

PUBLIC VERSION

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MONOLITHIC POWER SYSTEMS, INC.,
Petitioner,

v.

GREENTHREAD, LLC,
Patent Owner.

IPR2024-00469
Patent 9,190,502 B2

Before KEVIN F. TURNER, KRISTEN L. DROESCH, and
STEPHEN E. BELISLE, *Administrative Patent Judges*.

TURNER, *Administrative Patent Judge*.

JUDGMENT

Final Written Decision

Determining All Challenged Claims Unpatentable

35 U.S.C. § 318(a)

Denying Petitioner's Motion to Strike

37 C.F.R. § 42.71

Dismissing as Moot Patent Owner's Motion to Exclude

37 C.F.R. §§ 42.64, 42.71

I. INTRODUCTION

A. Background and Summary

Monolithic Power Systems, Inc. (“Petitioner”) filed a Petition for *inter partes* review (Paper 1, “Pet.”) challenging claims 7 and 8 of U.S. Patent No. 9,190,502 B2 (Ex. 1001 (“the ’502 Patent”). Greenthread, LLC (“Patent Owner”) filed a Preliminary Response. Paper 10 (“Prelim. Resp.”). With our authorization, Petitioner filed a Preliminary Reply (Paper 16, “Prelim. Reply”), and Patent Owner filed a Preliminary Sur-reply (Paper 17). Subsequently, we instituted an *inter partes* review of the challenged claims. Paper 30 (“Inst. Dec.”).¹

Subsequently, Patent Owner filed a Response (Paper 35, “PO Resp.”); Petitioner filed a Reply to Patent Owner’s Response (Paper 42, “Pet. Reply”); and Patent Owner filed a Sur-reply (Paper 47, “PO Sur-reply”).

Petitioner filed a motion to strike portions of Patent Owner’s Sur-reply (Paper 52, “Mot. Strike”), to which Patent Owner filed an opposition to that motion to strike (Paper 55, “Mot. Strike Opp.”). Patent Owner filed a motion to exclude evidence (Paper 56, “Mot. Exclude”), to which Petitioner filed an opposition thereto (Paper 60), and Patent Owner filed a reply thereto (Paper 62).

The Board heard arguments on September 10, 2025. Paper 91 (“Tr.”). As explained in more detail below, the time for filing this Final Written Decision was extended for good cause by six months, allowing the Board to order discovery and briefing, and conduct a hearing, on a privity issue. Papers 77–79. For reasons set forth below, we determine that Petitioner is not in privity with a time-barred entity. Taking account of the information

¹ We cite to the sealed versions of confidential papers and exhibits.

set forth in this proceeding, we determine Petitioner has established by a preponderance of the evidence that claims 7 and 8 of the '502 Patent are unpatentable. We also deny Petitioner's Motion to Strike and dismiss as moot Patent Owner's Motion to Exclude.

B. Real Parties-in-Interest

Petitioner identifies itself as the real party-in-interest. Pet. 1. Patent Owner identifies itself as the real party-in-interest. Paper 4, 1.

C. Related Matters

The parties identify several proceedings involving the '502 Patent as related matters, including *Greenthread, LLC v. Cirrus Logic, Inc.*, 1:23-cv-00369 (W.D. Tex.); *Greenthread, LLC v. OmniVision Technologies, Inc.*, No. 2:23-cv-00212 (E.D. Tex.); *Greenthread, LLC v. OSRAM GmbH*, No. 2:23-cv-00179 (E.D. Tex.); *Greenthread, LLC v. Texas Instruments Inc.*, No. 2:23-cv-00157 (E.D. Tex.); *Greenthread, LLC v. Monolithic Power Systems, Inc.*, No. 1:23-cv-00579 (D. Del.). Pet. 1–2; Paper 4, 1–2.

The parties also identify the following proceedings as involving the '502 Patent, and no longer pending: *Greenthread, LLC v. Intel Corporation, Dell Inc. and Dell Technologies Inc.*, 6:22-cv-00105-ADA (E.D. Tex.); *Greenthread, LLC v. Intel Corporation*, 3:22-cv-02001 (D. Or.); *Greenthread, LLC v. Micron Technology, Inc. et al.*, 1:23-cv-00333 (D. Del.); *Greenthread, LLC v. Western Digital Corporation et al.*, 1:23-cv-00326 (D. Del.); *Greenthread, LLC v. Samsung Electronics Co., Ltd. et al.*, 2:19-cv-000147 (E.D. Tex.). Pet. 1–2; Paper 4, 4.

The parties also identify four *inter partes* review proceedings involving the '502 Patent, namely IPR2020-00289, IPR2023-00548, IPR2024-00018, and IPR2024-00265. Pet. 2–3; Paper 4, 2.

D. The '502 Patent

The '502 Patent, titled "Semiconductor Devices with Graded Dopant Regions," issued on November 17, 2015. Ex. 1001, codes (45), (54). The '502 Patent "relates to all semiconductor devices and systems," including Bipolar Junction Transistors (BJT). *Id.* at 1:17–30.

The '502 Patent explains that in bipolar junction transistors, minority carriers are the principal device conduction mechanism, but majority carriers also play a small but finite role in modulating the conductivity in such devices. Ex. 1001, 1:27–30. The '502 Patent further explains that "[e]fforts have been made in graded base transistors to create an 'aiding drift field', to enhance the diffusing minority carrier's speed from emitter to collector" versus the standard "uniformly doped base" bipolar junction transistors. *Id.* at 1:38–40. The '502 Patent explains that this improvement has not been implemented in most semiconductor devices, including various power MOSFETs and IGBTs, which "still use a uniformly doped drift epitaxial region in the base." *Id.* at 1:40–44. The invention of the '502 Patent implements a graded dopant concentration in these devices, which results in two important performance enhancements: "electrons can be swept from source to drain rapidly, while at the same time holes can be recombined closer to the n⁺ buffer layer," thereby improving "t(on) and t(off) in the same device." *Id.* at 3:14–18.

Figure 1 of the '502 Patent is reproduced below.

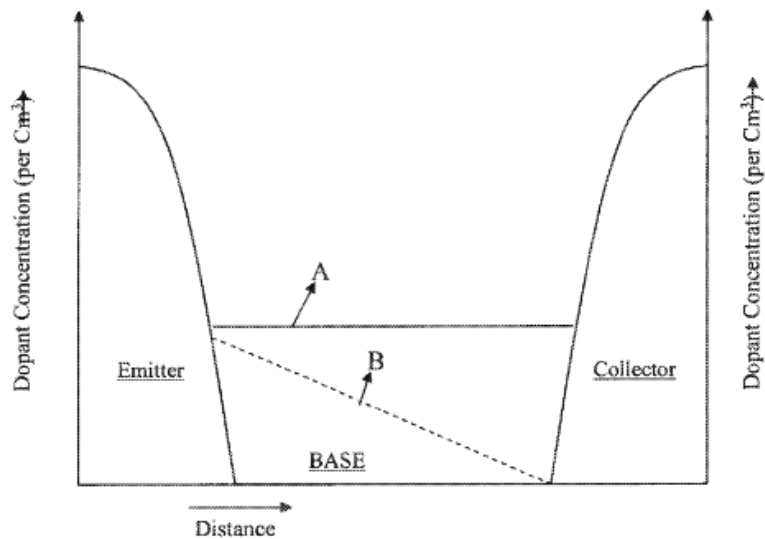


Figure 1 is labeled “Prior Art” and “illustrates the relative doping profiles of emitter, base, and collector for the two most popular bipolar junction transistors: namely, A—uniform base, and B—graded base.” Ex. 1001, 2:17–19.

Figure 3A of the '502 Patent is reproduced below.

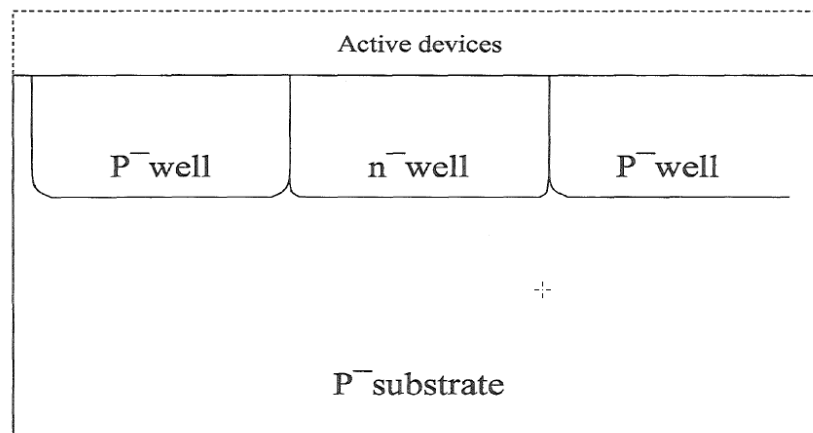


Figure 3A is labeled “Prior art” and shows a cross-sectional view of a “commonly used CMOS silicon substrate with two wells (one n- well in which p-channel transistors are subsequently fabricated, and one p- well in

which n-channel transistors are subsequently fabricated).” Ex. 1001, 2:22–27, Fig. 3A.

Figure 5A of the ’502 Patent is reproduced below.

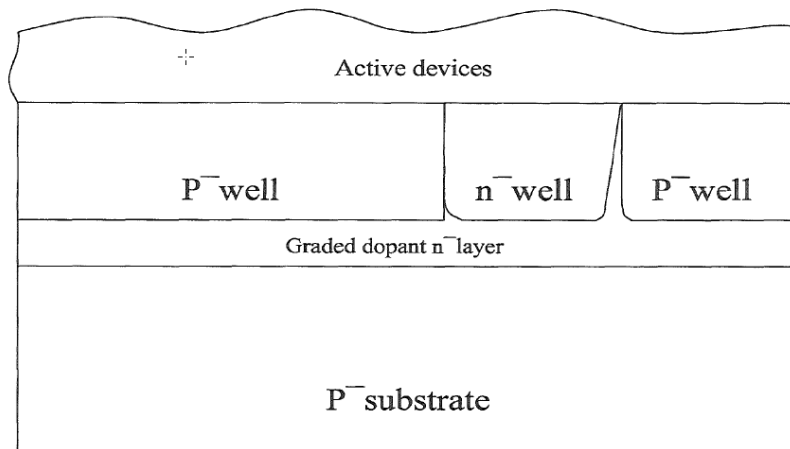


Figure 5A illustrates a cross section of a CMOS silicon substrate with two wells and an underlying layer using embodiments of the invention.

Ex. 1001, 2:31–35. According to the ’502 Patent, “[s]purious minority carriers can be generated by clock switching in digital VLSI logic and memory ICs,” and these “unwanted carriers can discharge dynamically-held ‘actively held high’ nodes,” and serve to degrade performance of various types of devices, including digital imaging ICs. *Id.* at 3:25–28. The ’502 Patent further explains that “a novel technique has been described here by creating a drift field to sweep these unwanted minority carriers into the substrate as quickly as possible, from the active circuitry at the surface.” *Id.* at 3:39–42. In particular, “[i]n a preferred embodiment, the subterranean n–layer has a graded donor concentration to sweep the minority carriers deep into the substrate.” *Id.* at 3:42–44.

E. Illustrative Claim

Claim 7 is the only independent claim challenged, and is reproduced below.

7. A semiconductor device comprising:
 - [7.1] a surface layer;
 - [7.2] a substrate;
 - [7.3] an active region including a source and a drain, disposed on one surface of said surface layer;
 - [7.4] a single drift layer disposed between the other surface of said surface layer and said substrate,
 - [7.5] said drift layer having a graded concentration of dopants generating a first static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate; and
 - [7.6] at least one well region disposed in said single drift layer, said well region having a graded concentration of dopants generating a second static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate.

Ex. 1001, 4:52–67 (bracketed numbering added by Petitioner).

F. Asserted Unpatentability Challenges

Petitioner asserts that claims 7 and 8 are unpatentable based on the following challenges:

Claims Challenged	35 U.S.C. §²	Reference(s)/Basis
7, 8	103	Onoda ³
7, 8	103	Onoda, Nishizawa ⁴

² The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284 (2011), amended 35 U.S.C. § 102 and § 103, effective March 16, 2013. Because applications from which the ’502 Patent claims priority were filed before this date, we apply the pre-AIA version of § 102 and § 103. Neither party indicates the result would change applying the AIA versions.

³ Japanese Unexamined Patent Application Publication No. H8-279598, published Oct. 22, 1996 (Ex. 1043). We cite to a certified translation. Ex. 1042.

⁴ U.S. Patent No. 5,384,476, filed June 9, 1987 and issued January 24, 1995, to Nishizawa et al. (Ex. 1046, “Nishizawa”).

Claims Challenged	35 U.S.C. § ²	Reference(s)/Basis
7, 8	103	Kawagoe ⁵

Pet. 4–5. Petitioner relies on the Declarations of Dr. Stephen Campbell. Ex. 1003; Ex. 1054 (supplemental declaration). Patent Owner relies on Declarations from Alexander D. Glew, Ph.D (Ex. 2057) and from G.R. Hohan Rao (Ex. 2072).

II. ANALYSIS

A. Legal Standards

Petitioner bears “the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016). The burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

A claim is unpatentable under 35 U.S.C. § 103 if “the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains.” 35 U.S.C. § 103. The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when present, objective evidence of non-obviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

⁵ U.S. Patent No. 6,043,114, filed September 22, 1997 and issued March 28, 2000, to Kawagoe et al. (Ex. 1007, “Kawagoe”).

To demonstrate obviousness, it is not enough to merely show that the prior art includes separate references covering each separate limitation in a challenged claim. *Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1360 (Fed. Cir. 2011). “Rather, obviousness requires the additional showing that a person of ordinary skill at the time of the invention would have selected and combined those prior art elements in the normal course of research and development to yield the claimed invention.” *Id.* (citing *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007)).

“This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known.” *KSR*, 550 U.S. at 418–19. On the other hand, an obviousness analysis “need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.” *Id.* at 418; accord *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1259 (Fed. Cir. 2007). Nevertheless, “[a] factfinder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of arguments reliant upon *ex post* reasoning.” *KSR*, 550 U.S. at 421.

B. Level of Ordinary Skill in the Art

The level of ordinary skill in the art 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)). In assessing the level of ordinary skill in the art, we may consider various factors, including the “type

of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995).

Petitioner argues that a person of ordinary skill in the art “would have had a Bachelor’s degree in electrical engineering, material science, applied physics, or a related field, and four years of experience in semiconductor design and manufacturing or equivalent work experience.” Pet. 5 (citing Ex. 1003 ¶ 17). According to Petitioner, “[a]dditional education might compensate for a deficiency in experience, and vice-versa.” *Id.*

Patent Owner counterargues that a person of ordinary skill in the art would have had “at least a Bachelor’s of Science degree in electrical or computer engineering, materials science, chemical engineering, applied physics, or a related field, with emphasis on semiconductor manufacturing, or an equivalent degree, and at least four years of experience in semiconductor design and manufacturing.” PO Resp. 7 (citing Ex. 2057 ¶¶ 17–18). According to Patent Owner, “[a]dditional education in a relevant field or industry experience may compensate for a deficit in one of the other aspects of the requirements stated above.” *Id.*

Upon review of the parties’ arguments and the prior art of record, we adopt Petitioner’s definition of the person of ordinary skill in the art as it is consistent with the disclosures of the ’502 Patent and the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (holding that the prior art itself can reflect the appropriate level of ordinary skill in the art). Neither party asserts, however, that the outcome of this proceeding would differ based on the minor differences between the two parties’ definitions of an ordinarily skilled artisan. Nor does either party question

whether the opposing party's declarant is a person of ordinary skill in the art under either proposed definition.

C. Claim Construction

In an *inter partes* review proceeding, a patent claim is construed “using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. [§] 282(b).” 37 C.F.R. § 42.100(b). Under that standard, the words of a claim are generally given their “ordinary and customary meaning,” which is the meaning the term would have had to a person of ordinary skill at the time of the invention, in the context of the entire patent including the specification. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc). Under this standard, the words of a claim are generally given their “ordinary and customary meaning,” which is the meaning the term would have to a person of ordinary skill at the time of the invention, in the context of the entire patent including the specification. *See Phillips*, 415 F.3d at 1312–13.

The parties are in agreement that express claim construction is not necessary in order to resolve the issues presented in the Petition. Pet. 5; PO Resp. 7. We concur with the parties that no claim terms require express construction for purposes of this Decision. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’”) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

Nevertheless, Patent Owner asks that we “clarify” that “the plain and ordinary meaning of ‘aid the movement of minority carriers’ requires that a carrier move in the specified direction.” PO Resp. 8. Patent Owner asserts

that this claim phrase cannot be met “in situations where there is no carrier movement—an absurd result.” *Id.* at 8. We address these issues in our analysis of the merits of the unpatentability challenges.

D. Timeliness of the Petition Under 35 U.S.C. § 315(b)

Pursuant to 35 U.S.C. § 315(b), “[a]n inter partes review may not be instituted if the petition requesting the proceeding is filed more than 1 year after the date on which the petitioner, real party in interest, or privy of the petitioner is served with a complaint alleging infringement of the patent.”

During the pre-institution phase of this proceeding, Patent Owner argued that the Petition should be dismissed because it is untimely. Prelim. Resp. 14–32. In particular, Patent Owner argued that Petitioner is in privity with Intel Corp. (“Intel”) and [REDACTED] (collectively “Licensees”), who Patent Owner asserts are time-barred under Section 315(b) and licensed under the ’502 Patent. *Id.*

Patent Owner advanced several theories supporting its privity arguments, including that Petitioner and Licensees “are ‘preceding and succeeding owners of’ the licensed and/or infringing products,” that Petitioner is a beneficiary of the Licensees’ agreements related to accused products, that Petitioner’s licensed sales encumber otherwise infringing articles, and that Petitioner acts as Licensees’ “agent” for Licensees’ “have made” rights. Prelim. Resp. 14–32.

In the Institution Decision, the Board determined that Patent Owner had not provided a sufficient factual basis upon which to question Petitioner’s representation that it is not time-barred, or that Petitioner and Intel or [REDACTED] were, in fact, privies, based on any of its theories regarding privity. Inst. Dec. 10–18. We incorporate that analysis here, and reconsider

Patent Owner’s contentions to the extent warranted by subsequent, post-hearing argument and evidence. *See Achates Reference Publ’g. Inc. v. Apple Inc.*, 803 F.3d 652, 658 (Fed. Cir. 2015) (“The Board’s reconsideration of the time-bar [in the final determination] is ‘still fair[ly] characterize[ed] as part of the decision to institute.’”) (citations omitted).

Subsequent to the Institution Decision, Patent Owner asserts that (1) control of prior litigation is not required to establish privity (PO Resp.36–38); (2) even though Petitioner bears the burden to show that the Petition was timely—namely, that Petitioner is not in privity with Intel, or ██████—Petitioner has not attempted to carry its burden (*id.* at 38–44); (3) evidence of record shows that the petition is time-barred (*id.* at 44–52); and (4) a finding in Petitioner’s favor would violate Patent Owner’s constitutional right to due process (*id.* at 52–55). We address these arguments below.

