

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.

IPR2024-00553
Patent 11,316,014 B2

Before JON B. TORNQUIST, MONICA S. ULLAGADDI, and
JULIA HEANEY, *Administrative Patent Judges*.

TORNQUIST, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

Monolithic Power Systems, Inc. (“Petitioner”) filed a Petition requesting *inter partes* review of claims 1, 3–9, 13, 15–17, 20, 21, and 23–28 (“Challenged Claims”) of U.S. Patent No. 11,316,014 B2 (Ex. 1001, “the ’014 patent”). Paper 1 (“Pet.”). Greenthread, LLC (“Patent Owner”) filed a Preliminary Response to the Petition. Paper 12 (“Prelim. Resp.”). With authorization, Petitioner filed a Preliminary Reply (Paper 17, “Prelim. Reply”) and Patent Owner filed a Preliminary Sur-reply (Paper 18, “Prelim. Sur-reply”).¹

An *inter partes* review may not be instituted “unless . . . the information presented in the petition . . . shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a) (2018). Having considered the arguments and evidence set forth by Petitioner and Patent Owner, we determine that the information presented in the Petition demonstrates a reasonable likelihood that Petitioner would prevail on at least one of the challenged claims of the ’014 patent. Accordingly, we institute an *inter partes* review as to all of the challenged claims of the ’014 patent on all of the grounds of unpatentability set forth in the Petition.

II. BACKGROUND

A. *Related Matters*

The parties indicate that the ’014 patent is at issue in the following proceedings:

¹ The Preliminary Response, Preliminary Reply, and Preliminary Sur-reply were filed under seal. Redacted versions of these papers may be found at Papers 15, 23, and 18, respectively.

IPR2024-00553
Patent 11,316,014 B2

Greenthread, LLC v. Monolithic Power Systems, Inc.,
No. 1:23-cv-00579 (D. Del. filed May 26, 2023);
Greenthread, LLC v. Cirrus Logic, Inc., No. 1:23-cv-00369 (W.D.
Tex. filed March 31, 2023);
Greenthread, LLC v. Texas Instruments Inc., No. 2:23-cv-00157 (E.D.
Tex. filed April 6, 2023);
Greenthread, LLC v. OSRAM GmbH, No. 2:23-cv-00179 (E.D. Tex.
filed April 19, 2023);
Greenthread, LLC v. OmniVision Technologies, Inc.,
No. 2:23-cv-00212 (E.D. Tex. filed May 10, 2023);
Cirrus Logic v. Greenthread, LLC, IPR2024-00019, filed October 27,
2023 (instituted on May 28, 2024); and
Semiconductor Components Industries, LLC d/b/a ON Semiconductor
v. Greenthread, LLC, IPR2023-00263 (instituted on August 14, 2024).
Pet. 1–2; Paper 3, 1–2 (Patent Owner’s mandatory notices).

The parties also identify several proceedings involving the ’014 patent
that are no longer pending. Pet. 1–2; Paper 3, 2–3.

B. Real Parties-in-Interest

Petitioner identifies itself as the real party-in-interest and Patent
Owner identifies itself as the real party-in-interest. Pet. 1; Paper 3, 1.

C. The ’014 patent

The ’014 patent, titled “Semiconductor Devices with Graded Dopant
Regions,” issued on April 26, 2022. Ex. 1001, codes (45), (54). The ’014
patent “relates to all semiconductor devices and systems,” including Bipolar
Junction Transistors (BJT). *Id.* at 1:39–52.

The '014 patent explains that in bipolar junction transistors, minority carriers are the principal device conduction mechanism, but majority carriers also play a small but finite role in modulating the conductivity in such devices. Ex. 1001, 1:50–54. The '014 patent further explains that “[e]fforts have been made in graded base transistors to create an aiding drift field to enhance the diffusing minority carrier’s speed from emitter to collector.” *Id.* at 1:62–64. The '014 patent explains that this improvement has not been implemented in most semiconductor devices, including various power MOSFETs and IGBTs, which “still use a uniformly doped ‘drift epitaxial’ region in the base.” *Id.* at 1:64–2:2. The '014 patent implements a graded dopant concentration in these devices, which results in at least two important performance enhancements: “electrons can be swept from source to drain rapidly, while at the same time holes can be recombined closer to the n+ buffer layer,” thereby improving “ t_{on} and t_{off} in the same device.” *Id.* at 3:42–47.

Figure 1 of the '014 patent is reproduced below.

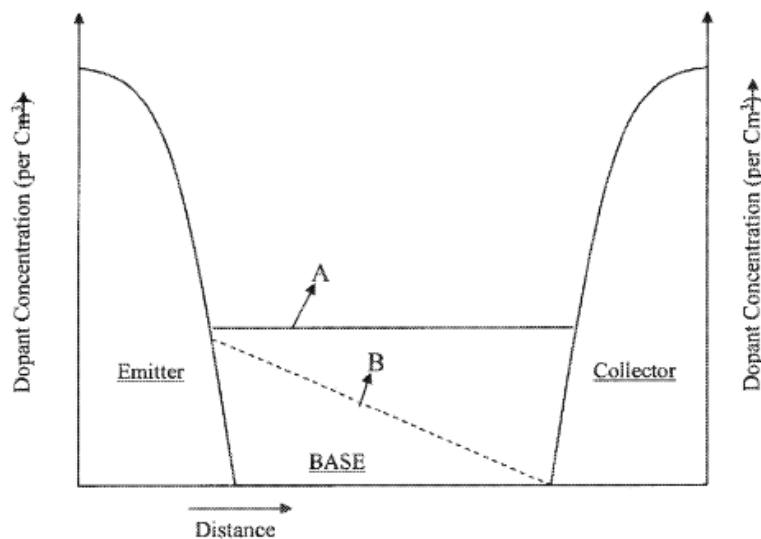


Figure 1 is labeled “Prior Art” and “illustrates the relative doping profiles of emitter, base and collector for the two most popular bipolar junction transistors: namely, uniform base (“A”) and graded base (“B”).” Ex. 1001, 2:40–43, Fig. 1.

Figure 3A of the ’014 patent is reproduced below.

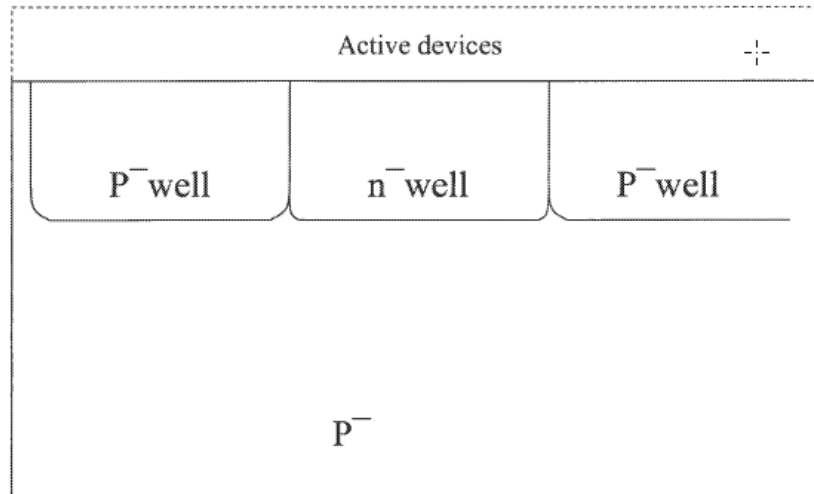


Figure 3A is labeled “Prior art” and shows a cross section of “a typical prior art IC with two wells (one n- well in which p-channel transistors are subsequently fabricated and one p-well in which n-channel transistors are subsequently fabricated).” Ex. 1001, 2:46–51, Fig. 3A.

Figure 5A of the ’014 patent is reproduced below.

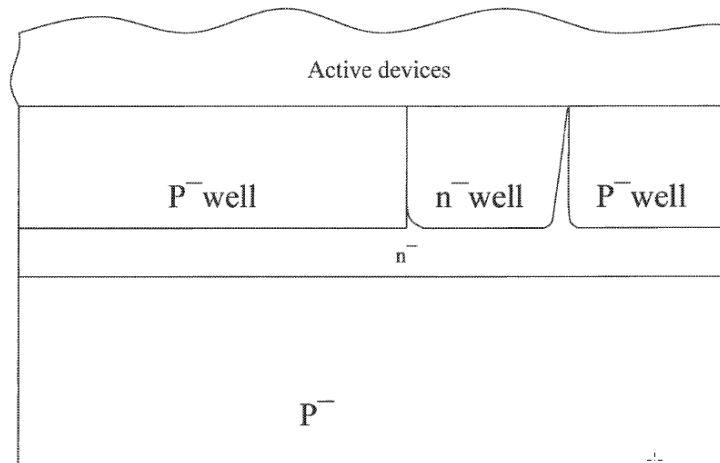


Figure 5A illustrates a cross section of a CMOS silicon substrate with two wells and an underlying layer using embodiments of the invention to improve performance in each application. Ex. 1001, 2:58–61. In this embodiment, “the subterranean n^- layer has a graded donor concentration” as may the n^- and p^- wells. *Id.* at 4:1–9.

