

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TEXAS INSTRUMENTS INCORPORATED,
Petitioner,

v.
t
GREENTHREAD, LLC,
Patent Owner.

IPR2024-00673
Patent 11,121,222 B2

Before DONNA M. PRAISS, JON B. TORNQUIST, and
MONICA S. ULLAGADDI, *Administrative Patent Judges*.

ULLAGADDI, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314
Granting Motion for Joinder
35 U.S.C. § 315(c); 37 C.F.R. § 42.122(b)

I. INTRODUCTION

On March 12, 2024, Texas Instruments Inc. (“Petitioner”) filed a Petition for *inter partes* review (Paper 4, “Pet.”) challenging claims 1–9, 13–28, and 32–42 of U.S. Patent No. 11,121,222 B2 (Ex. 1001 (“the ’222 patent”)). Petitioner filed a Motion for Joinder (Paper 2, “Mot.”) with the Petition, requesting that we join it with *Semiconductor Components Industries, LLC v. Greenthread, LLC*, IPR2023-01242 (“1242IPR”), which was instituted on February 12, 2024. Mot. 1. In addition, Petitioner filed a paper explaining and ranking the parallel petitions challenging the ’222 patent: the present Petition and the petition filed in IPR2024-00674. Paper 3. Greenthread, LLC (“Patent Owner”) filed a Preliminary Response (Paper 14, “Prelim. Resp.”)¹ and an Opposition to Petitioner’s Motion for Joinder (Paper 8, “Opp. Mot. Join.”). With our authorization, Petitioner filed a Preliminary Reply. Paper 17.

A. *Related Proceedings and Asserted Grounds of Unpatentability*

The Petition in this proceeding challenges the same claims of the ’222 patent on identical grounds of unpatentability, and relies on the same evidence, including the same declarant testimony, as presented in the 1242IPR. Pet. 5; Mot. 1, 4–6; 1242IPR, Paper 32, 6. The challenges are summarized in the chart below. Pet. 5. Petitioner supports its challenges with the Declaration of Dr. Travis Blalock. Ex. 1003.

¹ A redacted version of Patent Owner’s Preliminary Response was filed on July 22, 2024. Paper 19. We cite to this public version of Patent Owner’s Preliminary Response in this Decision.

Claims Challenged	35 U.S.C. § ²	Reference(s)
1–9, 13, 14, 16–21, 23–28, 32–42	103(a)	Kawagoe ³
1, 2, 4–9, 13–23, 25–28, 32–42	103(a)	Wieczorek, ⁴ Wolf ⁵
1–9, 13, 14, 16–21, 23–28, 32–42	103(a)	Kawagoe, Gupta ⁶
1, 2, 4–9, 13–23, 25–28, 32–42	103(a)	Wieczorek, Wolf, Gupta

² The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. § 103, effective March 16, 2013. Because the earliest application from which the ’222 patent claims priority was filed before this date, the pre-AIA version of § 102 and § 103 applies. Ex. 1001, code (60).

³ U.S. Patent No. 6,043,114, filed September 22, 1997 and issued March 28, 2000, to Kawagoe et al. (Ex. 1007, “Kawagoe”).

⁴ U.S. Patent Application Pub. No. 2003/0183856 A1, filed October 29, 2002 and published October 2, 2003, to Wieczorek et al. (Ex. 1006, “Wieczorek”).

⁵ Petitioner cites four volumes for Wolf: *Stanley Wolf & Richard Tauber, Silicon Processing For The VLSI Era*, Volume 1 – Process Technology, 2nd ed., (Lattice Press 2000) (Ex. 1008A); *Stanley Wolf & Richard Tauber, Silicon Processing For The VLSI Era*, Volume 2 – Process Integration, (Lattice Press 2000) (Ex. 1008B); *Stanley Wolf & Richard Tauber, Silicon Processing For The VLSI Era*, Volume 3 – The Submicron MOSFET, (Lattice Press 2000) (Ex. 1008C); and *Stanley Wolf & Richard Tauber, Silicon Processing For The VLSI Era*, Volume 4 – Deep-Submicron Process Technology, (Lattice Press 2000) (Ex. 1008D).

⁶ U.S. Patent No. 6,163,877, filed November 5, 1996 and issued December 19, 2000, to Gupta (Ex. 1014, “Gupta”).