Patent Owner’s argument (4) regarding violation of its constitutional right to due process is based on denial of its opportunity to show that Petitioner’s assertions as to its relationships with Licensees is inapposite. PO Resp. 60–61 (citing *Goldberg v. Kelly*, 397 U.S. 254, 269 (1970); *Greene v. McElroy*, 360 U.S. 474, 496 (1959)). Since Patent Owner’s Response, we have allowed and ordered additional discovery concerning privity for the reason discussed below.

On February 11, 2025, the Board entered Final Written Decisions in related proceedings. IPR2023-01242, Paper 84; IPR2023-01243, Paper 82; IPR2023-01244, Paper 83. On April 24, 2025, Patent Owner’s Request for Director Review in those proceedings was granted, and the Final Written Decisions were vacated and remanded to the Board for further proceedings.

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IPR2023-01242, Paper 94; IPR2023-01243, Paper 91; IPR2023-01244,
Paper 91 (Director Review Order or Dir. Rev. Order).

The Director Review Order remanded “to the Board with instructions to allow discovery, narrowly tailored to [a] privity issue” relating to an alleged relationship between Petitioner and a non-party, Intel. Dir. Rev. Order 3. In particular, the Director Review Order states that

[t]he Board should then determine on the full record whether Petitioner has met its burden of demonstrating it is not time-barred under § 315(b); that is, whether Patent Owner has produced some evidence to support its argument that Intel should be named as a privity so as to have put the issue into dispute.

Id. (citing *Worlds Inc. v. Bungie, Inc.*, 903 F.3d 1237, 1242–44 (Fed. Cir. 2018)). As the same privity issue arises in the present proceeding, we follow the guidance of the Director Review Order here as well.

On May 8, 2025, the Board held a teleconference with the parties to discuss the impact of the Director’s Decision on the instant cases. During the teleconference, the Board inquired as to whether Patent Owner would request additional discovery pursuant to the Director’s Decision vacating and remanding the Final Written Decisions issued in the first wave cases. Paper 63, 2. Patent Owner indicated that it believes the Board made a legal error in its Institution Decisions by failing to shift the burden of production to Petitioner with regard to the issue of privity. *Id.* at 3. As such, Patent Owner did not request additional discovery and indicated that, instead, it would “rest on its papers.” *Id.*; *see also* Paper 69, 4.

Accordingly, in this proceeding (as well as in other related proceedings), the Board *sua sponte* issued a Discovery Order (Paper 69, Disc. Order), “narrowly tailored,” consistent with the Director Review

Order, ordering Petitioner to provide the following discovery to Patent Owner:

- (a) . . . documents [including]:
 - a. [s]ales agreements between Petitioner and Intel for the Intel Accused Products;⁶ and
 - b. [i]ndemnification agreements between Petitioner and Intel for the Intel Accused Products. *See* IPR2023-01242, Paper 94, 3.
- (b) Documents sufficient to show the asserted privity relationship between Petitioner and Intel, including any new declaration(s) that establish that no documents responsive to Subsection (a) above exist, as well as any documents and new declaration(s) that establish (1) the time by which Petitioner became aware of the Intel litigation referenced in the [Director Review Order]; (2) whether Petitioner was the supplier of any product, or component of a product, accused of infringement in the Intel litigation; and (3) whether Petitioner was in a position to control, or actually controlled, Intel’s defense of that litigation.

Disc. Order 6–7.

In response to the Discovery Order, Petitioner produced and Patent Owner filed the Declaration of Carly Summers (Ex. 2086). Patent Owner cross-examined Ms. Summers and filed the deposition transcript for Ms. Summers (Ex. 2087). Patent Owner filed a Patent Owner’s Supplemental Brief Concerning Board-Ordered Discovery (Paper 75, “PO Privity Resp.”), Petitioner filed Petitioner’s Responsive Supplemental Brief (Paper 78, “Pet. Privity Reply”), and Patent Owner filed Patent Owner’s Reply Supplemental Brief Concerning Board-Ordered Discovery (Paper 79, “PO Privity Sur-Reply”). The parties subsequently agreed that oral argument on September

⁶ The “products accused” consist of “the ‘Intel Accused Products’” identified on pages 4–8 Exhibit 2021, namely, the Intel “products accused of practicing the challenged claims” in Patent Owner’s prior litigation.

10, 2025 would cover all relevant issues including the privity dispute, and that there need not be a separate telephonic hearing on privity. Paper 81.

Having considered the evidence of record, we determine that Petitioner is not in privity with Intel, and the Petition is not time-barred under 35 U.S.C. § 315(b).

The briefs comingle analyses of the issues of real party in interest (RPI) and privity, and often use the terms interchangeably. *See e.g.*, PO Privity Resp. 1–2; PO Privity Sur-Reply 2. The two terms, however, describe distinct concepts with differing effects under the statute. *See, e.g.*, 35 U.S.C. § 312(a)(2) (petition must identify all RPIs, but not privies). Prior to analyzing the parties’ arguments, we summarize the concept of privity below.

1. Statutory Bar as Nonparty Preclusion

The one-year statutory bar of Section 315(b) “helps to ensure that *inter partes* review provides a quick and cost effective alternative to litigation, and is not used as a tool for harassment or litigation gamesmanship.” *Johnson Health Tech. Co. v. Icon Health & Fitness, Inc.*, Case IPR2014-01242, Paper 16 at 3 (PTAB Feb. 11, 2015) (citing H.R. REP. NO. 112-98 at 48, *as reprinted in* 2011 U.S.C.C.A.N. at 78). In this sense, Section 315(b) is analogous to the common-law doctrines of claim preclusion and issue preclusion, which “preclude parties from contesting matters that they have had a full and fair opportunity to litigate,” thereby “protect[ing] their adversaries from the expense and vexation attending multiple lawsuits, conserv[ing] judicial resources, and foster[ing] reliance on judicial action by minimizing the possibility of inconsistent decisions.” *Montana v. United States*, 440 U.S. 147, 153–54 (1979). Our Practice

Guide,⁷ therefore, looks to these doctrines of preclusion in interpreting the language of Section 315(b). *See* TPG 12–15.

Like the common-law preclusion doctrines, the preclusive effect of Section 315(b) also extends beyond those who were parties to the prior lawsuit. Because nonparty preclusion risks binding those who have not had a full and fair opportunity to litigate, the Supreme Court has cautioned that there is a general rule against nonparty preclusion, subject only to limited exceptions. *See Taylor v. Sturgell*, 553 U.S. 880, 892–93 (2008). In *Taylor*, while noting that it was not a “definitive taxonomy” (*id.* at 893 n.6), the Court set forth a list of six “categories” under which nonparty preclusion may apply.⁸

(1) “[A] person who *agrees to be bound* by the determination of issues in an action between others is bound in accordance with the terms of his agreement.” *Id.* at 893.

(2) “[N]onparty preclusion may be justified based on a variety of *pre-existing substantive legal relationships* between the person to be bound and a party to the judgment,” such as “preceding and succeeding owners of property, bailee and bailor, and assignee and assignor.” *Id.* at 894.

(3) “[I]n certain limited circumstances,” such as class actions, “a nonparty may be bound by a judgment because she was *adequately represented* by someone with the same interests who was a party to the suit.” *Id.* The Court later elaborated that this exception applies only if there are “special procedures to protect the nonparties’ interests, or an understanding by the concerned parties that the first suit was brought in a

⁷ *See* Patent Trial and Appeal Board Consolidated Trial Practice Guide (“TPG”) (available at www.ptab.info/PDFS/251212-TrialPracticeGuideUSPTO.pdf).

⁸ For clarity, we omit internal quotation marks and citations throughout the list of categories enumerated in *Taylor*, add emphasis on certain key phrases, and generally cleaned up the quotations.

representative capacity.” *Id.* at 900.

(4) “[A] nonparty is bound by a judgment if she *assumed control* over the litigation,” because that person “has had the opportunity to present proofs and argument . . . even though he was not a formal party to the litigation.” *Id.* at 895.

(5) “[A] party bound by a judgment may not avoid its preclusive force by *relitigating through a proxy*,” such as “when a nonparty later brings suit as an agent for a party who is bound by a judgment.” *Id.*

(6) “[A] *special statutory scheme*,” such as bankruptcy or probate, “may expressly foreclose successive litigation by nonlitigants . . . if the scheme is otherwise consistent with due process.” *Id.*

Having listed these categories, the Court then held that a broader doctrine of nonparty preclusion, termed “virtual representation,” was inconsistent with Federal common law, and risked violating due process. *Id.* at 898–900. Therefore, nonparty preclusion cannot be based on mere “identity of interests and some kind of relationship between parties and nonparties.” *Id.* at 901.

2. Case Law on Privity

“[T]he mere existence of some relationship between a petitioner and another entity is not sufficient” to place that petitioner in privity with that entity. *Google LLC v. DDC Technology, LLC*, IPR2023-00707, Paper 27 at 37 (PTAB Oct. 25, 2023). Instead, “that relationship must be related to [an earlier] lawsuit and be sufficiently close that it can be fairly said *the petitioner had a full and fair opportunity to litigate the validity of the patent in that lawsuit.*” *Id.* (emphasis added). In other words, privity concerns “whether the petitioner and the prior litigant’s relationship—as it relates to the [earlier] lawsuit—is sufficiently close that it can be fairly said that the

petitioner had a full and fair opportunity to litigate the validity of the patent in that lawsuit,” or “whether the petitioner is simply serving as a proxy to allow another party to litigate the patent validity question that the other party raised in an earlier filed litigation.” *WesternGeco LLC v. ION Geophysical Corp.*, 889 F.3d 1308, 1319 (Fed. Cir. 2018).

Though expansive, the concept of privity has boundaries set by due process. As the Court held in *Taylor*, extending the preclusive concept of privity to those in “virtual representation,” through identity of interest and a determination that the relationship of the parties is “‘close enough’ to bring the second litigant within the judgment,” is impermissible. *See Taylor*, 553 U.S. at 898. Only if the nonparty can be said to have had a “full and fair opportunity to litigate” can that nonparty be precluded as a privy. *Id.* at 892–93; *see Aspex Eyewear, Inc. v. Zenni Optical, Inc.*, 713 F.3d 1377, 1382 (Fed. Cir. 2013) (“A full and fair opportunity to litigate is the touchstone of any preclusion analysis.”).

Courts examine different aspects of the parties’ relationship, depending on the issue for which privity is being asserted. *See Int’l Nutrition Co. v. Horphag Research, Ltd.*, 220 F.3d 1325, 1329 (Fed. Cir. 2000) (“A variety of relationships between two parties can give rise to the conclusion that a nonparty to an action is ‘in privity’ with a party to the action”). For example, the parties’ contractual relationship (privity of contract) regarding a product is relevant when determining whether an injunction against the sale of that product applies. *See In re Cyclobenzaprine Hydrochlorine Extended-Release Capsule Patent Litigation*, 504 F. App’x 900, 906 (Fed. Cir. 2013) (unpublished). In other situations—for example, in the case of a judgment with respect to a particular property interest—the relationship between the parties with

respect to the transfer of the property may be the focus. *See Int'l Nutrition*, 220 F.3d at 1329. Therefore, the same two parties may be in privity for certain purposes, but not for others. *Id.*

In the context of Section 315(b), the goal of the preclusion is to prevent successive challenges to a patent by those who previously have had the opportunity to make such challenges in prior litigation. As such, the focus of our privity inquiry is on the relationship between the parties *during the prior lawsuit*. In other words, we ask whether the instant petitioner and the prior litigant's relationship—as it relates to the lawsuit—is sufficiently close that it can be fairly said that the petitioner has had a full and fair opportunity to litigate the validity of the patent in the lawsuit.

In this sense, our privity inquiry will typically fall into *Taylor*'s fourth category of nonparty preclusion, which applies to situations in which the petitioner “has had the opportunity to present proofs and argument” such that it can be said to have “assumed control” over the action. *Taylor*, 553 U.S. at 895. Our Practice Guide reflects this, noting that control is a “common consideration” in the privity inquiry. TPG 14.

Furthermore, we note that *actual* assumption of control of the lawsuit is not necessary for a finding of privity; the opportunity, or legal right, to assume control is sufficient. “Substantial control . . . connotes the availability of a significant degree of effective control in the prosecution or defense of the case—what one might term, in the vernacular, the power—whether exercised or not—to call the shots.” *Gonzalez v. Banco Central Corp.*, 27 F.3d 751, 758 (1st Cir. 1994); *see Arris Group, Inc. v. C-Cation Techs., LLC*, Case IPR2014-00746, slip op. at 10 (PTAB Nov. 24, 2014) (Paper 22) (inquiring into whether party exercised, or could have exercised, control over District Court action); *see also* Practice Guide, 77 Fed. Reg. at

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48,759 (quoting 18A Charles Alan Wright, Arthur R. Miller & Edward H. Cooper, *Federal Practice & Procedure* § 4451 (2d ed. 2011)) (“[C]ontrol generally means that ‘it should be enough that the nonparty has the actual measure of control or *opportunity to control* that might reasonably be expected between two formal coparties.’”) (emphasis added).

Finally, privity is based on “flexible and equitable considerations,” and, therefore, neither the Practice Guide nor our decisions set any bright-line test for when privity exists. TPG 14. Nor should the preceding discussion be understood to mandate that all Section 315(b) privity relationships must fall within the fourth “assumed control” category set forth in *Taylor*. Common to our cases, however, is a focus on the relationship between the parties in the context of the prior lawsuit, and an inquiry as to whether the petitioner’s relationship with the prior litigant was sufficiently close that it can be said that the petitioner had, or will have, a full and fair opportunity to litigate the validity of the patent in that prior action.

If we are satisfied that petitioner has “enjoyed its day in court” through its relationship with the litigant, it is fair to consider the parties to be privies. In *Taylor*, the Court held that

a party bound by a judgment may not avoid its preclusive force by relitigating through a proxy. Preclusion is thus in order when a person who did not participate in a litigation later brings suit as the designated representative of a person who was a party to the prior adjudication . . . [I]t also seems clear that preclusion is appropriate when a nonparty later brings suit as an agent for a party who is bound by a judgment.

Taylor, 553 U.S. 895.

3. *Petitioner's Arguments*

Petitioner contends that “[t]here is no privity between Petitioner and Intel,” and “[a]ccordingly, the Petitions are not time-barred.” Pet. Privity Reply 15. According to Petitioner, “even if Petitioner had known about and wanted to control the Intel litigation, it could not have because Petitioner has no contractual agreements with Intel that would give it the right of such control. Pet. Privity Reply 9 (citing Ex. 2086 ¶¶ 6, 7). Petitioner contends that “[t]he legal relationship factors also weigh heavily against privity because Petitioner does not have any indemnity or sales agreements with Intel and is not the supplier to Intel for any product or component which was accused in the Intel litigation.” *Id.* at 10–11; *see* Ex. 2086 ¶¶ 6–8); Ex. 2085, 35:1–4.

Petitioner contends that

in *WesternGeco*, the Federal Circuit affirmed that no privity existed even when there was an indemnification clause in a sales agreement because the clause did not specify the meaning of “‘indemnify’ as requiring [the party] . . . to pay for any litigation defense expenses or for any damages related to infringement.” If no privity exists even when an indemnification clause and sales agreement exist, then certainly, no indemnification or sales agreements push the present situation further away from a finding of privity.

Pet. Privity Reply 11 (citing *WesternGeco*, 889 F.3d at 1321) (alterations by Petitioner)). Petitioner clarifies that its Declarant, Ms. Carly Summers, “did not merely look for sales and indemnity agreements just for the Intel Accused products (‘IAPs’), but instead investigated if Petitioner had *any* sales or indemnity agreements with Intel.” *Id.* at 12 (citing PO Privity Resp. 5–6; Ex. 2086 ¶¶ 6, 7 (stating there are “no sales [and indemnification] agreements at all between Petitioner and Intel” (emphasis omitted))).

Petitioner asserts that, because its “products were not implicated in the Intel lawsuit,” “Petitioner would have had no grounds to step in even if there was such an obligation.” Pet. Privity Reply 10.

Petitioner’s Declarant testified that “Petitioner first learned of Patent Owner’s litigation against Intel on or about May 26, 2023,” (Ex. 2086 ¶ 10) and Petitioner asserts that this “was a month *after* the Intel case settled (and was after Intel’s own one-year time bar had already run” (Pet. Privity Reply 9). Thus, according to Petitioner, “[t]he control factor weighs against privity because Petitioner did not control or direct the lawsuit between Patent Owner and Intel.” Pet. Privity Reply 9. Declarant Summers also testified that “Petitioner had no knowledge of, or involvement in, Intel’s defense in its litigation against Patent Owner. Petitioner did not actually control, nor was it in a position to control, Intel’s defense in that litigation.” Ex. 2086 ¶ 12. “It is common sense,” according to Petitioner, that “Petitioner could not have controlled the Intel case when it did not even know it was happening.” Pet. Privity Reply 10. Petitioner further contends that “there is ‘no evidence to suggest that [Petitioner] . . . directed, funded, controlled, or influenced’ the Intel case.” *Id.* (quoting *WesternGeco*, 889 F.3d at 1320).

4. *Patent Owner’s Arguments*

Patent Owner argues that it “has presented far more than ‘some evidence’ that time-barred parties, including Intel,[□] should have been named as RPI in the Petition.” PO Privity Resp. 2. Patent Owner also argues that it “maintains that Petitioner is in privity with both [REDACTED] and [REDACTED] two other time-barred parties,” and “that discovery should have been granted as to these parties for at least the reasons presented in the Joint Paper Concerning

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Additional Discovery in the Wave 1 (*onsemi*) IPRs.” *Id.* at 2 n.2 (citing IPR2023-01242, Paper 108 at 2–5). We address this argument below.

Patent Owner argues that its evidence confirms that MPS is a component supplier to Intel and “[a]s a result, Petitioner received a sublicense as a ‘have made vendor’ to make and sell products to Intel under Intel’s license with [Patent Owner].” PO Privity Resp. 2–3 (citing Prelim. Reply 5; Exs. 2017–2019; Ex. 2011, 3). According to Patent Owner, Petitioner’s Declarant “testified that ‘MPS sells some custom products,’” and “confirmed [Patent Owner]’s longstanding belief that Petitioner’s sales ‘contract include an indemnity clause against patent infringement.’” *Id.* at 3 (quoting Ex. 2087, 34:11–17, 31:11–15). Patent Owner also contends that it “has previously submitted evidence that Petitioner ‘maintains a staff of applications engineers who work directly with [] customer’ engineers.” *Id.* (quoting Ex. 2022, 6).

Patent Owner contends that the position of Petitioner’s declarant “is undermined by two critical admissions: Petitioner is a *component* supplier and has an *indirect* sales model,” and “[a]s a result, she failed to present to the Board a comprehensive account of Petitioner’s relationship with Intel under the guise of conducting a complete and thorough ‘investigation.’” PO Privity Resp. 6. Patent Owner argues that Petitioner’s declarant did not investigate *indirect* sales of parts or components to Intel, nor did she consult with the parties or people who would possess relevant information. *Id.* at 6–13; *see id.* at 7 (quoting Ex. 2086, 16:21–17:2). In particular, Patent Owner argues that “Ms. Summers testified that she did not know whether *any* MPS components are included in *any* Intel devices and, as discussed in more detail below, she did not avail herself of any opportunity to learn the answer to that question.” *Id.* at 9. Patent Owner also takes the position that

“Ms. Summers clearly admitted that she does not ‘know whether the Intel Core i5-12400 processor’—or any of the other processors included in the list of IAPs—‘includes any element designed or manufactured’ by MPS.” *Id.* (citing Ex. 2087, 25:5–26:2).