According to the '014 patent, “[s]purious minority carriers can be generated by clock switching in digital VLSI logic and memory ICs.” Ex. 1001, 3:51–52. The '014 patent states that these “unwanted carriers can discharge dynamically-held ‘actively held high’ nodes,” and serve to degrade performance of various types of devices, including CMOS digital images and DRAMs. *Id.* at 3:51–59. According to the '014 patent, “a novel technique is described” that “creates a drift field to sweep these unwanted minority carriers from the active circuitry at the surface into the substrate in a monolithic die as quickly as possible.” *Id.* at 3:64–4:1. For example, a graded donor concentration in subterranean n^- layer may be used to “sweep the minority carriers deep into the substrate.” *Id.* at 4:1–3.

D. Illustrative Claim

Claims 1 and 21 are independent, with challenged claims 3–9, 13, 15–17 and 20 depending from claim 1 and challenged claims 23–28 depending from claim 21. Ex. 1001, 4:49–6:56. Claim 1 is representative of the challenged claims and is reproduced below.

1. An electronic system, the system comprising:

at least one semiconductor device, the at least one semiconductor device including:

a substrate of a first doping type at a first doping level having a surface;

a first active region disposed adjacent the surface with a second doping type opposite in conductivity to the first doping type and within which transistors can be formed;

a second active region separate from the first active region disposed adjacent to the first active region and within which transistors can be formed;

transistors formed in at least one of the first active region or second active region;

at least a portion of at least one of the first and second active regions having at least one graded dopant concentration to aid carrier movement from the first and second active regions towards an area of the substrate where there are no active regions; and

at least one well region adjacent to the first or second active region containing at least one graded dopant region, the graded dopant region to aid carrier movement from the surface towards the area of the substrate where there are no active regions, wherein at least some of the transistors form digital logic of the semiconductor device.

Ex. 1001, 4:49–5:7 (spacing added to aid readability).

E. Asserted Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability (Pet. 10):²

Claims Challenged	35 U.S.C. §	Reference(s)/Basis
1, 3–9, 13, 15–17, 20, 21, 23–28	103(a)	Kawagoe ³

² The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112–29, took effect on March 16, 2013. The ’014 patent claims priority to an application filed September 3, 2004. Ex. 1001, code (60). Thus, we apply the pre-AIA version of §103. See Pet. 5 n.1.

³ US 6,043,114, issued Mar. 28, 2000 (Ex. 1007).

Claims Challenged	35 U.S.C. §	Reference(s)/Basis
1, 3–9, 13, 15–17, 20, 21, 23–28	103(a)	Onoda ⁴
1, 3–9, 13, 15–17, 20, 21, 23–28	103(a)	Onoda, Nishizawa ⁵

Petitioner also relies upon the declaration testimony of Stephen Campbell, Ph.D. Ex. 1003.

III. ANALYSIS

A. Legal Standard

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter 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 ordinary skill in the art; and (4) when in evidence, objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. Level of Ordinary Skill in the Art

In order to determine whether an invention would have been obvious at the time the application was filed, we consider the level of ordinary skill

⁴ JP Publication No. H8-279598, published Oct. 22, 1996 (Ex. 1043; certified translation provided as Exhibit 1042).

⁵ US 5,384,476, issued Jan. 24, 1995 (Ex. 1046).

in the pertinent art. *Graham*, 383 U.S. at 17. In assessing 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) (quotation omitted).

Petitioner contends that one of ordinary skill in the art would have had “a Bachelor’s degree in electrical engineering, material science, applied physics, or a related field, and four years of experience in semiconductor design and manufacturing or equivalent work experience.” Pet. 10 (citing Ex. 1003 ¶ 18). Petitioner further contends that “[a]dditional education might compensate for less experience, and vice-versa.” *Id.*

Patent Owner does not address the level of ordinary skill in the art.

On this record, we adopt Petitioner’s definition of the person of ordinary skill in the art as it appears consistent with the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (holding that the prior art itself can reflect the appropriate level of ordinary skill in the art).

C. Claim Construction

In an *inter partes* review proceeding, a patent claim is construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b) (as amended Oct. 11, 2018). This rule adopts the claim construction standard used by Article III federal courts, which follow *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc), and its progeny. Under this standard, the words of a claim are generally given their “ordinary and customary

meaning,” which is the meaning the term would have to a person of ordinary skill at the time of the invention, in the context of the entire patent including the specification. *See Phillips*, 415 F.3d at 1312–13.

Petitioner contends that no claim terms require express construction to resolve the issues presented in the Petition. Pet. 10.

Patent Owner does not assert that any claim terms require express construction. *See generally* Prelim. Resp.

Upon review of the record, we determine that no claim terms require express construction for purposes of this Decision. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’”) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

D. Discretionary Denial Pursuant to 35 U.S.C. § 314(a)

Patent Owner contends the present Petition is “an improper serial petition” and that the Board should deny institution under 35 U.S.C. § 314(a) based on the factors set forth in *General Plastic Co., Ltd. v. Canon Kabushiki Kaisha*, IPR2016-01357, Paper 19 (PTAB Sept. 6, 2017) (precedential as to § II.B.4.i) (“*General Plastic*”). Prelim. Resp. 13–20.

When determining whether to exercise our discretion to deny a follow-on petition, we consider the following seven factors:

1. whether the same petitioner previously filed a petition directed to the same claims of the same patent;
2. whether at the time of filing of the first petition the petitioner knew of the prior art asserted in the second petition or should have known of it;

3. whether at the time of filing of the second petition the petitioner already received the patent owner's preliminary response to the first petition or received the Board's decision on whether to institute review in the first petition;
4. the length of time that elapsed between the time the petitioner learned of the prior art asserted in the second petition and the filing of the second petition;
5. whether the petitioner provides adequate explanation for the time elapsed between the filings of multiple petitions directed to the same claims of the same patent;
6. the finite resources of the Board; and
7. the requirement under 35 U.S.C. § 316(a)(11) to issue a final determination not later than 1 year after the date on which the Director notices institution of review.

General Plastic, Paper 19 at 16.

Although *General Plastic* focused on whether the same petitioner previously filed a petition directed to the same claims of the same patent, application of the *General Plastic* factors is not limited solely to instances when multiple petitions are filed by the same petitioner. *See Valve Corp. v. Elec. Scripting Prods., Inc.*, IPR2019-00062, Paper 11 at 2 (PTAB Apr. 2, 2019) (precedential) (“Valve”). “Rather, when different petitioners challenged the same patent, we consider any relationship between those petitioners when weighing the *General Plastic* factors.” *Id.*

The Director's decisions in *Ford Motor Co. v. Neo Wireless LLC*, IPR2023-00763, Paper 28 (Vidal Mar. 22, 2024) (“*Ford*”) and *Videndum Prod. Sols., Inc v. Rotolight Ltd.*, IPR2023-01218, Paper 12 (Vidal Apr. 19, 2024) (“*Videndum*”) subsequently clarified the Board's application of the frameworks set forth in *General Plastic* and *Valve*. In *Ford*, the Director

explained that “[u]nder existing Office policy and precedent, the Board does not recognize a ‘significant relationship’ between parties [i.e., serial petitioners] having *different accused products* that merely engage in court-ordered pretrial coordination.” *Ford*, Paper 28 at 3 (emphasis added). In *Videndum*, the Director further explained that where “the first and second petitioners are neither the same party, nor possess a significant relationship under *Valve, General Plastic* factor one necessarily outweighs the other *General Plastic* factors.” *Videndum*, Paper 12 at 6–7. Thus, per *Ford* and *Videndum*, we will not discretionarily deny a later petition in view of an earlier petition where the earlier and later petitioners are neither the same party nor have a “significant relationship.” *Id.* at 6 (noting that *General Plastic* has never been extended to a case “in which the first and second petitioners *do not have* a significant relationship”).