Claims Challenged	35 U.S.C. § ²	Reference(s)
19, 37	103(a)	Kawagoe, Silverbrook ⁷
19, 37	103(a)	Wieczorek, Wolf, Silverbrook

B. Real Parties in Interest

Petitioner identifies itself as the real party in interest. Pet. 1. Patent Owner identifies itself as the real party in interest. Paper 6, 1.

C. Related Matters

The parties identify several proceedings involving the '222 patent as related matters, including *Greenthread, LLC v. Cirrus Logic, Inc.*, No. 1:23-cv-00369 (W.D. Tex.); *Greenthread, LLC v. Texas Instruments Inc.*, No. 2:23-cv-00157 (E.D. Tex.); *Greenthread, LLC v. OSRAM GmbH et al.*, No. 2:23-cv-00179 (E.D. Tex.); *Greenthread, LLC v. ON Semiconductor Corporation et al.*, No. 1:23-cv-00443 (D. Del.); *Greenthread, LLC v. OmniVision Technologies, Inc.*, No. 2:23-cv-00212 (E.D. Tex.); *Greenthread, LLC v. Monolithic Power Systems, Inc.*, No. 1:23-cv-00579 (D. Del.). Pet. 1–2; Paper 6, 1–2. Petitioner also identifies *Greenthread, LLC v. Western Digital Corp.*, No. 1:23-cv-00326 (D. Del.).

The parties also identify seven *inter partes* review proceedings involving the '222 patent, namely IPR2023-01242, IPR2023-01244, IPR2024-00020, IPR2024-00021, IPR2024-00470, IPR2024-00674, and IPR2024-00552. Pet. 2; Paper 3, 1; Paper 6, 2–3.

⁷ U.S. Patent No. 6,614,560 B1, filed July 10, 1998 and issued September 2, 2003, to Silverbrook (Ex. 1042, “Silverbrook”).

The parties note that the '222 patent was at issue in a number of district court and *inter partes* review proceedings that are no longer pending. Pet. 2–3; Paper 6, 3–5.

II. PARALLEL PETITIONS

Petitioner filed two petitions challenging the '222 patent in IPR2024-00673 (this proceeding) and IPR2024-00674. Paper 3, 1. According to the Board's Consolidated Patent Trial Practice Guide (Nov. 2019) (CTPG),⁸ “one petition should be sufficient to challenge the claims of a patent in most situations,” but “there may be circumstances in which more than one petition may be necessary.” CTPG 59. Petitioner explains that the two petitions filed here have “material differences” including “mutually exclusive claim sets,” “significant differences in claim scope between claims of the two claim sets,” and “different prior art and prior art combinations to better address the difference in claim scope.” Paper 3, 3. In addition, Petitioner notes that the petition in IPR2024-00673 addresses a potential claim construction dispute, requiring that petition to be longer than it might have been otherwise. *Id.* at 4. Patent Owner has not challenged Petitioner's arguments for the institution of multiple petitions, despite having an opportunity to do so. Prelim. Resp. 1–40; CTPG 60–61.

On the present record, we agree with Petitioner that the two petitions filed to challenge the claims of the '222 patent will not substantially burden the Board or the parties. The petitions in IPR2024-00673 and IPR2024-00674 challenge different claims and, on the present record, those claims

⁸ Patent Trial and Appeal Board Consolidated Trial Practice Guide (Nov. 2019), available at <https://www.uspto.gov/TrialPracticeGuideConsolidated> (“CTPG”).

appear to have different claim scope, as Petitioner argues. Paper 3, 3–4 (arguing that claim 44, challenged in IPR2024-00674, recites “a ‘surface layer,’ a ‘single drift layer,’ and ‘at least one well region disposed in the single drift layer,’ which are not” recited in the claims challenged in IPR2024-00673); Ex. 1001, 4:39–8:39. In addition, there is little overlap between the prior art asserted in the two petitions, and what overlap there is—reliance on Kawagoe in both petitions—is applied in different prior art combinations in each petition. *Compare* IPR2024-00673, Paper 4, 5 (asserting Kawagoe alone and in combination with Gupta or Silverbrook), *with* IPR2024-00674, Paper 4, 5 (asserting Kawagoe in combination with Sakai). Accordingly, we do not exercise our discretion to deny either of the petitions challenging the ’222 patent for being parallel petitions.