Patent Owner argues that “[n]ot only does Ms. Summer’s conclusory declaration fail to satisfy the Order, but Petitioner offered no accompanying documents to substantiate the claims made by its declarant.” PO Privity Resp. 13. According to Patent Owner,

Ms. Summers testified about numerous issues where, presumably, she would have come across pre-existing documents or would have generated documents as part of the investigation. For example, she described how she “searched” for all sales and indemnification agreements concerning the IAPs, but did not attach any computer printouts or other documents confirming that no such agreements existed. Relatedly, she mentioned searching her own files, emails, and those of “every employee in Petitioner’s legal department,” and instructed the “IT department [to] search the archived files and e-mails of . . . former employees.” Ms. Summers provided no proof whatsoever to corroborate her declaration.

Id. at 14 (citing Ex. 2086⁹ ¶¶ 6, 7, 9).

5. *Analysis of the Parties’ Arguments*

Our analysis below concerns whether Petitioner is in privity with Intel. *See Dir. Rev. Order 3. Worlds* is a seminal case that addresses burdens on the parties when § 315 is at issue. In *Worlds*, the Court held that “an IPR petitioner’s initial identification of the real parties in interest should be accepted unless and until disputed by a patent owner.” *Worlds*, 903 F.3d at 1242. The Court also “agree[d] that a patent owner must produce *some*

⁹ Patent Owner erroneously cites Ex. 2087 instead of Ex. 2086.

evidence to support its argument that a particular third party should be named a real party in interest.” *Id.* “There can be no doubt that the IPR petitioner bears the ultimate burden of persuasion to show that its petitions are not time-barred under § 315(b) based on a complaint served on an alleged real party in interest more than a year earlier.” *Id.* Although *Worlds* addressed RPI, it more broadly discussed § 315 in general, which covers both RPI and privity.

In the present proceeding, Patent Owner did not produce “some evidence” tending to show that Petitioner is in privity with Intel, and the burden never shifted to Petitioner. Even if Patent Owner did produce sufficient evidence to put the relationship between Petitioner and Intel into dispute, the evidence adduced during trial sufficiently supports Petitioner’s position and, in particular, satisfies Petitioner’s burden to show it is not time-barred under § 315(b).

The evidence adduced during trial does not support a finding that the relationship between Petitioner and Intel is sufficiently close that both should be bound by the trial outcome and related estoppels, nor does it suggest, without more, that the parties were litigating either the district court action or the IPRs as proxies for one another. In a nutshell, the record is devoid of evidence tending to show that Petitioner controlled, or had an opportunity to control, the litigation. To the contrary, as explained below, the only record evidence on point supports Petitioner’s position that it did not control, or have any opportunity to control, the litigation.

Petitioner contends that “it had no knowledge of the lawsuit between Patent Owner and Intel (‘the Intel litigation’) until after that lawsuit had concluded,” “its components were not implicated in the Intel litigation,” and “it did not participate in, control, or have an opportunity to control, the Intel

litigation in any way.” Pet. Privity Reply 1. According to Petitioner’s Declarant, Petitioner “first learned of Patent Owner’s litigation against Intel on or about May 26, 2023,” “as it began to investigate the allegations in, and merits of, Patent Owner’s May 26, 2023 complaint against Petitioner.” Ex. 2086 ¶ 10. She also testified that “Petitioner had no knowledge of, or involvement in, Intel’s defense in its litigation against Patent Owner” and “did not actually control, nor was it in a position to control, Intel’s defense in that litigation.” *Id.* ¶ 12.

In light of the assertions of lack of *actual* participation in and control of, or opportunity to control, the Intel litigation by Petitioner, and the lack of evidence as to whether Intel controlled or had an opportunity to control Petitioner’s decisions in the Petitioner-initiated IPRs, we next consider Petitioner’s and Intel’s relationship, as it relates to the Intel litigation. We consider whether that relationship is sufficiently close such that the Intel litigation would have given Petitioner a full and fair opportunity to litigate the validity of the challenged claims of the ’502 Patent or whether Petitioner is “simply serving as a proxy to allow” Intel “to litigate the patent validity question that” Intel “raised in an earlier filed litigation.” *See Western Geco*, 889 F.3d at 1319, 1320 (“[T]he privity analysis is broader than simply inquiring whether PGS controlled or had an opportunity to control ION’s decisions in the ION patent infringement litigation, or whether ION controlled or had an opportunity to control PGS’s decisions in the PGS-initiated IPRs.”).

In response to the Board’s Discovery Order, Petitioner produced evidence, none of which supports Patent Owner’s argument that Intel should be named as a privy. *See Dir. Rev. Order* 3–4. It is worth emphasizing here that, contrary to Patent Owner’s position (*see, e.g., PO Privity Resp.* 1–2),

the Director did not indicate that Patent Owner had met its burden of production under the *Worlds* decision. To the contrary, the Director ordered the Board to allow discovery to determine, on the full record, “whether Patent Owner has produced some evidence to support its argument that Intel should be named as a privy *so as to have put the issue into dispute.*” Dir. Rev. Order 3 (emphasis added) (citing *Worlds*, 903 F.3d at 1242–44).

We are not persuaded that Petitioner is in privity with Intel because the evidence of record supports the following findings: “(1) [Petitioner] has no sales or indemnity agreements with Intel, (2) it does not supply any products to Intel, (3) it had no knowledge of [the Intel litigation] until after that lawsuit had concluded, (4) its components were not implicated in the Intel litigation, and (5) it did not participate in, control, or have an opportunity to control, the Intel litigation in any way.” Pet. Privity Reply 1.

Notwithstanding Patent Owner’s arguments, addressed below, we find persuasive Petitioner’s Declarant’s testimony. Specifically, Declarant Summers has been Senior Corporate Counsel in MPS since August 2021, and her responsibilities include “leading the negotiation, drafting, and preparation of commercial contracts, including vendor, licensing, and supply agreements” and “support[ing] Petitioner’s Supply Chain and Sales team functions, including identifying legal risks and proposing strategies to safeguard Petitioner’s interests.” Ex. 2086 ¶¶ 1, 3. We are persuaded Declarant Summers’ experience supports that she had sufficient knowledge to attest to her testimony that “Petitioner’s principal customers are contract manufacturers located in Asia, rather than downstream branded companies such as Intel,” “Petitioner did not sell to Intel, or supply Intel with, any of the Intel Accused Products,” and “Petitioner was not the supplier to Intel of

any product, or component of a product, accused of infringement in the Intel litigation.” *Id.* ¶ 8.

Petitioner persuasively contends that Patent Owner’s attack against Declarant Summers “for not knowing whether Petitioner’s products could somehow, through some unknown, hypothetical chain of third-party transactions, wind up in an [Intel Accused Product (IAP)]” is “irrelevant to the privity analysis” as “Patent Owner does not cite a case showing that a party’s product which was not implicated as an accused product in another lawsuit was a dispositive factor for finding privity.” Pet. Privity Reply 13 (citing PO Privity Resp. 10–13); *see also id.* (“[D]espite having years to investigate [the IAPs], Patent Owner has never claimed, much less produced **any** evidence, that **any** of the IAPs contains **any** of Petitioner’s products.”). Petitioner also persuasively contends that in response to Patent Owner’s attack of Declarant Summers “for not investigating whether there were indirect sales from Petitioner to Intel,” “offering a product that some unknown downstream customer, through some unknown string of transactions, might ultimately supply to Intel, cannot serve as the basis for finding privity.” *Id.* at 13–14 (citing PO Privity Resp. 4–10). Petitioner persuasively argues that “even if Patent Owner had produced evidence that any of Petitioner’s products were in any of the IAPs, that fact would carry little weight in the privity analysis and would certainly not outweigh the predominant factors—control, indemnity and sales agreements, and fairness—which weigh heavily against a finding of privity,” especially considering the un rebutted assertion that “[t]he IAPs were Intel-fabricated microprocessors, not low-level components such as Petitioner’s tiny power converters and regulators.” *Id.* at 15 (citing Ex. 2009 ¶ 65; Ex. 2005; Pet. Reply 26).

We see no issue as to Petitioner’s inability to provide sales agreements or other documents that would prove a negative—that Petitioner did not sell the IAPs or components thereof to Intel. Patent Owner alleges that Petitioner’s Declarant limited her investigation to a subset of the issues highlighted in the Board’s order and did not investigate indirect sales of parts or components to Intel. PO Privity Resp. 5–10. According to Patent Owner, for example, Declarant “Summers clearly admitted that she does not ‘know whether the Intel Core i5-12400 processor’—or any of the other processors included in the list of IAPs—‘includes any element designed or manufactured’ by MPS” and “[s]he has never ‘seen a parts list for any of these processors,’ and did not know whether ‘anyone [else] in-house’ had either.” *Id.* at 9 (citing Ex. 2087, 25:5–26:2, 26:8–13). This is beyond the scope of the Discovery Order, which required sales and indemnifications agreements “*between* Petitioner and *Intel* for the Intel Accused Products,” “as well as any documents and new declaration(s) that establish . . . whether Petitioner was the supplier of *any product, or component of product, accused of infringement in the Intel litigation.*” Disc. Order 6–7 (emphasis added). The Discovery Order did not specifically require Petitioner to adduce evidence concerning whether Petitioner supplied products or components to Intel for use in or with other Intel products not accused in the Intel Litigation.

a. Indirect Sales and Third-Party Resellers

Patent Owner takes the position that Petitioner’s Declarant’s investigations included insufficient efforts to learn whether any of its parts or products are or were, in any way, incorporated into Intel processors in post-transfer, downstream transactions because Declarant “Summers never

consulted with the sales or engineering teams at MPS to determine the extent of Petitioner’s relationship with Intel,” and did not “reach out to anyone in sales or engineering to find out whether or not MPS components are included in Intel devices.” PO Privity Resp. 12 (quoting Ex. 2087, 19:10–20:2). The Discovery Order did not specifically require Petitioner to produce evidence beyond agreements between Petitioner and Intel concerning products accused of practicing the challenged claims. Disc. Order 6–7. Stated differently, the Discovery Order did not require Petitioner to produce evidence of any *indirect* sales of its components or products to Intel that occurred after Petitioner surrendered control of the items. Disc. Order 6–7. Such evidence, in any case, would be insufficient to establish privity between Petitioner and Intel based on control of, or an opportunity to control, the relevant litigation.

According to Patent Owner, Petitioner’s Declarant “confirmed [Patent Owner]’s longstanding belief that Petitioner’s sales ‘contract include an indemnity clause against patent infringement.’” PO Privity Resp. 3 (citing Ex. 2087, 31:11–15). Irrespective of whether the general nature of Petitioner’s contracts include an indemnity clause, Petitioner’s Declarant’s testimony persuasively “confirm[s] that . . . ‘[t]here are no indemnification agreements at all *between Petitioner and Intel.*’” Pet. Privity Reply 10 (citing Ex. 2086 ¶ 7) (emphasis added).

b. Incorporation of Petitioner’s Products Into Non-Accused Intel Products

To the extent Patent Owner is arguing that Petitioner’s investigation is lacking for failure to determine any potential use of Cirrus Logic, OmniVision, or GlobalFoundries products in *non-accused* Intel products (see, e.g., PO Privity Resp. 2–3), this argument is unavailing. A

“manufacturer-customer relationship alone does not establish privity” at least because any such relationship does not concern supplying *IAPs or components thereof*. See *WesternGeco*, 889 F.3d at 1321 (“Regarding the pre-suit business alliance, the Board found that ION and PGS had a contractual and fairly standard customer-manufacturer relationship regarding the accused product. This finding does not necessarily suggest that the relationship is sufficiently close.”). The Discovery Order did not specifically require evidence of sales of components to Intel for integration in non-accused Intel products because, even if such evidence existed, it would be insufficient to establish privity between Petitioner and Intel based on control of, or an opportunity to control, the relevant litigation.

c. Providing Custom Products to Customers

To the extent that Patent Owner suggests that, because “Ms. Summers, Petitioner’s declarant and Senior Corporate Counsel, testified that ‘MPS sells some custom products,’ and [Patent Owner] has previously submitted evidence that Petitioner ‘maintains a staff of applications engineers who work directly with [] customers’ engineers,’” such collaboration implies privity, presumably with Intel, we disagree. PO Privity Resp. 3 (quoting Ex. 2087 at 34:11–17, Ex. 2022, 6). Generally collaborating and making custom products is not dispositive and, instead, what matters for privity is that Petitioner did not make the Intel Accused Products or components thereof such that Petitioner was in a position to or had opportunity to control the relevant litigation and should not be provided a second bite at the same apple. See, e.g., *WesternGeco*, 889 F.3d at 1319–22 (the parties “had a contractual and fairly standard customer-manufacturer relationship regarding the accused product,” which “does not necessarily

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suggest that the relationship is sufficiently close that both” parties should be considered to be in privity); *Wi-Fi One, LLC v. Broadcom Corp.*, 887 F.3d 1329, 1340–41 (Fed. Cir. 2018)(same); *Samsung Electronics Co. Ltd. v. Netlist Inc.*, IPR2022-00615, Paper 64 at 22–26 (PTAB June 30, 2023)(same).

We did not order a particular style or depth of investigation (*see* Disc. Order 6–7), nor do we discern that Petitioner’s investigations were in any way insufficient. In particular, we disagree with Patent Owner’s position that compliance with the Discovery Order required any of Petitioner’s Declarant to undertake discovery from Intel to determine whether any IAPs that were accused of infringement in the related litigation included components sold or manufactured by Petitioner, much less contact distributors, manufacturing fabrication plants, or corporate affiliates as part of their investigation to discover whether any of Petitioner’s products ultimately were included in such IAPs. *See, e.g.*, PO Privity Resp. 10–13. The Declaration produced by Petitioner is sufficient to comply with the Discovery Order.

When Patent Owner was inquired as to whether Patent Owner would request additional discovery pursuant to the Director’s Decision vacating and remanding the Final Written Decisions issued in the first wave cases, Patent Owner indicated it would not seek additional discovery, preferring instead to “rest on its paper.” Paper 58, 4 (citations omitted). Thus, it is not clear to us what Petitioner could have produced that would satisfy Patent Owner’s demands for an adequate investigation. Moreover, we are not apprised of, and can discern no evidence of inaccuracies, inconsistencies, or any other impropriety, particularly as Petitioner’s Declarant testified under penalty of perjury.

In view of the above, the evidence adduced during trial does not support Patent Owner’s argument that Intel should be named as a privy so as to put the issue into dispute. *See Dir. Rev. Order 3* (making plain that the question on remand is whether Patent Owner has met that burden of production). Moreover, even if Patent Owner had met their burden of production, the totality of evidence adduced during trial does not support a finding that the relationship between Petitioner and Intel is sufficiently close that both should be bound by the trial outcome and related estoppels, nor does it suggest, without more, that the parties were litigating either the district court action or the IPRs as proxies for one another. Further, the record is devoid of evidence that Petitioner had any opportunity to control the Intel litigation.

As for Patent Owner’s argument that it “maintains that Petitioner is in privity with both [REDACTED] and [REDACTED] two other time-barred parties,” and “that discovery should have been granted as to these parties for at least the reasons presented in the Joint Paper Concerning Additional Discovery in the Wave 1 (*onsemi*) IPRs,” we decline to address this argument. PO Privity Resp. 2 n.2 (citing IPR2023-01242, Paper 108 at 2–5). The Director Review Order made clear that the Board’s Final Written Decisions were remanded to consider issues of privity with respect to only Intel and we decline to enlarge the scope of the “narrowly tailored” discovery set forth in the Director Review Order. *See Dir. Rev. Order 3*.

d. Non-Intel Parties

According to Patent Owner, “Intel and [REDACTED] were served with a complaint alleging infringement of the Challenged Patent on February 1, 2022” and “[REDACTED] was an RPI to the First Amended Complaint against [REDACTED]

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(served by ECF on April 29, 2022).” Paper 11, 28 (citing Ex. 2002, 2, 4; Ex. 2001; Ex. 2003; Ex. 2008, 7). “Thus,” Patent Owner contends that “the Petition is untimely if Petitioner is in privity with Intel *or* [REDACTED].” *Id.* (emphasis added). In the Order Authorizing Supplemental Discovery and Briefing of June 27, 2025, the Board noted that “the Board conducted a teleconference with the parties in the above-captioned proceedings,” IPR2024-00468, IPR2024-00469, IPR2024-00470, IPR2024-00550, IPR2024-00551, IPR2024-00552, and IPR2024-00553. Paper 58, 4.

During the teleconference, the Board inquired as to whether Patent Owner would request additional discovery pursuant to the Director’s Decision vacating and remanding the Final Written Decisions issued in the first wave cases. Patent Owner indicated it would not seek additional discovery, preferring instead to “rest on its papers.”

Id. (citing IPR2024-00468, Paper 63, 2–3). That the Board chose to *sua sponte* craft a post-institution, discovery order on Patent Owner’s behalf, without sufficient input from Patent Owner, can hardly leave the Board to blame if Patent Owner did not obtain the discovery materials and briefing it sought.

In addition, [REDACTED] is not alleged to be an RPI or privy of Petitioner. *See* PO Resp. 36 (identifying Licensees as [REDACTED] Intel, and [REDACTED]). Rather, [REDACTED] is alleged to be an RPI of an alleged RPI—[REDACTED] (*see* PO Resp. 35–36)—a degree of separation that is not contemplated by the clear language of the statute. Thus, Patent Owner’s arguments as to [REDACTED] are unavailing.

*E. Objective Indicia of Non-Obviousness*¹⁰

Patent Owner alleges that a license agreement with RPX Corp. (“RPX”) (“the RPX license”) that covers the patent family including the ’502 Patent is evidence supporting the objective indicia of nonobviousness. PO Resp. 32–34. Patent Owner further argues that because the licensees, [REDACTED] approached Patent Owner through RPX without threat of litigation against them, the RPX license agreement is especially probative of non-obviousness. *Id.* at 4–5, 32–33. Patent Owner further argues that its invention is “part and parcel” of the RPX license because all of the claims of the licensed patents relate to “using graded dopants to move carriers at the ‘surface’ or ‘active region’ further down into the device.” *Id.* at 33 (citing-in-part Ex. 1001).

Objective indicia of non-obviousness, or secondary considerations of non-obviousness, serve “an important role as a guard against the statutorily proscribed hindsight reasoning in the obviousness analysis,” and must be considered in every case in which they are presented. *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1328 (Fed. Cir. 2016). Objective indicia of non-obviousness may include evidence of a long-felt need in the art, praise within the industry, skepticism in the industry about whether or how a problem could be solved, copying, and commercial success. *Id.* at 1132–37.