Patent Owner argues that Petitioner “may not wait until related entities have initiated IPR proceedings to file its own IPR petition of the same patent claims,” with Petitioner gaining an “advantage derived from having already seen [Patent Owner’s] arguments.” Prelim. Resp. 13 (citing IPR2016-01357, Paper 19 at 11 (PTAB Sept. 6, 2017) (precedential)). And, according to Patent Owner, in this proceeding Petitioner “filed [a] modified version of the IPRs [of] [Petitioner’s] co-defendants.” *Id.* at 14.

Patent Owner further contends that Petitioner cannot deny that it has a “significant relationship” with prior petitioners Cirrus Logic, Inc., Omnivision Logic Inc., and Texas Instruments, Inc., as it “is a party to a Joint Defense Group (‘JDG’) in the current district court litigations in Delaware and Texas” with these parties and they all filed “virtually identical invalidity contentions.” *Id.* at 14–16. According to Patent Owner, Petitioner “is so closely aligned with the other members of the JDG, which previously

filed IPR petitions of the '014 Patent, that the Board should consider them the same entity for the purposes of a *General Plastic* analysis.” *Id.* at 18 (citing Valve, IPR2019-00062, Paper 11 at 2) (“[N]ot only are the members of the JDG accused of infringing the same patent in district court cases; they are actively coordinating their defense and sharing purportedly highly confidential information with competitors.”).

Petitioner responds that it “has not previously filed a petition challenging the '014 patent” and it “does not have a ‘significant relationship’ with any entities that have,” in part because Petitioner “and the other component manufacturer petitioners are *competitors* with *different accused products* [that were] sued in different district court proceedings.” Prelim. Reply 1 (emphasis added). Petitioner also argues that it “did not contribute to any other petitioner’s IPR filings,” “no other petitioner contributed to [Petitioner] on the [present] Petition,” and the present Petition is based on Petitioner’s own independent analysis of the art and challenges a different set of claims based on grounds that “differ in significant ways from those put forth in the other component manufacturer’s petitions.” *Id.* at 3. Petitioner also contends that there is “no licensing relationship” with any member of the Joint Defense Group, and that Petitioner “did not copy the prior petitions or coordinate with the other petitioners on the IPRs.” *Id.* at 1–3 (emphasis omitted). Petitioner also notes that Patent Owner “filed all its preliminary responses *under seal* outside of [Petitioner’s] access, so any alleged benefit gained from successive petitions is wholly illusory.” *Id.* at 4 (emphasis added).

Patent Owner argues in response that the Joint Defense Group was formed “to file serial, substantially similar IPRs, from different entities, against the same claims of the same Greenthread patents,” which is the

“exact scenario *General Plastic* and its progeny expressly preclude.”

Prelim. Sur-reply 1–2. Patent Owner further argues that Petitioner’s denial that it copied from its co-defendants IPRs is not credible, with Petitioner making “virtually no effort to distinguish” the various petitions. *Id.* at 2.

With respect to the “significant relationship” analysis, Patent Owner contends that a licensing agreement is not necessary to show a “significant relationship” exists, and *Valve* expressly considered the co-defendant relationship between the parties in the district court litigation. *Id.* at 3.

Patent Owner further contends that Petitioner’s focus on whether the same products are at issue in the district court litigations is wrong because *Valve* “contains no such limitation.” *Id.* at 4. Thus, according to Patent Owner, “[t]he determining factor is not the accused product, but rather,” whether “the same claims of the same patent” are challenged. *Id.* (Patent Owner asserting that different petitioners “will *usually* have different products”).

Finally, Patent Owner contends that *Ford* does not stand for the proposition that any pretrial coordination between the parties before the district court is irrelevant, because in *Ford* the parties were ordered to coordinate by the district court, whereas Petitioner’s coordination “was entirely voluntary.” *Id.* at 4–5.

Based on the current record, we find that no significant relationship has been identified between Petitioner and any other member of the Joint Defense Group that would justify application of the *Valve* framework in this case. In *Valve*, both petitioners were co-defendants in the *same* proceeding and were accused of infringing the *same* patent based upon the *same* product for which they had an *ongoing* licensing relationship. *Valve*, Paper 11 at 9–10. Here, there is no dispute that Petitioner is a *competitor* of the various defendants in the district court proceedings. Nor are the parties “co-

defendants,” as that term was used in *Valve*. Rather, each defendant is accused of infringement in a different proceeding, based on different accused devices, for which there is no alleged relationship between the parties related to product development or design.

Contrary to Patent Owner’s arguments, the specific relationship between the parties discussed in *Valve*, i.e., *co-defendants* in the *same* proceeding with allegations of infringement based on the *same* product on which *Valve* provided technical assistance for its development, was critical to the analysis. *Valve*, Paper 11 at 9–10. Thus, we disagree with Patent Owner’s argument that “[t]he determining factor is not the accused product, but rather,” whether “the same claims of the same patent” are challenged. Prelim. Sur-reply 3.

With respect to the Joint Defense Agreement and potential coordination of invalidity contentions, as noted by Patent Owner, this case differs from *Ford* in that the Petitioner’s coordination of district court invalidity contentions was apparently voluntary, as opposed to court ordered. Prelim. Sur-reply 4–5; Prelim. Reply 3. We do not find this voluntary coordination sufficient to find a “significant relationship” between the parties, however, especially where the parties are not co-defendants in the same proceeding, are competitors, and are alleged to infringe different products. *See Qualcomm Inc. v. Monterey Research*, IPR2020-01493, Paper 11 at 15–16 (PTAB Mar. 8, 2021); *Sony Mobile Commc’ns. AB v. Ancora Tech., Inc.*, IPR2021-00663, Paper 17 at 10 (PTAB June 10, 2021) (“A common desire to challenge the validity of the asserted patent without more is insufficient to establish” that a petitioner has a significant relationship with the other prior petitioners). Moreover, there is no persuasive evidence of coordination with any prior petitioner in the filing of the present Petition,

nor any evidence of gamesmanship, as the preliminary responses in the prior actions were filed under seal, preventing Petitioner from obtaining the advantage of seeing Patent Owner's arguments prior to filing.

Petitioner has not previously filed an IPR with respect to the '014 patent. Nor does the record sufficiently support a finding under the framework set forth in *Valve* that Petitioner has or had a significant relationship with any prior petitioner that has challenged the '014 patent. Thus, *General Plastic* factor one necessarily outweighs the other *General Plastic* factors. Accordingly, we do not discretionarily deny the present Petition.

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

Pursuant to 35 U.S.C. § 315(b), “[a]n inter partes review may not be instituted if the petition requesting the proceeding is filed more than 1 year after the date on which the petitioner, real party in interest, or privy of the petitioner is served with a complaint alleging infringement of the patent.” Patent Owner argues that the Petition should be dismissed because it is untimely under §315(b). Prelim. Resp. 20–21, 28. In particular, Patent Owner argues that Petitioner is in privity with Intel Corp. (“Intel”) and [REDACTED] (collectively “Licensees”), who are time-barred under 35 U.S.C. § 315(b) and licensed with respect to the '014 patent. *Id.* at 22–23, 28

Patent Owner advances several theories supporting its privity arguments, including that Petitioner serves as an “agent” of the Licensees by exercising their “have made” rights under the license, that Petitioner is a beneficiary of the Licensee's agreements related to accused products, that Petitioner and the Licensees are “preceding and succeeding owners of”

licensed (or infringing) products,” and that Petitioner’s licensed sales encumber otherwise infringing articles. Prelim. Resp. 32–38.

1. *Legal Standard*

Patent Owner contends that Petitioner was served with a complaint alleging infringement of the ’014 patent on May 26, 2023. Prelim. Resp. 23 (citing Ex. 2026). The present Petition was filed on March 18, 2024, i.e., within one year of the service of the district court complaint. Pet. 91. Thus, Petitioner is not time-barred under 35 U.S.C. § 315(b).

Patent Owner contends, however, that Petitioner is in privity with the Licensees who are time-barred. Prelim. Resp. 28, 32. “A person who is not a party to a suit generally has not had a ‘full and fair opportunity to litigate’ the claims and issues settled in that suit.” *Taylor v. Sturgell*, 553 U.S. 880, 892 (2008). Thus, in general, Petitioner should not be precluded from addressing the unpatentability of a patent based on the filing of previous complaints alleging infringement by Intel or [REDACTED]. *See id.* (noting that, in general, one is not bound by a judgment “in which he is not designated as a party or to which he has not been made a party by service of process”); *WesternGeco LLC v. ION Geophysical Corp.*, 889 F.3d 1308, 1319 (Fed. Cir. 2018) (noting the “general rule against nonparty preclusion”). This rule is deeply-rooted in the “historic tradition that everyone should have his own day in court.” *Taylor*, 553 U.S. at 892–93 (quoting *Richards v. Jefferson County*, 517 U.S. 793, 798 (1996)).

