 208." *Id*.

In the Sur-reply, Patent Owner argues that Petitioner's figure "fails to show what its claim construction requires: entire coverage of the sidewalls in the base layer by the lateral contact layer." We reproduce Patent Owners argument below:

> As Petitioner's own figure shows, the bottom of the source contact trench is *below* the bottom of Shiraishi's layer 14 (purple). Thus, there are necessarily portions of the sidewalls in the contact trench that are not covered by layer 14 (purple).
>
> . . . . But the relevant question is not whether the source contact trench sidewalls contact parts of the base layer other than layer 14 (i.e., whether the green touches the sidewalls). Rather, the claim as Petitioner itself has construed it, requires that *only* layer 14 (purple) contact the sidewalls of the source contact trench in the base layer.
>
> . . . .
>
> Ignoring its own construction, Petitioner compares Shiraishi to the disclosures of the '634 patent. Reply 19-20. However, unlike Shiraishi, FIG. 2G of the '634 Patent *does* illustrate the entire sidewalls of the source contact trench being covered by the lateral contact layer—the bottom of lateral contact layer 209 is plainly depicted as below the bottom of the contact metal plugs 211. Ex. 1001, Fig. 2G.

Sur-reply 19–22.

We also reproduce below Figure 2G from the '634 patent, which further assists in understanding Patent Owner's above-recited arguments:

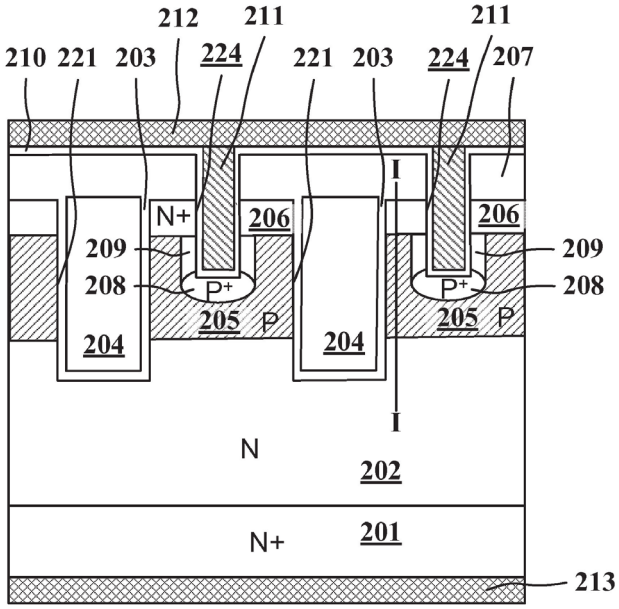
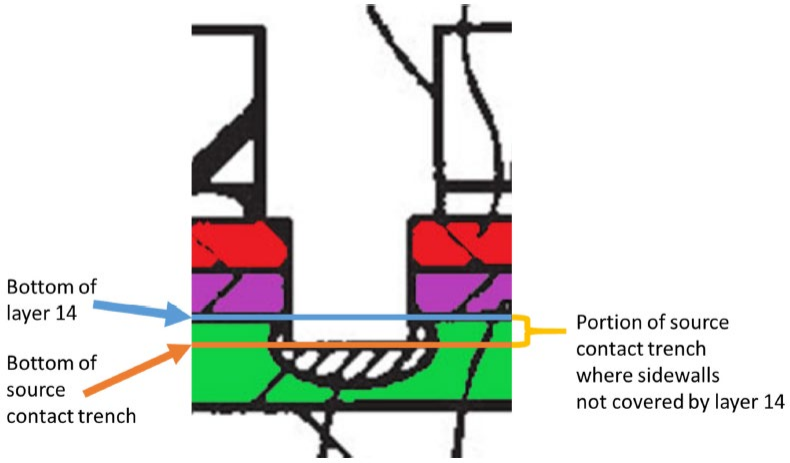


Fig. 2G

Figure 2G is a sectional view for describing a process in accordance with the '634 patent. Ex. 1001, 2:43–44.

In addition, Patent Owner also presents its own further annotated version of Petitioner's annotated version of Shiraishi's Figure 8.



Sur-reply 21 (with further annotations added by Patent Owner to Petitioner's annotations to Ex. 1009, Fig. 8). Shiraishi's Figure 8 is a sectional view illustrating a step of manufacturing the claimed semiconductor. Ex. 1009

¶ 38. Petitioner adds color highlights to identify layer 13 (green), layer 14 (purple), and layer 15 (red). Patent Owner adds labels to identify two areas of interest that Patent Owner argues depict a portion of the sidewalls within the source contact trench not covered by layer 14.