Patent Owner bears the burden of establishing that a nexus exists between the objective evidence and the claimed invention. *Fox Factory, Inc. v. SRAM, LLC*, 944 F.3d 1366, 1373 (Fed. Cir. 2019). Nexus is a legally and factually sufficient connection between the objective evidence and the

¹⁰ In Section II.E, we refer to the sealed version of the Patent Owner Response (Paper 35).

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claimed invention, such that the objective evidence should be considered in determining non-obviousness. *Demaco Corp. v. F. Von Langsdorff Licensing Ltd.*, 851 F.2d 1387, 1392 (Fed. Cir. 1988).

“A nexus may not exist where, for example, the merits of the claimed invention were ‘readily available in the prior art.’” *ClassCo, Inc. v. Apple, Inc.*, 838 F.3d 1214, 1220 (Fed. Cir. 2016) (quoting *Richdel, Inc. v. Sunspool Corp.*, 714 F.2d 1573, 1580 (Fed. Cir. 1983)). “Unlike products, which may incorporate numerous features beyond those claimed or described in a patent and therefore may require careful parsing to establish a nexus, actual licenses to the subject patent do not demand the same, as they are, by their nature, directly tied to the patented technology.” *Ancora Techs. Inc. v. Roku Inc.*, 140 F.4th 1351, 1362 (Fed. Cir. 2025) (citing *LaserDynamics, Inc. v. Quanta Computer, Inc.*, 694 F.3d 51, 79 (Fed. Cir. 2012)).

1. *The Parties’ Arguments*

Patent Owner contends that “[d]uring its prior litigation against [REDACTED] RPX Corp. (‘RPX’) approached Greenthread about negotiating a license on behalf of [REDACTED] and other companies,” [REDACTED] PO Resp. 26 (citing Ex. 2072 (Rao Declaration)). Patent Owner contends that it “never threatened litigation against either [REDACTED] or [REDACTED] in any way.” *Id.* (citing Ex. 2072). Patent Owner asserts that licenses taken without threat of litigation are especially probative of non-obviousness. *Id.* (citing *Transocean Offshore Deepwater Drilling, Inc. v. Maersk Drilling USA, Inc.*, 699 F.3d 1340, 1353 (Fed. Cir. 2012); *Samsung Elec. Co. Ltd. v. Neonode Smartphone LLC*, IPR2021-00144, Paper 59 at 51 (PTAB Dec. 15, 2022)). Patent Owner contends [REDACTED] are

sophisticated companies who frequently file IPR petitions, yet both paid for licenses covering just the single patent family at issue here. *Id.* at 26–27. Patent Owner further contends that as part of litigation settlements, at least five other large, sophisticated parties have taken licenses, with eight major semiconductor companies now having paid more than [REDACTED] for licenses “which covered only one patent family.” *Id.* at 29.

Petitioner argues in its Reply that litigation-based licenses require a nexus to the merits of the claimed invention because parties often pay licenses to avoid litigation costs, and [REDACTED] licenses were made through RPX, which structures its arrangements to avoid litigation costs. Pet. Reply 24–25 (citing *Iron Grip Barbell Co. Inc. v. USA Sports, Inc.*, 392 F.3d 1317, 1324 (Fed. Cir. 2004); Exs. 1060, 1061).

Patent Owner argues in its Sur-Reply that “[t]here is zero doubt that there is a ‘legally and factually sufficient connection between the [licenses] and the patented invention,’” and “[e]ach license agreement covers a *single patent family* with nearly identical specifications, and the claimed feature of using a graded dopant *is* recited in the licenses.” PO Sur-Reply 23 (quoting *Quanergy Sys., Inc. v. Velodyne Lidar USA, Inc.*, 24 F.4th 1406, 1417 (Fed. Cir. 2022); citing Ex. 2078 ¶¶ 2, 3, pp. 19, 45). Patent Owner further argues that “[i]t is . . . undisputed that RPX *approached Greenthread* on behalf of [REDACTED]—two companies under no threat of litigation” and “Petitioner’s reliance on RPX’s marketing material is simply out of place, as it can point to zero evidence that [REDACTED] were motivated by ‘avoid[ing] litigation costs.’” *Id.* (citing Ex. 2078 ¶ 4; quoting Pet. Reply 24).

2. *Analysis of the Parties' Arguments*

We find that there is a nexus between the objective indicia and the challenged claims based on the RPX license that includes Application No. 14/515,584, which issued as the '502 Patent in the listing of the patent family covered by the license. *See* Ex. 2072, 45 (Appendix B, Exhibit B); *Ancora*, 140 F.4th at 1362. Patent Owner relies on the RPX license to [REDACTED] and asserts that its technique of “creating ‘a drift field to sweep these unwanted minority carriers from the active circuitry at the surface into the substrate’” is “part and parcel” with the RPX license. PO Resp. 33 (quoting Ex. 1001, 3:52–56). We have considered the RPX license and Patent Owner’s argument.

Even though Patent Owner has established a nexus between the RPX license and the challenged claims, such evidence does not outweigh the strong evidence of obviousness presented by Petitioner. As set forth above, Patent Owner asserts that the innovative and “novel technique” of the patent family is creating “a drift field to sweep these unwanted minority carriers from the active circuitry at the surface into the substrate.” PO Resp. 27 (quoting Ex. 1001, 3:39–42). For the reasons discussed below, Petitioner persuasively demonstrates that Onoda, Kawagoe, and the combination of Onoda and Nishizawa each respectively discloses such a drift field. Thus, the allegedly novel advancement of the '502 Patent is found in the prior art. *See Yita LLC v. MacNeil IP LLC*, 69 F.4th 1356, 1364 (Fed. Cir. 2023) (“But our case law makes clear that objective evidence of nonobviousness lacks a nexus if it exclusively relates to a feature that was known in the prior art—not necessarily well-known.” (internal quotations and citations omitted)).

Despite that the RPX license conveys a right to the challenged claims sufficient to support a nexus, we decline to give significant weight to the RPX license. We do not agree with Patent Owner that the RPX license is especially probative because [REDACTED] were under no apparent threat of litigation. *See* PO Resp. 26–27. Although Patent Owner argues that the RPX license was not motivated by a threat of litigation, and that [REDACTED] frequently file IPR petitions (*id.* at 26), the weight of evidence does not support those arguments. RPX markets itself as a cost-saving service that spreads litigation cost across a large network of companies and “remove[s] patents from circulation before they become costly issues.” Ex. 1060, 1.

In view of this evidence, Patent Owner’s argument that [REDACTED] and [REDACTED] entered a license under no apparent threat of litigation is not persuasive because RPX is a risk mitigation service and, therefore, on this record, the license may reflect the value of avoiding the risk of litigation rather than the value of the challenged patent specifically. *Cf. Transocean Offshore Deepwater Drilling, Inc. v. Maersk Drilling USA, Inc.*, 699 F.3d 1340, 1353 (Fed. Cir. 2012) (License found to be due to the merits of the claimed invention to support nonobviousness where royalties exceeding the cost of litigation reflected the value of the licensed technology); *Samsung Elec. Co. Ltd. v. Neonode Smartphone LLC*, IPR2021-00144, Paper 59 at 51 (PTAB Dec. 15, 2022) (License found to be due to an interest in “[the patent owner’s] technology exclusively” and not some “other economic reason that might discount . . . interest in exclusively licensing the technology.”).

Unlike in the *Samsung v. Neonode* case, the record here does not provide sufficient evidence that the amount paid for the RPX license is due exclusively to the licensed technology rather than some other economic

reason. In addition, unlike in the *Transocean* case, the record here includes no evidence of the contribution that [REDACTED] made towards the lumpsum licensing fee, relative to the contribution of [REDACTED] and/or any other RPX member. The record is not sufficiently developed to determine whether the contribution amounts of [REDACTED] are significant compared to the potential cost of litigation. Ex. 2072 ¶ 6.

As to Patent Owner’s argument that the license evidences non-obviousness because “moving carriers ‘from the active circuitry at the surface’ is missing from the prior art” (PO Resp. 28), we disagree for the reasons discussed below. *See Tokai Corp. v. Easton Enters., Inc.*, 632 F.3d 1358, 1369 (Fed. Cir. 2011) (“If commercial success is due to an element in the prior art, no nexus exists.”); *Ormco Corp. v. Align Technology, Inc.*, 463 F.3d 1299, 1312 (Fed. Cir. 2006) (“[I]f the feature that creates the commercial success was known in the prior art, the success is not pertinent.”). Accordingly, we find the RPX license is not entitled to significant weight.

Having determined the weight to be given to Patent Owner’s licenses, we turn to the evidence and argument regarding the remaining *Graham* factors in evaluating Petitioner’s obviousness contentions as to the challenged claims. Even if we were to give the RPX license significant weight, we determine that Petitioner’s showings of *prima facie* obviousness, particularly in view of the strength of the unpatentability challenge based on Kawagoe (a single reference obviousness ground), the strength of the unpatentability challenge based on Onoda (a single reference obviousness ground), and the strength of the unpatentability challenge based on Onoda and Nishizawa, discussed below, outweigh Patent Owner’s objective evidence of nonobviousness. *See Tokai*, 632 F.3d at 1371 (“A strong case

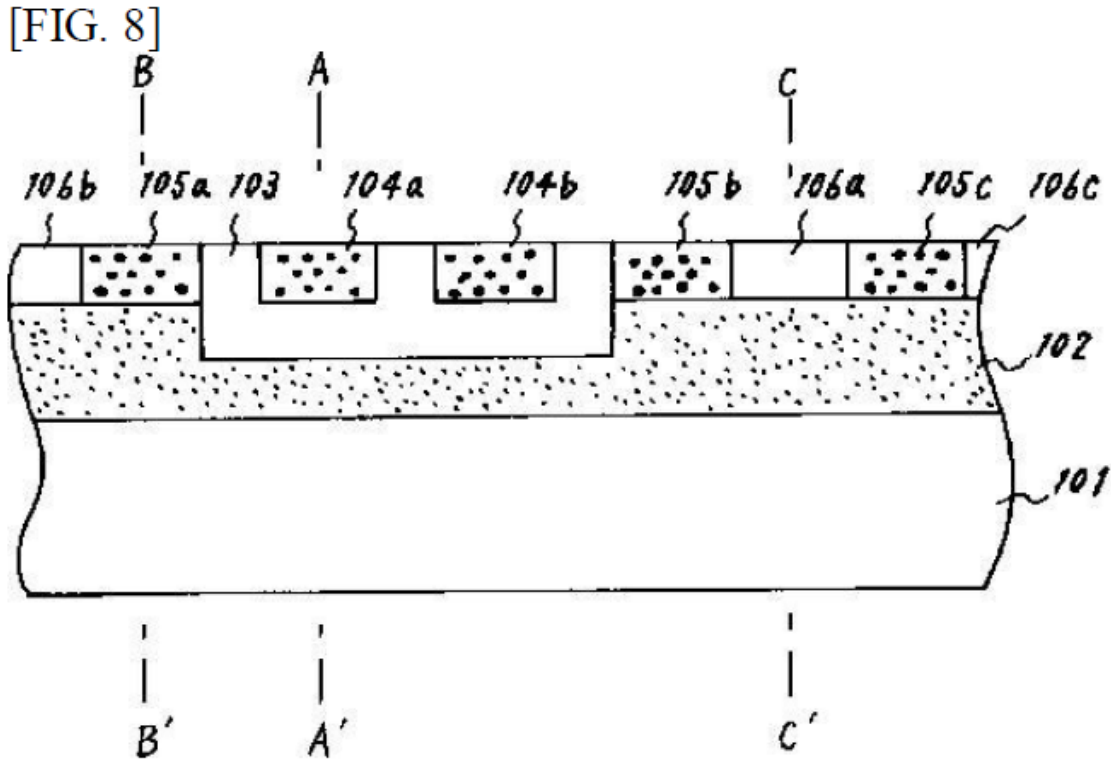
of prima facie obviousness . . . cannot be overcome by a far weaker showing of objective indicia of nonobviousness.”).

F. Obviousness over Onoda

Petitioner contends claims 7 and 8 would have been obvious in view of Onoda (Petitioner’s Ground I). Pet. 17–43.

1. Onoda

Onoda is titled “Semiconductor Integrated Circuit Device, Nonvolatile Semiconductor Storage Device, and Manufacturing Method” and describes “a nonvolatile semiconductor storage device with improved latch-up resistance and punch-through breakdown voltage and improved junction breakdown voltage between the well regions and the semiconductor substrate.” Ex. 1042, codes (54), (57). Onoda “relates to a semiconductor integrated circuit device, to a nonvolatile semiconductor storage device, and to methods of manufacturing thereof, and, in particular, relates to a nonvolatile semiconductor storage device wherein a triple-well structure is formed in an epitaxial substrate.” *Id.* ¶ 1. Figure 8 of Onoda, reproduced below, “is a cross-sectional drawing illustrating, in step order [in conjunction with Figures 4–7], manufacturing of a semiconductor substrate 100 to which the first embodiment according to the present invention is applied.” *Id.* at 28.



Onoda's Figure 8, in conjunction with Figures 4–7, depicts a method for manufacturing a flash memory structured as shown. Ex. 1042 ¶ 46. Figure 8 depicts a first semiconductor layer 101, which comprises a heavily-doped P-type silicon substrate (silicon wafer) with a dopant concentration of $1 \times 10^{19}/\text{cm}^3$ (*id.*) and a lightly-doped P-type second semiconductor layer 102 wherein the epitaxial layer 102a, as a whole, is between 1×10^{16} and $1 \times 10^{18}/\text{cm}^3$ (*id.* ¶ 47). Figure 8 also depicts an N-type first well region 103 with a depth of about $3 \mu\text{m}$ and a dopant concentration of between 1×10^{15} and $1 \times 10^{18}/\text{cm}^3$. *Id.* ¶ 48. Also shown in Figure 8 are boron implantation layers 104A, 104B, 105A, 105B, and 105C, and phosphorus implantation layers 106A through 106C. *Id.* ¶ 49.

2. Petitioner's Evidence Regarding Claim 7

The preamble of claim 7 recites: "A semiconductor device comprising:" Ex. 1001, 4:52. Petitioner contends that "[t]o the extent the

preamble is limiting, Onoda discloses a semiconductor device.” Pet. 19–20. Petitioner provides evidence to support its argument that Onoda discloses a semiconductor integrated circuit device that has both N-channel MOS (NMOS) transistors and P-channel MOS (PMOS) transistors in the circuitry of its flash memory devices. *Id.* at 20 (citing Ex. 1042 ¶¶ 52, 44, 45, 6, Fig. 2, claim 2; Ex. 1003 ¶¶ 55–57).

Claim limitation 7.1 recites “a surface layer.” Ex. 1001, 4:53. Petitioner contends that “Onoda teaches a surface layer.” Pet. 20. Petitioner directs us to evidence that tends to show that Onoda discloses a surface layer similar to that in the ’502 patent. Ex. 1003 ¶¶ 58–59; Ex. 1042 ¶¶ 29, 43, 44, Fig. 3; *see* Ex. 1030, 6, 13. In particular, Figure 5(b) of the ’502 patent and Onoda’s Figure 3 show quite similar structures, and Patent Owner’s district court claim construction brief identified the relevant structure in Figure 5(b) of the ’502 patent as a surface layer. Ex. 1030, 6, 12.

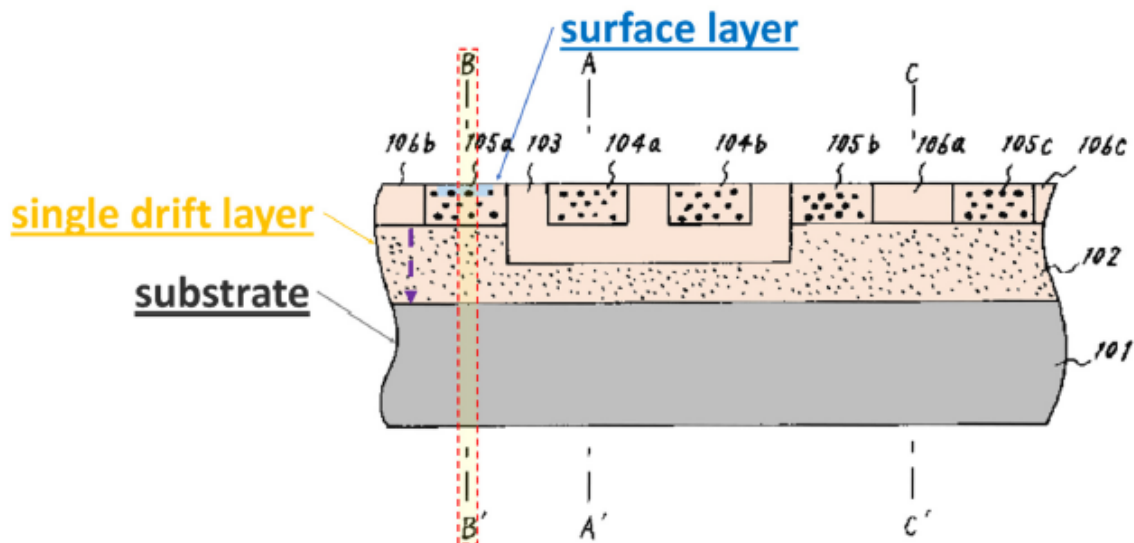
Claim limitation 7.2 recites “a substrate.” Ex. 1001, 4:54. Petitioner argues that “Onoda discloses ‘a semiconductor substrate 100’ on which the flash memory is formed.” Pet. 22. Onoda discloses fabricating its CMOS device “in a silicon semiconductor substrate.” *Id.* at 24 (citing Ex. 1042 ¶ 41, Fig. 3; Ex. 1030, 6, 15).

Claim limitation 7.3 recites “an active region including a source and a drain, disposed on one surface of said surface layer.” Ex. 1001, 4:55–56. Petitioner argues that Onoda discloses this element. Pet. 24–28. Petitioner relies on Onoda’s Figure 3 to illustrate that “the surface layer contains a source and a drain which form an active region.” *Id.* at 24 (citing Ex. 1042, Fig. 3, ¶¶ 29, 43, 44, claim 2). Petitioner directs us to evidence that a person of ordinary skill in the art would have considered the transistors to be active

regions. Ex. 1001, Fig. 5(b); Ex. 1030, 4–5, 7, 11; Ex. 1003 ¶¶ 62–65; Ex. 1008, 299; Ex. 1008B, Fig. 5–1.

Claim limitation 7.4 recites “a single drift layer disposed between the other surface of said surface layer and said substrate.” Ex. 1001, 4:57–58. Petitioner argues that Onoda discloses this element. Pet. 28–30 (citing Ex. 1003 ¶¶ 66–71). Onoda discloses a first tub region with a surface region in it that, on the present record, appears quite similar to the single drift layer and well region of the ’502 Patent. Compare Ex. 1042, Figs. 3, 5, 8, 10–12, ¶¶ 41–51, with Ex. 1001, Fig. 5(b); Ex. 1030, 7, 11. Additionally, Onoda’s Figure 11 shows a dopant concentration in second semiconductor layer 102 that decreases with increasing depth. Ex. 1042 ¶¶ 46–50, 52, Figs. 8, 11.