III. WHETHER THE PETITION IS TIME-BARRED

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 is untimely under 35 U.S.C. § 315(b) because Petitioner is in privity with time-barred entities. Prelim. Resp. 19–39. However, 35 U.S.C. § 315(b) also provides that the one-year time bar “shall not apply to a request for joinder under subsection (c).” *See also* 37 C.F.R. § 42.122(b). Because the Petition is accompanied by a timely request for joinder (Paper 2) to the instituted proceeding (IPR2023-01242), which we grant as further discussed below (*see infra* § V), Patent Owner’s argument that the Petition is time-barred under 35 U.S.C. § 315(b) is moot, irrespective of whether Petitioner is in privity with time-barred entities.

IV. MOTION FOR JOINDER

A party in an *inter partes* review may be joined as a party in another *inter partes* review, subject to certain statutory provisions:

(c) JOINDER.—If the Director institutes an *inter partes* review, the Director, in his or her discretion, may join as a party to that *inter partes* review any person who properly files a petition under section 311 that the Director, after receiving a preliminary response under section 313 or the expiration of the time for filing such a response, determines warrants the institution of an *inter partes* review under section 314.

35 U.S.C. § 315(c); *see also* 37 C.F.R. § 42.122 (“Any request for joinder must be filed, as a motion under § 42.22, no later than one month after the institution date of any *inter partes* review for which joinder is requested.”). “To join a party to an instituted [*inter partes* review (IPR)], the plain language of § 315(c) requires two different decisions.” *Facebook, Inc. v. Windy City Innovations, LLC*, 973 F.3d 1321, 1332 (Fed. Cir. 2020). “First, the statute requires that the Director (or the Board acting through a delegation of authority) . . . determine whether the joinder applicant’s petition for IPR ‘warrants’ institution under § 314.” *Id.* “Second, to effect joinder, § 315(c) requires the Director to exercise [] discretion to decide whether to ‘join as a party’ the joinder applicant.” *Id.*

A. *Whether the Petition Warrants Institution*

The instant Petition presents arguments and evidence substantially similar to that of the Petition in the 1242IPR. In the 1242IPR, in its Preliminary Response, Patent Owner only argued about whether the 1242IPR Petitioner, Semiconductor Component Industries, Inc., was time-barred under § 315(b). *See generally* 1242IPR, Paper 18. In the present proceeding, Patent Owner presents arguments in its Preliminary Response

that are similar to arguments presented in Patent Owner’s Response to Semiconductor Component Industries, Inc.’s Petition in the 1242IPR. *Compare* 1242IPR, Paper 47, 13–34, *with* Prelim. Resp. 1–19. We address these arguments below.

Asserted Obviousness over Kawagoe

Petitioner argues that claims 1–9, 13, 14, 16–21, 23–28, and 31–42 would have been obvious in view of Kawagoe. Pet. 6–45. Patent Owner argues that “[t]he Petition fails to demonstrate that Kawagoe teaches the ‘aid carrier movement’ claim limitation.” Prelim. Resp. 12. For the reasons that follow, at this stage of the proceeding, we are persuaded that Petitioner sufficiently demonstrates a reasonable likelihood that it would prevail in showing that at least independent claim 1 would have been obvious in view of Kawagoe.

1. Summary of Kawagoe (Ex. 1007)

Kawagoe discloses a process for manufacturing a semiconductor integrated circuit device using an epitaxial wafer. 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,”⁹ as well as “drastically reduc[ing] the defect density of the gate insulating film”

⁹ Petitioner submits Wang and Agrawal, *Single Event Upset: An Embedded Tutorial*, 21st Int’l Conf on VLSI Design, 429–434, IEEE 2008 (Ex. 1009, “Wang”), 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 “alpha particles [that] are emitted when the nucleus of an unstable isotope decays to a lower energy state.” Ex. 1009, Abstract, 430. Dr. Blalock characterizes “latchup” as “a ‘short-circuit’ failure condition in poorly designed circuits.” Ex. 1003 ¶ 79.

of a semiconductor integrated device. *Id.* at 1:33–40. Kawagoe discloses a process for manufacturing a semiconductor integrated circuit device including a step of forming a semiconductor region (well) extending below the epitaxial layer and having an impurity concentration that decreases with increasing depth below the epitaxial layer. *Id.* at 3:10–25.