Critically, Patent Owner directs us to Dr. Neikirk's testimony, which is supported by Shiraishi's disclosure, demonstrating why Shiraishi layer 14 cannot cover the entire sidewalls of the claimed "base layer" within the source contact trench. PO Resp. 44 (citing Ex. 2012 ¶ 143). Dr. Neikirk explains that nothing in Shiraishi suggests "layer 13 being entirely replaced or coextensive with layer 14." To the contrary, layer 14 is "inside" layer 13. Ex. 2012 ¶ 143 (citing Ex. 1009 ¶ 81). Further, Dr. Neikirk observes that layer 14 "is a thin layer of 'about .1 to about 0.4 μm,'" while "layer 13 extends down to about 0.9 μm from the semiconductor surface (0.1 μm less than the 1 μm deep gate trenches)." *Id.* (citing Ex. 1009 ¶ 81).

"Thus, all of Shiraishi's written disclosures indicate that layer 13 is considerably thicker than layer 14." *Id.* (citing Ex. 1009 ¶ 81). Dr. Neikirk concludes by stating that, if the claimed "base layer" consists of layer 13 and 14 together, then layer 14 does not cover the entire sidewalls of the source contact trenches in the base layer. *Id.* Petitioner's Reply provides no substantive response to Dr. Neikirk's testimony. *See generally* Reply.

On this record, even if we accept Petitioner's argument (stated in the Reply and gleaned from its annotations to Shiraishi's Figure 8 in the Petition) that Shiraishi's layers 13 and 14 together represent a "base layer" within the scope of claim 1[a], Petitioner directs us to evidence insufficient to make out an anticipation of the claim 1[g] limitation, "wherein the

sidewalls of said trenches in said base layer are covered by the lateral contact layer." Ex. 1001, 6:14–15; *see* Sur-reply 18–22 (citing Ex. 2012).

On that point, a figure may be relied upon for what it clearly shows. *See In re Wagner*, 63 F.2d 987, 987–88 (CCPA 1933) ("[T]he board did not err in holding that the drawings are sufficient to afford a proper basis for the rejection." Where "the shading in the drawing clearly indicates" the claimed feature.); *PlaSmart, Inc. v. Kappos*, 482 F. App'x 568, 572 (Fed. Cir. 2012) ("[D]rawings can be used as prior art, without referring to the surrounding description, only if prior art features are clearly disclosed by the drawing.").

Referring to the annotated version of Figure 8 advanced by Patent Owner in its Sur-reply, and reproduced above (Sur-reply 21), Shiraishi's Figure 8 plainly shows that layer 14, which Petitioner identifies as the "lateral contact layer," does *not* cover "the entire sidewalls" of the source contact trench in the base layer as required by claim 1[g]. Pet. 18–19; Reply 21; Sur-reply 21. We agree with Patent Owner that the bottom of layer 14 (marked by a blue line) does not extend to the bottom of the source contact trench (marked by an orange line). Petitioner's argument that Shiraishi's Figure 8 is like the '634 patent's depiction of the source contact trench, thus, is unpersuasive. Reply 19. No matter how similar Petitioner contends the two figures are, Shiraishi's Figure 8 (upon which Petitioner relies) does not show coverage of the entire sidewalls by layer 14.

In addition, we determine that Dr. Neikirk persuasively rebuts Petitioner's contentions and adds insight into Shiraishi's Figure 8. As Dr. Neikirk explains, layer 13 is about 0.9 μm and layer 14 is about ".1 μm to about .4 μm." Ex. 2012 ¶ 143 (citing Ex. 1009 ¶ 83). Layer 14, therefore, cannot cover the entire sidewalls of a combined base layer consisting of

layers 13 and 14 because layer 14's depth is not greater than layer 13's. That testimony stands unchallenged in Petitioner's Reply. *See* Reply 16–22.

Petitioner's lack of an additional declaration in light of Patent Owner's Response detracts from the Reply's persuasiveness. Patent Owner presents credible and persuasive testimony from Dr. Neikirk that is supported by the intrinsic disclosures of Shiraishi, and that testimony is not opposed effectively by Petitioner's bare attorney arguments in the Reply. *See* Reply 16–22. We assign persuasive weight to Dr. Neikirk's analysis of Shiraishi's Figure 8 because it is supported by other disclosures in the reference and stands essentially unrebutted on this record. *See* Ex. 2012 ¶¶ 142–143 (Dr. Neikirk's persuasive testimony on point).