Claim limitation 7.5 recites “said drift layer having a graded concentration of dopants generating a first static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate.” Ex. 1001, 4:58–62. Petitioner argues that Onoda discloses this element. Pet. 30–34. Petitioner provides an annotated version of Onoda’s Figure 8, reproduced below.



As shown in the annotated version of Onoda's Figure 8, Petitioner maps the claimed substrate to Onoda's first semiconductor layer 101. Pet. 31; Ex. 1042, Figs. 8, 11, ¶¶ 46–50; Ex. 1003 ¶¶ 66–71. Petitioner relies on the parent patent's file history and cited references to argue that the presence of “a downward-sloping graded-dopant concentration creates an inherent built-in unidirectional electric drift field to aid the movement of minority carriers.” Pet. 33–34 (citing Ex. 1003, ¶¶ 73; Pet. § VII.B).

Claim limitation 7.6 recites “at least one well region disposed in said single drift layer, said well region having a graded concentration of dopants generating a second static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate.” Ex. 1001, 4:63–67. Petitioner argues that Onoda discloses this element. Pet. 34–40. Petitioner argues that Onoda's single drift layer (“SDL”), with a well region disposed within it, satisfies this claim limitation. *Id.* at 34–36 (citing Ex. 1042, Fig. 3, ¶¶ 42, 44, 46, 48–50). Petitioner also argues that Onoda's Figure 11 depicts the gradient profile of cross-sectional B-B' of Figure 8, which would aid the movement of minority carriers from the surface layer to the substrate for the same reasons as described in limitation 7.5. *Id.* at 36–38 (citing Ex. 1042, Figs. 8, 11, ¶ 52; Ex. 1003 ¶¶ 75–78; Pet. § VII.B). Relying on Patent Owner's arguments during prosecution '195 parent patent, Petitioner contends that the presence of this layer creates a second “static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate.” Pet. 37–40; Ex. 1003 ¶¶ 72–83; Ex. 1042, Figs. 8, 13, ¶ 48, 87.

3. *Patent Owner's Arguments Regarding Claim 7*

With respect to independent claim 7, Patent Owner raises multiple issues with the instant unpatentability challenge of that claim. PO Resp. 8–19. We address these arguments below.

a) *No Aiding the Movement of Minority Carriers*

Patent Owner contends that “Petitioner’s references do not teach the ‘aid the movement of minority carriers’ claim limitation.” PO Resp. 8. Patent Owner further contends that “Petitioner’s expert admitted *in his report* that a graded concentration of dopants does not inherently aid minority carrier movement.” *Id.* at 9. According to Patent Owner, “to locate ‘aid the movement of minority carriers’ in the prior art, the Petition assumes that *any* ‘graded concentration of dopants’ will ‘aid the movement of minority carriers.’” *Id.* at 8–9; *see id.* at 10 (“Dr. Campbell and the Petition point to the mere gradient itself as evidence that the prior art gradients ‘aids movement.’”). Patent Owner contends that “Petitioner’s assumption that the gradients in their prior art references would aid carrier movement fails, because the Petition fails to analyze whether the specific gradients at issue in the context of the disclosed devices would suffice to overcome the other forces that are present,” and “[s]ince Petitioner does not measure or account for these forces, and does not compare them to the magnitude of the force exerted by the gradients in the alleged prior art, they fail to establish that the disclosed gradients would ‘aid the movement of minority carriers.’” *Id.* at 12–13 (citing Ex. 2057 ¶ 50).

Patent Owner contends Dr. Campbell’s “report states that ‘an electric field *that is properly constructed* will push the minority carriers away from the surface.’” PO Resp. 9 (quoting Ex. 1003 ¶ 32) (alteration by Patent

Owner). According to Patent Owner, when it asked Dr. Campbell, “What did you mean by ‘properly constructed’?” Dr. Campbell replied ‘the direction has to be correct’ and ‘you have to have a sufficient electric field intensity.’” *Id.* (quoting Ex. 2058, 34:1–14) (alteration by Patent Owner). Patent Owner contends that “nothing in Dr. Campbell’s report addresses the ‘intensity’ of the electrical fields.” *Id.* Patent Owner argues, “[e]ven if Dr. Campbell had included relevant analysis in his report, his analysis would be inadequate, because he failed to address key factors that he admits are important to the electric fields and carrier movement,” including “temperature, capacitance effects at the PN junction, and imperfections in the silicon crystal.” *Id.* at 10 (citing Ex. 2058, 34:15–36:19; 39:8–12).

b) Petitioner Misinterprets the Prosecution History

Patent Owner argues:

During prosecution, the examiner . . . said that in “a complex electronic device, movement of minority carriers is affected by multiple forces and fields” and that a “drift field may attempt to apply a force on all minority carriers in a specific direction” but that “without knowing other parameters of the device” one cannot say whether the field would aid carrier movement. This is exactly what MPS’s expert, Cirrus Logic’s 30(b)(6) witness, and Greenthread’s expert testified.

PO Resp. 12 (citing Ex. 1002, 270; Ex. 2057 ¶ 50).

Patent Owner contends that “Petitioner argues that Greenthread argued in prosecution that the ‘graded dopant concentration itself creates a “built-in” electrical field that forces the movement of carriers into a particular direction.’” *Id.* at 15 (citing Pet. 10). Patent Owner argues, “[t]he point of the sentence Greenthread actually wrote is that a ‘graded dopant concentration’ must move carriers *to meet the claim limitation*, not

that any and every graded dopant concentration must move carriers.” *Id.*
Patent Owner contends, “[i]n context, [it] said:”

Defendants assert that the specification does not provide guidance on how to assess or measure carrier movement. This is not true. The claims and the specification make clear that the electric field must move the carriers in a particular direction (from the surface layer to the substrate). Whether the carrier movement has a particular speed or acceleration is beyond the scope of the claim, as long as it meets the other limitations of the claim.

Id. at 15 (quoting Ex. 2030, 38).

In response to Petitioner’s claim “that Greenthread represented during prosecution that a downward-sloping graded-dopant concentration was known in the prior art to create an inherent built-in unidirectional electric field that moves carriers deep into the substrate” (*id.* at 15–16 (quoting Pet. 10) (internal quotation marks omitted)), Patent Owner contends that, during prosecution, it “added that the movement of carriers ‘[d]epend[s] on the particular slope of the graded concentration of dopant[s].’” *Id.* (citing Ex. 1002, 289).

Patent Owner argues, “[t]hose additional claim limitations were, as Greenthread said, an ‘additional parameter for ensuring that all minority carriers are moved in one direction.’” *Id.* (citing Ex. 1002, 289). “The fact that an ‘additional parameter’ *besides* the graded dopants is necessary to ‘ensur[e] that all minority carriers are moved’ shows that Greenthread was not asserting that ‘graded’ entails ‘aided.’” *Id.* at 16.

c) Two District Courts – Not All Doping Gradients Aid Carrier Movement

Patent Owner contends that “[n]ot one but two District Courts have previously agreed with [Patent Owner] that not *all* doping gradients aid carrier movement.” PO Resp. 14.

The Western District of Texas unequivocally stated, “a graded concentration . . . that is [not ‘sufficiently graded’] will not aid in the movement of minority carriers[.]” Ex. 2074, 39–40. And the Eastern District of Texas understood that direction alone does not determine whether a gradient aids carrier movement—the *magnitude* of the gradient must also be considered. Ex. 2075, 15 (explaining that “the slope [of the gradient] has both a direction and a magnitude and [d]efendant [incorrectly] suggests that the direction of the drift electric field depends solely on *the direction* of the slope of the graded concentration”).

Id. at (alteration by Patent Owner) (emphasis in original).

d) Onoda Fails to Show Aiding the Movement of Minority Carriers

Patent Owner argues, “[f]or the Onoda-based grounds, the Petition points to Onoda disclosing ‘a downward-sloping dopant concentration’ and jumps to the conclusion that the gradient would necessarily ‘aid the movement of minority carriers[.]’” PO Resp. 17 (quoting Pet. 32–34). Patent Owner contends that “[n]othing in the Petition explains how Onoda’s field is ‘properly constructed’ or analyzes the numerous factors that Dr. Campbell admits affect carrier movement (e.g. temperature, silicon imperfections, resistance, and slope),” and since “there are a number of PN junctions that create ‘substantial electric fields’ which Dr. Campbell failed to account for” and “[s]ince Dr. Campbell does not identify the net force acting on the carriers, or analyze the factors necessary to identify it, the Petition fails to show that the gradient aids carrier movement.” *Id.* at 17–18 (citing

Ex. 2058, 34:15–36:19; 39:8–12); *see id.* at 18–19 (Patent Owner alleging other factors affect carrier movement).

4. Petitioner’s Arguments Regarding Claim 7

Petitioner responds to Patent Owner’s arguments. *See generally* Pet. Reply.

The claims recite an apparatus with a graded concentration that creates a “electric drift field” that “aid[s] the movement of minority carriers.” PO twice—without equivocation—argued that a graded dopant concentration inherently creates a field that “aid[s] the movement of minority carriers” to overcome a 35 U.S.C. § 112 rejection and a district court indefiniteness challenge. PO cannot disavow these arguments to avoid obviousness.

Pet. Reply 1.

a) A Graded Dopant Concentration Aids the Movement of Minority Carriers

Petitioner contends that the challenged claims are apparatus claims—not method claims—and as such, the “to aid the movement of minority carriers” terms should be understood to cover what a device *is*, not what a device *does*. Pet. Reply 2–3 (citing *ParkerVision, Inc. v. Qualcomm Inc.*, 903 F.3d 1354, 1361 (Fed. Cir. 2018)). Petitioner argues that the claims “merely require that the claimed ‘electric field’ form the ‘drift layer’ [to] ‘aid the movement,’ not that the field overcome all other forces that may exist within a theoretical device—none of which are identified [in] the specification or prosecution history.” *Id.* (citing *ParkerVision*, 903 F.3d at 1361 (a device may be “reasonably capable of operating so as to meet the claim limitations, even if it does not meet the claim limitations in all modes of operation”).

Petitioner argues that “Dr. Glew and [Patent Owner] have expressly—and repeatedly—acknowledged that a graded dopant concentration will create a drift field to aid carrier movement:”

“When the dopant concentration is graded in a particular direction, other charge carriers will move in the gradient direction (or opposite direction) depending on the charge carrier’s polarity. This phenomenon is called ‘carrier drift.’”

Pet. Reply 14 (quoting Ex. 2057 ¶ 33; citing Ex. 1002, 289; Ex. 1030, 26, 28; Ex. 1055, 72:11–74:11). Petitioner argues that “[Patent Owner’s] listing of other ‘forces’ (resistance, temperature, and imperfections . . .) does nothing to counteract the dopant gradient’s drift field,” and notes that Patent Owner did not raise any such arguments or alleged “facts” during prosecution when attempting to persuade the Examiner to allow the subject claims. *Id.* at 14–16 (discussing such “forces”).

b) Patent Owner Ignores Its Explicit Prosecution Statements Concerning Aiding the Movement of Minority Carriers

Petitioner argues that Patent Owner “directly contradicts arguments it made in district court and during prosecution to overcome § 112 challenges,” and “[t]his is improper.” Pet. Reply 4 (citing *Omega Eng’g, Inc. v. Raytek Corp.*, 334 F.3d 1314, 1323 (Fed. Cir. 2003) (patentees cannot “recaptur[e] through claim interpretation specific meanings disclaimed during prosecution”); *Data Engine Techs. LLC v. Google LLC*, 10 F.4th 1375, 1381 (Fed. Cir. 2021) (claims cannot be twisted like a “nose of wax” across challenges)).

In district court, [Patent Owner] argued that “aid the movement” is “a simple term” (EX1030, 25) that was definite because “[e]lectric drift fields are a well-known phenomenon that cause carriers to move, and [the skilled artisan] would have readily recognized that when a ‘static unidirectional electric drift field’

is present that it aids the movement of minority carriers.” (*Id.*, 26, 2.) [Patent Owner] continued: “[w]hile the claims require that the graded dopants create an electric field that aids movement of the carriers, they do not require a specific range of doping, a particular doping field, or a particular result, and this information is not necessary to understand the scope of [Inventor’s] invention.” (*Id.*, 28.) This directly contradicts PO’s newly manufactured arguments that a slope’s magnitude, and the combined effects of numerous “forces,” would need to be calculated to ascertain whether the limitation is present in the prior art.

Pet. Reply 4–5.

Petitioner argues that, during prosecution, Patent Owner unequivocally stated, in arguing against a § 112 rejection, that “the graded dopant concentration itself creates a ‘built-in’ electrical field that forces the movement of carriers into a particular direction.” Pet. Reply 5 (citing Ex. 1002, 289–90; Ex. 1055, 72:11–74:11 (Dr. Glew agreeing with statement and stating that gradient creates a field vector.)); *see id.* at 5–10 (Petitioner discussing how Patent Owner itself conceded during prosecution that “a graded dopant concentration inherently aids movement”).

c) Patent Owner Misinterprets the Two District Court’s Findings on Carrier Movement

Petitioner argues that the two district court actions entertained “different disputes” that ultimately “held that the claimed ‘graded concentration’ merely requires a relative slope.” Pet. Reply 3–4.

Regarding the Western District of Texas action, Petitioner submits that the parties disputed in the context of indefiniteness whether “graded” had any meaning—Patent Owner “argued that the specification sufficiently depicted ‘graded’ because it depicted a downward slope[,] while a third-party argued that ‘graded’ hinges on an intentional design choice and is

indefinite.” Pet. Reply 3–4 (citing Ex. 2074, 34–36, 38–39). Petitioner submits that “[t]he court found definiteness based on the specification’s disclosure of a *relative slope*.” *Id.* (citing Ex. 2074, 39) (emphasis added).

Regarding the Eastern District of Texas action, Petitioner submits that the court “construed the ‘single drift layer’ and its ‘unidirectional electric field,’” and “addressed whether the construction required a nonvarying, constant slope.” Pet. Reply 4 (citing Ex. 2075, 10). Petitioner submits that the court held that “the slope of the graded concentration need not be solely decreasing or solely increasing to yield the recited ‘unidirectional electric drift field.’” *Id.* (citing Ex. 2075, 11).

d) Onoda Teaches or At Least Fairly Suggests Aiding the Movement of Minority Carriers

Petitioner argues that Onoda “teach[es] a graded dopant concentration that generates a field” to aid movement of minority carriers. Pet. Reply 11 (citing Ex. 1042, Fig. 11); *see id.* at 17. Petitioner submits that “[t]he dopant concentration is graded in a particular direction and, as [Patent Owner] repeatedly represented, [the skilled artisan] knows that a gradient generates a unidirectional electric drift field.” *Id.* “Naturally, there is only one of two directions of the overall force applied to the electron (up or down) and it would have been obvious to [the skilled artisan] that the graded dopant concentration would apply a downward force.” *Id.* (citing Ex. 1054 ¶ 4); *see id.* at 11–12 (discussing wheelchair ramp analogy).

Petitioner also argues that Patent Owner, in arguing against the asserted art, “overlooks that the prior art dopant gradients match those of the ’502 Patent’s specification”:

[Patent Owner] argues that the relative slope in the ’502 Patent (decrease of 10x, EX1001, 2:38–40) generates a sufficient

electric field to aid the movement of a minority carrier. ([PO Resp.], 10–11.) Onoda provides a 10x decrease. (EX1042, FIG. 11 (from 10^{17} to 10^{16} .) Nishizawa shows a 1000x decrease. (EX1046, 18:50–54 (start at 10^{17}), 18:64 (substrate at 10^{14} .) Kawagoe shows a 46x decrease. (EX1007 at 16:13 (starts at 6×10^{16}), 6:62–64 (substrate at 1.3×10^{15} .) The prior art slope magnitudes are equal to—or larger than—the ’195 Patent’s and render obvious “aid the movement.”

Pet. Reply 13.

5. Consideration of Issues Raised in the Briefs

We have considered the cited evidence, including expert testimony, as cited in the parties’ briefs, and the parties’ arguments pertaining to the limitations of claim 7 that are in dispute. Below, we set forth our findings and conclusions as to those disputed issues.

a) Whether a Graded Dopant Concentration “Aids the Movement” of Minority Carriers

With regard to the parties’ arguments concerning the “graded concentration of dopants” “to aid the movement of minority carriers” limitation, we briefly summarize the prosecution of U.S. Patent Application No. 11/622,496, the application leading to the issuance of a grandparent patent to the ’502 Patent (i.e., U.S. Patent No. 8,421,195 B2 (“’195 patent”), having the same Specification). During prosecution, the Examiner rejected claims under the pre-AIA version of 35 U.S.C. § 112, first paragraph, and found that “movement of minority carriers is affected by multiple forces and fields” and that “it does not appear that simply the presence of ‘a unidirectional drift field’ in itself can achieve ‘drawing all minority carriers from said surface layer to said substrate.’” Ex. 1002, 269–270; *see id.* at 289. The Applicant responded with the following argument:

[A] unidirectional drift (electric) field necessarily affects all the present minority carriers in the same way - moving all minority carriers in the same direction because of the unidirectional drift due to the existence of the electric field. See “Physics and Technology of Semiconductor Devices,” A.S. Grove, pp. 224–225, John Wiley and Sons, Inc., New York, 1st Edition 1967 (“This same electric field will then be of such direction as to aid the motion of injected holes. Thus the injected minority carriers will now move not only by diffusion but also by drift due to the existence of this electric field.”). Depending on the particular slope of the graded concentration of dopant, all minority carriers are either swept “down” (from the surface layer to the substrate) or “up” (from the substrate to the surface layer). See Applicant’s Figs. 5(b) and 5(c).

Id. at 289. In response to the Examiner’s argument that the simple presence of a “graded dopant concentration” “does not appear to ensure (without knowing [the] other parameters of the device) that it will draw ‘all’ minority carriers,” the Applicant responded:

[T]his argument appears to not consider that the graded dopant concentration itself creates a “built-in” electrical field that forces the movement of carriers into a particular direction, whereby the “direction” of the electrical field and the resulting direction of the carrier movement depends *solely* on the slope of the graded concentration of dopant. With regard to the existence of a “built-in” electric field created by a graded dopant density, . . . *this inherent “built-in” unidirectional electric field is the additional parameter for ensuring that all minority carriers are being moved in one direction* and which parameter the Office Action deemed to be missing from the disclosure.

Id. at 289–90 (emphases added). Also, “without conceding [its] position on this issue,” the Applicant amended the claims to no longer require “drawing *all* minority carriers,” and instead, requiring that the claimed “unidirectional

drift field” created by the “graded concentration of dopants” “aid the movement of minority carriers.”¹¹ *Id.* at 289–290.

We determine that the statements made by the Applicant (Patent Owner) during prosecution of the ’195 parent patent were clear, unambiguous, and indicate that one of ordinary skill in the art need not know whether there are other “forces and fields” in an electronic device, as the mere presence of a graded dopant concentration creating a “unidirectional drift field,” facing in the appropriate direction, will “aid the movement of minority carriers from” the surface layer to the substrate. Ex. 1002, 270, 289–290. The public is entitled to rely on these clear and unambiguous statements when considering the scope of the challenged claims.