Kawagoe describes seven embodiments, including Embodiment 1 (Ex. 1007, 6:41–12:40, Figs. 1–8) and Embodiment 4 (*id.* at 14:46–19:64, Figs. 16–25). According to Embodiment 1, 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. According to Embodiment 4, substrate body 2S and epitaxial layer 2E are doped with p-type impurity, and the impurity concentration of substrate body 2S is higher than that of epitaxial layer 2E “to improve the resistance to the latchup.” Ex. 1007, 14:64–15:6, 15:13–17, 16:16–21, 19:59–63, Fig. 17. Embodiment 4 includes p-well 6*p* formed with nMOS 4N and n-well 6*n* formed with pMOS 4P. *Id.* at 15:26–40, 17:40–18:35, Figs. 16, 21–23. In Embodiment 4, the impurity concentration in p-well 6*p* and n-well 6*n* decreases with increasing depth below the epitaxial layer. *Id.* at 15:62–16:15, 17:55–61, Fig. 17. Kawagoe discloses that the concentration gradient reduces soft errors by attracting carriers (electrons) to the substrate and preventing them from entering the p-well. *Id.* at 16:2–11.

Petitioner relies on Kawagoe Figures 17 and 23, which are reproduced below and illustrate Embodiment 4 and its properties.

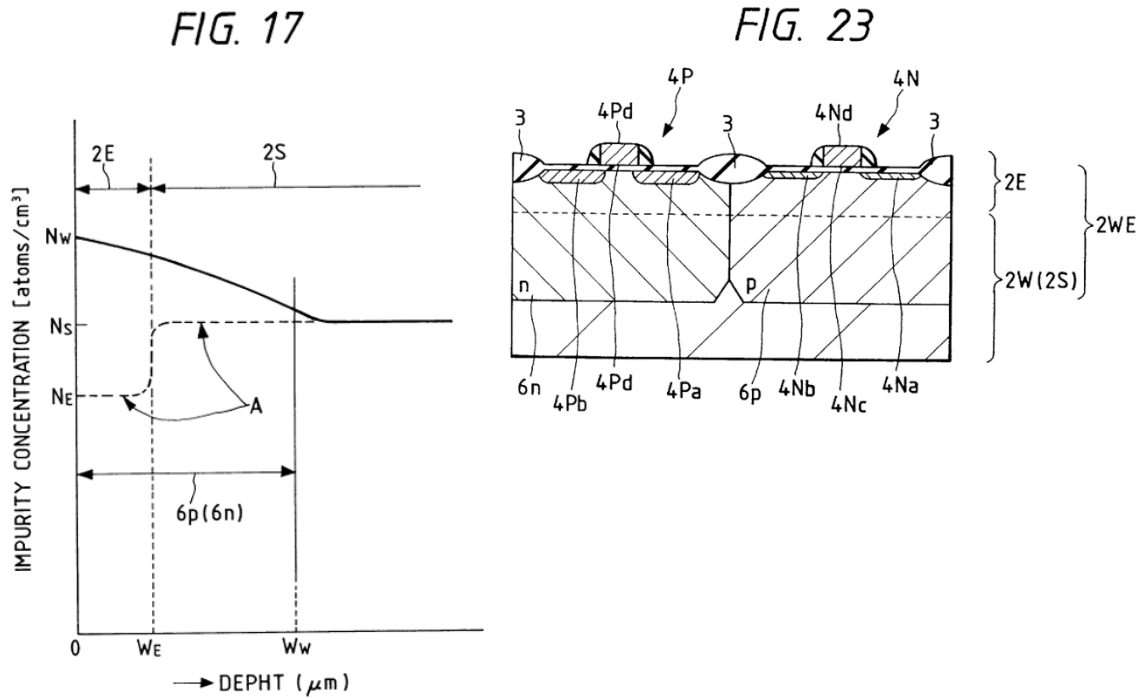


Figure 17 is a plot of impurity concentration as a function of depth in a semiconductor integrated circuit device, which shows “the p-well 6p and n-well 6n have their impurity concentrations gradually lowered in the depthwise direction from the principal surface (having an impurity concentration N_w) of the epitaxial layer 2E.” Ex. 1007, 5:41–45, 15:62–16:40. Figure 23 shows a step in a process for manufacturing a semiconductor integrated circuit device, 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.