An exception to this deeply-rooted rule exists for parties that are in privity with a defendant in an earlier litigation. *See WesternGeco*, 889 F.3d at 1319 (noting that “the standards for the privity inquiry must be grounded

in due process”). The Supreme Court in *Taylor* identified considerations where nonparty preclusion would be justified, including:

- (1) an agreement to be bound; (2) pre-existing substantive legal relationships between the person to be bound and a party to the judgment (e.g., “preceding and succeeding owners of property”); (3) adequate representation by someone with the same interests who was a party (e.g., “class actions” and “suits brought by trustees, guardians, and other fiduciaries”); (4) assumption of control over the litigation in which the judgment was rendered; (5) where the nonparty to an earlier litigation acts as a proxy for the named party to relitigate the same issues; and (6) a special statutory scheme expressly foreclosing successive litigation by nonlitigants.

Id. (citing *Taylor*, 553 U.S. at 894–95).

As this list of considerations indicates, “the 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,” or the evidence must demonstrate “that 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.” *Id.*; *WesternGeco*, 889 F.3d at 1319; *see also Ventex Co. v. Columbia Sportswear North America, Inc.*, IPR2017-00651, Paper 148, at 10, 12 (PTAB Jan. 24, 2019) (precedential) (finding privity where the two parties “had a specially structured, preexisting, and well established business relationship with one another, including indemnification and exclusivity arrangements”).

A petitioner’s “initial identification of the real parties in interest [and privies] should be accepted unless and until disputed by a patent owner.” *Worlds Inc. v. Bungie, Inc.*, 903 F.3d 1237, 1244 (Fed. Cir. 2018). In order to raise such a dispute, “a patent owner must produce *some* evidence that tends to show that a particular [time-barred] third party should be named a [privy].” *Id.* The amount of evidence a patent owner must produce does not rise to the level of that required to overcome a burden of production. *Id.* at 1244 n.8. One potential formulation of the amount of evidence required is “evidence that ‘reasonably brings into question the accuracy of a petitioner’s’” assertion that it is not time-barred. *Id.* (quoting *Atlanta Gas Light v. Bennett Regulator Guards, Inc.*, IPR2013-00453, Paper 88 (PTAB Jan. 6, 2015) (addressing the amount of evidence required from a patent owner to question a petitioner’s identification of the real parties-in-interest)). Although the “burden remains with the petitioner to establish” the timeliness of its petition, it need not respond until the patent owner reasonably brings into question the accuracy of its assertion that it is not time-barred. *Id.* at 1242.

2. *The Effect of the Earlier Suits Against [REDACTED] on the Timeliness of the Present Petition*

Patent Owner contends that Intel, [REDACTED]
[REDACTED] were served with a complaint alleging infringement of the “Challenged Patent and others” on February 1, 2022. Prelim. Resp. 20 (citing Exs. 2001, 2002).⁶ Patent Owner further contends

⁶ There is no evidence that the challenged ’014 patent was identified in the original complaint filed on February 1, 2022. Ex. 2001. Rather, it appears that the ’014 patent was first asserted in the amended complaint filed on

that [REDACTED] was a real party-in-interest to the [REDACTED] litigation in view of, among other things, incorporation of [REDACTED] components in [REDACTED] products. *Id.* at 21 (citing Ex. 2003 ¶¶ 18, 60, 76–81; Ex. 2005, 7, 17–19; Ex. 2006, 1–34). According to Patent Owner, because [REDACTED] was served with an infringement complaint early enough to create a time bar, and because [REDACTED] was a real party-in-interest of [REDACTED] in that infringement litigation, [REDACTED] is time-barred under § 315(b). Prelim. Resp. 28 (arguing that [REDACTED] is time-barred because it was a real party-in-interest to the [REDACTED] litigation). Patent Owner presents no authority, however, for extending Section 315(b)’s time bar to a real party-in-interest, such as [REDACTED].

That said, we note that Patent Owner presents evidence that [REDACTED] was added to the [REDACTED] litigation on January 23, 2023, whereas the present Petition was filed on March 18, 2024, i.e., more than one year after the filing of the second amended complaint. Ex. 2009. Therefore, we treat [REDACTED] as a time-barred party.

3. *Licensees as Alleged Privies*

In the subsections below, we address Patent Owner’s arguments that Intel and [REDACTED] are privies of Petitioner under § 315(b).

a. *Preceding and Succeeding Owners of Property*

Patent Owner argues that Petitioner and the Licensees are in privity because they are “preceding and succeeding owners” of “licensed and/or infringing products that Petitioner makes and supplies to Licensees.” Prelim. Resp. 32 (citing *Taylor*, 553 U.S. at 894); *see id.* at 33 (asserting that

April 29, 2022. Ex. 2003. Given that both complaints were served more than one year prior to the filing of the Petition, however, this error appears harmless.

the Licensees are Petitioner’s customers). It is true that entities who are “preceding and succeeding owners of property” can be in privity with one another. *Taylor*, 553 U.S. at 894. This rule, however, is based on property law and “is extended or denied in an effort to protect conflicting property interests rather than an effort to implement concepts of participation or representation.” 18A C. Wright, A. Miller, & E. Cooper, *Federal Practice and Procedure* § 4448 (3d. ed. 2023); *see also id.* § 4462 (“Successive Property Relationships”) (“There is no independent reason to treat the defeated litigant as the representative of his transferee. Preclusion is limited to the property involved in the judgment.”). As noted above, our relevant analysis is based on the relationships between the parties with respect to the prior proceeding or the Petition (e.g., participation or representation), not on property interests. *See WesternGeco*, 889 F.3d at 1319 (noting that the privity requirement is used “to prevent successive challenges to a patent by those who previously have had the opportunity to make such challenges in prior litigation”).

Moreover, the rule related to preceding and succeeding owners of property does not extend to the point where all manufacturers of allegedly infringing goods are in privity with the customers who buy those goods. *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 Electronics Co. Ltd. v. Netlist Inc.*, IPR2022-00615, Paper 64 at 22–26 (PTAB June 30, 2023) (same).

Patent Owner's evidence that Petitioner's products are components of Licensees' products (Prelim. Resp. 24) does not come close to suggesting that "it can be fairly said that the petitioner had a full and fair opportunity to litigate the validity of the patent" in the prior law suit, or that petitioner is serving as a proxy to allow any Licensee to again challenge the patent. *WesternGeco*, 889 F.3d at 1319. Thus, Patent Owner does not present evidence that lends support to a finding that Petitioner's and Licensees' status as preceding and succeeding owners of allegedly infringing products renders them privies for purposes of § 315(b).

b. Beneficiaries of License Agreement

Patent Owner argues that Petitioner and the Licensees are privies because Petitioner is a "beneficiary" of Patent Owner's license, which Patent Owner asserts is "directly related to" the accused products. Prelim. Resp. 33–34 (citing *Ventex*, Paper 148). We disagree. Unlike the agreements in *Ventex*, Paper 148 at 12, Patent Owner's license to the Licensees is not evidence of a privity relationship between Petitioner and the Licensees because Petitioner is not a party to the license agreement. Nor is there any argument that Petitioner is a third-party beneficiary of the license agreement, or argument that such a status would evidence a privity relationship.

c. Patent Exhaustion

Patent Owner argues that the doctrine of patent exhaustion gives rise to privity because "after Petitioner sells products under the license, any downstream user of the article sold would have an exhaustion defense against [Patent Owner]." Prelim. Resp. 34. According to Patent Owner, "Petitioner is effectively providing rights to third-parties under the license

and, therefore, is in privity with Licensees.” *Id.* at 35. We disagree. It is true that downstream purchasers and users of Licensees’ products that incorporate products made by Petitioner and fall under the License may have a license (or exhaustion) defense against any claim of infringement by Patent Owner. The relevant question for this proceeding, however, is ultimately whether the relationship between Petitioner and the Licensees is sufficiently close to justify denying Petitioner its day in court. *See Taylor*, 553 U.S. at 892. Patent Owner does not sufficiently explain why a license defense supports such a privity relationship between Petitioner and the Licensees.

d. *Agency*

Patent Owner argues that Petitioner acts as the Licensees’ “agent” by making accused products on their behalf under the “have made” clause of the license. Prelim. Resp. 35–37. We disagree.