Hockerson-Halberstadt v. Avia Group Int’l, 222 F.3d 951, 957 (Fed. Cir. 2000) (“The prosecution history constitutes a public record of the patentee’s representations concerning the scope and meaning of the claims, and competitors are entitled to rely on those representations when ascertaining the degree of lawful conduct, such as designing around the claimed invention.”).

We agree with Petitioner that, contrary to Patent Owner’s arguments in this proceeding, neither the specification nor the prosecution history requires a calculation of magnitude of a slope to meet the requirements of claim 1—all that is required is a determination of relative slope as described by direction. Pet. Reply 10–16.

¹¹ The examined claims of the ’195 patent application generally recited “a unidirectional drift field drawing all minority carriers from said surface layer to said substrate.” Ex. 1002, 250. The Applicant amended the claims of the ’195 patent application to recite “maintain[ing] a single static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate.” *Id.* at 286.

Based on the complete record developed during trial, Patent Owner's statements during prosecution of the '195 patent, along with the specification of the '195 patent, support a determination that a graded dopant concentration is enough to teach or at least fairly suggest to the skilled artisan aiding minority carrier movement in a particular direction.

We observe, in that regard, that the inventor "did not provide the type of detail in" the '195 patent's specification that Patent Owner "now argues is necessary in [the] prior art references." *In re Epstein*, 32 F.3d 1559, 1568 (Fed. Cir. 1994).

Claim 7 also does not require the movement of any particular number of carriers, let alone a need to move all the carriers. On this point, we note that independent claim 7 is not a method claim.

In *ParkerVision*, the Court emphasized that "[a]pparatus claims cover what a device *is*, not what a device *does*." *ParkerVision*, 903 F.3d at 1361. That is, to effectively challenge claim 7, Petitioner must show that "the reference discloses an apparatus that is reasonably capable of operating so as to meet the claim limitations, *even if it does not meet the claim limitations in all modes of operation*." *Id.* (emphasis added).

Petitioner must show a "first static unidirectional electric drift field" in the "drift layer" that is *capable* of "aid[ing] the movement of minority carriers from said surface layer to said substrate" as well as "a graded concentration of dopants and a second static unidirectional electric drift field" in "at least one well region" that is *capable* of "aid[ing] the movement of minority carriers from said surface layer to said substrate." We are persuaded Petitioner has done so by showing that Onoda discloses a graded dopant concentration with a slope, in a particular direction, in Figures 8

and 11 of Onoda that is not only reasonably capable, but actually does, move carriers in the claimed direction.

b) The Two District Courts' Conclusions Appear Consistent With Petitioner's Positions in this Case

Patent Owner contends that “two District Courts have previously agreed with [Patent Owner] that not *all* doping gradients aid carrier movement.” PO Resp. 14. In particular, Patent Owner contends the Western District of Texas “unequivocally stated, ‘a graded concentration . . . that is [not ‘sufficiently graded’] will not aid in the movement of minority carriers,’” and the Eastern District of Texas “understood that direction alone does not determine whether a gradient aids carrier movement—the magnitude of the gradient must also be considered.” *Id.* at 14 (alterations by Patent Owner) (emphasis omitted) (citing Ex. 2074, 39–40; Ex. 2075, 15).

Before the Western District of Texas, Cirrus Logic, a petitioner in the parallel proceedings, asserted that the term “graded dopant concentration” was indefinite, as it was unclear where the boundary between “graded” and “uniform” doping concentrations would be. Ex. 2074, 32. Patent Owner argued in response that the patent provides sufficient guidance as to the meaning of the claim term, with “graded” meaning varying or not “uniform.” *Id.* at 32, 36, 38 (“[Patent Owner] contends that Figure 1 in the ’195 Patent depicts the difference between uniform and graded concentrations, namely, that the concentration in the former is the same across a region while in the latter, the concentration has a slope.”). The District Court determined that the term was not indefinite for multiple reasons and that “graded” “describes a sloped doping concentration.” *Id.* at 39–41. According to the Court, a graded dopant concentration must be sufficiently graded to result in a “static unidirectional electric drift field to

aid the movement of minority carriers,” as recited in claim 7 of the ’502 Patent. *Id.* at 39–40.

We discern no finding in the Court’s order that one must quantify the magnitude of the field in order to know if the electric field will “aid the movement of minority carriers.” First, the Court was not addressing the same argument raised by Patent Owner in this proceeding. Rather, it was addressing whether the term “graded dopant concentration” is indefinite. Second, the Court’s Order can reasonably be interpreted to require only that the graded dopant concentration be sufficiently graded to create a “static unidirectional electric drift field,” as recited in the claims, which, as the Applicant argued during prosecution and in its claim construction brief before the Western District of Texas, would “aid in the movement of minority carriers.” Ex. 2074, 39–40; *see also* Ex. 1030, 26 (“[A person of ordinary skill in the art] would have readily recognized that when a ‘static unidirectional electric drift field’ is present that it aids the movement of minority carriers. If it isn’t present, then it doesn’t.”), 28 (“The intrinsic record consistently confirms that the electric fields aid the movement of the carriers.”).

Before the Eastern District of Texas, the parties disputed the proper construction of the term “single drift layer . . . having a graded concentration of dopants . . . having a first static unidirectional electric drift field.” Ex. 2075, 10. Plaintiff Greenthread asserted that no construction was necessary, whereas defendant Cirrus Logic argued that the term should be construed as a “single layer whose concentration of dopants either increases across the layer or decreases across the layer.” *Id.* The Court explained that the dispute distilled into two issues: (1) whether the graded concentration of dopants could only increase or decrease across the layer; and (2) whether

the “single drift layer” is necessarily a single layer. *Id.* at 13–14.

In addressing the question of whether the graded concentration of dopants could both increase and decrease in the drift layer, the Court rejected the defendant’s suggestion that the prosecution statement that the direction of the electrical field and the carrier movement “depends solely on the slope of the graded concentration of dopant” demonstrates that “the slope must be only increasing or only decreasing to maintain a unidirectional drift field.” *Id.* at 15. In rejecting this argument, the Court found that the Applicant affirmatively argued during prosecution “that a graded dopant concentration will provide a unidirectional electric drift field to move the minority carriers in a single direction and *Grove*,” relied upon by the Applicant during prosecution, “discloses a dopant concentration that both increases and decreases in the drift layer.” *Id.* at 15–16.

Contrary to Patent Owner’s arguments, the Court’s conclusion regarding the scope of the claims appears consistent with both the Applicant’s assertions during prosecution and Petitioner’s arguments in this proceeding, i.e., that “a graded concentration of dopants” will “aid the movement of minority carriers” as recited in claim 1.

c) Whether Onoda Must Account for Additional Forces Acting on Carriers

Initially, we determine that the mechanism of carrier movement encompassed by the claims does not require devices to be in their “ON” state—that is, the relevant carrier motion at issue does *not* require an application of external voltage. *See e.g.*, Ex. 1002, 128 (“the claimed invention relates to . . . devices which include graded dopant concentrations in regions capable of providing a localized drift electric field without the application of an external potential”), 289–290.

We agree with Petitioner that, as Patent Owner and Dr. Grew acknowledged, a graded dopant concentration creates a draft field to *aid* carrier movement. Pet. Reply 14 (citing Ex. 2057 ¶ 33; Ex. 1002, 289; Ex. 1030, 26, 28; Ex. 1055, 72:11–74:11).

Patent Owner finds fault in Petitioner’s application of Onoda to claim 1’s limitation of a “graded concentration of dopants” “to aid the movement of minority carriers,” because allegedly Onoda does not teach an assessment of “all” forces that might act on carriers to show that its carriers move at all (despite the graded dopant concentration). *See, e.g.*, PO Resp. 17–19 (“Dr. Campbell does not identify the net force acting on the carriers, or analyze the factors necessary to identify it”). We find Patent Owner’s “net forces” line of arguments unavailing.

We agree with Petitioner that Patent Owner’s “net forces” arguments rest on the flawed premise that the claims require actually moving a carrier: “The graded dopant concentration is *static*—always present regardless of the device’s power state. [Patent Owner] has no viable position for its all-force-calculation argument.” Pet. Reply 16. Because the challenged claims are all *apparatus* claims, we find Petitioner does not need to show that Onoda teaches actually moving any given minority carrier (although it does do so). *See ParkerVision*, 903 F.3d at 1361 (“We explained long ago that “[a]pparatus claims cover what a device *is*, not what a device *does*.” (quoting *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 909 F.2d 1464, 1468 (Fed. Cir. 1990))). Rather, Petitioner need only show that Onoda teaches or at least fairly suggests a “graded concentration of dopants” that is *reasonably capable* of “aid[ing] the movement of minority carriers.” *See* Pet. Reply 2–3; *ParkerVision*, 903 F.3d at 1361 (“[A] prior art reference may anticipate or render obvious an apparatus claim . . . if the reference

discloses an apparatus that is *reasonably capable* of operating so as to meet the claim limitations, even if it does not meet the claim limitations in all modes of operation.” (emphasis added)). Petitioner persuasively argues that Onoda’s graded dopant concentrations are all reasonably capable of aiding the movement of minority carriers in the claimed direction, notwithstanding hypothetical forces or resistances that could sometimes prevent motion. *See* Pet. Reply 17.

d) “Minority” Carriers

Claim 7 recites, in part, “aid[ing] the movement of *minority* carriers.” Ex. 1001, 4:57–67 (emphasis added). The parties dispute whether Onoda teaches aiding the movement of “minority” carriers versus some other carrier.

Petitioner asserts that the region and the dopant type in the region dictates what constitutes the *majority* and *minority* carriers in a transistor. Tr. 25:11–26, 26:8–13, 30:12–25, 70:23–26; Ex. 1003 ¶ 32; Ex. 2085, 97:20–21. Relying on persuasive objective evidence, Petitioner identifies minority carriers as holes in an n-type semiconductor and electrons in a p-type semiconductor. Pet. Reply 23–24 (“**Minority Carrier:** ‘a hole in an n-type or an electron in a p-type semiconductor.’”) (quoting Ex. 1056; citing Ex. 1057; Ex. 1058 (objective evidence)).

Petitioner applies that understanding of majority and minority carriers in its unpatentability challenges. For example, in its challenges based on Onoda, Petitioner contends that Onoda’s figures depict the unidirectional electric drift field generated in Onoda’s p-well 105a/102. Pet. 32–33; Ex. 1042, Figs. 8 and 11; *see also* Pet. 31–32 (citing Ex. 1042 ¶¶ 46, 47, 48–50, 52, Figs. 8, 11). Petitioner contends the electric field aids the

movement of minority carriers, which Petitioner identifies as electrons in the p-well, downward toward the substrate. Pet. 36–38 & n.7; Ex. 1003 ¶ 79. Petitioner also contends that the electric field would be pointing in the opposite direction in Onoda’s p-well, but would still aid the movement of minority carriers, identified as electrons in P-wells, downward to the substrate. Pet. 32 n.6; Ex. 1003 ¶¶ 72–74.

Patent Owner responds that, in the context of the ’502 Patent, dopant type in a particular region is not the basis for characterizing majority and minority carriers. PO Sur-reply 17–23. According to Patent Owner, “*majority* carriers are used for channel conduction,” as “[t]he specification explains that ‘MOS devices are majority carrier devices for conduction.’” *Id.* at 18 (quoting Ex. 1001, 1:47–49; citing Ex. 1055, 147:17–148:17). Patent Owner contends that “the term majority carrier or minority carrier is defined by what’s going to carry the charge in the transistor.” Tr. 60:21–22.

Consistent with this, Patent Owner asserts that in an NMOS transistor with n-type source and drain formed in a p-type layer, the only carrier that can conduct a charge, by forming a conductive channel between the source and the drain, is an electron – so electrons are the majority carrier, and “the minority carrier has to be holes.” PO Sur-reply 18–20 (showing Ex. 1001, Fig. 5(b), with annotations; citing Ex. 2057 ¶ 36 & n.4); *see also* Ex. 2057 ¶ 36 n.3 (Dr. Glew, explaining that when a positive voltage is applied to the gate shown in Figure 5(b) of the patent and enough electrons have accumulated in the surface layer, they form a conductive channel of electrons between the source and drain, and “[b]ecause the channel is formed by electrons with a negative charge, the MOSFET is referred to as an n-channel MOSFET, and the ‘minority carriers’ are holes.”). Patent Owner further argues that the opposite would be true for a PMOS transistor,

meaning holes are the majority carriers and electrons are the minority carriers. PO Sur-reply 22.

Contrary to the position taken in the Sur-reply and at the final hearing, however, Patent Owner's prior statement to the Office (made as the Applicant during prosecution) indicate *dopant type* is the basis for determining what constitutes majority and minority carriers in transistors. During prosecution of the '195 patent, Patent Owner stated:

The specification further states that 'the relative slope of the donor [sic: dopant] concentration throughout the base creates a suitable aiding drift electric field, to help the *holes (p-n-p transistor)* transverse from emitter to collector.' In other words, the drift field for the *holes (minority carriers)* is unidirectional, i.e., from the emitter (surface layer) to the collector (substrate) because of the particular slope of the donor [sic: dopant] concentration.

Ex. 1002, 254 (emphasis added); *see also* Ex. 1001, 2:49–51 (“the aiding drift field helps hole conduction”). This statement by Patent Owner, made in reference to the discussion of a bipolar junction transistor (“BJT”) in the specification, aligns with Petitioner's position that electrons are the minority carriers in a p-type well of transistor, and holes are the minority carriers in an n-type well of a transistor. Pet. 36–38 & n.7; Ex. 1003 ¶ 32.

This unequivocal statement made during prosecution not only contradicts Patent Owner's position about the meaning of the claim phrase “minority carriers,” but also fully comports with Petitioner's position. Patent Owner does not attempt to reconcile its contrary arguments with this prosecution statement, which apprises the public of the correct meaning of the phrase “minority carriers,” as used, for example, in claim 7.

Additional evidence of record supports Petitioner's view that majority and minority carriers are identified based on dopant type. For example,

Jastrzebski, a reference Patent Owner relied on during prosecution of the '195 patent (as noted by Petitioner in the Petition), refers to electrons as minority carriers in p-type semiconductor material and holes as minority carriers in n-type semiconductive material. Ex. 1010, 1:56–62; Pet. 11–12; Ex. 1002, 289.

In another example, Chen, a textbook reference Patent Owner's expert, Dr. Glew, relied on for his declaratory testimony in this proceeding, refers to electrons as minority carriers in n-p-n transistors. Ex. 2059, 13 ("For *npn* devices, it was assumed that minority carriers (electrons) that reached the depletion edge of the reversely biased collector-base junction were swept across so that electron density (*n*) in the depletion region was negligible."); Ex. 2057 ¶ 35 (citing Ex. 2059 as "Chen textbook").

Patent Owner's arguments, regarding the identity of minority carriers in NMOS transistors, and which are based on the assertion that "**majority** carriers are used for channel conduction," is unavailing. PO Sur-reply 18; *see* Tr. 61:17–21 (counsel for Patent Owner arguing that in NMOS transistor in p-well, Dr. Rao's intention "wasn't trying to move an electron," but "was trying to move a hole that would have interfered with the MOS transistor"). By way of support, Patent Owner refers to the language in column 1 of the '502 Patent regarding MOS devices being "majority carrier devices for conduction." PO Sur-reply 18; Ex. 1001, 1:47–49.

According to Patent Owner, this language refers to the channel between the source and drain, and the fact that electrons would move from the source to the drain through the channel between them. PO Sur-reply 18–20. Patent Owner also refers to the language in column 3 of the '502 Patent discussing Figures 5(a), 5(b), and 5(c), referring to sweeping "unwanted minority carriers" into the substrate and away from the active

circuitry at the surface. *Id.* at 19; Ex. 1001, 3:25–42. In Patent Owner’s further view, this discussion depicts the specification’s preferred embodiment. PO Sur-reply 22.

Patent Owner does not reconcile the substantial discrepancies with its prior prosecution statements and with the references it relied on during prosecution and its expert relied on in this proceeding. Nor does Patent Owner sufficiently explain how Petitioner’s position is incorrect because it excludes the inventor’s allegedly preferred embodiment,¹² particularly under the circumstance here, where Petitioner’s position aligns with the statement made during prosecution and with the references Patent Owner and its expert relied on.

Patent Owner’s attempt to support its position by reference to paragraph 36 of Dr. Glew’s Declaration and, in particular, footnote 3 of that paragraph, also is unavailing. Footnote 3 explains that, “[b]ecause the channel is formed by electrons with a negative charge, the MOSFET is referred to as an n-channel MOSFET, and the ‘minority carriers’ are holes.” Ex. 2057, ¶ 36 n.3. Dr. Glew, however, does not direct us to any textbook, technical disclosure, or other objective evidence to support this statement, and does not reconcile such testimony with the prior prosecution statements and references relied on during prosecution (noted above). *See, e.g., Xerox Corp. v. Bytemark, Inc.*, IPR2022-00624, Paper 9, at 15–17 (PTAB Aug. 24, 2022) (precedential) (holding an expert’s declaration testimony is entitled to little weight when it “is conclusory and unsupported, [and] adds little to the conclusory assertion for which it is offered to support”).

¹² The ’502 Patent states that, “[a]lthough the invention has been described with reference to specific embodiments, these descriptions are not meant to be construed in a limiting sense.” Ex. 1001, 4:4–6.

Our Trial Practice Guide cautions against crediting unsupported testimony:

The Board has broad discretion to assign weight to be accorded expert testimony. *Yorkey v. Diab*, 601 F.3d 1279, 1284 (Fed. Cir. 2010). However, the testimony must be based on sufficient facts and data. Fed. R. Evid. 702(b). “Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.” 37 C.F.R. § 42.65(a).

TPG 25–27. Because Dr. Glew’s statement in footnote 3 is conclusory, we assign it little or no weight. *See Xerox Corp.*, Paper 9 at 15 (“Dr. Jones does not cite to any additional supporting evidence or provide any technical reasoning to support his statement.”).

Furthermore, by asserting that the identification of majority and minority carriers is not based on dopant type, but rather on the charge carrier, Patent Owner overlooks the fact that the dopant type of the source and drain will determine what the charge carrier will be in the channel between them. Tr. 25:22–27:8. According to Patent Owner’s assertion, holes within the p-type doped region between the n-type doped source and drain in an NPN transistor are “minority carriers” in the p-type doped region even when the device is off and there is no channel in the p-type doped region carrying electrons from the n-type source to drain. Tr. 26:13–25, 27:2–6, 60:23–26. Additionally, Patent Owner’s identification of what the charge carriers are, for each type of transistor, is consistent with Petitioner’s assertion that the dopant type of the source and drain determines what the majority carriers will be—electrons in an n-type source, holes in a p-type source. PO Sur-reply 19–20 (showing annotated Fig. 5(b) with a channel formed between the n-type doped source and drain); Tr. 26:4–17. This

further supports Petitioner's position that dopant type generally controls the identification of majority and minority carriers.

