

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.

IPR2024-00468
Patent 8,421,195 B2

Before KRISTEN L. DROESCH, GRACE KARAFFA OBERMANN, and
STEPHEN E. BELISLE, *Administrative Patent Judges*.

BELISLE, *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

Monolithic Power Systems, Inc. (“Petitioner” or “MPS”) filed a Petition (Paper 1, “Pet.”) requesting an *inter partes* review of claims 1–3, 5, and 6 (“Challenged Claims”) of U.S. Patent No. 8,421,195 B2 (Ex. 1001, “the ’195 patent”). Greenthread, LLC (“Patent Owner” or “Greenthread”) filed a Preliminary Response. Paper 10 (“Prelim. Resp.”). With our authorization (Ex. 3002), Petitioner filed a Preliminary Reply (Paper 16, “Prelim. Reply”), and Patent Owner filed a Preliminary Sur-reply (Paper 17).

Upon review of the preliminary record, the Board instituted *inter partes* review, pursuant to 35 U.S.C. § 314, as to the Challenged Claims based on the challenges set forth in the Petition. Paper 23 (“Institution Decision” or “Inst. Dec.”). Patent Owner filed a Response (Paper 35, “Patent Owner’s Response” or “PO Resp.”); Petitioner filed a Reply to Patent Owner’s Response (Paper 42, “Petitioner’s Reply” or “Pet. Reply”); and Patent Owner filed a Sur-reply (Paper 47, “Patent Owner’s Sur-reply” or “PO Sur-reply”).

Petitioner filed a motion to strike portions of Patent Owner’s Sur-reply. Paper 52 (“Motion to Strike” or “Mot. Strike”). Patent Owner filed an opposition to the motion. Paper 55 (“Mot. Strike Opp.”).

Patent Owner filed a motion to exclude evidence. Paper 56 (“Motion to Exclude” or “Mot. Exclude”). Petitioner filed an opposition to the motion. Paper 60 (“Mot. Exclude Opp.”). Patent Owner filed a reply thereto. Paper 62 (“Mot. Exclude Reply”).

On September 10, 2025, the Board held an oral hearing in this case. A transcript of the hearing is included in the record. Paper 89 (“Tr.”).

For the reasons discussed below, we determine Petitioner has established by a preponderance of the evidence that claims 1–3, 5, and 6 of the ’195 patent are unpatentable. We also deny Petitioner’s Motion to Strike and dismiss as moot Patent Owner’s Motion to Exclude.

II. BACKGROUND

A. *Real Parties in Interest*

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

B. *Related Matters*

The parties identify several proceedings involving the ’195 patent as related matters, including *Greenthread, LLC v. Cirrus Logic, Inc.*, 1:23-cv-00369 (W.D. Tex.); *Greenthread, LLC v. OmniVision Techs., 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.); and *Greenthread, LLC v. Monolithic Power Systems, Inc.*, No. 1:23-cv-00579 (D. Del.). Pet. 1; Paper 4, 1–2.

The parties also identify the following proceedings as involving the ’195 patent, and no longer pending: *Greenthread, LLC v. Intel Corp., Dell Inc., and Dell Techs. Inc.*, 6:22-cv-00105 (W.D. Tex.); *Greenthread, LLC v. Intel Corp.*, 3:22-cv-02001 (D. Or.); *Greenthread, LLC v. Micron Tech., Inc.*, 1:23-cv-00333 (D. Del.); *Greenthread, LLC v. Western Digital Corp.*, 1:23-cv-00326 (D. Del.); and *Greenthread, LLC v. Samsung Electronics Co.*, 2:19-cv-00147 (E.D. Tex.). Pet. 1–2; Paper 4, 4.

The parties identify four *inter partes* review proceedings involving the ’195 patent, namely: IPR2020-00289; IPR2023-00548; IPR2024-00017; and

IPR2024-00266. Pet. 2–3; Paper 4, 2, 4–5. Petitioner also identifies IPR2024-00771. Paper 65, 2.

C. The '195 Patent

The '195 patent, titled “Semiconductor Devices with Graded Dopant Regions,” issued on April 16, 2013. Ex. 1001, codes (45), (54).¹ The '195 patent “relates to all semiconductor devices and systems.” *Id.* at 1:13–14. According to the '195 patent, in bipolar junction transistors, “[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.” *Id.* at 1:32–51. This improvement has not been implemented in “most semiconductor devices, including various power MOSFETs . . . [and] IGBT[s],”² which “still use a uniformly doped drift epitaxial region in the base.” *Id.* at 1:36–40. The invention of the '195 patent implements graded dopant concentration in these devices, which causes “[t]wo important performance enhancements.” *Id.* at 2:49–3:9. These include sweeping electrons “from source to drain rapidly” and simultaneously causing holes to “be recombined closer to the n+ buffer layer,” which “can improve t(on) and t(off) in the same device.” *Id.* at 3:10–13.

¹ The '195 patent is a division of application No. 10/934,915, filed on Sept. 3, 2004, now abandoned. Ex. 1001, code (62).

² “MOSFET” refers to “Metal-Oxide-Semiconductor Field-Effect Transistor.” “IGBT” refers to “Insulated Gated Base Transistors.” Ex. 1001, 1:39.

Figure 1 of the '195 patent is reproduced below.

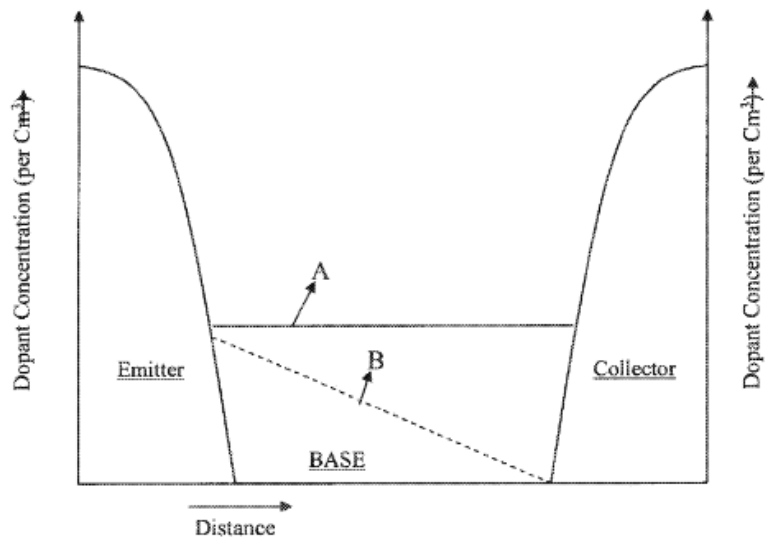


Figure 1 is labeled “Prior Art” and “illustrates the relative doping profiles of emitter, base, and collector, for the two most popular bipolar junction transistors: namely, A—uniform base, and B—graded base.” Ex. 1001, 2:13–15.

Figure 3(a) of the '195 patent is reproduced below.

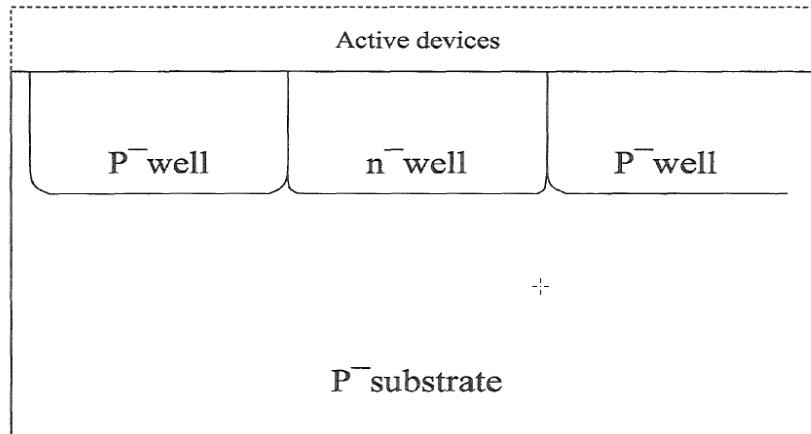


Figure 3(a) is labeled “Prior art” and shows a cross-sectional view of a “commonly used CMOS silicon substrate with two wells (one n-well in

which p-channel transistors are subsequently fabricated, and, one p-well in which n-channel transistors are subsequently fabricated).” Ex. 1001, 2:18–23, Fig. 3(a).

Figure 5(a) of the ’195 patent is reproduced below.

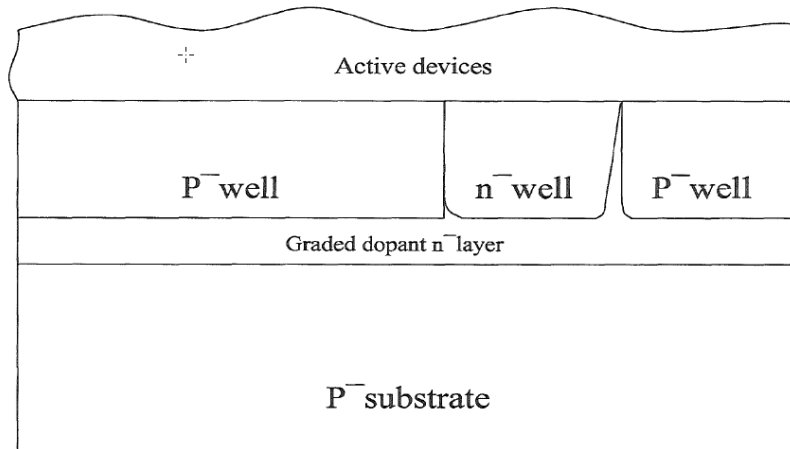


Figure 5(a) illustrates a cross section of “a [C]MOS silicon substrate with two wells, and, an underlying layer using embodiments of the invention.” Ex. 1001, 2:27–29. According to the ’195 patent, “[s]purious minority carriers can be generated by clock switching in digital VSLI logic and memory IC’S,” and “[t]hese 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 3:17–25. The ’195 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 3:30–33. In particular, “[i]n a preferred embodiment, the subterranean n-layer has a graded [dopant] concentration to sweep the minority carriers deep into the substrate.” *Id.* at 3:33–35.

D. Illustrative Claim

Of the Challenged Claims, claim 1 is independent and is reproduced below.

1. A CMOS Semiconductor device comprising:
 - [1.1] a surface layer;
 - [1.2] a substrate;
 - [1.3] an active region including a source and a drain, disposed on one surface of said surface layer;
 - [1.4] a single drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate,
 - [1.5] said drift layer further having a first static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate; and
 - [1.6] at least one well region disposed in said single drift layer, said well region having a graded concentration of dopants and a second static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate.

Ex. 1001, 4:13–29 (bracketed designations added by Petitioner (*see* Pet. 19–34)).

E. Asserted Challenges to Patentability

Petitioner asserts that claims 1–3, 5, and 6 are unpatentable based on the following challenges:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–3, 5, 6	103(a) ³	Onoda ⁴
1–3, 5, 6	103(a)	Onoda, Nishizawa ⁵
1–3, 5, 6	103(a)	Kawagoe ⁶

Pet. 4–5. Petitioner relies on the Declarations of Dr. Stephen Campbell. Exs. 1003, 1054. Patent Owner relies on the Declaration of Dr. Alexander Glew. Ex. 2057.

III. PRIVACY – TIMELINESS OF PETITION UNDER 35 U.S.C. § 315(b)

Patent Owner argues that the Petition (and thus this proceeding) should be dismissed because it is untimely. *See, e.g.*, PO Resp. 31–52. In particular, Patent Owner argues Petitioner is *in privity* with Intel Corp.

³ The Leahy-Smith America Invents Act, Pub. L. No. 112–29, 125 Stat. 284 (2011) (“AIA”), included revisions to 35 U.S.C. §§ 102 and 103 that became effective after the effective filing date of the challenged claims. *See* Ex. 1001, codes (22), (60). Therefore, we apply the pre-AIA versions of 35 U.S.C. §§ 102 and 103(a).

⁴ Japanese Unexamined Patent Application Publication No. H8-279598, published Oct. 22, 1996 (Ex. 1043). We cite to a certified translation. Ex. 1042.

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

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

(“Intel”) or [REDACTED]⁷ (collectively “Licensees”), who Patent Owner asserts are time-barred under 35 U.S.C. § 315(b) and licensed under the ’195 patent. *Id.* at 33–52; *see id.* at 39 (“[T]he Petition is untimely if Petitioner is in privity with Intel or [REDACTED]”).

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” (emphasis added). The question of whether Petitioner is time-barred under § 315(b) is part of the determination of whether to institute an *inter partes* review. *See Thryv, Inc. v. Click-to-Call Techs., LP*, 590 U.S. 45, 54 (2020) (“§ 315(b) expressly governs institution and nothing more”). We explain below why we address this issue of timeliness at this juncture.