First, Patent Owner’s agency argument is not based on the applicable legal standard. For purposes of privity under § 315(b), the relevant question is whether Petitioner is acting as an agent for the Licensees in filing a petition for *inter partes* review. *See Taylor*, 553 U.S. at 895 (“[P]reclusion is appropriate when a nonparty later brings suit as an agent for a party who is bound by a judgment.”). As the Federal Circuit explains, the rationale behind § 315(b)’s time bar is “to prevent successive challenges to a patent by those who previously have had the opportunity to make such challenges in prior litigation.” *WesternGeco*, 889 F.3d at 1319. Here, Patent Owner does not assert that Petitioner is acting as an agent for the Licensees in this proceeding. Any such assertion would be appropriate only based on evidence suggesting that any of those entities, and in particular Intel, is controlling Petitioner’s conduct in the proceeding. *See Taylor*, 553 U.S. at

906 (cautioning that “preclusion is appropriate only if the putative agent’s conduct of the suit is subject to the control of the party who is bound by the prior adjudication”). No such evidence is in this record.

Patent Owner argues that to be in privity with the Licensees what matters is whether the prior action concerned a matter within the agency. Prelim. Resp. 35 (citing *Herrion v. Children’s Hosp. Nat. Med. Ctr.*, 786 F. Supp. 2d 359 (D.D.C.), *aff’d*, 448 F. App’x 71 (D.C. Cir. 2011)). This conclusion, however, would significantly expand the analysis set forth in *Taylor*, which noted that preclusion is only appropriate “if the putative agent’s conduct is subject to the control of the party who is bound by the prior adjudication.” *Taylor*, 553 U.S. at 906 (explaining that “courts should be cautious about finding preclusion” on the basis of agency). Moreover, the privity inquiry must take into account the rationale behind § 315(b)’s preclusion provision, which “is to prevent successive challenges to a patent by those who previously have had the opportunity to make such challenges in prior litigation.” *WesternGeco*, 889 F.3d at 1319. Patent Owner’s broad interpretation would be inconsistent with this purpose.

Even if Patent Owner’s argument that a general agency relationship is sufficient to demonstrate privity for purposes of nonparty preclusion were on solid legal footing, it lacks factual support in the record. An “essential element[] of agency” is “the principal’s ‘right to direct or control the agent’s actions.’” *In re Google LLC*, 949 F.3d 1338, 1345 (Fed. Cir. 2022) (quoting *Meyer v. Holley*, 537 U.S. 280, 286 (2003)). Patent Owner does not argue in the Preliminary Response that either Licensee has or had such a right with respect to Petitioner, or vice-versa, much less direct us to any evidence that would tend to prove the existence of such a right. Prelim. Resp. 35–37.

e. Conclusion as to Timeliness of the Petition

As noted above, 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*, 889 F.3d at 1319. Moreover, a petitioner’s “initial identification of the real parties in interest [and privies] should be accepted unless and until disputed by a patent owner.” *Worlds*, 903 F.3d at 1244. In order to raise such a dispute, “a patent owner must produce *some* evidence that tends to show that a particular [time-barred] third party should be named a [privity].” *Id.* Here, Patent Owner argues that it has produced such evidence in several respects, but, on the present record, none of the evidence in question tends to show that any time-barred Licensee is a privy of Petitioner for purposes of § 315(b). As such, we find the evidence of record does not tend to suggest that Petitioner is time-barred under 35 U.S.C. § 315(b), and does not call into question Petitioner’s assertion that the Petition is timely-filed.

F. Claims 1, 3–9, 13, 15–17, 20, 21, and 23–28 in View of Kawagoe

Petitioner contends the subject matter of claims 1, 3–9, 13, 15–17, 20, 21, and 23–28 would have been obvious in view of Kawagoe. Pet. 15–41.

1. Kawagoe

Kawagoe discloses a process for manufacturing a semiconductor integrated circuit device by forming an epitaxial layer over the surface of a semiconductor substrate body. Ex. 1007, 1:13–20, 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,”⁷ and also the gate insulating film formed over the epitaxial layer may have “excellent breakdown characteristics” that “drastically reduce the defect density of the gate insulating film” of a semiconductor integrated device. *Id.* at 1:33–40.

Kawagoe describes seven embodiments, including Embodiment 1 (Ex. 1007, 6:41–12:40, Figs. 1–8) and Embodiment 4 (*id.* at 14:46–19:63, Figs. 16–25). Figure 1, reproduced below, depicts the device of Embodiment 1.

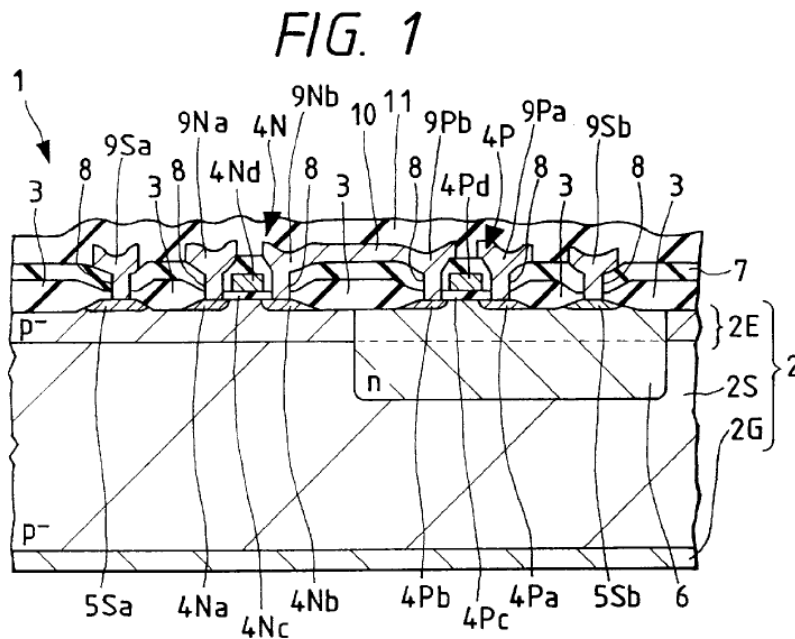


Figure 1 depicts “an essential portion of a semiconductor integrated circuit device” that includes semiconductor substrate body 2S, epitaxial layer 2E, and gettering layer 2G. *Id.* at 6:51–56, Fig. 1. Substrate body 2S and

⁷ Wolf explains that latch-up in CMOS circuits “is a phenomenon that causes the formation of a low resistance path between the supply voltage and ground. As a result, it is possible for the circuit to draw an unusually high amount of current.” Ex. 1008A, 227.

epitaxial layer 2E are doped with a 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 deeper than epitaxial layer 2E. *Id.* at 8:46–52, 9:32–40, 11:18–24, 11:43–50, Figs. 1, 5, 7.

Figure 16 of Kawagoe is reproduced below.

FIG. 16

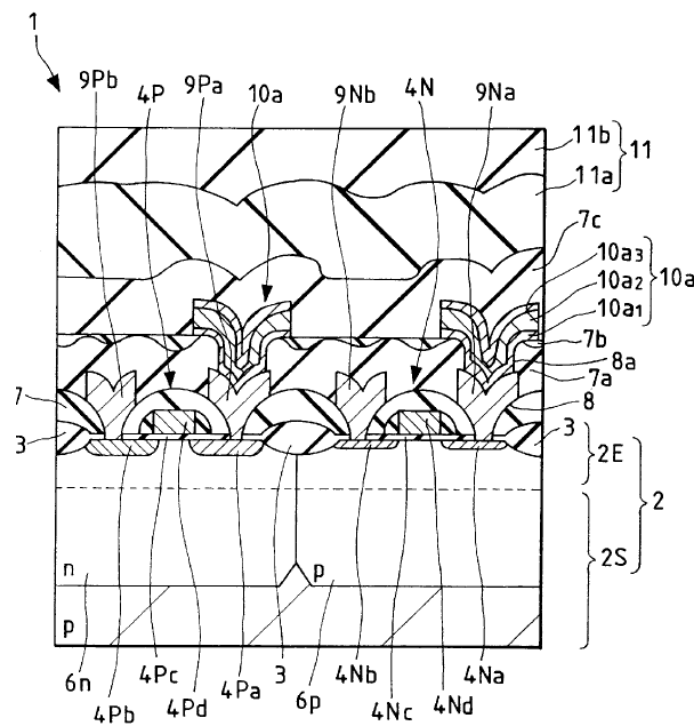


Figure 16 “is a section showing an essential portion of a semiconductor integrated circuit device according to” one embodiment of Kawagoe. *Id.* at 5:38–40. In the device depicted in Figure 16, substrate body 2S is relatively lightly doped with a p-type impurity, such as boron. *Id.* at 14:61–67. Epitaxial layer 2E is made of a p⁻-type Si single crystal that is formed over a principle surface of substrate body 2S and doped with a p-type impurity in a concentration that is lower than that of substrate body 2S. *Id.* at 15:1–6.