Based on the foregoing and the plain meaning of the claim language, we find Patent Owner's arguments here unavailing. Rather, we find Petitioner has shown by a preponderance of the evidence that Onoda teaches or at least fairly suggests this feature of aiding the movement of "minority" carriers, as recited in claim 7.

6. Conclusion for Independent Claim 7

In view of the foregoing and notwithstanding Patent Owner's proffered objective indicia of nonobviousness discussed above, we are persuaded that Petitioner establishes, by a preponderance of the evidence, that claim 7 is unpatentable as obvious over Onoda. As discussed above, Patent Owner's objective indicia of nonobviousness are entitled to little weight (even considering nexus to exist), but even if we were to give them more weight, they still would not overcome Petitioner's strong showing of obviousness.

7. Dependent Claim 8

Petitioner presents additional arguments for obviousness of claim 8 based on Onoda. Pet. 40–43. In brief, Petitioner asserts that Onoda's second semiconductor layer 102 generates a first static unidirectional electric field that aids the movement of carriers, and that well region 105a generates a second unidirectional electric field that aids the movement of carriers. *Id.* at 41 (citing Ex. 1003 ¶¶ 161–62). Other than as explained above, Patent Owner does not dispute Petitioner's contention with respect to dependent claim 8. *See generally* PO Resp.; PO Sur-reply. As discussed above, we are persuaded that the cited evidence sufficiently supports Petitioner's

contentions that independent claim 7 would have been unpatentable as obvious over Onoda, and also are persuaded that the cited evidence sufficiently shows claim 8 to be likewise obvious. For the same reasons provided above for independent claim 7, and the reasons set forth in the Petition (Pet. 40–43), and notwithstanding Patent Owner’s proffered objective indicia of nonobviousness discussed above, we conclude that Petitioner has demonstrated by a preponderance of the evidence that dependent claim 8 would have been unpatentable as obvious over Onoda.

8. Conclusions on Obviousness over Onoda

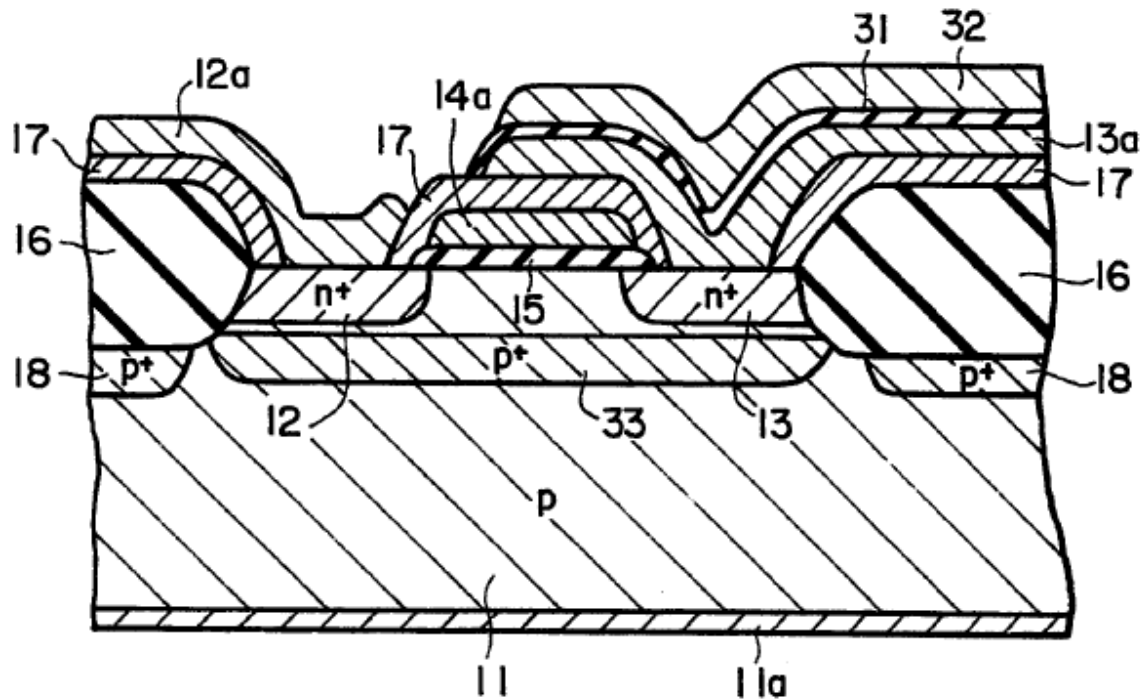
For the reasons set forth above, Petitioner demonstrates by a preponderance of the evidence that claims 7 and 8 would have been obvious in view of Onoda.

G. Obviousness over Onoda and Nishizawa

Petitioner contends claims 7 and 8 would have been obvious based on Onoda and Nishizawa (Petitioner’s Ground II). Pet. 43–49.

1. Nishizawa

Nishizawa “relates to a semiconductor device, and more particularly to a semiconductor device such as an insulation-gate transistor which allows a high packing density integration and effects a good holding of memory contents and which does not make soft errors induced by alpha-particle irradiation.” Ex. 1046, 1:21–29. Figure 16 of Nishizawa, reproduced below, is a diagrammatic sectional view showing the structures of a dynamic random access memory (“d-RAM”) cell. *Id.* at 8:25–26.



Nishizawa's Figure 16 depicts a p-type substrate 11 and a substrate electrode 11a. The cell includes n+ type regions 12, n+ type storage region 13, and p+ type buried region 33a. *Id.* at 17:40–47. Numerals 12a and 13a represent a source electrode and a drain electrode, respectively, which are made of a metal such as aluminum. *Id.* at 2:7–10. Numeral 15 represents a gate oxide film, 16 a field oxide film, and 17 a PSG film. *Id.* at 2:6–7. Numeral 18 represents a p+ type region which serves as a channel-stopper region for inhibiting the tendency of formation of a current channel between the field oxide film 16 and p type substrate 11. *Id.* at 2:10–13. Numeral 14a represents a gate electrode made of p+ type polysilicon, 13a an n-type polysilicon, 31 a thin oxide film, and 32 a metal electrode such as aluminum. *Id.* at 10:17–20.

2. Petitioner's Evidence Regarding Claim 7

According to Petitioner, "Ground II takes Nishizawa's teachings of minority carrier diffusion, and combines it with teachings from Onoda."

Pet. 44. Regarding motivation to combine Onoda with Nishizawa, Petitioner argues that a POSITA “would have been motivated to apply Nishizawa’s teachings of minority carrier diffusion based on a downward sloping dopant gradient (e.g., Nishizawa at 18:46–67) to Onoda’s teachings of a downward sloping dopant gradient (e.g., Onoda at FIG. 11).” *Id.* at 45 (citing Ex. 1003 ¶¶ 91–92). Petitioner asserts that a “POSITA would have been motivated to combine teachings of Nishizawa’s explicit discussion of concepts to the structures described in Onoda” and “would have seen such combinations as yielding expected results with known prior art elements and would have moreover found it obvious to try.” *Id.* at 45–46 (citing Ex. 1003 ¶¶ 92–93).

Petitioner relies on its Onoda-based Ground I arguments for limitations 7.1–7.4. *Id.* at 47. For limitation 7.5, Petitioner argues that “Nishizawa makes these elements explicit.” *Id.* at 47–49 (citing Ex. 1046, 18:9–18, 18:35–59, 19:1–9, 20:23–27, Fig. 16; Ex. 1003 ¶¶ 89, 96–97). For limitation 7.6, Petitioner argues that the “Onoda-Nishizawa combination makes clear that this well region in Onoda provides a second static unidirectional electric drift field” for the same reasons for limitation 7.5. *Id.* at 49 (citing Ex. 1003 ¶ 98).

3. Parties’ Arguments Regarding Claim 7

Patent Owner proffers the same arguments of general applicability related to Onoda, as discussed above in Section II.F.3. PO Resp. 1–4, 8–16; PO Sur-reply. With respect to Nishizawa in particular, Patent Owner contends that Nishizawa does not cure the deficiencies of Onoda regarding claim 1. *Id.* at 19 (citing Pet. 17–40).

First, Patent Owner contends, “Nishizawa does not expressly teach the claim limitations 7.5 and 7.6, because it does not teach moving carriers

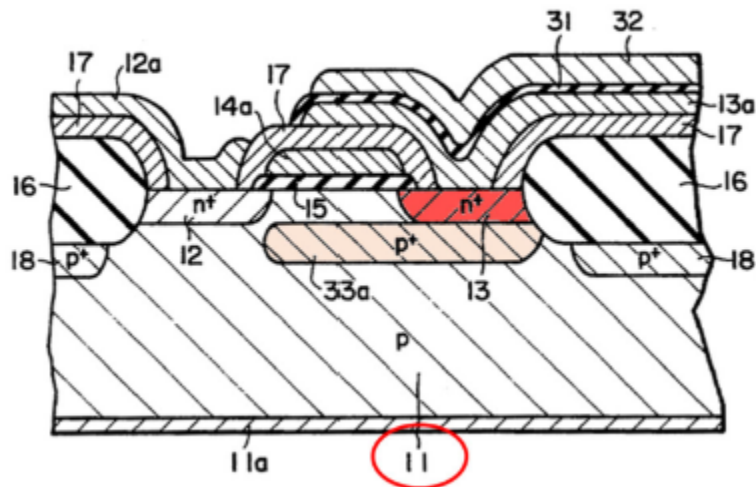
down from the surface layer.” PO Resp. 19–22. Patent Owner argues that “Nishizawa expressly says that it was *not* addressing carriers at the surface of the device, because alpha rays do not create carriers there in large enough quantities to be relevant,” and that “Nishizawa says carriers at the surface of the device can be ‘disregarded’ for its purposes and does not provide any teaching about how its gradient would affect carriers in the surface layer.” *Id.* at 19 (citing Ex. 1046, 19:21–34, 20:19–22). Patent Owner alleges that “Dr. Campbell confirms that the problem that Nishizawa was trying to solve is preventing carriers moving up from the substrate, not assisting in moving carriers at the surface downwards.” *Id.* at 20 (citing Ex. 2058, 43:8–20).

Second, Patent Owner contends “Petitioner cannot simply rely on a gradient in Nishizawa for the same reason it cannot rely on the mere gradient in Onoda.” PO Resp. 21–22. Patent Owner repeats its arguments about Petitioner failing to address “net force” acting on carriers. *See id.*

Petitioner responds by arguing that Patent Owner “misrepresents the Petition as relying on Nishizawa to teach the ‘surface,’ and aiding carrier movement therefrom to the ‘substrate,’” and “does not address the teachings of Nishizawa (column 18) Petitioner relied on.” Pet. Reply 17. Petitioner argues, “[i]nstead, [the Onoda-Nishizawa challenge] relies on Onoda’s device structure supplemented with *Nishizawa’s recognition that a layer with a downward dopant concentration creates a field that drifts electrons downward.*” *Id.* (citing Pet. 47–49) (emphasis added).

Petitioner also contends that Patent Owner’s arguments “contradict Nishizawa’s teachings of a graded dopant concentration to drift electrons downward.” Pet. Reply 18–20. Petitioner’s annotated version of Nishizawa’s Figure 35 (Pet. Reply 19) is reproduced below.

FIG. 35



Nishizawa's Figure 35 (annotated). Ex. 1046.

Referring to its annotated version of Nishizawa's Figure 35, Petitioner proffers how Nishizawa teaches this drifting of electrons:

Nishizawa teaches that a p+ type buried region 33a (tan)—with a substantially uniform dopant concentration—will prevent electrons generated in the p-type substrate 11 (red circle) from entering the p+ type buried region 33a. (EX1046, 18:4–6, 18:18–22.) A uniform concentration, however, does not solve the problem of electrons generated via alpha-rays in the p+ type buried region 33a from reaching the n+ type region 13 (red). (*Id.*, 18:35–43.) To solve this problem, Nishizawa teaches “it is only necessary to form an impurity concentration gradient in the p+ type buried region 33a in the direction toward the p type substrate 11.” (*Id.*, 18:46-50; EX1055 at 104:5–14 (stating that this layer is creating a force to push electrons downward), 100:2–18 (same); EX1054, ¶9)[.]

Pet. Reply 18. Additionally, Petitioner argues that “Nishizawa teaches that an alpha-ray ‘will not make many’ electrons near the surface, which means that some are created,” and thus, “PO’s arguments that Nishizawa does not create electrons at its surface are wrong.” *Id.* at 19.

For the same reasons set forth above in Section IV.F.5, we determine Patent Owner's arguments to be unavailing. That is, no particular magnitude or specific numerical value of slope must be shown in order to satisfy the claims. Petitioner sufficiently shows that the combination of Onoda and Nishizawa teaches the relative slope encompassed by the scope of independent claim 7, and particularly, a graded concentration of dopants to aid the movement of minority carriers as set forth in claim 7. Our reasoning above, presented in the context of the ground based on Onoda, applies with equal force here. *See, e.g., supra* § IV.F.5.

4. Dependent Claim 8

Petitioner does not provide separate arguments for claim 8 with respect to this ground. Pet. 43–49. Other than as explained above, Patent Owner does not dispute Petitioner's contention with respect to dependent claim 8. *See generally* PO Resp.; PO Sur-reply. Per our discussion in Section II.F.5 above, we determine that Petitioner demonstrates by a preponderance of the evidence that claim 8 is obvious over Onoda alone, and thus is also obvious over the combination of Onoda and Nishizawa.

5. Conclusions on Obviousness over Onoda and Nishizawa

For the reasons set forth above, Petitioner demonstrates by a preponderance of the evidence that claims 7 and 8 would have been obvious in view of Onoda and Nishizawa.

H. Obviousness over Kawagoe

Petitioner contends claims 7 and 8 would have been obvious based on Onoda and Nishizawa. Pet. 49–78.

1. *Kawagoe*

Kawagoe discloses a process for manufacturing a semiconductor integrated circuit device using an epitaxial wafer, i.e., a semiconductor wafer having a semiconductor single crystal epitaxial layer grown over a polished semiconductor substrate. Ex. 1007, 1:13–27, 2:31–35. According to Kawagoe, “[t]he epitaxial wafer is advantageous in that it is excellent in suppressing the soft errors and resisting to the latchup,” as well as “drastically reduc[ing] the defect density of the gate insulating film” of a semiconductor integrated device. *Id.* at 1:33–40.

Kawagoe discloses various “[r]epresentative” processes, including processes in which the single crystal (epitaxial) layer contains an impurity of the same type and in the same concentration as the substrate body. Ex. 1007, 2:55–3:9. According to Kawagoe, the impurity concentration of the substrate body can be made higher than that of epitaxial layer “so that the resistance of the semiconductor substrate body can be relatively lowered to improve the resistance to the latchup.” *Id.* at 4:1–8. Kawagoe discloses a process for manufacturing a semiconductor integrated circuit device including a step of forming a semiconductor region (well) extending below the epitaxial layer and having an impurity concentration that decreases with increasing depth below the epitaxial layer. *Id.* at 3:10–25. According to Kawagoe, the well can be used for forming a complementary Metal-Oxide-Semiconductor.Field-Effect-Transistor (“MOS.FET”) circuit. *Id.* at 3:32–38.

Kawagoe describes seven embodiments, including Embodiment 1 (Ex. 1007, 6:41–12:40, Figs. 1–8) and Embodiment 4 (*id.* at 14:46–19:64, Figs. 16–25). According to Embodiment 1, a semiconductor integrated circuit device includes semiconductor substrate body 2S, epitaxial layer 2E, and gettering layer 2G. *Id.* at 6:51–56, Fig. 1. Substrate body 2S and

epitaxial layer 2E are doped with p-type impurity in equal concentrations. *Id.* at 6:60–7:3, 10:51–55, 11:12–16. Embodiment 1 includes n-channel MOS.FET (“nMOS”) 4N and p-channel MOS.FET (“pMOS”) 4P, the latter being formed in n-well 6, which is doped with n-type impurity and extends below the epitaxial layer. *Id.* at 8:46–52, 9:32–40, 11:18–24, 11:43–50, Figs. 1, 5, 7.

According to Embodiment 4, substrate body 2S and epitaxial layer 2E are doped with p-type impurity, and the impurity concentration of substrate body 2S is higher than that of epitaxial layer 2E “to improve the resistance to the latchup.” Ex. 1007, 14:64–15:6, 15:13–17, 16:16–21, 19:59–63, Fig. 17. Embodiment 4 includes p-well 6 p formed with nMOS 4N and n-well 6 n formed with pMOS 4P. *Id.* at 15:26–40, 17:40–18:35, Figs. 16, 21–23. In Embodiment 4, the impurity concentration in p-well 6 p and n-well 6 n decreases with increasing depth below the epitaxial layer. *Id.* at 15:62–16:15, 17:55–61, Fig. 17. Kawagoe discloses that the concentration gradient reduces soft errors by attracting carriers (electrons) to the substrate and preventing them from entering the p-well. *Id.* at 16:2–11.

Petitioner relies primarily on Kawagoe Figures 16 and 17, which are reproduced below and illustrate Embodiment 4 and its properties.

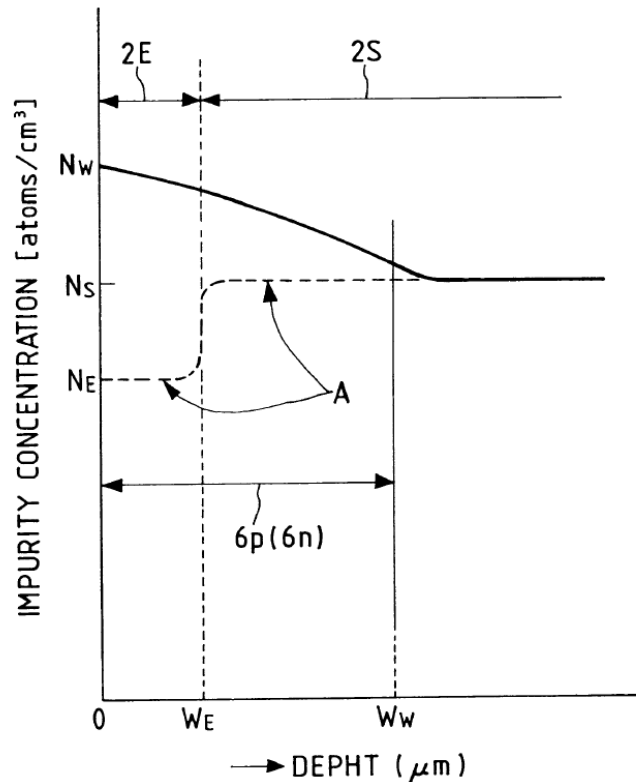


Figure 17 is a plot of impurity concentration as a function of depth in a semiconductor integrated circuit device, which shows “the p-well $6p$ and n-well $6n$ have their impurity concentrations gradually lowered in the depthwise direction from the principal surface (having an impurity concentration N_w) of the epitaxial layer $2E$.” Ex. 1007, 5:41–45, 15:62–16:40.

2. *Petitioner’s Evidence Regarding Claim 7*

Petitioner presents arguments and evidence in support of its contention that Kawagoe discloses or suggests each limitation of claim 7. Pet. 49–78.