Prior to institution, Patent Owner’s arguments regarding privity were based on several theories, including that Petitioner and Licensees “are ‘preceding and succeeding owners of’ the licensed and/or infringing products,” that Petitioner makes and supplies accused goods to Licensees, 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 serves as an “agent” of Licensees by exercising their “have made” rights under the license. *See generally* Prelim. Resp. 25–30.

⁷ Patent Owner argues that “[REDACTED] was a real-party-in-interest to the litigation,” and Intel and [REDACTED] were served with a complaint alleging infringement of the ’195 patent on February 1, 2022. PO Resp. 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 to show that Petitioner and Intel or [REDACTED] were, in fact, privies, based on any of its theories regarding privity. Inst. Dec. 30–36. We incorporate that analysis here, and reconsider Patent Owner's contention to the extent it is warranted by subsequent, post-hearing argument and evidence. *Id.* at 27–36; *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 written decision] 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 its petition was timely, i.e., Petitioner is not in privity with Intel or [REDACTED] 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 alleged denial of its opportunity to show that Petitioner's assertions as to its relationships with Licensees are untrue or incomplete, but this issue is now moot. *See* PO Resp. 54–55 (citing *Goldberg v. Kelly*, 397 U.S. 254, 269 (1970); *Greene v. McElroy*, 360 U.S. 474, 496 (1959); Paper 23, 32). Since Patent Owner's Response, we have

allowed and ordered additional discovery concerning privity, as discussed below.

On February 11, 2025, the Board entered Final Written Decisions in certain related Greenthread proceedings. IPR2023-01242, Paper 84; IPR2023-01243, Paper 82; IPR2023-01244, Paper 83 (collectively referred to as “first wave” cases). Patent Owner sought Director Review of these decisions, and on April 24, 2025, Patent Owner’s Requests for Director Review were granted, and the Final Written Decisions were vacated and remanded to the Board for further proceedings. IPR2023-01242, Paper 94; IPR2023-01243, Paper 91; IPR2023-01244, Paper 91 (“Director Review Order” or “Dir. Rev. Order”).

The Director Review Order remands “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:

The 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 privy 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 also 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 Review Order on various Greenthread proceedings, including this one. Paper 63, 2. During the teleconference, the Board inquired as to whether Patent Owner would request additional

discovery in this case pursuant to the Director Review Order. *Id.* Patent Owner indicated that it believes the Board made a legal error in its Institution Decision 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.

Nonetheless, in this proceeding (as well as in IPR2024-00469, IPR2024-00470, IPR2024-00550, IPR2024-00551, IPR2024-00552, and IPR2024-00553), 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) [D]ocuments [including]:

[i. s]ales agreements between Petitioner and Intel for the Intel Accused Products;⁸ and

[ii. i]ndemnification agreements between Petitioner and Intel for the Intel Accused Products. *See* IPR[2024-0]1242, [Dir. Rev. Order] 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’s Decision; (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

⁸ The “products accused” consist of “the ‘Intel Accused Products’” listed on pages 4–8 of Exhibit 2005, namely, the Intel “products accused of practicing the challenged claims” in Patent Owner’s prior litigation.

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, “Summers Decl.”). Patent Owner cross-examined Ms. Summers and filed a deposition transcript for Ms. Summers (Ex. 2087). Patent Owner subsequently filed a Patent Owner’s Supplemental Brief Concerning Board-Ordered Discovery (“PO Privity Resp.,” Paper 74); Petitioner filed Petitioner’s Responsive Supplemental Brief (“Pet. Privity Reply,” Paper 77); and Patent Owner filed Patent Owner’s Reply Supplemental Brief Concerning Board-Ordered Discovery (“PO Privity Sur-reply,” Paper 78). The parties subsequently agreed that oral argument on September 10, 2025, would cover all relevant issues including the privity dispute, and that there need not be a separate hearing on privity. Paper 79.

We note that 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).

Based on the complete record before us, we determine that Petitioner is not in privity with Intel,⁹ and the Petition is not time-barred under 35 U.S.C. § 315(b). We turn first to a review of § 315(b) and privity, followed by the parties’ arguments and evidence and our analysis thereof.

⁹ We address [REDACTED] (and [REDACTED]) below in Section III.E.5.

A. Statutory Bar as Nonparty Preclusion

The one-year statutory bar of § 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.*, 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, § 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, therefore, looks to these doctrines of preclusion in interpreting the language of § 315(b). *See Consolidated Trial Practice Guide* (“Practice Guide” or “CTPG”) ¹⁰ at I.D.1.

Like the common-law preclusion doctrines, the preclusive effect of § 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

¹⁰ Available at www.uspto.gov/patents/ptab/trial-practice-guide.

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.¹¹

(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 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.*

¹¹ For clarity, we omit internal quotation marks and citations throughout the list of categories enumerated in *Taylor*, and add emphasis on certain key phrases, and generally cleaned up the quotations.

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.

B. Privity Law

“[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 also Aspex Eyewear, Inc. v. Zenzi 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 § 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 (internal quotations omitted). Our Practice Guide reflects this, noting that control is a “common consideration” in the privity inquiry. CTPG at I.D.1.

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*, IPR2014-00746, Paper 22 at 10 (PTAB Nov. 24, 2014) (inquiring into whether party exercised, or could have exercised, control over District Court action); *see also* CTPG at I.D.1 (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. CTPG at I.D.1. Nor should the preceding discussion be understood to mandate that all § 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 the 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:

[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. at 895.

C. Petitioner’s Privity Arguments

Petitioner contends that “[t]here is no privity between Petitioner and Intel,” and “[a]ccordingly, the Petition[] [is] not time-barred.” Pet. Privity Reply 15. Petitioner submits:

- (1) it has no sales or indemnity agreements with Intel,
- (2) it does not supply any products to Intel,

- (3) it had no knowledge of the lawsuit between Patent Owner and Intel (“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.

Id.; *see, e.g., id.* at 5 (“There are **no sales agreements** at all between Petitioner and Intel, much less any sales agreements between Petitioner and Intel that would cover any of the Intel Accused Products.” (quoting Summers Decl. ¶ 6)), 13 (“Patent Owner has never claimed, much less produced **any** evidence, that **any** of the IAPs contains **any** of Petitioner’s products.”); Ex. 2086 (Summers Decl.) ¶¶ 6–8, 10, 12. Petitioner argues, “Neither the Federal Circuit nor the P.T.A.B. has ever held a petitioner barred by privity in such circumstances.” *Id.* at 1.

Moreover, Petitioner takes issue with Patent Owner’s attempts to paint Petitioner’s privity discovery efforts as insufficient or non-compliant with the Director Review Order: “Faced with the fact that there is **absolutely no evidence** supporting a privity argument, and substantial evidence ‘proving the negative,’ Patent Owner now has the temerity to argue that Petitioner’s response to the Board’s order, while ‘superficially [] compliant with the Board’s order,’ was somehow deficient.” *Id.* at 2.

D. Patent Owner’s Privity Arguments

Patent Owner argues that it “has presented far more than ‘some evidence’ that time-barred parties, including Intel, should have been named as [an] 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 Additional Discovery in the Wave 1 (*onsemi*) IPRs.” *Id.* at 2 n.2 (citing IPR2023-01242, Paper 108 at 2–5).

With respect to *Monolithic Power Systems* (MPS), Patent Owner argues 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, Ms. Summers, “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 testimony of Petitioner’s corporate witness, Ms. Summers, as to MPS’s product relationship with Intel, lacks persuasive value. *See* PO Privity Resp. 1–14; PO Privity Sur-reply 1–11. In particular, Patent Owner contends—through attorney argument—that Ms. Summers’ *testimony* “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 Ms. Summers 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.

E. Analysis of the Parties’ Privity Arguments

1. Overview

Our analysis below concerns whether Petitioner is in privity with Intel. *See* Dir. Rev. Order 2–3. *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 evidence* to support its argument that a particular third party should be named a real party in interest.” *Id.* “[T]here 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, contrary to its repeated protestations and flowery attorney rhetoric (*see, e.g.*, Papers 74, 78), 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 we were to agree that Patent Owner produced sufficient evidence to put the relationship between Petitioner and Intel into dispute, the evidence adduced during trial sufficiently supports Petitioner’s contention and, in particular, satisfies

Petitioner's burden to show it is not time barred under § 315(b), as discussed below.

The evidence adduced during trial does not support a finding that the relationship between Petitioner and Intel is sufficiently close such 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 Intel 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 Intel litigation.

Petitioner submits 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. Privy Reply 1 (emphasis added). According to Petitioner's witness, Ms. Summers, "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. Ms. Summers also testifies 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 IPRs¹², 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 '195 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 WesternGeco*, 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. It is worth emphasizing here that, contrary to Patent Owner's position (*see, e.g.,* PO Privy 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 remanded to 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).

¹² Patent Owner does not argue that Intel is an RPI to the present *inter partes* review proceeding and there is no evidence in the record to support this.

We are not persuaded that Petitioner is in privity with Intel because the *evidence* of record sufficiently 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. *See, e.g.*, Ex. 2086 ¶¶ 6–8, 10, 12 (testimony of Petitioner’s corporate witness, Ms. Summers); *see also* Pet. Privity Reply 1.

Notwithstanding Patent Owner’s arguments, addressed below, we find persuasive Petitioner’s witness testimony that Petitioner itself lacks any connection to the Intel Accused Products. Specifically, Ms. 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 that Ms. Summers’ experience supports that she had sufficient knowledge to attest to her testimony, including 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 argues that Patent Owner’s attack against Ms. 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 argues that, in response to Patent Owner’s attack of Ms. 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.” Pet. Privity Reply 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 unrebutted 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).

The Board did not order a particular style or depth of investigation by Petitioner (*see* Disc. Order 9), 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 our Discovery Order required Petitioner’s Declarant to contact Intel to determine whether IAPs (Intel Accused Products) include components sold or manufactured by Petitioner’s distributors, manufacturing fabrication plants, or corporate affiliates as part of their investigation. *See, e.g.*, PO Privy Resp. 10–13. The Declaration of Ms. Summers, produced by Petitioner, is sufficient to comply with our Discovery Order. Moreover, as to the Director’s mandate that we resolve, on the full record, whether “Petitioner was a supplier of” products that were “accused of practicing the challenged claims” in the Intel litigation (Dir. Rev. Order 3), we find that the answer is no.

2. *Indirect Sales and Third-Party Resellers*

Patent Owner alleges 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 “Ms. 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 Privy 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 related to products accused of practicing the challenged claims. Disc. Order 9. 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 to the market. Disc. Order 6–7. Regardless, such evidence would be insufficient to establish privity between Petitioner and Intel based on control of, or an opportunity to control, the relevant litigation.

3. *Incorporation of Petitioner’s Products into Non-Accused Intel Products*

To the extent Patent Owner argues that Petitioner’s investigation is lacking for failure to determine any potential use of Petitioner’s 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.” (citation omitted)). 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.

4. *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, 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 supply 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 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 Elecs. Co., Ltd., v. Netlist, Inc.*, IPR2022-00615, Paper 64 at 22–26 (same).

5. *Summary*

Based on the complete record before us, we determine Patent Owner did not produce at least “some evidence” to support its argument that Intel should be named as a privy so as to have 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). Even if we were to agree that

Patent Owner met its burden of production, we determine that the totality of evidence adduced during trial sufficiently supports Petitioner’s contention and, in particular, satisfies Petitioner’s burden to show it is not time barred under § 315(b).

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, 2–5). The Director Review Order made clear that the Board’s earlier Final Written Decisions in related proceedings (i.e., IPR2023-01242, IPR2023-01243, IPR2023-01244) 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. Regardless, [REDACTED] is not alleged to be an RPI or privy of Petitioner; rather, [REDACTED] is alleged to be an RPI of an alleged RPI—[REDACTED]—a degree of separation that is not contemplated by the clear language of the statute. *See* PO Resp. 31–33.

We turn next to Petitioner’s challenges to the patentability of the Challenged Claims. In doing so, we note that the Supreme Court in *Thryv* emphasized that “Congress prioritized *patentability* over § 315(b)’s timeliness requirement,” and by providing for *inter partes* review, “sought to weed out bad patent claims efficiently.” *Thryv*, 590 U.S. at 55 (emphasis added). The Court also emphasized that the statutory scheme of *inter partes* review “consistently elevat[es] resolution of patentability above a petitioner’s compliance with § 315(b) . . . , thereby preserving the Board’s

adjudication of the merits.” *Id.*; *see id.* (“[B]ecause a patent owner would need to appeal on § 315(b) untimeliness grounds only if she could not prevail on patentability, § 315(b) appeals would operate to save bad patent claims.”).