P-well 6p and n-well 6n are formed, with pMOS 4P located in n-well 6n and nMOS 4N located in p-well 6p. *Id.* at 15:26–36.

Petitioner relies on Kawagoe's Figure 17, which is reproduced below and illustrates properties of the semiconductor device of Embodiment 4.

FIG. 17

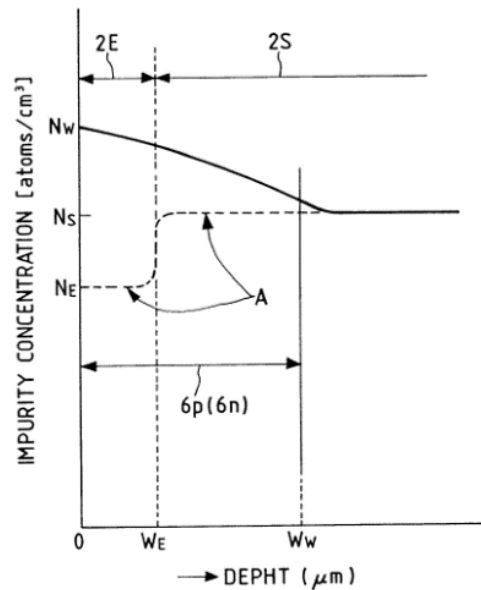


Figure 17 is an impurity distribution diagram for the semiconductor integrated circuit device shown in Figure 16. *Id.* at 14:49–51. Kawagoe explains that Figure 17 plots impurity concentration as a function of depth in the semiconductor integrated circuit device and shows that “the impurity concentration of the p-well 6p and n-well 6n is given such a gradient that it is gradually lowered in the depthwise direction 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.” Ex. 1007, 16:2–16:7. “Specifically, the electrons produced by the α -ray are attracted to the substrate body 2S by that concentration gradient and prevented from entering the p-well 6p so that the soft errors can be reduced.” *Id.* at 16:7–11.

Figure 23, reproduced below, depicts a semiconductor device of Embodiment 4 in the process of manufacture. *Id.* at 6:1–4, 17:11–13, 18:3–8.

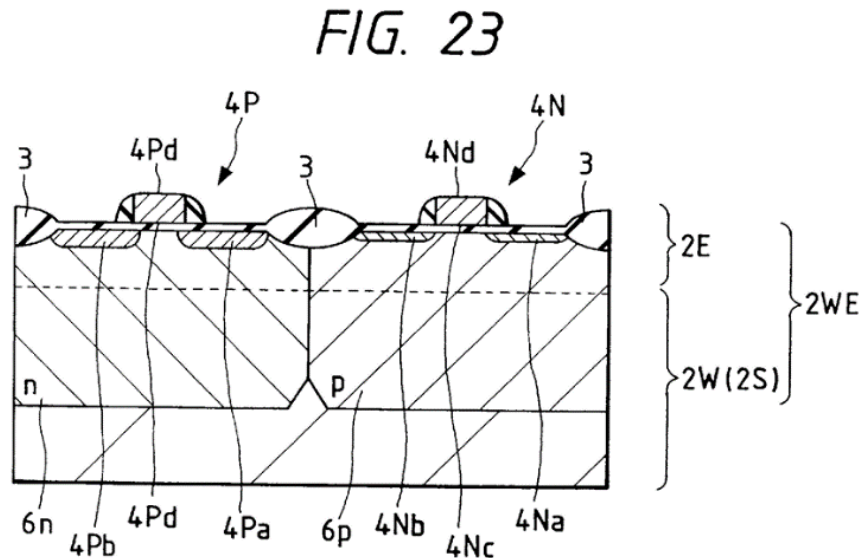


Figure 23 shows the semiconductor integrated circuit device of Embodiment 4, including p-well 6p formed with nMOS 4N and n-well 6n formed with pMOS 4P. *Id.* at 6:1–4, 15:26–32, 18:3–35. In Embodiment 4, p-well 6p and n-well 6n have their impurity concentrations gradually lowered in the depthwise direction from the principal surface of epitaxial layer 2E. *Id.* at 15:62–16:2.

Figure 28 of Kawagoe is reproduced below.

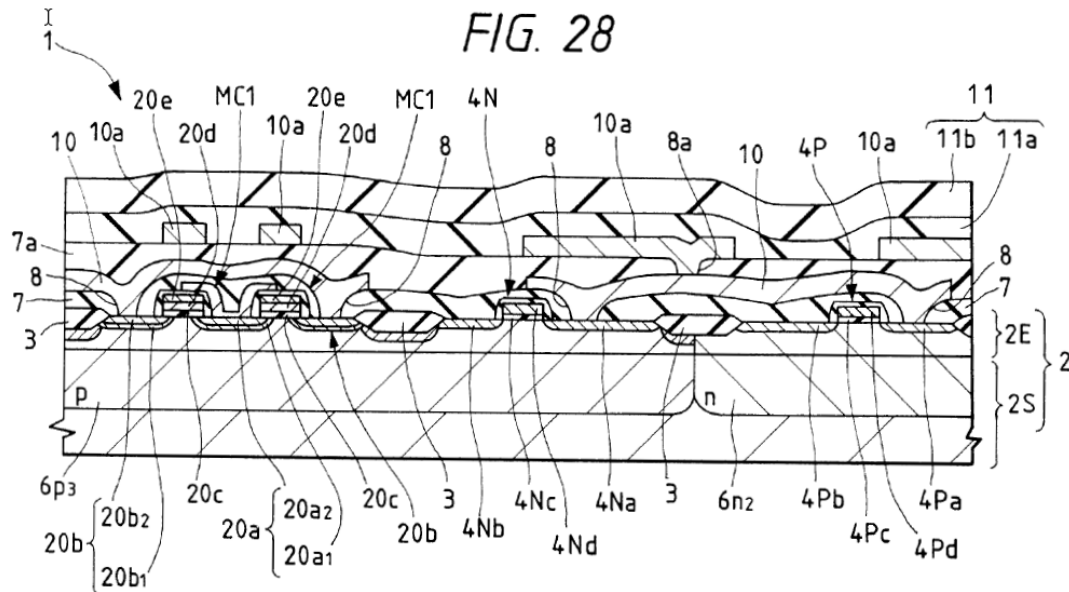


Figure 28 is a section showing an essential portion of another embodiment of Kawagoe. *Id.* at 22:11–15. The device shown in Figure 28 may be a flash memory capable of electrically erasing/programming data. *Id.* at 22:14–18. As in Embodiment 4, “the impurity concentration of the epitaxial layer 2E is made lower than that of the semiconductor substrate body 2S.” *Id.* at 22:18–21.

2. Analysis—Independent Claims 1 and 21

Petitioner identifies where it contends that Kawagoe discloses the limitations of independent claims 1 and 21. Pet. 15–30, 38–40. Patent Owner expressly contests only whether Kawagoe teaches or suggests a graded dopant concentration that will “aid carrier movement,” as recited in independent claims 1 and 21. Prelim. Resp. 2–13.

The preamble and first clause of independent claims 1 and 21 in combination require “An electronic system, [the system] comprising: at least one semiconductor device, the at least one semiconductor device

including.”⁸ Ex. 1001, 4:49–51, 6:4–6. Petitioner contends that Kawagoe discloses a “semiconductor integrated circuit device,” such as a microcomputer and memories, that each constitute an electronic system. Pet. 15–16, 38 (citing Ex. 1007, 1:13–23, 24:21–31; Ex. 1003 ¶¶ 151, 458). We find that Petitioner’s contentions are sufficiently supported for purposes of institution. Therefore, we need not determine whether the preamble is limiting.

Claims 1 and 21 recite “a substrate of a first doping type at a first doping level having a surface.” Ex. 1001, 4:52–53, 6:7–8. Petitioner contends that Kawagoe discloses substrate 2 that includes a p-type Si body 2S and a p-type single crystal epitaxial layer 2E. Pet. 16. Petitioner further contends that substrate 2 has various surfaces between different layers of components, and identifies the top surface of epitaxial layer 2E as a first surface and the bottom surface of N well 6n and P well 6p as the second surface. *Id.* We find that Petitioner’s contentions for this limitation are sufficiently supported for purposes of institution.