Petitioner contends that the teachings of Kawagoe disclose or suggest a single drift layer having a graded concentration of dopants, similar to what is shown in Kawagoe Figures 16 and 17. Pet. 57–66. Similar to its arguments regarding Onoda discussed above, Petitioner contends that in

light of Patent Owner’s representations to the Patent Office, Kawagoe’s graded dopant concentration creates a static unidirectional electric drift field that aids the movement of minority carriers from the surface layer to the substrate. Pet. 66–76 (citing Ex. 1007, Fig. 17; Ex. 1003 ¶¶ 36, 117–126). Petitioner also notes that Kawagoe teaches that its graded dopant profile causes carriers to move to the substrate. Pet. 76 (citing Ex. 1007, 16:7–11).

3. Parties’ Arguments Regarding Claim 7

Patent Owner proffers the same arguments of general applicability related to Onoda, as discussed above at Section IV.F.3. PO Resp. 1–5, 8–16; PO Sur-reply. In particular, Patent Owner contends that Petitioner fails to demonstrate that Kawagoe teaches the “aid the movement of minority carriers” limitation. *Id.* at 22 (Ex. 2057 ¶¶ 47–55); *see id.* at 22–25 (discussing “magnitude of the slope of the gradient” and “net forces”).

Patent Owner argues that “[the ’502 Patent] and Kawagoe are talking about two very different things. Kawagoe’s teaching is about preventing carriers in the substrate from reaching the top of the device—just like Nishizawa,” whereas the Challenged Claims “require a graded dopant concentration to move carriers from the surface towards the bottom of the device” and “Kawagoe does not talk about that at all.” PO Resp. 22; *see id.* at 22–25. Patent Owner argues that the skilled artisan “would have understood that Kawagoe’s electrons that are prevented from entering the p-well are not created near the surface,” and that “Kawagoe says nothing about how any carriers at the surface are affected by its gradient.” *Id.* at 24.

Petitioner responds to Patent Owner’s arguments by arguing that Patent Owner’s arguments, which demand a depth of disclosure far beyond that of the ’502 Patent, “go against Kawagoe’s literal teachings.” Pet.

Reply 20. Petitioner contends that “[Patent Owner’s] argument that Kawagoe excludes α -rays generating electrons near the surface is wrong”:

Kawagoe teaches: “electrons produced by the α -ray are attracted to the substrate body 2S.” (EX1007, 16:7–9.) Parsing this language, electrons will be attracted to the substrate body 2S (yellow) which means that they exist outside the substrate body 2S (i.e., epitaxial layer 2E (green)) to be attracted to it (red arrow). Kawagoe, moreover, states that its purpose is to reduce the influence of α -rays by including a graded dopant concentration “from the surface of the epitaxial layer 2E, so that the influence to be caused by the carriers (or electrons) due to the α -ray is lowered.” (*Id.*, 16:2–7; EX1054, ¶12.)

Pet. Reply 20–21 (referring to Petitioner’s annotated version of Kawagoe’s Figure 16 (Pet. 21)).

Petitioner likewise contends that “[Patent Owner’s] argument that Kawagoe solely ‘*inhibits* carrier movement’ contradicts its literal text”:

[Patent Owner] illogically suggests that everything following the “and” in 16:7–11 (“prevented”) negates everything preceding it (“attracted”). Kawagoe contains literal teachings that “electrons produced by the α -ray are *attracted* to the substrate body 2S.” (EX1007, 16:7–9 (emphasis added); EX1055, at 122:1–123:7 (conceding that the gradient imparts a force).) This is enough to render obvious “aid the movement.”

Pet. Reply 21–22.

For the same reasons set forth above in Section IV.F.5, Patent Owner’s arguments are unavailing. That is, no particular magnitude or specific numerical value of slope must be shown in order to satisfy the claims. Petitioner sufficiently shows that Kawagoe teaches the relative slope encompassed by the scope of independent claim 7, and particularly, a graded concentration of dopants to aid the movement of minority carriers as set forth in claim 7. Our reasoning above, presented in the context of the

ground based on Onoda, applies with equal force here. *See, e.g., supra* § IV.F.5.

In addition, as to the parties' arguments concerning whether Kawagoe teaches aiding or inhibiting the movement of carriers, Petitioner persuasively argues that an electric field from a graded dopant concentration aids carrier movement in one direction and inhibits carrier movement in the opposite direction. Pet. Reply 21–22. Petitioner persuasively argues that that is exactly what Kawagoe says:

[Patent Owner] illogically suggests that everything following the “and” in [Ex. 1007,] 16:7–11 (“prevented”) negates everything preceding it (“attracted”). Kawagoe contains literal teachings that “electrons produced by the α -ray are *attracted* to the substrate body 2S [by that concentration gradient].”

Id. (citing Ex. 1007, 16:7–11; Ex. 1055, 122:1–123:7 (Dr. Glew’s testimony cited by Petitioner for “conceding that the gradient imparts a force.”)).

Patent Owner’s litigation position also supports our determination on this issue: “Electric drift fields are a well-known phenomenon that cause carriers to move, and [the skilled artisan] would have readily recognized that when a ‘static unidirectional electric drift field’ is present that it aids the movement of the minority carriers. If it isn’t present, then it doesn’t.”

Ex. 1030, 26 (Patent Owner’s Responsive Claim Construction Brief in a related litigation, *supra* § II.B). Patent Owner’s litigation position is also that “[t]he drift field points to one direction and charge carriers, when free to move, respond to the drift field by moving in *one direction or the other depending on their charge polarity.*” *Id.* at 27 (emphasis added). More particularly, Patent Owner contends in the related litigation:

Defendants argue that the claims do not recite a range of doping, a particular doping profile, or a particular result. But this is not

the test for indefiniteness. While the claims require that the graded dopants create an electric field that aids movement of the carriers, *they do not require a specific range of doping, a particular doping field, or a particular result, and this information is not necessary to understand the scope of Dr. Rao's invention.*

Id. at 28 (emphasis added). Thus, we find Patent Owner's "inhibiting carrier movement" line of arguments unavailing in this case and inconsistent with positions taken in related litigation.

4. *Dependent Claim 8*

Petitioner presents additional arguments for obviousness of claim 8 based on Kawagoe. Pet. 76–78. In brief, Petitioner asserts that Kawagoe's diffusion layer generates a first static unidirectional electric field that aids the movement of carriers and that well region 105a generates a second unidirectional electric field that aids the movement of carriers. *Id.* at 76 (citing Ex. 1003 ¶¶ 175–76). Other than as explained above, Patent Owner does not dispute Petitioner's contention with respect to dependent claim 8. *See generally* PO Resp.; PO Sur-reply. As discussed above, we are persuaded that the cited evidence sufficiently supports Petitioner's contentions that independent claim 7 would have been unpatentable as obvious over Kawagoe, and also are persuaded that the cited evidence sufficiently shows claim 8 to be likewise obvious. For the same reasons provided above for independent claim 7, and the reasons set forth in the Petition (Pet. 76–78), and notwithstanding Patent Owner's proffered objective indicia of nonobviousness discussed above, we conclude that Petitioner has demonstrated by a preponderance of the evidence that dependent claim 8 would have been unpatentable as obvious over Kawagoe.

5. *Conclusions on Obviousness over Kawagoe*

For the reasons set forth above, Petitioner demonstrates by a preponderance of the evidence that claims 7 and 8 would have been obvious in view of Kawagoe.

III. CONSTITUTIONALITY OF AIA

In less than two pages, Patent Owner argues “[t]he Board should dismiss this IPR, because the AIA violates the Supreme Court’s non-delegation doctrine and the Constitution.” PO Resp. 55–57. Patent Owner argues the Director improperly has authority to direct whether Patent Owner may receive legal process in the federal courts. *See id.* at 55–56 (“[T]he Director decides whether [Patent Owner] ‘should receive *certain legal processes* (those accompanying Article III proceedings)’ such as the protections of a jury trial and the clear and convincing evidence standard for patent validity.”). Patent Owner also takes issue with the Director’s “unreviewable discretion” to institute proceedings. *See id.* at 56–57 (“Since Congress provided no intelligible principle for the Director to apply in deciding whether to institute IPR proceedings, the statute governing these proceedings is unconstitutional and the Petition must be dismissed.”).

The Supreme Court has already upheld the constitutionality of IPRs. *Oil States Energy Servs., LLC v. Greene’s Energy Grp., LLC*, 584 U.S. 325, 344–45, (2018). The specific challenge raised by Patent Owner is also logically flawed. According to Patent Owner, IPRs are unconstitutional because “the Director decides whether [Patent Owner] ‘should receive *certain legal processes* (those accompanying Article III proceedings)’ such as the protections of a jury trial and the clear and convincing evidence standard for patent validity.” PO Resp. 56 (citing *Jarkesy v. Sec. & Exch.*

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Comm'n, 34 F.4th 446, 461 (5th Cir. 2022)). But this IPR did not foreclose Patent Owner from litigating its patents in an Article III court. Indeed, as discussed above in Section II.B, Patent Owner has initiated litigations against many defendant companies in many district court actions. Management of those Article III district court actions is controlled by federal judges, not the Director.

As to the challenged “unreviewable discretion” of the Director, we note that the Federal Circuit recently denied petitions for writ of mandamus challenging such discretion. *See, e.g., In re Motorola Sols., Inc.*, 159 F.4th 30, 36 (Fed. Cir. 2025) (“Congress committed institution decisions to the Director’s discretion” and “protected that exercise of discretion from judicial review by making such determinations ‘final and nonappealable.’” (citing 35 U.S.C. § 314(d); *SAS Inst., Inc. v. Iancu*, 584 U.S. 357, 366 (2018))); *see also United States v. Arthrex, Inc.*, 594 U.S. 1, 8–9 (2021) (“Congress has committed the decision to institute inter partes review to the Director’s unreviewable discretion.”).

IV. PETITIONER’S MOTION TO STRIKE AND OBJECTIONS TO DEMONSTRATIVES

With the Board’s authorization, Petitioner moves to strike portions of Patent Owner’s Sur-reply, which, Petitioner contends, “do not respond to arguments in Petitioner’s Reply.” Mot. Strike 1. Patent Owner opposes Petitioner’s Motion to Strike, arguing that “the alleged new arguments were properly presented in the Patent Owner’s earlier papers and are responsive to arguments presented in Petitioner’s Reply.” Mot. Strike Opp. 2. Petitioner did not file a reply.

For the same reasons, Petitioner also objected to certain demonstratives that Patent Owner submitted for the oral hearing. *See*

Paper 86, 1–2 (objecting to portions of Ex. 2088, slides 57–84, 100–111). Petitioner asserts that these slides include material that is “subject to Petitioner’s motion to strike (Paper 52).” *Id.* at 2.

For the reasons below, Petitioner’s Motion to Strike is *denied*, and thus, Petitioner’s objections to Patent Owner’s demonstratives are *moot*.

A. Onoda’s Figure 11

In the Motion to Strike, Petitioner asserts:

On pages 13-15 of the Patent Owner Sur-Reply, Patent Owner presents new argument and evidence supporting the argument [] for claim limitations Patent Owner did not argue against in its Response—that Onoda’s Figure 11 does not disclose the claimed graded concentration of dopants because the dopant concentration remains flat throughout the claimed surface layer.

Mot. Strike 1 (citing Ex. 1055, 91:22–92:4, 94:7–13, 178:1–18).

In the Opposition, Patent Owner argues that it “properly presented argument regarding Onoda’s ‘graded concentration’ and its effect (or lack thereof) on minority carriers in its PO Response.” Mot. Strike Opp. 2 (citing PO Resp. 1, 3, 9, 17, 28; Prelim. Resp. 13).

We agree with Patent Owner that Patent Owner’s Response provides a reasonable basis for the alleged new argument. The Petition relies on Onoda’s Figure 11 to assert that “Onoda’s semiconductor device has a dopant profile whose impurities decrease from the surface, *i.e.*, depth 0, to the substrate, *i.e.*, depth 5 um.” Pet. 31–32 (citing Ex. 1042 ¶¶ 46, 47, 48–50, 52). Patent Owner’s Response contends that “moving carriers ‘from the active circuitry at the surface’ is missing from the prior art.” PO Resp. 28. In the Reply, Petitioner again relies on Onoda’s Figure 11 to argue that “the graded dopant concentration is like a wheelchair ramp,” “aid[ing] the movement of someone in a wheelchair.” Pet. Reply 11–12

(citing Ex. 1030, 25, 27–28; Ex. 1042, Fig. 11) (internal quotation marks omitted). In the challenged portion of the Sur-reply, Patent Owner argues that “Onoda has a *uniform* concentration in the ‘surface layer’ (where the ‘active regions’ are located)” and Onoda’s “Figure 11 does *not* disclose a graded concentration that would actually aid carrier movement where it is required—*from* the ‘surface layer.’” PO Sur-reply 13–14. In view of the foregoing, we find that the challenged portion of Patent Owner’s Sur-reply was reasonably based on Patent Owner’s Response and was reasonably responsive to the arguments made by Petitioner in its Reply.

Since the subject argument presented in Patent Owner’s Sur-reply is deemed a legitimate reply to arguments introduced in the Petition and Petitioner’s Reply, we determine that any ambiguity as to whether the Sur-reply constitutes a new argument is eliminated. *Cf. Everstar Merch. Co. v. Willis Elec. Co.*, No. 2021-1882, 2022 WL 1089909, at *4 (Fed. Cir. Apr. 12, 2022) (citing *Apple Inc. v. Andrea Elecs. Corp.*, 949 F.3d 697, 706–707 (Fed. Cir. 2020)) (“Any ambiguity as to whether a reply constitutes a new argument is eliminated when the reply is a legitimate reply to arguments introduced in a patent owner’s response or the Board’s institution determination.”).

Accordingly, we deny Petitioner’s Motion to Strike as to the subject challenged portion of Patent Owner’s Sur-reply. Nonetheless, as discussed above in Section II.F, we have considered Patent Owner’s line of argument here and find it unavailing.

B. Minority Carrier

In the Motion to Strike, Petitioner asserts:

On pages 17-23 of the Patent Owner Sur-Reply, Patent Owner presents new argument and evidence supporting the argument—

for claim limitations Patent Owner did not argue against in its Response—that Petitioner failed to identify the claimed “minority carrier” in the prior art references under the interpretation that a minority carrier in the identified layer can only be a hole (as opposed to an electron).

Mot. Strike 1–2 (citing Ex. 2057 ¶ 36 n.3; Ex. 1055, 38:10–39:5, 69:20–70:6, 125:4–10, 126:15–18, 130:4–7, 133:17–18, 136:10–14, 138:25–139:3, 139:7–9, 149:4–17, 152:23–153:2, 154:25–155:12, 157:7–11, 158:13–18, 159:6–21, 176:17–22, 183:13–16, 188:8–14; Ex. 2085, 80:12–81:4, 95:11–17, 98:16–99:5, 109:12–19, 128:7–12, 129:10–18, 160:2–19).

In the Opposition, Patent Owner argues that it:

(a) properly presented argument regarding Petitioner’s mapping to the wrong “charge carrier” in Kawagoe’s and Onoda’s NMOS transistors in its PO Response *and* (b) this portion of the PO Sur-reply is responsive to new arguments and “evidence” offered in Petitioner’s Reply that attack Dr. Glew’s reliance on the claim specification in his deposition testimony and instead offer an interpretation (citing new exhibits) at odds with how the term is used in the patent.

Mot. Strike Opp. 3 (citing PO Resp. 5–6, 16–18, 22–25; Ex. 2057 ¶ 36 n.3; Pet. Reply 23–24).

We agree with Patent Owner that the challenged portion of its Sur-reply is responsive to Petitioner’s Reply and does not present a new argument. In the Reply, Petitioner argues that during the deposition, Patent Owner’s expert, Dr. Grew, “filibustered, and refused to answer simple questions, *e.g.*, . . . plainly what constitutes a minority carrier in a p-layer or an n-layer, even though that is clearly identified in standard references:

Minority carrier: ‘a hole in an n-type or an electron in a p-type semiconductor.’”

Pet. Reply 23–24 (citing Ex. 1055, 127:6–128:12, 129:19–130:7, 130:25–131:22, 133:19–138:11; Ex. 1056; Ex. 1057; Ex. 1058). In the challenged portion of the Sur-reply, Patent Owner argues that its “expert was not ‘evasive’ or ‘refused to answer [the] simple question[]’ of ‘what constitutes a minority carrier,’ as Petitioner wrongly suggests,” and “Dr. Glew’s deposition testimony was consistent that *holes* are minority carriers in an NMOS device.” PO Sur-reply 20 (citing Pet. Reply 23; Ex. 1055, 38:10–39:5, 125:4–10, 126:15–18, 133:17–18, 136:10–14, 138:25–139:3, 149:4–17, 152:23–153:2, 154:25–155:12, 157:7–11, 176:17–22, 188:8–14). In view of the foregoing, we find that the challenged portion of Patent Owner’s Sur-reply was reasonably responsive to the arguments made by Petitioner in its Reply regarding “what constitutes a minority carrier.”

Accordingly, we deny Petitioner’s Motion to Strike as to the subject challenged portion of Patent Owner’s Sur-reply. *Cf. Everstar Merch. Co.*, 2022 WL 1089909, at *4. Nonetheless, as discussed above in Section II.F, we have considered Patent Owner’s line of argument here and find it unavailing.

V. PATENT OWNER’S MOTION TO EXCLUDE EVIDENCE

Patent Owner moves to exclude Petitioner’s Exhibit 1059, titled “Understanding the p-n Junction,” for being irrelevant and lacking proper authentication. Mot. Exclude 2. Because we do not rely on Exhibit 1059 in this Decision, we dismiss this Motion to Exclude as moot. *See* TPG 51–53 (Motions to Exclude) (“In the Board’s experience, consideration of the objected-to evidence is often unnecessary to resolve the patentability of the challenged claims, and the motion to exclude is moot.”).

VI. CONCLUSION¹³

For the foregoing reasons, we determine that Petitioner demonstrates by a preponderance of the evidence that claims 7 and 8 are unpatentable. We deny Petitioner's Motion to Strike, and thus, Petitioner's objections to demonstratives are moot. We also dismiss as moot Patent Owner's Motion to Exclude. Our conclusions are summarized in the following table.

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claim(s) Shown Unpatentable	Claim(s) Not Shown Unpatentable
7, 8	103	Onoda	7, 8	
7, 8	103	Onoda, Nishizawa	7, 8	
7, 8	103	Kawagoe	7, 8	
Overall Outcome			7, 8	

VII. ORDER

For the foregoing reasons, it is:

ORDERED that Petitioner demonstrates by a preponderance of the evidence that claims 7 and 8 of the '502 Patent are unpatentable;

FURTHER ORDERED that Petitioner's Motion to Strike is *denied*;

FURTHER ORDERED that Patent Owner's Motion to Exclude is *dismissed as moot*;

¹³ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

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FURTHER ORDERED that, in view of the orders to seal, this Decision is being filed “Board and Parties Only”;

FURTHER ORDERED that, after conferring, the parties shall, within ten days of this Decision, jointly submit to the Board via email to Trials@uspto.gov, a version of this Decision to be filed in the public record, with any redactions proposed by either party; and

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

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