IV. PATENTABILITY

A. *Applicable Law*

“In an [*inter partes* review], the petitioner has 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) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)) (emphasis added). This burden never shifts to Patent Owner. *See 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 subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). 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 skill in the art; and (4) when of record, objective evidence of obviousness or nonobviousness, i.e., secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). Secondary considerations may

include the following: “commercial success, long felt but unsolved needs, failure of others, etc.” *Id.* The totality of the evidence submitted may show that the challenged claims would not have been obvious to one of ordinary skill in the art. *In re Piasecki*, 745 F.2d 1468, 1471–72 (Fed. Cir. 1984). When evaluating a combination of teachings, we must also “determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

The Supreme Court has made clear that we apply “an expansive and flexible approach” to the question of obviousness. *KSR*, 550 U.S. at 415. Whether a patent claiming a combination of prior art elements would have been obvious is determined by whether the improvement is more than the predictable use of prior art elements according to their established functions. *Id.* at 417. To reach this conclusion, however, requires more than a mere showing that the prior art includes separate references covering each separate limitation in a claim under examination. *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.* “To satisfy its burden of proving obviousness, a petitioner cannot employ mere conclusory statements. The petitioner must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016).

We analyze the challenges presented in the Petition in accordance with the above-stated principles.

B. Level of Ordinary Skill in the Art

In determining the level of ordinary skill in the art, various factors may be considered, 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:

[a] person of ordinary skill in the art (“POSITA”) of the subject matter of the ’195 Patent 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. Additional education might compensate for a deficiency in experience, and vice-versa.

Pet. 5 (citing Ex. 1003 ¶ 17).

Patent Owner argues:

[a] person of ordinary skill in the art (POSITA) in the technology field of the Challenged Patent would be a person with 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. Additional education in a relevant field or industry experience may compensate for a deficit in one of the other aspects of the requirements stated above.

PO Resp. 6–7 (citing Ex. 2057 ¶¶ 17–18).

Petitioner's and Patent Owner's definitions for the level of ordinary skill in the art are substantially similar. In light of the record before us, we adopt Petitioner's proposal regarding the level of ordinary skill in the art. Based on our review of the '195 patent and the prior art of record, we determine that the definition offered by Petitioner comports with the qualifications a person would have needed to understand and implement the teachings of the '195 patent and the prior art. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (explaining that specific findings regarding ordinary skill level are not required "where the prior art itself reflects an appropriate level and a need for testimony is not shown") (quoting *Litton Indus. Prods., Inc. v. Solid State Sys. Corp.*, 755 F.2d 158, 163 (Fed. Cir. 1985)). Patent Owner does not argue, nor do we determine, that the outcome of our Decision depends on which party's definition is selected.

C. Claim Construction

We construe claims "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), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent." 37 C.F.R. § 42.100(b); *see also Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc).

In this context, claim terms "are generally given their ordinary and customary meaning" as understood by a person of ordinary skill in the art in question at the time of the invention. *Phillips*, 415 F.3d at 1312–13;

see CCS Fitness, Inc. v. Brunswick Corp., 288 F.3d 1359, 1366 (Fed. Cir. 2002) (There is “a ‘heavy presumption’ that a claim term carries its ordinary and customary meaning.”). “In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence.” *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17). Extrinsic evidence is “less significant than the intrinsic record in determining ‘the legally operative meaning of claim language.’” *Phillips*, 415 F.3d at 1317.

Neither party proposes any claim terms for *express* construction. Pet. 5; PO Resp. 7 (citing Ex. 2057 ¶¶ 20–25, 46). However, Patent Owner implicitly construes “graded concentration of dopants” and “aid the movement of minority carriers” to require carrier movement, and Petitioner disagrees. PO Resp. 7–16; Pet. Reply 1–16. We address the implicit constructions below in Section IV.E.5 (analysis of Onoda challenge).

After considering the arguments and information presented during trial, we agree that we do not need to otherwise expressly construe any terms in order to resolve the dispute between the parties. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”)).

D. Objective Indicia of Nonobviousness

Patent Owner alleges that a license agreement with RPX Corp. (“RPX”) (“the RPX license”) that covers the patent family including the ’195 patent is evidence supporting the objective indicia of nonobviousness. PO Resp. 26–29. 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 nonobviousness. *Id.* at 4, 26–28 (citing Ex. 2072). 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 ‘from active circuitry at the surface’ further down into the device.” *Id.* at 28 (citing, *inter alia*, the ’195 patent).

Objective indicia of nonobviousness, or secondary considerations of nonobviousness, 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 nonobviousness 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 claimed invention, such that the objective evidence should be considered in determining nonobviousness. *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.* 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 to just one patent family. *Id.* at 29. Patent Owner asserts that licenses taken without threat of litigation are especially probative of non-obviousness, and contends even litigation-inspired licenses have some probative value. PO Resp. 26, 29 (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.

Petitioner argues in its Reply that licenses that result from settlement require affirmative evidence of nexus because it is often cheaper to take a license than to defend infringement suits, and one license was negotiated 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 [*i.e.*, nexus] 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] or [REDACTED] were motivated by ‘avoid[ing] litigation costs.’” *Id.* (quoting Pet. Reply 24–25) (citing Ex. 2078 ¶ 4).

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. 11/622,496, which issued as the '195 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. 27–28 (quoting Ex. 1001, 3:30–33). We have considered the RPX license to [REDACTED] and Patent Owner’s argument.

Even though Patent Owner has established a nexus between its licensing revenue and the Challenged Claims of the '195 patent, we determine 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 (citing Ex. 1001, 3:30–33). 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 '195 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)). Nevertheless, for our analysis and decision in this case, we consider the RPX license to sufficiently support nexus.

Even so, 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 the expense for [REDACTED] to litigate the challenged patents “would have been trivial” (*id.* at 27), 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. RPX further markets itself as working on behalf of its clients to prevent potential litigation and associated legal defense costs and settlements. *Id.* at 3.

In view of this evidence, Patent Owner’s argument that [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 Electronics* 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. Indeed, there is no evidence of record that the average per-company license fee identified by Patent Owner is more (let alone significantly so) than a given company's total external costs (e.g., fees for attorneys, experts, consultants, document review, depositions, and trial) and internal costs (e.g., employee time and business disruption) for multi-year trial and appeal over the Challenged Patents.

As to Patent Owner's argument that the license evidences nonobviousness 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 are 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 ground based on Onoda (a single reference obviousness ground), the strength of the ground based on Kawagoe (a single reference obviousness ground), and the strength of the ground 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.”).

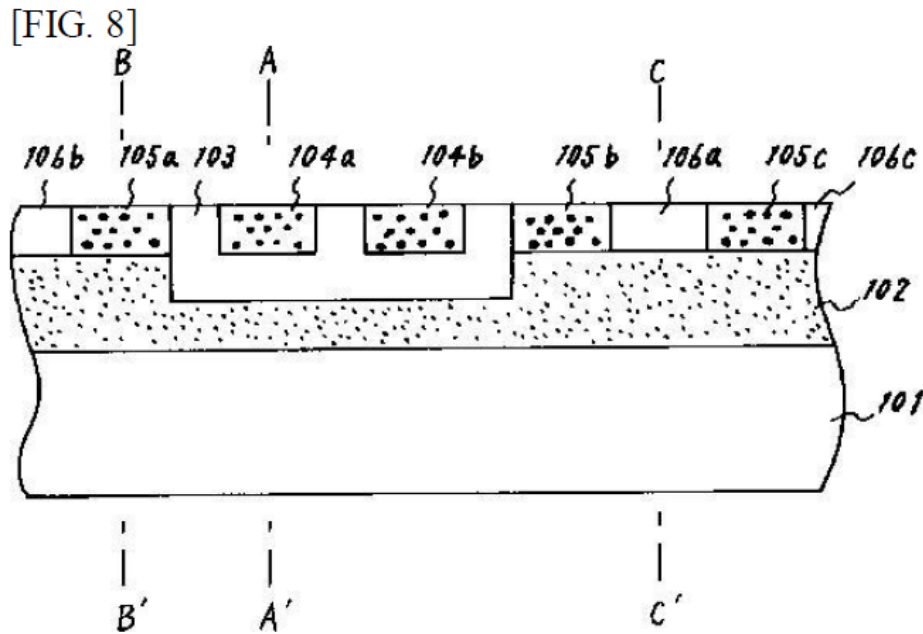
E. Obviousness of Claims 1–3, 5, and 6 over Onoda

Petitioner contends claims 1–3, 5, and 6 would have been obvious over Onoda. Pet. 4, 17–46; Pet. Reply 2–17. Patent Owner opposes Petitioner’s contentions. PO Resp. 8–18; PO Sur-reply 2–6, 12–23. For the reasons expressed below, and based on the complete record before us, we determine that Petitioner has demonstrated by a preponderance of the evidence that claims 1–3, 5, and 6 are unpatentable as obvious over Onoda. *See Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1361 (Fed. Cir. 2016) (“[A] patent can be obvious in light of a single prior art reference if it would have been obvious to modify that reference to arrive at the patented invention.”); *Therasense, Inc. v. Becton, Dickinson & Co.*, 593 F.3d 1325,

1336–37 (Fed. Cir. 2010) (affirming an invalidity judgment where claims were held obvious over a single reference). We turn first to an overview of Onoda.

1. Overview of 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 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.* ¶ 46) 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 Contentions for Independent Claim 1

Petitioner argues that Onoda teaches or at least fairly suggests the limitations of claim 1. Pet. 17–40.

a) *Preamble: “[a] CMOS Semiconductor device”*

Petitioner contends that “[t]o the extent the preamble is limiting, Onoda discloses a CMOS semiconductor device.” Pet. 19. Petitioner provides evidence to support its argument that the skilled artisan would have understood Onoda’s teachings “to be directed to CMOS-based fabrication technologies and [the skilled artisan] would have thusly understood Onoda to disclose CMOS.” *Id.* at 19–20 (citing Ex. 1042 ¶¶ 52, 44, 45, 6, Figs. 2, 3, claim 2; Ex. 1003 ¶¶ 55–57).

Patent Owner does not contest Petitioner’s evidence pertaining to the preamble of claim 1. Based on the complete record developed during trial, we determine that Petitioner demonstrates by a preponderance of the evidence that Onoda teaches the subject matter of the preamble of claim 1. As such, we need not and do not determine whether the preamble of claim 1 is limiting.

b) *[1.1] “a surface layer”*

Petitioner argues that Onoda teaches a surface layer. Pet. 20–22. Petitioner directs us to evidence that shows sufficiently that Onoda discloses a surface layer similar to that in the ’195 patent. Ex. 1003 ¶¶ 58–59; Ex. 1042 ¶¶ 29, 43, 44, Fig. 3; *see also* Ex. 1030, 6, 13. In particular, Figure 5(b) of the ’195 patent and Onoda’s Figure 3 show substantially similar structures, and Patent Owner’s district court claim construction brief identified the relevant structure in Figure 5(b) of the ’195 patent as a surface layer. Ex. 1030, 6, 12–13.

Patent Owner does not contest Petitioner’s evidence pertaining to limitation [1.1]. Based on the complete record developed during trial,

we determine that Petitioner establishes by a preponderance of the evidence that Onoda teaches this limitation of claim 1.

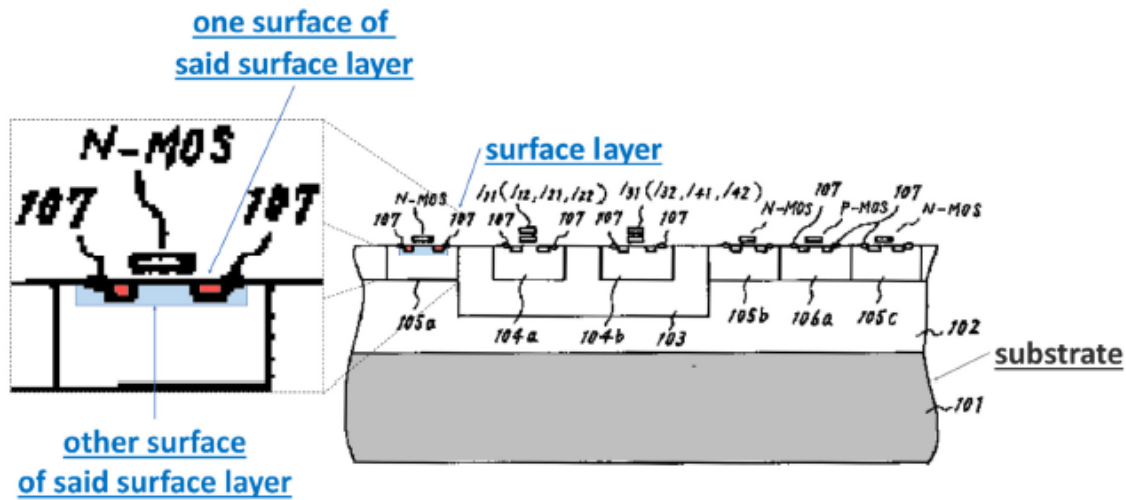
c) [1.2] “a substrate”

Petitioner argues that “Onoda discloses ‘a semiconductor substrate 100’ on which the flash memory is formed.” Pet. 23–24. Onoda discloses “semiconductor substrate 100” and, within it, element 101, a “first semiconductor substrate layer made from heavily-doped . . . p-type silicon substrate.” *Id.* (citing Ex. 1042 ¶ 41, Fig. 3; Ex. 1030, 6, 15).