Petitioner makes other arguments regarding claim 1[g], and we have examined them, but they do not address the deficiencies discussed above. *See* Reply 16–22. Accordingly, we determine that Petitioner does not prove Shiraishi anticipates claim 1, or claim 2 which depends therefrom, because Petitioner fails to explain adequately how or why this reference teaches the limitation of claim 1[g], which recites "wherein the sidewalls of said trenches in said base layer are covered by the lateral contact layer." Ex. 1001, 6:14–15.

2. *Ground 4: Alleged Obviousness over Shiraishi in view of Kobayashi*

Ground 4 challenges claims 3–9 and is based on arguments that the additional features of claims 3–9 (relative to claim 1) would have been obvious over Shiraishi in view of Kobayashi. Pet. 42–51. Claims 3–9 depend, directly or indirectly, from claim 1 and, to make out this challenge, Petitioner relies on the adequacy of the anticipation arguments advanced against claim 1 in Ground 3. *Id.*

Our analysis above, therefore, regarding the deficiencies in Petitioner's anticipation challenge as to claim 1, applies with equal force to the obviousness challenge against claims 3–9. Those deficiencies are not cured by Petitioner's inclusion of Kobayashi, or the general knowledge of an ordinarily skilled artisan, to account for the further features of dependent claims 3–9. *Id*.

Accordingly, on this record, Petitioner does not establish that the subject matter of claims 3–9 would have been obvious over Shiraishi in view of Kobayashi.

E. The Kobayashi Ground

Petitioner identifies disclosures in Kobayashi and Shiraishi that allegedly render obvious claims 1–9 of the '634 patent (Ground 5). Pet. 52–66. Petitioner fails to show, by a preponderance of the evidence, that Kobayashi in view of Shiraishi renders obvious claim 1[g] and, therefore, fails to carry its burden with respect to claim 1 and, further, claims 2–9, which depend directly or indirectly from claim 1.

Claim limitation 1[g] recites, "wherein the *sidewalls* of said trenches in said base layer *are covered by the lateral contact layer*." Ex. 1001, 6:14–15 (emphasis added). To teach that limitation, the Petition relies in-part on Shiraishi's Figure 8 and layer 14 as teaching a lateral contact layer:

> As shown in Figure 8, Shiraishi discloses an additional semiconductor layer (14) along the entire sidewalls in the base layer of the contact trench that serves as a "punch-through stopper layer." Ex. 1009 at Fig. 8, [0073], [0080], [0084]-[0085]; Ex. 1003 at ¶¶ 146-148.

Pet. 56.

As we determined above in connection with Ground 3, however, the record does *not* support a finding that Shiraishi's layer 14 covers the entire

sidewalls in the base layer as required by claim 1[g]. Petitioner's analysis here, in connection with Ground 5, offers no additional information or argument to change that conclusion. Ground 5, therefore, suffers from the same deficiencies as Ground 3 regarding the sufficiency of the evidence pertaining to claim 1[g]. Specifically, Petitioner does not prove, on this record, that the asserted prior art references suggest the claim 1[g] requirement "wherein the sidewalls of said trenches in said base layer are covered by the lateral contact layer." Ex. 1001, 6:14–15.

For the above reasons, Petitioner fails to demonstrate by a preponderance of the evidence that Kobayashi and Shiraishi render obvious claim 1. Because the other challenged claims inherit the claim 1[g] limitation through dependence on claim 1, we find Petitioner has proven no claim unpatentable based on the Kobayashi ground.

F. Conclusions on Petitioner's Grounds of Unpatentability

Our analysis above explains why Petitioner fails to prove that claim 1 is unpatentable based on the grounds presented in the Petition. None of the other references cited in the Petition are shown to cure the above-discussed deficiencies. Further, all of the challenged claims depend from claim 1, therefore, the above deficiencies apply to all challenged claims.

On this record, Petitioner fails to demonstrate that any claim is unpatentable under any ground asserted in the Petition.

IV. CONCLUSION

For the above reasons, we determine that Petitioner fails to establish by a preponderance of the evidence that claims 1–9 of the '634 patent are unpatentable.

In summary:

Claims	35 U.S.C. §	Reference(s) /Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1, 2, 6	102(b)	Hirler		1, 2, 6
3–5, 7–9	103(a)	Hirler, Kobayashi		3–5, 7–9
1, 2	102(b)	Shiraishi		1, 2
3–9	103(a)	Shiraishi, Kobayashi		3–9
1–9	103(a)	Kobayashi, Shiraishi		1–9
Overall Outcome				1–9

V. ORDER

It is

ORDERED that claims 1–9 of the '634 patent are not proven unpatentable; and

FURTHER ORDERED that because this decision is final, a party to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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