Claims 1 and 21 also recite “a first active region disposed adjacent the surface [of the substrate] with a second doping type opposite in conductivity to the first doping type and within which transistors can be formed [in the surface thereof].” Ex. 1001, 4:54–57, 6:9–13. Petitioner contends that the n-type region-well 6n shown in Figure 16 is a “first active region” that has a second doping type (n-type) that is opposite in conductivity to the first doping type (p-type) and that transistors may be formed in this first active

⁸ Brackets are used where there is a difference in language between independent claims 1 and 21.

region. Pet. 18–20, 38. We find that Petitioner’s contentions for this limitation are sufficiently supported for purposes of institution.

Claims 1 and 21 also recite “a second active region separate from the first active region disposed adjacent to the first active region and within which transistors can be formed [in the surface thereof]” and “transistors formed in at least one of the first active region or second active region.” Ex. 1001, 4:58–62, 6:14–19. Petitioner contends that the identified “second active region” is separate from and adjacent to the first active region and includes the source, drain, and channel regions that form the NMOS transistor in p-well 6p of Figure 16.⁹ Pet. 20–21, 24, 38. We find that Petitioner’s contentions for this limitation are sufficiently supported for purposes of institution.

Claims 1 and 21 also recite “at least a portion of at least one of the first and second active regions having at least one graded dopant concentration to aid carrier movement from the [first and second active regions/surface] [towards/to] an area of the substrate where there are no active regions.” Ex. 1001, 4:63–67, 6:21–25. Petitioner contends that Kawagoe discloses a graded dopant concentration in p-well 6p and n-well 6n that extends downward from the top surface to the bottom surface of each well “to generate a drift electric field to move their respective minority carriers downward to the bottom surface of each well.” Pet. 26–27.

⁹ To the extent this claim limitation is construed to require that the first and second active regions be present in the same well, Petitioner contends such an implementation would have been obvious in view of Kawagoe’s other embodiments, including the embodiment depicted in Figure 28. Pet. 22–23. Because Patent Owner does not dispute this limitation is disclosed in Kawagoe, we need not address this argument at this time.

Petitioner contends that Kawagoe's graded concentration thus meets the claimed "aid carrier movement from the first and second active regions" and "surface" "towards an area of the substrate where there are no active regions" limitations. *Id.* at 27, 38.

In support of its arguments, Petitioner notes that during prosecution of U.S. Patent No. 8,421,195 ("the 195 patent"), which is the parent of the '014 patent, the applicant admitted that downward-sloping graded dopant concentrations were known in the art to create an "inherent 'built-in' unidirectional electric field." *Id.* at 12 (citing Ex. 1002, 289–290). Petitioner further contends that the applicant asserted that "a unidirectional drift (electric) field necessarily affects all the present minority carriers in the same way" and "[d]epending on the particular slope of the graded concentration of dopant, all minority carriers are either swept 'down' . . . or 'up . . .'" *Id.* at 12–13 (quoting Ex. 1002, 289).

Petitioner notes that the applicant cited to Jastrzebski (US 4,481,522), which teaches a downward-sloping graded-dopant concentration that "force[s] most of the charge carriers . . . deep into the substrate[.]" Pet. 13–14 (quoting Ex. 1010, 5:14–22). Petitioner further notes that the applicant similarly cited to Kamins (US 4,160,985) to demonstrate that a downward-sloping graded dopant concentration will cause minority carriers to be accelerated into the substrate. *Id.* at 14–15 (citing Ex. 1009, 3:6–13, Figs. 2–3).

Patent Owner asserts that the Petition fails to establish that Kawagoe teaches or suggests the "aid carrier movement" limitation of independent claims 1 and 21. Prelim. Resp. 2–5, 9–11. Patent Owner contends that the presence of a graded dopant concentration does not mean that "carrier movement" will be aided. *Id.* at 2–3. According to Patent Owner, a review

of the entire prosecution history demonstrates that the applicant made clear that the movement of carriers depends on more than the mere presence of a graded dopant concentration. *Id.* at 3 (citing Ex. 1002, 289).

First, Patent Owner contends that the fact that “graded dopant concentration” is a separate limitation from “aid carrier movement” demonstrates that “graded” does not mean “aided.” *Id.* at 3–4. Second, Patent Owner contends that Petitioner “ignores what the specification says,” as the applicant’s statements address the *slope* of the dopant concentration, not merely its direction. *Id.* at 4. Third, Patent Owner contends that during prosecution the examiner stated 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 the movement of carriers. Ex. 1002, 270. According to Patent Owner, this is consistent with the applicant’s arguments during prosecution and with “basic logic,” because “[i]f two forces are acting on an object in opposite directions, both forces cannot aid its movement.” Prelim. Resp. 4. Finally, Patent Owner asserts that in Kawagoe the graded dopant concentration actually prevents the carriers from entering the p-well, which “confirm[s] that graded dopant concentrations can’t *always* aid the movement of carriers, as Petitioner claims, because sometimes that ‘concentration gradient’ can ‘prevent[]’ carrier movement.” *Id.* (citing Ex. 1007, 28); *see id.* at 9–11 (asserting that the graded dopant concentration prevents electrons from entering the p-well).

On this preliminary record, we determine that Patent Owner’s arguments are not persuasive. First, Patent Owner’s argument that a “graded

dopant concentration” is a separate limitation from the “aid carrier movement” limitation appears to disregard the claim language. Claims 1 and 21 do not specify in which direction the “graded dopant concentration” will move the carriers. Rather, it is the “aid carrier movement” limitation that provides the direction of carrier movement, i.e., from the active regions to the substrate in which there are no active regions. Thus, contrary to Patent Owner’s arguments, Petitioner’s argument that a graded dopant concentration will necessarily “aid carrier movement” does not appear to render any claim language superfluous.

Second, the applicant’s arguments regarding the slope of the graded dopant concentration during prosecution do not appear to support Patent Owner’s arguments. The applicant argued that “[d]epending on the 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).” Ex. 1002, 289. This suggests that the slope of the graded dopant concentration determines the direction in which carrier movement is aided, not that the magnitude of the slope dictates whether carriers will be aided in that movement. *Id.*; *see id.* at 289–290 (“[T]he ‘direction’ of the electrical field and the resulting direction of the carrier movement depends solely on the slope of the graded concentration of dopant.”).

Third, as noted by Patent Owner, during prosecution the Examiner asserted that movement of carriers is affected by multiple forces and fields and “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.’” *Id.* The applicant’s response is telling: “Applicant respectfully disagrees with this position because (as previously argued by

Applicant) 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.” *Id.*

Finally, Patent Owner’s argument about the direction of carrier movement in Kawagoe raises, at most, a material issue of fact that is best resolved on a complete trial record. Kawagoe discloses that carriers (or electrons) are produced by α -ray strikes. Ex. 1007, 16:7–11. Dr. Campbell testifies that one of ordinary skill in the art would understand Kawagoe to teach moving electrons from p-well 6p into the substrate body 2S. Ex. 1003 ¶ 177. Patent Owner argues in response that Nishizawa explains that the number of electrons produced above the substrate is so low that they can be disregarded with respect to adverse effects on the memory. Prelim. Resp. 11 (citing Ex. 1046, 20:19–22). What Nishizawa actually says, however, is that the number of electrons does not exceed 10% of the stored electric charge, “and thus it can be disregarded.” Ex. 1046, 20:19–22. There is no lower threshold in either independent claim 1 or 21 as to the number of electrons that the graded dopant field must aid in their movement towards the substrate where there are no active areas. As such, Patent Owner’s arguments do not dissuade us from instituting trial.

In view of the foregoing, we determine that Petitioner’s contentions for the “aiding” limitations of independent claims 1 and 21 are sufficiently supported for purposes of institution.

Claims 1 and 21 also require “at least one well region adjacent to the first or second active region containing at least one graded dopant region, the graded dopant region to aid carrier movement from the surface [towards/to] the area of the substrate where there are no active regions.” Ex. 1001, 5:1–5,

6:26–30. Petitioner contends that Kawagoe discloses p-well and n-well structures that have a graded dopant region beginning at their surface that will aid in the movement of carriers from the surface towards the area of the substrate with no active regions. Pet. 28–30.

In response, Patent Owner generally repeats its arguments discussed above.

For the reasons discussed above, we find that Petitioner’s contentions for this limitation are sufficiently supported for purposes of institution.

Claim 1 also requires “wherein at least some of the transistors form digital logic of the semiconductor device.” Ex. 1001, 5:5–7. Petitioner contends that Kawagoe states that its techniques may be applied to a “semiconductor integrated circuit device which has a logic circuit such as the so-called ‘microcomputer.’” Pet. 30 (quoting Ex. 1007, 24:28–31; Ex. 1003 ¶ 465). We find that Petitioner’s contentions for this limitation are sufficiently supported for purposes of institution.