Patent Owner does not contest Petitioner’s evidence pertaining to limitation [1.2]. Based on the complete record developed during trial, we determine that Petitioner establishes by a preponderance of the evidence that Onoda teaches this limitation of claim 1.

d) [1.3] “an active region including a source and a drain, disposed on one surface of said surface layer”

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.” Pet. 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 source and drain configurations of Onoda to disclose an active region. Ex. 1001, Fig. 5(b); Ex. 1030, 4–5, 7, 11; Ex. 1003 ¶¶ 62–65; Ex. 1008, 299; Ex. 1008B, Fig. 5–1.



Petitioner's annotated version of Onoda's Figure 3.
Pet. 25.

Patent Owner does not contest Petitioner's evidence pertaining to limitation [1.3]. Based on the complete record developed during trial, we determine that Petitioner establishes by a preponderance of the evidence that Onoda teaches this limitation of claim 1.

- e) [1.4] “a single drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate”

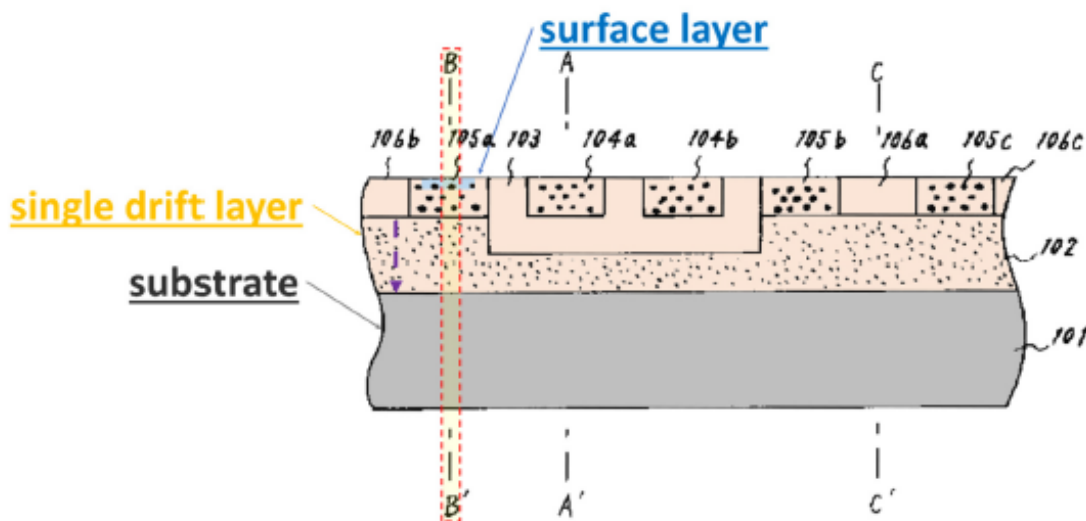
Petitioner argues that Onoda discloses this element. Pet. 28–32 (citing Ex. 1003 ¶¶ 66–71). Onoda discloses second semiconductor layer 102 between the bottom surface of the surface layer and the substrate that is substantially similar to the single drift layer of the '195 patent. *Compare* Ex. 1042, Figs. 3, 5, 8, 10–12, ¶¶ 41–51, *with* Ex. 1001, Fig. 5(b); Ex. 1030, 7. 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.

Patent Owner does not contest Petitioner’s evidence pertaining to limitation [1.4]. Based on the complete record developed during trial, we determine that Petitioner establishes by a preponderance of the evidence that Onoda teaches this limitation of claim 1.

- f) [1.5] “said drift layer further having a first static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate”

Petitioner argues that Onoda discloses this element. Pet. 32–34. Petitioner provides an annotated version of Onoda’s Figure 8, reproduced below.



Petitioner’s annotated version of Onoda’s Figure 8.
Pet. 33.

As shown in the annotated version of Onoda’s Figure 8, Petitioner depicts the “single drift layer” in tan, the “first static unidirectional electric drift field (purple arrow)” and the “surface layer” in blue, and maps the claimed

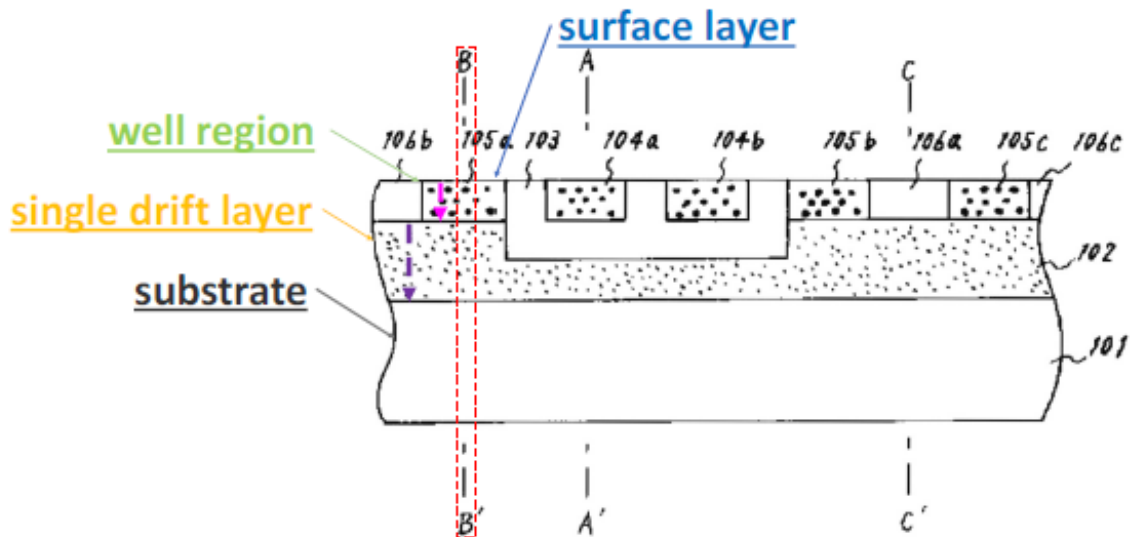
substrate (gray) to Onoda’s first semiconductor layer 101. Pet. 32–33; Ex. 1042, Figs. 8, 11, ¶¶ 47–50; Ex. 1003 ¶¶ 72–74. Petitioner relies on the file history and cited references to argue that the presence of a “a downward-sloping graded-dopant concentration creates an inherent built-in unidirectional electric drift field to aid the movement of minority carriers.” Pet. 33–34 (citing Ex. 1003 ¶ 73; Pet. § VII.B).

Patent Owner disputes Petitioner’s evidence pertaining to limitation [1.5]. We resolve the dispute about this limitation in our analysis below.

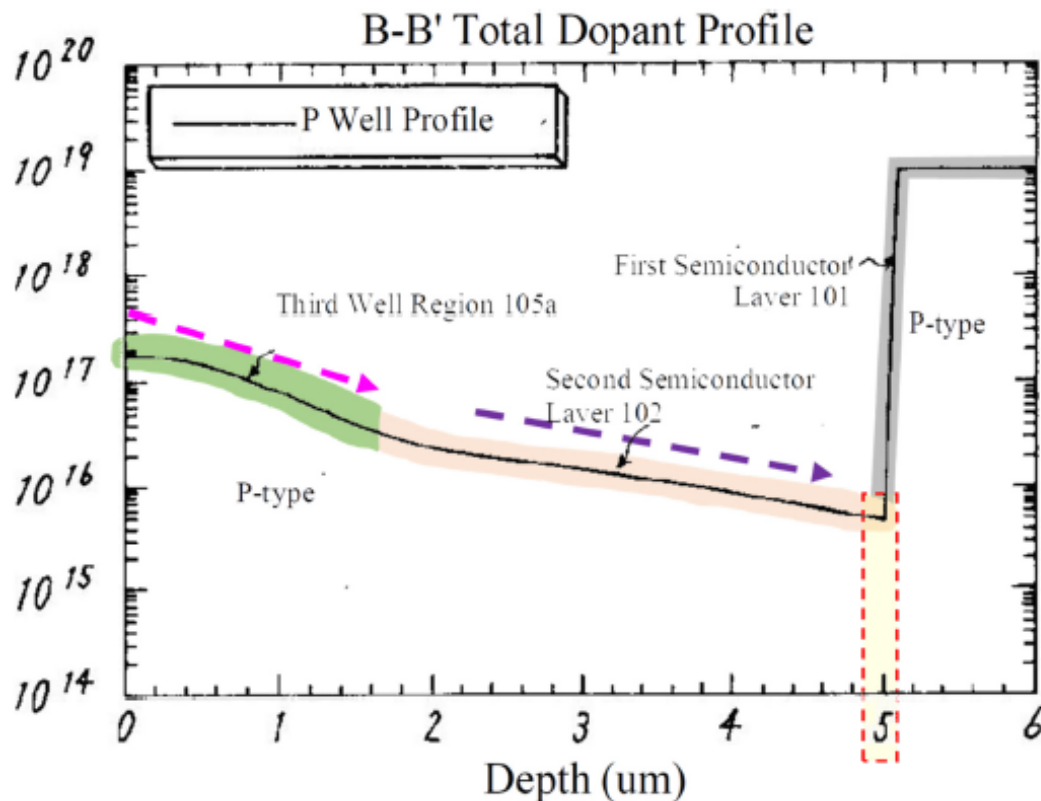
g) *[1.6] “at least one well region disposed in said single drift layer, said well region having a graded concentration of dopants and a second static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate”*

Petitioner argues that Onoda discloses this element. Pet. 34–40. Petitioner argues that Onoda’s single drift layer with a well region disposed within it satisfies this claim limitation. *Id.* at 34–36 (citing Ex. 1042, Fig. 3 (annotated to depict well region in green), ¶¶ 42, 44, 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 1.5. *Id.* at 36–38 (citing Ex. 1042, Figs. 8, 11 (annotated to depict second static unidirectional electric drift field, i.e. “the drift of electrons (minority carriers) in the p-well” with a pink arrow) (reproduced below), ¶ 52; Ex. 1003 ¶¶ 75–83; Pet. § VII.B). Relying on Patent Owner’s arguments during prosecution, Petitioner contends that the presence of this

dopant profile over the well region creates a “second static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate.” Pet. 38–40; Ex. 1003 ¶¶ 72–83; Ex. 1042, Figs. 8, 13, ¶ 48.



Petitioner's annotated version of Onoda's Figure 8.
Pet. 37.



Petitioner's annotated version of Onoda's
Figure 11. Pet. 37.

Patent Owner disputes Petitioner's evidence pertaining to limitation [1.6]. We resolve the dispute about this limitation in our analysis below.

3. *Patent Owner's Arguments*

Patent Owner disputes Petitioner's showing with respect to Onoda. *See generally* PO Resp.; PO Sur-reply.

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.* 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.*; *see id.* at 9 (“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 (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. 8 (alteration in original) (quoting Ex. 1003 ¶ 32). 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.* at 9 (alteration in original) (quoting Ex. 2058, 34:1–14). 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.” PO Resp. 9–10 (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. 11–12 (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 14 (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. 1030, 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 (quoting Pet. 9–10) (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, 290). “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 15–16.

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. 13.

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 13–14 (alteration in original) (emphasis in original).

d) Asserted Art 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. 16–17 (quoting Pet. 32–33). 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 (citing Ex. 2058, 34:15–36:19; 39:8–12); *see id.* at 18 (Patent Owner alleging other factors affect carrier movement).

Patent Owner argues Nishizawa does not cure the deficiencies alleged by Patent Owner. *See* PO Resp. 19–22. In particular, Patent Owner argues, “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, 20:19–22). Patent Owner argues, “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).

As for Kawagoe, Patent Owner argues that the Petition “fails to demonstrate that Kawagoe teaches the ‘aid the movement of minority carriers’ claim limitation.” PO Resp. 22 (citing Ex. 2057 ¶¶ 47–55). Patent Owner argues that the ’195 patent and Kawagoe “are talking about two very different things.” *Id.*

Kawagoe’s teaching is about preventing carriers in the substrate from reaching the top of the device—just like Nishizawa. [Patent Owner’s] claims require a graded dopant concentration to move carriers from the surface towards the bottom of the device. Kawagoe does not talk about that at all.

Id. In particular, Patent Owner argues that “Kawagoe’s teaching is about preventing carriers from moving up, not about moving them down,” and alleges this is “confirmed” by Dr. Campbell. *Id.* at 23 (citing Ex. 2058, 43:8–20).

4. *Petitioner’s Reply Arguments*

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.

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.* (emphasis added) (citing Ex. 2074, 39).

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) Asserted Art Teaches or At Least Fairly Suggests Aiding the Movement of Minority Carriers

Petitioner argues that “[e]ach of Onoda, Nishizawa, and Kawagoe teach a graded dopant concentration that generates a field” to aid movement of minority carriers. Pet. Reply 11 (citing Ex. 1042, Fig. 11; Ex. 1046, 18:35–58; Ex. 1007, 16:2–9); *see id.* at 17–22. 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 ’195 Patent’s specification”:

[Patent Owner] argues that the relative slope in the ’195 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. *Analysis of the Parties' Arguments*

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 1 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 '195 patent. 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. 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.”¹³ *Id.* at 289–290.

We determine that the statements made by the Applicant (Patent Owner) during prosecution of the ’195 parent patent were clear,

¹³ 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.

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.

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 1 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 1 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 1, 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. 13. 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 13–14 (alterations in original) (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 1 of the ’195 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 (“[T]he 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. 16–18 (“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 (and the other asserted arts’) 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 supra* § IV.E.2, E.4; Pet. Reply 17.

d) “Minority” Carriers

Claim 1 recites, in part, “aid[ing] the movement of *minority* carriers.” Ex. 1001, 4:18–24 (emphasis added). The parties dispute whether Onoda (and the other asserted art) 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)); *see also* 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, 11; *see also* Pet. 30–31 (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.6; 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.5; Ex. 1003 ¶¶ 72–74.

Patent Owner responds that, in the context of the ’195 patent, dopant type in a particular region is not the basis for characterizing majority and minority carriers. 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.’” PO Sur-reply 18 (quoting Ex. 1001, 1:43–44; 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.3); *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 [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 [dopant] concentration.

Ex. 1002, 254 (emphasis added); *see also* Ex. 1001, 2:42–46 (“[T]he 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.6; 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 1.

Additional evidence of record supports Petitioner's view that majority and minority carriers are identified based on dopant type. For example, Jastrzebski (U.S. Patent No. 4,481,522 (Ex. 1010)), 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. 10–11; Ex. 1002, 290.

In another example, Chen (a textbook reference that 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 '195 patent regarding MOS devices being “majority carrier devices for conduction.” PO Sur-reply 18; Ex. 1001, 1:43–44.

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 '195 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, 3:30–35. 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,¹⁴ 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*

¹⁴ The '195 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, 3:62–64.

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”).

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).

CTPG at I.G. 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 1.

e) *Aiding Movement of Minority Carriers “From”
the Surface Layer*

Claim 1 recites, in part, “a graded concentration of dopants extending between said surface layer and said substrate . . . to aid the movement of minority carriers from said surface layer to said substrate.” Ex. 1001, 4:18–24 (emphases added).

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. 30–31 (citing Ex. 1042 ¶¶ 46, 47, 48–50, 52). As discussed above, Patent Owner’s Response contends that “moving carriers ‘from the active circuitry at the surface’ is missing from the prior art”—*but this language also is missing from claim 1*. 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 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; *but see* Tr. 27:11–28:23 (Petitioner’s counsel arguing, “Patent Owner’s expert himself said that he would expect the surface layer to extend to .5 [or] .6 microns which is clearly, by the time you hit .5 or .6 microns on this Figure [11] . . . for Onoda, the slope has already started to go downward.”).

As discussed above, claim 1 requires “a graded concentration of dopants extending *between* said surface layer and said substrate . . . to aid the movement of minority carriers *from* said surface layer to said substrate,” *but not* a graded concentration of dopants *through* said surface layer. Based on 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 “from” the surface layer to the substrate (i.e., *between* the surface layer and the substrate), as recited in claim 1.

6. *Conclusion for Independent Claim 1*

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 1 is unpatentable as obvious over Onoda. As discussed above in

Section IV.D, 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 Claims 2, 3, 5, and 6*

Claims 2, 3, 5, and 6 depend directly from independent claim 1. Ex. 1001, 4:30–39. The Petition provides a detailed assessment of these claims, with references to the Petition's analysis of claim 1, disclosures in Onoda, and the declaration testimony of Dr. Campbell. Pet. 40–46. Patent Owner does not contend that the limitations in claims 2, 3, 5, and 6 are absent in Onoda, and therefore, has waived such arguments.¹⁵ *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 1 would have been unpatentable as obvious over Onoda, and also are persuaded that the cited evidence sufficiently shows claims 2, 3, 5, and 6 likewise obvious. For the same reasons provided above for independent claim 1, and the reasons set forth in the Petition (Pet. 40–46), and notwithstanding Patent Owner's proffered objective indicia of nonobviousness discussed above, we conclude that Petitioner has

¹⁵ *In re NuVasive, Inc.*, 842 F.3d 1376, 1379–82 (Fed. Cir. 2016) (holding that patent owner waived arguments on an issue that were not raised in its response after institution); *see also Papst Licensing GmbH & Co. KG v. Samsung Elecs. Am., Inc.*, 924 F.3d 1243, 1250 (Fed. Cir. 2019) (holding patent owner forfeited argument for patentability not presented to the Board); *Bradium Techs. LLC v. Iancu*, 923 F.3d 1032, 1048 (Fed. Cir. 2019) (explaining that arguments not presented to the Board are waived).

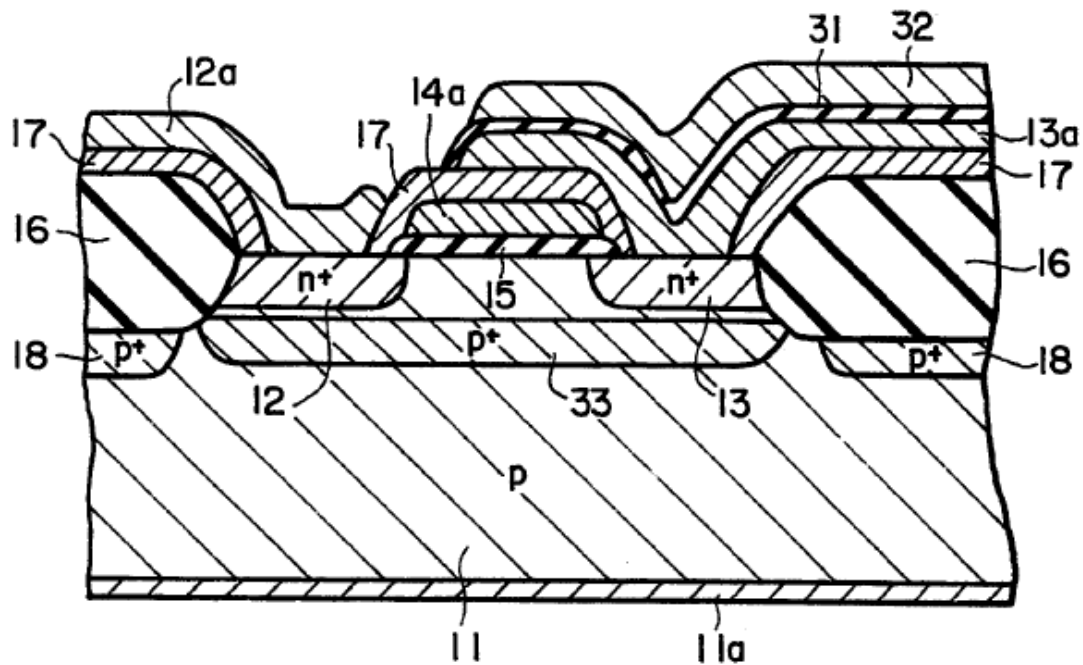
demonstrated by a preponderance of the evidence that dependent claims 2, 3, 5, and 6 would have been unpatentable as obvious over Onoda.

F. Obviousness of Claims 1–3, 5, and 6 over the Combination of Onoda and Nishizawa

Petitioner contends claims 1–3, 5, and 6 would have been obvious over the combination of Onoda and Nishizawa. Pet. 5, 46–53; Pet. Reply 2–20. Patent Owner opposes Petitioner’s contentions. PO Resp. 8–22; PO Sur-reply 2–6, 12–23. For the reasons expressed below, and based on the complete record before us, we determine that Petitioner has demonstrated by a preponderance of the evidence that claims 1–3, 5, and 6 are unpatentable as obvious over the combination of Onoda and Nishizawa. We turn first to an overview of Nishizawa.

1. Overview of 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.

Ex. 1046, 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.

Nishizawa discloses “a semiconductor device whose memory retention characteristic will not [degrade] even where the channel length of

this device is shortened,” including one “suitable for use as a CMOS.”
Ex. 1046, 7:40–43, 7:61–63.

2. *Petitioner’s Contentions for Independent Claim 1*

According to Petitioner, “Ground II takes Nishizawa’s teachings of CMOS and minority carrier diffusion, and combines it with teachings from Onoda.” Pet. 47. Petitioner argues that the combination of Onoda and Nishizawa teaches or at least fairly suggests the limitations of claim 1 and that a person of ordinary skill in the art would have had a rational reason to combine the teachings of Onoda and Nishizawa with a reasonable expectation of success in doing so. Pet. 46–52.

a) *Reason to Combine Onoda and Nishizawa*

Petitioner argues that the skilled artisan “would have been motivated to apply Nishizawa’s teachings of minority carrier diffusion based on a downward sloping dopant gradient to Onoda’s teachings of a downward sloping dopant gradient.” Pet. 48 (citing Ex. 1046, 18:46–67, 18:10–18; Ex. 1042, Fig. 11; Ex. 1003 ¶¶ 91–92). Petitioner argues “Nishizawa makes explicit the concept of an ‘electric field’ that migrates minority carriers to a substrate based on a dopant gradient, whereas Onoda describes the structure (e.g., the downward dopant gradient), which [the skilled artisan] would have understood necessarily creates the specified physical conditions.” *Id.* (citing Ex. 1046, 18:10–18; Ex. 1042, Fig. 11).

Petitioner asserts that the skilled artisan “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.” Pet. 48–49 (citing Ex. 1003 ¶¶ 92–93).

Patent Owner does not dispute Petitioner’s rationale for combining Onoda and Nishizawa or expectation of success in doing so. *See* PO Resp. 19–22; *see generally* PO Resp. Based on Petitioner’s persuasive contentions and evidence, we determine that Petitioner shows sufficiently that a person of ordinary skill in the art would have had a rational reason to combine the teachings of Nishizawa with those of Onoda with a reasonable expectation of success in doing so.

b) Preamble and Limitations [1.1]–[1.4]

Petitioner relies on its Onoda-based Ground I arguments for the preamble and limitations [1.1]–[1.4]. Pet. 49–50.

Patent Owner does not contest Petitioner’s evidence pertaining to these limitations of claim 1. Based on the complete record developed during trial, we determine that Petitioner establishes by a preponderance of the evidence that the combination of Onoda and Nishizawa teaches these limitations of claim 1. *See supra* §§ IV.E.2.a–2.e, IV.E.5.

c) [1.5] “said drift layer further having a first static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate”

Petitioner contends that, “[a]s described in Ground I, Element [1.5], Onoda discloses a drift layer whose dopant concentration has a downward gradient which [the skilled artisan] would have recognized as providing a built-in, static, unidirectional electric drift field to aid the movement of minority carriers from the surface layer to the substrate.” Pet. 50. Petitioner

argues that “Nishizawa makes these elements explicit.” *Id.* at 50–52 (citing Ex. 1046, 19:1–9, 18:9–18, 18:35–67, Fig. 16; Ex. 1003 ¶¶ 96–97).

Patent Owner disputes Petitioner’s evidence pertaining to limitation [1.5]. We resolve the dispute about this limitation in our analysis below.

- d) [1.6] “*at least one well region disposed in said single drift layer, said well region having a graded concentration of dopants and a second static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate*”

Petitioner argues that “Onoda discloses a drift layer having a well-region with an impurity dopant profile with a downward gradient,” and the “Onoda-Nishizawa combination makes clear that this well region in Onoda provides a second static unidirectional electric drift field to aid the movement of minority carriers” for the same reasons given for limitation [1.5]. Pet. 52 (citing Ex. 1003 ¶ 98).

Patent Owner disputes Petitioner’s evidence pertaining to limitation [1.6]. We resolve the dispute about this limitation in our analysis below.