Claim 21 also requires “wherein the graded dopant concentration is linear, quasilinear, error function, complementary error function, or any combination thereof.” Ex. 1001, 6:30–33. Petitioner contends that Kawagoe’s Figure 17 may be interpreted as disclosing linear, quasi-linear, or exponential gradients. Pet. 38–39. Petitioner further contends that one of ordinary skill in the art would have understood that any of these types of dopant profiles would improve the transport of minority carriers to the substrate. *Id.* at 39. We find that Petitioner’s contentions for this limitation are sufficiently supported for purposes of institution.

In view of the foregoing, and on this preliminary record, Petitioner demonstrates sufficiently for purposes of institution that Kawagoe discloses, or teaches or suggests in combination with the knowledge of one of ordinary

skill in the art, every limitation of independent claims 1 and 21.

Accordingly, Petitioner demonstrates a reasonable likelihood that claims 1 and 21 would have been obvious over the disclosures of Kawagoe.

3. Analysis—Remaining Dependent Claims

Petitioner identifies where it contends the subject matter of claims 3–9, 13, 15–17, 20, and 23–28 is taught or suggested in Kawagoe. Pet. 31–38, 40–41. Patent Owner does not, on this record, dispute Petitioner’s identifications, apart from its arguments discussed above with respect to independent claims 1 and 21.

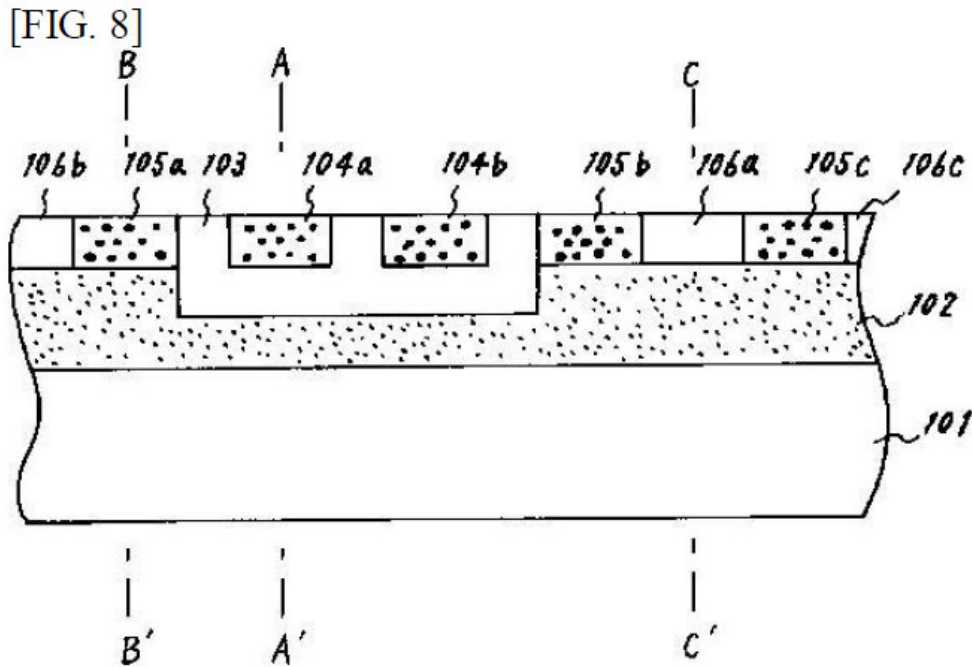
Upon review of Petitioner’s arguments and supporting evidence, we determine that Petitioner demonstrates a reasonable likelihood that claims 3–9, 13, 15–17, 20, and 23–28 would have been obvious over Kawagoe.

G. Claims 1, 3–9, 13, 15–17, 20, 21, and 23–28 in view of Onoda

1. Onoda

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

substrate 100 to which the first embodiment according to the present invention is applied.” *Id.* at 28.



Onoda’s Figure 8, in conjunction with Figures 4–7, depicts a method for manufacturing a flash memory structured as shown. *Id.* ¶ 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.*), and lightly-doped P-type second semiconductor layer 102, that has a dopant concentration between 1×10^{16} and $1 \times 10^{18}/\text{cm}^3$ (*id.* ¶ 47). Figure 8 also depicts N-type first well region 103 that has a depth of about 3 μm 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. Independent Claims 1 and 23

Petitioner identifies where it contends Onoda discloses every limitation of claims 1 and 23. Patent Owner only disputes, at this stage of the proceeding, whether Onoda discloses a graded dopant concentration that aids carrier movement from the active regions towards an area of the substrate where there are no active regions, as recited in independent claims 1 and 21. Prelim. Resp. 1–8. As such, we address only this disputed limitation for purposes of institution.

Petitioner contends that Onoda’s semiconductor device has a graded dopant concentration that gradually decreases from the top of the doped epitaxial semiconductor layer 102, through well region 105a, and into the doped first semiconductor layer 101 of substrate 100. Pet. 41, 52–55 (citing Ex. 1042 ¶¶ 46–47, 52, Fig. 11). Petitioner further contends that this graded dopant concentration would aid the movement of carriers from the top surface of Onoda to the junction between second semiconductor layer 102 and first semiconductor layer 101. *Id.* at 56–58.

Patent Owner contends that Petitioner fails to point to anything in Onoda describing how a graded dopant concentration affects carrier movement at all, “[m]uch less” identify any disclosure in Onoda that would be sufficient to meet the claimed limitations. Prelim. Resp. 6. Patent Owner asserts that Petitioner relies entirely on purported admissions made during prosecution that a downward sloping dopant concentration will aid carrier movement from a first surface to a second surface of a substrate, which Patent Owner contends is a misreading of the prosecution history and the applicant’s position. *Id.* at 7.

As discussed above, Petitioner presents sufficient argument and evidence to show a reasonable likelihood that a downward sloping dopant

gradient, absent some identified force in the opposite direction, will aid the movement of carriers from the first and second active regions towards an area of the substrate where there are no active regions. Patent Owner's counter-arguments raise, at most, material issues of fact that are best resolved on a complete trial record.

In view of the foregoing, Petitioner demonstrates a reasonable likelihood that independent claims 1 and 23 would have been obvious in view of Onoda.

3. Dependent Claims 3–9, 13, 15–17, 20, and 23–28

Petitioner identifies where it contends Onoda teaches or suggests every limitation of dependent claims 3–9, 13, 15–17, 20, and 23–28. Pet. 63–76. Patent Owner does not address these claims, apart from its arguments regarding the “aiding” limitations of independent claims 1 and 21. Upon review of the arguments and evidence of record, we determine that Petitioner demonstrates a reasonable likelihood that claims 3–9, 13, 15–17, 20, and 23–28 would have been obvious in view of Onoda.

H. Claims 1, 3–9, 13, 15–17, 20, 21, and 23–28 in view of Onoda and Nishizawa

Petitioner contends the subject matter of claims 1, 3–9, 13, 15–17, 20, 21, and 23–28 would have been obvious over the combined disclosures of Onoda and Nishizawa. Pet. 76–82. In view of our determination that Petitioner establishes a reasonable likelihood of prevailing on its challenge with respect to all Challenged Claims based on Onoda alone (Petitioner's Ground II), we institute *inter partes* review, without expressly analyzing whether these same claims would have been obvious over the combination of Onoda and Nishizawa. *See* 37 C.F.R. § 42.108(a); *SAS*, 138 S. Ct. at

1353 (“The agency cannot curate the claims at issue but must decide them all.”); *PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018) (interpreting the statute as requiring “a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition”).

IV. CONCLUSION

For the foregoing reasons, we determine that there is a reasonable likelihood that Petitioner would prevail with respect to at least one of the claims challenged in the Petition. In addition, we are not persuaded on the present record that the Petition is time-barred under 35 U.S.C. § 315(b) or should be discretionarily denied under 35 U.S.C. § 314. Accordingly, we institute an *inter partes* review of all challenged claims based on the grounds asserted in the Petition.

V. ORDER

For the foregoing reasons, it is:

ORDERED that, pursuant to 35 U.S.C. § 314(a), *inter partes* review is instituted with respect to the grounds of unpatentability set forth in the Petition;

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(a) and 37 C.F.R. § 42.4, notice is given of institution of trial commencing on the entry date of this Decision;

FURTHER ORDERED that, in view of the pending Renewed Motion to Seal (Paper 24), this Decision is being filed “Board and Parties Only”; and

FURTHER ORDERED that after conferring, within one week of this Decision, the parties shall jointly submit to the Board via email to

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Trials@uspto.gov, a version of this Decision to be filed on the public record,
with any redactions proposed by either party.

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