3. *Patent Owner’s Arguments*

Patent Owner proffers the same arguments of general applicability related to Onoda, as discussed above in Section IV.E.3. PO Resp. 1–4, 8–16. 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 1.5 and 1.6, because it does not teach moving carriers down from the surface layer.” PO Resp. 19–21. 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.*

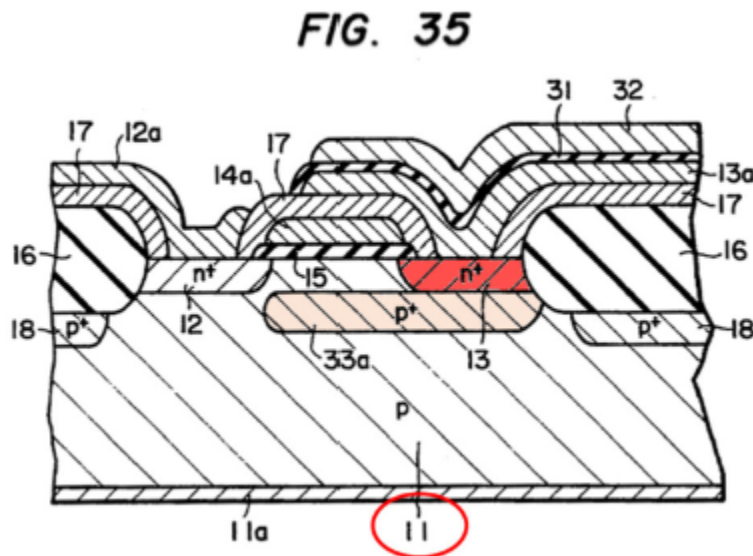
4. *Petitioner’s Reply Arguments*

Petitioner responds to Patent Owner’s arguments with respect to the combination of Onoda and Nishizawa. *See generally* Pet. Reply.

Petitioner argues 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. (emphasis added) (citing Pet. 52).

Petitioner 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.



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.

5. *Analysis of the Parties’ Arguments*

For the same reasons set forth above in Section IV.E.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 the combination of Onoda and Nishizawa teaches the relative slope encompassed by the scope of independent claim 1, and particularly, a graded concentration of dopants to aid the movement of minority carriers as set forth in claim 1. Our reasoning above, presented in the context of the ground based on Onoda, applies with equal force here. *See, e.g., supra* § IV.E.5.

6. *Conclusion for Independent Claim 1*

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 1 is unpatentable as obvious over the combination of Onoda and Nishizawa. As discussed above in Section IV.D, 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 Claims 2, 3, 5, and 6*

Claims 2, 3, 5, and 6 depend directly from independent claim 1. Ex. 1001, 4:30–39. Petitioner contends that “the Onoda-Nishizawa combination renders them obvious for the same reason” as independent claim 1 and those reasons set forth above for the Onoda-only challenge. Pet. 49. Patent Owner does not contend that the limitations in claims 2, 3, 5, and 6 are absent in the Onoda-Nishizawa combination, and therefore, has waived such arguments. *See, e.g., In re NuVasive*, 842 F.3d at 1379–82; *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 1 would have been unpatentable as obvious over the combination of Onoda and Nishizawa, and also are persuaded that the cited evidence sufficiently shows claims 2, 3, 5, and 6 likewise obvious. For the same reasons provided above for independent claim 1, and the reasons set forth in the Petition (Pet. 40–46), 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 claims 2, 3, 5, and 6 would have been unpatentable as obvious over the combination of Onoda and Nishizawa.

G. *Obviousness of Claims 1–3, 5, and 6 over Kawagoe*

Petitioner contends claims 1–3, 5, and 6 would have been obvious over Kawagoe. Pet. 5, 53–87; Pet. Reply 2–16, 20–22. Patent Owner opposes Petitioner’s contentions. PO Resp. 8–16, 22–25; PO Sur-reply 2–12, 17–23. For the reasons expressed below, and based on the complete record before us, we determine that Petitioner has demonstrated by

a preponderance of the evidence that claims 1–3, 5, and 6 are unpatentable as obvious over Kawagoe. We turn first to an overview of Kawagoe.

1. Overview of 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,”¹⁶ 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 “representative” 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

¹⁶ Petitioner submits Exhibit 1013 (Wang and Agrawal, *Single Event Upset: An Embedded Tutorial*, 21st Int’l Conf. on VLSI Design, 429–434, IEEE 2008), which explains that “soft errors” are “random and not related to permanent hardware faults” and “[t]heir causes may be internal (e.g., interconnect coupling) or external (e.g., cosmic radiation),” including “[a]lpha particles [that] are emitted when the nucleus of an unstable isotope decays to a lower energy state.” Ex. 1013, Abstr., 430.

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). Figure 1, reproduced below, depicts the device of Embodiment 1.

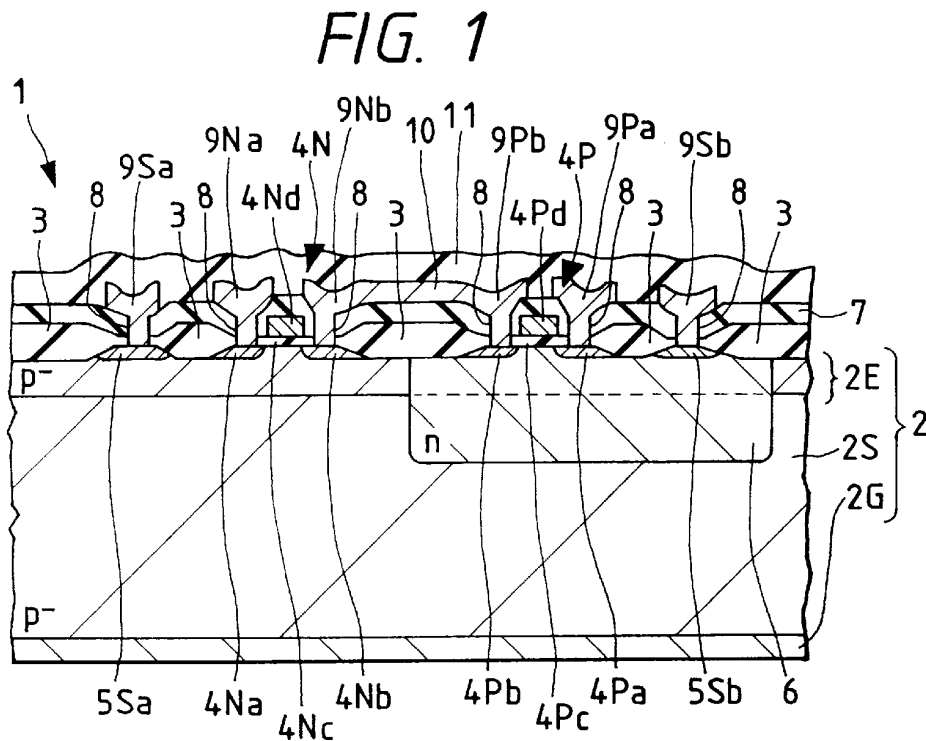


Figure 1 of Kawagoe is a section showing an essential portion of a semiconductor integrated circuit device 1. Ex. 1007, 4:59–61.

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.

Figure 16, reproduced below, depicts a section showing an essential portion of a semiconductor integrated circuit device. Ex. 1007, 5:38–40.

FIG. 16

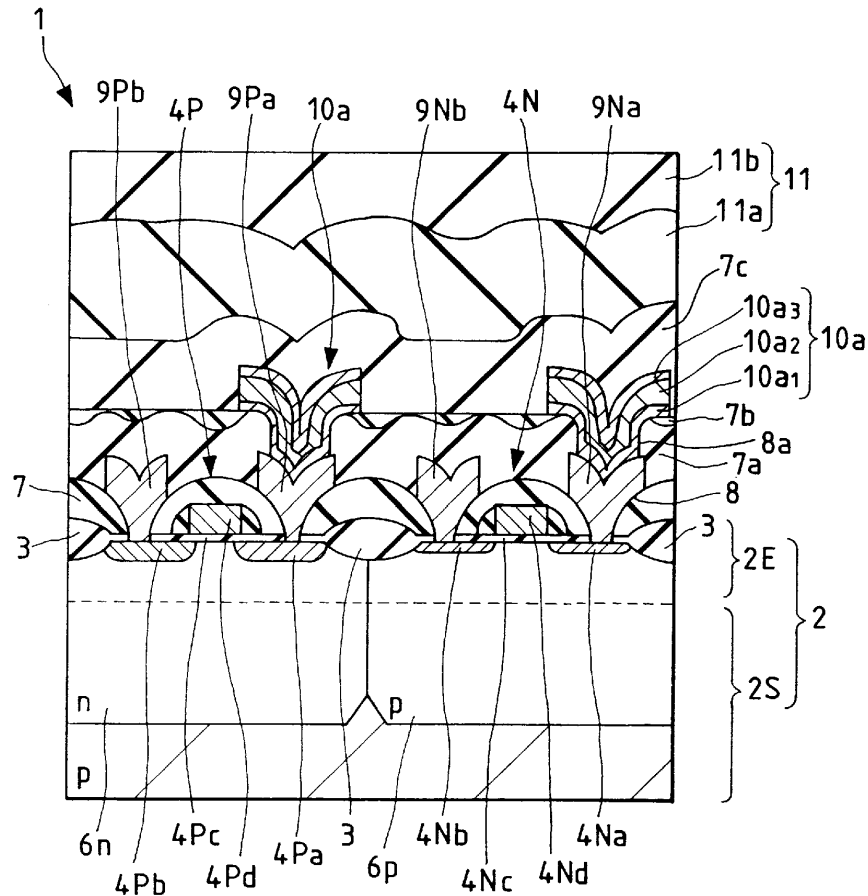


Figure 16 of Kawagoe is a section showing an essential portion of a semiconductor integrated circuit device 1. Ex. 1007, 5:38–40.

The semiconductor integrated circuit device comprises a relatively lightly doped semiconductor substrate body 2S made of a p-type Si single crystal or the like. *Id.* at 14:61–64. An epitaxial layer 2E made of a p-type Si single crystal or the like is formed over a principal surface of the semiconductor substrate body 2S. *Id.* at 15:1–3. The epitaxial layer 2E is doped with a p-type impurity such as boron in a concentration lower than the designed one of the semiconductor substrate body 2S. *Id.* at 15:3–6. The semiconductor substrate 2 is formed in its upper portion with a p-well

(i.e., the first semiconductor region) 6*p* and an n-well (i.e., the first semiconductor region) 6*n*. *Id.* at 15:26–28. The p-well 6*p* is doped with a p-type impurity such as boron and is formed with the nMOS 4*N*. *Id.* at 15:28–30. The n-well 6*n* is doped with an n-type impurity such as phosphor and is formed with the pMOS 4*P*. *Id.* at 15:30–32. On the insulating film 7, there is deposited an insulating film 7*a* of SiO₂, for example, on which is deposited a flattening insulating film 7*b*. *Id.* at 15:44–46. The insulating films 7, 7*a* and 7*b* are formed with connection holes 8*a* extending to reach the electrodes 9*Nb* and 9*Pb*, through which a second-layer wiring line 10*a* is electrically connected with the electrodes 9*Na* and 9*Pa*. *Id.* at 15:46–50.

According to Embodiment 4, substrate body 2*S* and epitaxial layer 2*E* are doped with p-type impurity, and the impurity concentration of substrate body 2*S* is higher than that of epitaxial layer 2*E* “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 4*N* and n-well 6*n* formed with pMOS 4*P*. *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. Figure 17, which is reproduced below, illustrates properties of the semiconductor device of Embodiment 4.

FIG. 17

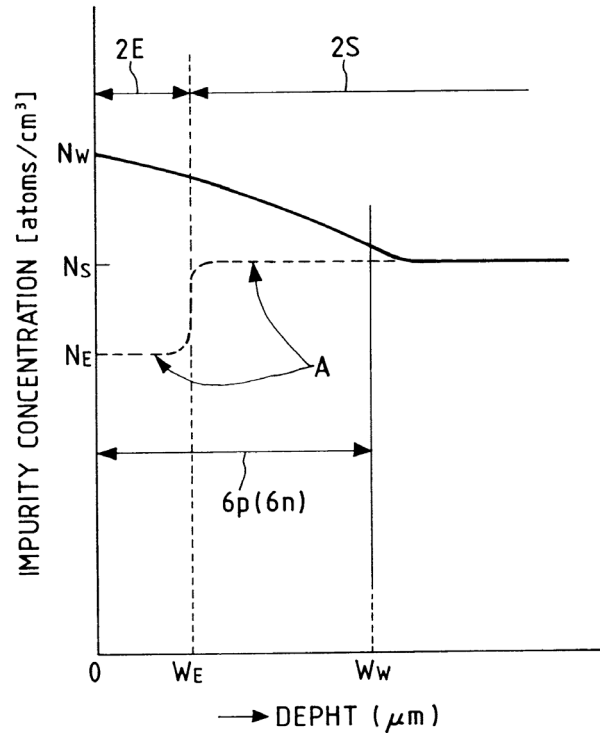


Figure 17 of Kawagoe is a plot of impurity concentration as a function of depth in a semiconductor integrated circuit device.
Ex. 1007, 5:41–45.

Figure 17 is an “impurity distribution diagram in the semiconductor integrated circuit device of FIG. 16,” 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, 15:62–16:2.

2. *Petitioner’s Contentions for Independent Claim 1*

Petitioner argues that Kawagoe teaches or at least fairly suggests the limitations of claim 1. Pet. 54–79.

a) Preamble: “[a] CMOS Semiconductor device”

Petitioner contends that “Kawagoe discloses a CMOS semiconductor device.” Pet. 54 (citing Ex. 1007, 15:37–40 (describing the CMOS structure of the embodiment of Fig. 16 having an NMOS 4N and PMOS 4P), 8:46–54 (describing the CMOS); Ex. 1003 ¶ 101).

Patent Owner does not contest Petitioner’s evidence pertaining to the preamble of claim 1. Based on the complete record developed during trial, we determine that Petitioner demonstrates by a preponderance of evidence that Kawagoe teaches the subject matter of the preamble of claim 1. As such, we need not and do not determine whether the preamble of claim 1 is limiting.

b) [1.1] “a surface layer”

Pointing to its annotated version of Kawagoe’s Figure 16, Petitioner contends that “Kawagoe teaches a surface layer as depicted . . . in blue in annotated FIG. 16” that “exists in the epitaxial layer (2E) and . . . has an active region with a source and drain formed within it (4Nb and 4Na).” Pet. 55–56 (citing Ex. 1007, 8:66–9:6, 15:26–32; Ex. 1003 ¶ 102).

Patent Owner does not contest Petitioner’s evidence pertaining to limitation [1.1]. Based on the complete record developed during trial, we determine that Petitioner establishes by a preponderance of the evidence that Kawagoe teaches this limitation of claim 1.

c) [1.2] “a substrate”

Pointing to its annotated version of Kawagoe’s Figure 16, Petitioner contends that “Kawagoe’s substrate is annotated in gray” and that “Kawagoe forms its p-well 6p and n-well 6n in part of the substrate body 2S from the

original wafer.” Pet. 58 (citing Ex. 1007, 15:62–65, 17:50–61, Fig. 21). According to Petitioner, “[the skilled artisan] would understand that at least the portion of the substrate—separate from the well regions—would satisfy the claimed substrate.” *Id.* (citing Ex. 1003 ¶ 104).

Patent Owner does not contest Petitioner’s evidence pertaining to limitation [1.2]. Based on the complete record developed during trial, we determine that Petitioner establishes by a preponderance of the evidence that Kawagoe teaches this limitation of claim 1.

d) [1.3] “*an active region including a source and a drain, disposed on one surface of said surface layer*”

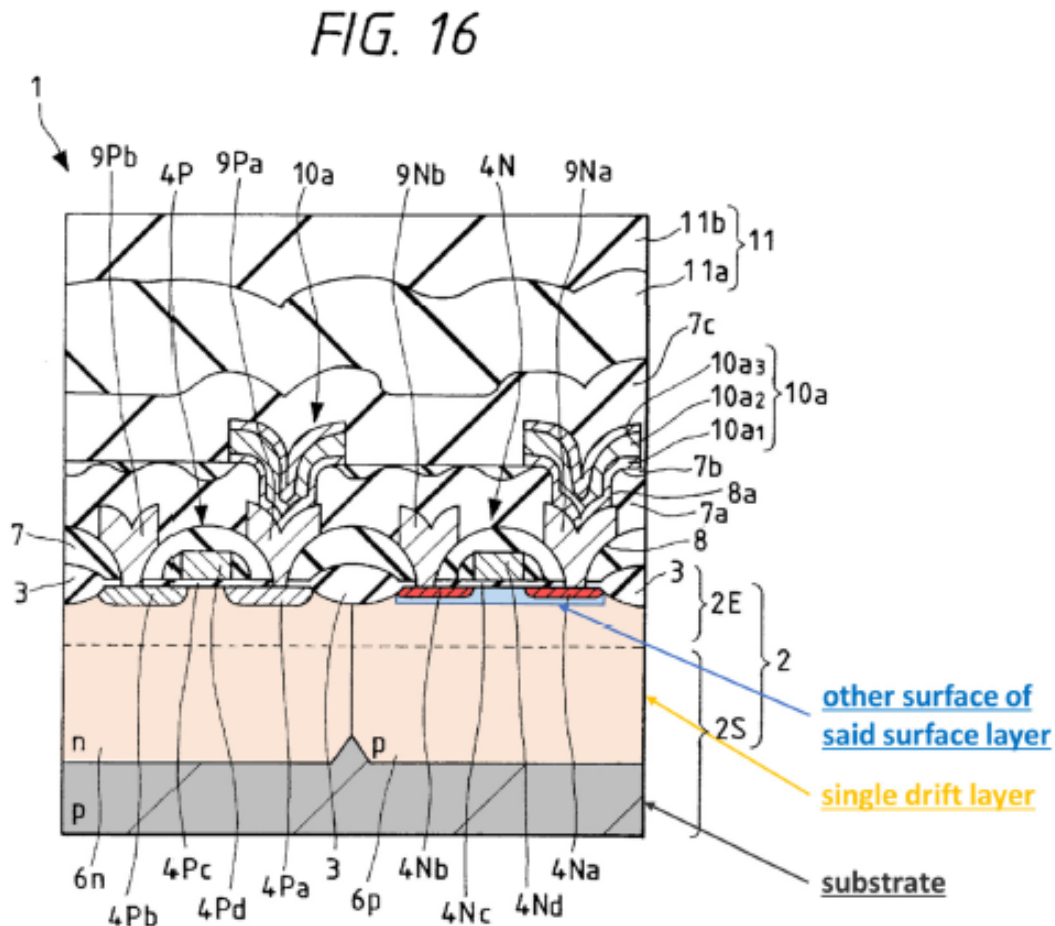
Pointing to its annotated version of Kawagoe’s Figure 16, Petitioner contends that Kawagoe’s “surface layer contains source and drain 4Nb and 4Na which form an active region.” Pet. 59–60 (citing Ex. 1007, 8:66–9:6, 9:47–53; Ex. 1003 ¶ 106).

Patent Owner does not contest Petitioner’s evidence pertaining to limitation [1.3]. Based on the complete record developed during trial, we determine that Petitioner establishes by a preponderance of the evidence that Kawagoe teaches this limitation of claim 1.

e) [1.4] “*a single drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate*”

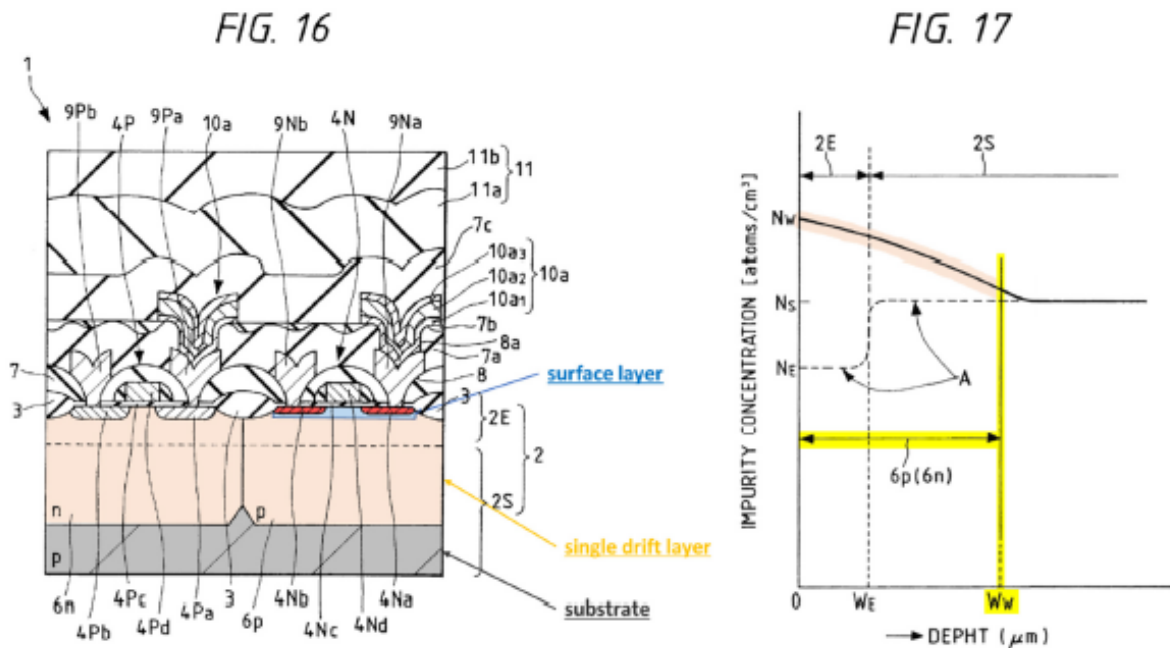
Pointing to its annotated version of Kawagoe’s Figure 16, reproduced below, Petitioner contends that “Kawagoe teaches the claimed single drift layer (annotated tan, below) disposed between the other surface of said

surface layer (blue) and said substrate (gray), where the drift layer has a graded concentration of dopants extending between the surface layer and substrate.” Pet. 63–64.



the semiconductor device and is formed into the CMOS device so that minority carriers (*e.g.*, electrons in the p-well) are attracted to the substrate to reduce errors.” *Id.* at 64 (citing Ex. 1007, 16:7–11, 15:62–16:15; Ex. 1003 ¶ 111).

Petitioner contends that “[t]he single drift layer comprises both p-wells and n-wells, where the ‘impurity concentrations [of those wells are] gradually lowered in the depthwise direction from the principal surface . . . of the epitaxial layer 2E.’” Pet. 64 (citing Ex. 1007, 15:66–16:2). According to Petitioner, “[t]he depthwise gradient extends from the surface of the semiconductor device into its substrate and is formed by diffusing impurities in the upper portion of the semiconductor substrate. *Id.* at 64–65 (citing Ex. 1007, 16:2–15, 15:26–36). Pointing to Petitioner’s annotated versions of Kawagoe’s Figures 16 and 17 reproduced below, Petitioner contends that “Kawagoe’s graded concentration of dopants is depicted in FIG. 17 where the gradient of dopants in the drift layer (tan) extends from the surface of 2E (epitaxial layer wafer) through the p and n wells (6p and 6n) (with depth depicted in yellow) and a portion of the substrate (substrate of wafer).” *Id.* at 65–66 (citing Ex. 1003 ¶ 111).



Petitioner’s annotated versions of Kawagoe’s
Figures 16 and 17. Pet. 66.

Patent Owner does not contest Petitioner’s evidence pertaining to limitation [1.4]. Based on the complete record developed during trial, we determine that Petitioner establishes by a preponderance of the evidence that Kawagoe teaches this limitation of claim 1.

- f) [1.5] “said drift layer further having a first static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate”

Petitioner contends that “Kawagoe teaches a single drift layer with a graded dopant profile” and that “[t]his graded dopant profile results in ‘electrons . . . [being] attracted to the substrate body 2S by that concentration gradient.’” Pet. 70–71 (citing Ex. 1007, 16:7–11). Petitioner further contends that “[the skilled artisan] would understand that electrons refer to minority carriers in the p-well, and that the electrons are attracted to the

substrate due to a static unidirectional electric drift field.” *Id.* at 71 (citing Ex. 1003 ¶ 117). Petitioner also contends that “[the skilled artisan] would understand the field to be static because it is created by doping impurities that are fixed during device fabrication, as depicted in Kawagoe.” *Id.* (citing Ex. 1007, 15:26–36, Figs. 20–21; Ex. 1003 ¶ 117).

Citing Patent Owner’s statements during prosecution of the ’195 patent, Petitioner states:

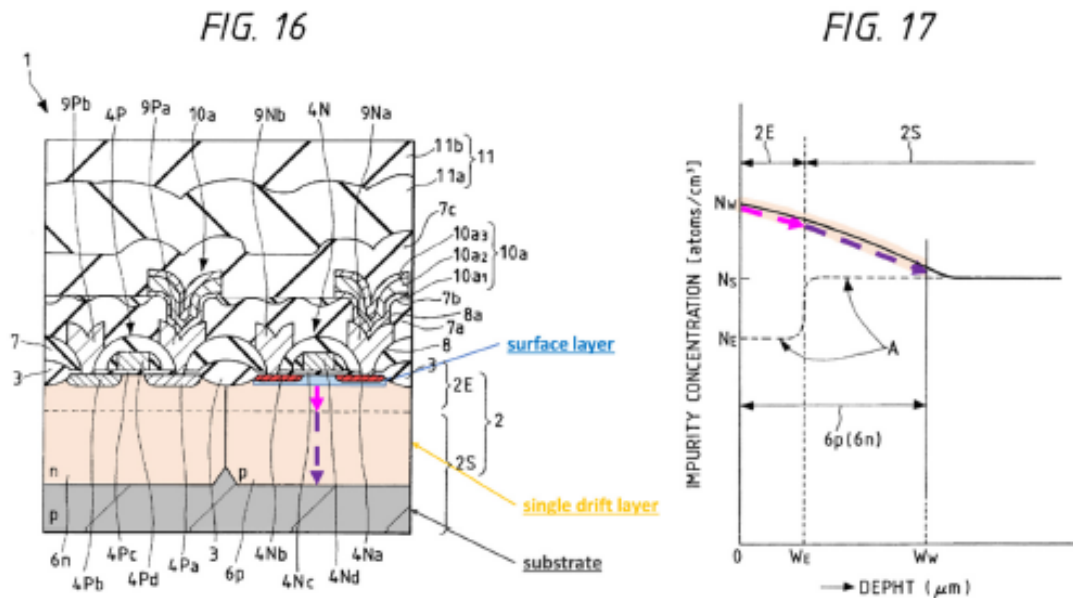
This was, moreover, recognized by Patent Owner as a property of a graded dopant profile in the specification of the ’195 Patent and during prosecution. There are electric fields in separate regions due to the graded doping concentrations, *e.g.*, those depicted by pink and purple arrows in annotated FIG. 17 below, where the pink field satisfies the first static unidirectional electric drift field.□

Pet. 71 (citing Ex. 1003 ¶¶ 36, 118); *see id.* at 71 n.14 (“The arrow orientation and direction are depicting the drift of minority carriers (electrons) in the p-well. [The skilled artisan] would understand that the electric field would exist in the opposite direction.” (citing Ex. 1003 ¶ 117)).

Pointing to its annotated versions of Kawagoe’s Figures 16 and 17, reproduced below, Petitioner contends that “[t]hese electric fields are not exhaustive, and [the skilled artisan] would understand that numerous fields exist in the diffusion layer to attract minority carriers to the substrate.” Pet. 72 (citing Ex. 1003 ¶ 118); *see id.* at 72 n.15 (“Indeed, Patent Owner has argued that the limitation is not limited to a drift layer that has only one electric field, and covers the instance where there are multiple such fields.” (citing Ex. 1030, 21 (stating that “[t]here is nothing in the claim preventing additional electric fields”))).

[The skilled artisan] would understand that Kawagoe's single drift layer has multiple static unidirectional electric drift fields that aid in the movement of minority carriers to the substrate, and that any one of them satisfies the claimed "first static unidirectional electric drift field," *e.g.*, the one depicted in pink over the epitaxial layer.

Id. (citing Ex. 1003 ¶ 118).



Petitioner's annotated versions of Kawagoe's
Figures 16 and 17. Pet. 72.

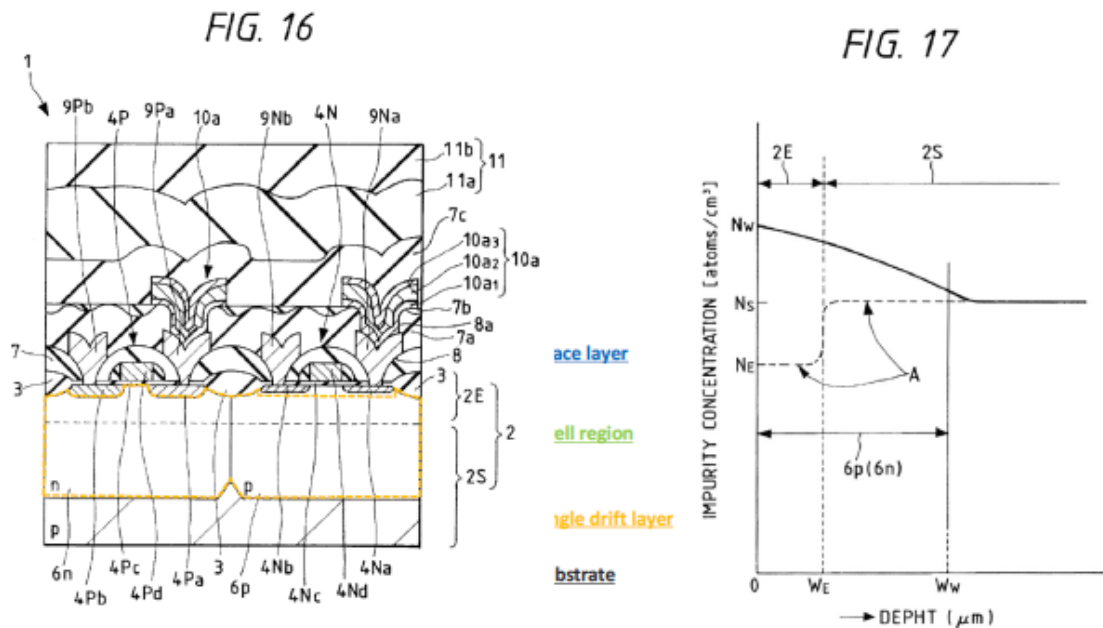
Patent Owner disputes Petitioner's evidence pertaining to limitation [1.5]. We resolve the dispute about this limitation in our analysis below.

- g) [1.6] “at least one well region disposed in said single drift layer, said well region having a graded concentration of dopants and a second static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate”

Citing Petitioner’s annotated versions of Kawagoe’s Figures 16 and 17, reproduced below, Petitioner contends that “Kawagoe’s single drift layer (the diffusion layer which comprises n and p wells) has at least one well region disposed within it (*e.g.*, the p well).” Pet. 74. According to Petitioner, “[t]his p-well is part of the diffusion layer and, like the diffusion layer described in Element [1.4], it has a graded dopant concentration.” *Id.* (citing Ex. 1007, 15:62–16:15, 15:26–36, 17:11–21, 1:59–2:5, 2:20–23, 15:62–16:15; Ex. 1003 ¶ 120).

[A]s described in Element [1.5], this dopant concentration results in several static unidirectional electric drift fields, where the pink arrow indicates the first static unidirectional electric drift field. The second static unidirectional electric drift field is annotated in purple. As depicted below, the well region (green) is disposed within the single drift layer (tan with tanned dashes) and graphically overlaps.

Id. at 74–75 (citing Ex. 1003 ¶ 120).



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.

4. *Petitioner’s Reply Arguments*

Petitioner responds to Patent Owner’s arguments with respect to Kawagoe. *See generally* Pet. Reply. Petitioner argues that Patent Owner’s arguments, which demand a depth of disclosure far beyond that of the ’195 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.

5. *Analysis of the Parties’ Arguments*

For the same reasons set forth above in Section IV.E.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 1, and particularly, a graded concentration of dopants to aid the movement of minority carriers as set forth in claim 1. Our reasoning above, presented in the context of the ground based on Onoda, applies with equal force here. *See, e.g., supra* § IV.E.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.

6. Conclusion for Independent Claim 1

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 1 is unpatentable as obvious over Kawagoe. As discussed above in Section IV.D, 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 Claims 2, 3, 5, and 6*

Claims 2, 3, 5, and 6 depend directly from independent claim 1. Ex. 1001, 4:30–39. The Petition provides a detailed assessment of these claims, with references to the Petition's analysis of claim 1, disclosures in Kawagoe, and the declaration testimony of Dr. Campbell. Pet. 80–87. Patent Owner does not contend that the limitations in claims 2, 3, 5, and 6 are absent in Kawagoe, and therefore, has waived such arguments. *See, e.g., In re NuVasive*, 842 F.3d at 1379–82; *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 1 would have been unpatentable as obvious over Kawagoe, and also are persuaded that the cited evidence sufficiently shows claims 2, 3, 5, and 6 likewise obvious. For the same reasons provided above for independent claim 1, and the reasons set forth in the Petition (Pet. 80–87), 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 claims 2, 3, 5, and 6 would have been unpatentable as obvious over Kawagoe.

H. Reliability of Expert Testimony

Both parties argue that *the other party's* expert testimony is not credible and should be given no weight. *See* PO Resp. 29–31 (regarding Dr. Campbell); Pet. Reply 23–24 (regarding Dr. Glew).

Patent Owner, on the one hand, argues that the declaration testimony of Petitioner's expert, Dr. Campbell, "is unreliable and should be disregarded for numerous reasons." PO Resp. 29. In particular, Patent Owner alleges that Dr. Campbell's Declaration is unreliable because (1) his declaration "does not add anything of value beyond what is already found in the Petition" (PO Resp. 29); (2) he admitted during his deposition that "the analysis that he conducted for the IPRs was either not complete or inconsistent with what he stated in his declaration" (PO Resp. 29–30); and (3) "despite knowing that Intel had taken a license and understanding that 'the taking of licenses under the patent' was relevant to obviousness, Dr. Campbell blatantly admitted that he did not consider that in his obviousness analysis (PO Resp. 30–31 (citing Ex. 2058, 26:6–8)).

Petitioner, on the other hand, argues that the declaration testimony of Patent Owner's expert, Dr. Glew, "should not be given weight." Pet. Reply 23. Petitioner alleges that Dr. Glew "was evasive, biased, and not credible," particularly where "[h]e has worked with [Patent Owner] on its countless litigations and Inter Partes Reviews . . . , billing hundreds of hours." *Id.* (citing Ex. 1055, 145:5–19). Petitioner alleges that Dr. Glew "repeatedly took positions that contradict the prior art's plain wording," and "took extreme positions: e.g., that no α -rays would hit Kawagoe's p-well to generate electrons." *Id.* (citing Ex. 1055, 116:19–120:19). Petitioner further alleges that Dr. Glew "filibustered, and refused to answer simple questions,

e.g., whether electrons generated via an α -ray will move up, down, or stay locked in place,” “or plainly what constitutes a minority carrier in a p-layer or an n-layer . . . even though that is clearly identified in standard references.” *Id.* (citing Ex. 1055, 106:8–109:21, 127:6–128:12, 129:19–130:7, 130:25–131:22, 133:19–138:11). Petitioner submits that “[Patent Owner’s] request to give Dr. Campbell’s declaration no weight because he looked at excerpts of a 391-page file history and did not look at licenses lacks merit, *as the same applies to Dr. Glew.*” *Id.* at 24 (citing Ex. 1055, 71:7–10, 144:23–145:4).

Expert witnesses have broad latitude in how they research, structure, and draft their declarations. They may rely upon information that they personally identified or information provided by the parties’ attorneys. They may also adopt nearly verbatim a previous declarant’s testimony. Indeed, this procedure is often required when a previous declarant is no longer able to testify in a proceeding. *See Jeisys Medical Inc v. Serendia, LLC*, IPR2024-00384, Paper 8 (PTAB March 1, 2024). This does not make a declaration inherently unreliable or necessarily entitled to less weight. Through effective cross-examination, counsel may identify portions of a declaration that the expert witness cannot explain or justify. In that case, the witness’s testimony on those matters may be entitled to less or even no weight, and if it happens repeatedly may lead to a conclusion that the entire declaration should be given little to no weight.

In this case, given the parties’ broad-brush complaints against the other party’s expert testimony, we assess the credibility of both parties’ experts based on the plausibility of and support for any particular relied-upon testimony, and weigh such testimony accordingly. *See CTPG at I.F.5*

(“[T]he credibility of experts often turns less on demeanor and more on the plausibility of their theories.”), I.G (“The Board has broad discretion to assign weight to be accorded expert testimony.”); *see also* 84 Fed. Reg. 64,280 (Nov. 21, 2019).

V. 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. 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.”).

VI. 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 84, 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, 8–9, 17, 28; Prelim. Resp. 12–13).

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. 30–31 (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 IV.E.5, 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 IV.E.5, we have considered Patent Owner’s line of argument here and find it unavailing.

VII. 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* CTPG at II.K (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.”).

VIII. CONCLUSION

For the reasons discussed above, we are persuaded that the Petition is not time-barred under 35 U.S.C. § 315(b) and that Petitioner has met its burden to show, by a preponderance of the evidence, that all of the Challenged Claims (i.e., claims 1–3, 5, and 6) are unpatentable under 35 U.S.C. § 103.¹⁷ We deny Petitioner’s Motion to Strike, and thus, Petitioner’s objections to Patent Owner’s demonstratives are moot. We also dismiss as moot Patent Owner’s Motion to Exclude. Our conclusions are summarized in the following table.

¹⁷ 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).

Claim(s)	35 U.S.C. §	Reference(s)/ Basis	Claim(s) Shown Unpatentable	Claim(s) Not Shown Unpatentable
1–3, 5, 6	103(a)	Onoda	1–3, 5, 6	
1–3, 5, 6	103(a)	Onoda, Nishizawa	1–3, 5, 6	
1–3, 5, 6	103(a)	Kawagoe	1–3, 5, 6	
Overall Outcome			1–3, 5, 6	

IX. ORDER

For the foregoing reasons, it is:

ORDERED that Petitioner demonstrates, by a preponderance of the evidence, that each of the challenged claims 1–3, 5, and 6 of the ’195 patent is unpatentable as obvious under 35 U.S.C. § 103(a);

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

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

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.

IPR2024-00468
Patent 8,421,195 B2

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