2. Petitioner’s Initial Contentions for Claim 1

a. [1.pre] “[a] VLSI semiconductor device, comprising:”

Petitioner argues that Kawagoe teaches the preamble. Pet. 6–8. Patent Owner does not dispute this argument. Prelim. Resp. 1–40. Kawagoe

discloses “a semiconductor integrated circuit device.” Ex. 1007, 1:15–16, 14:50–51. In particular, Kawagoe discloses “4 Megabit Dynamic RAM” devices. *Id.* at 19:15–18. At this stage of the proceeding, Petitioner has shown sufficiently that Kawagoe teaches the subject matter of the preamble of claim 1.¹⁰

b. [1.1] “a substrate of a first doping type at a first doping level having a surface”

Relying on a combination of Kawagoe’s Embodiment 1 and Embodiment 4, Petitioner argues that Kawagoe teaches this limitation. Pet. 8–13. Patent Owner does not dispute this argument. Prelim. Resp. 1–40. Petitioner contends that “a substrate of a first doping type” is taught by Kawagoe’s epitaxial substrate, including epitaxial layer 2E and substrate body 2S doped with p-type impurity, and that the recited “surface” corresponds to the top surface of the epitaxial substrate. Pet. 8–9 (citing Ex. 1007, 6:50–7:3, 14:61–15:12, 17:10–18:38, Figs. 20, 23). Petitioner contends that the recitation, “at a first doping level,” is taught by Kawagoe’s Embodiment 1, which has a uniformly-doped epitaxial substrate, with epitaxial layer 2E and substrate body 2S having the same impurity concentration. Pet. 10 (citing Ex. 1007, code (57), 2:57–3:9, 6:60–7:3).

Petitioner contends that a POSITA would have understood that Kawagoe teaches forming a twin-well CMOS device on either a uniformly doped epitaxial substrate, as described in Embodiment 1, or a non-uniformly

¹⁰ At this stage of the proceeding, we need not determine whether the preamble is limiting because the cited reference(s) describe the subject matter therein.

doped latchup-resistant epitaxial substrate, as described in Embodiment 4. Pet. 10 (citing Ex. 1003 ¶ 74). At this stage of the proceeding, Petitioner has shown sufficiently that Kawagoe teaches limitation 1.1 of claim 1.

c. [1.2] “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”

Petitioner argues that Kawagoe teaches this limitation. Pet. 13–16. Patent Owner does not dispute this argument. Prelim. Resp. 1–40. Kawagoe discloses “semiconductor regions 4Na and 4Nb . . . for forming the source-drain regions of the nMOS 4N.” Ex. 1007, 8:66–67, Fig. 23. Petitioner contends that Kawagoe’s semiconductor regions 4Na and 4Nb, asserted to correspond to the “first active region,” have a doping type (n-type) opposite to the doping type (p-type) of the substrate. Pet. 14. Kawagoe discloses that these regions “are doped with an n-type impurity such as phosphor[us] (P) or arsenic (As).” Ex. 1007, 8:67–9:3. Petitioner directs us to evidence that would support a preliminary finding that source-drain regions 4Na and 4Nb, as well as the channel region between those regions and below insulating film 4Nc all would have been considered part of an active region. Pet. 14–16; Ex. 1008B, 299–300 (“The active regions are those in which transistor action occurs; i.e., the channel and the heavily doped source and drain regions.”). At this stage of the proceeding, Petitioner has shown sufficiently that Kawagoe teaches limitation 1.2 of claim 1.

d. [1.3] “a second active region separate from the first active region disposed adjacent to the first active region and within which transistors can be formed”

Petitioner argues that Kawagoe teaches this limitation. Pet. 17–18. Patent Owner does not dispute this argument. Prelim. Resp. 1–40. Kawagoe discloses “semiconductor regions 4Pa and 4Pb . . . for forming the source-drain regions of the pMOS 4P.” Ex. 1007, 9:47–48, Fig. 23. These regions “are doped with a[] p-type impurity such as boron.” *Id.* at 9:48–50. Petitioner directs us to evidence that source-drain regions 4Pa and 4Pb, as well as the channel region between those regions and below insulating film 4Pc all would have been considered part of an active region. Pet. 17; Ex. 1008B, 299–300. According to Petitioner, this active region is separate from and disposed adjacent to the first active region. Ex. 1007, Fig. 23. At this stage of the proceeding, Petitioner has shown sufficiently that Kawagoe teaches limitation 1.3 of claim 1.

e. [1.4] “transistors formed in at least one of the first active region or second active region”

Petitioner argues that Kawagoe teaches this limitation. Pet. 19.¹¹ Patent Owner does not dispute this argument. Prelim. Resp. 1–40. Kawagoe discloses forming transistors 4N and 4P, each in an active region, as

¹¹ Petitioner’s entire argument with respect to this limitation is a cross-reference to another portion of the Petition. Pet. 19. Specifically, Petitioner directs us to “§§VIII.A.1.c-d.” *Id.* We note that these sections of the Petition do not exist. It is clear from context, however, that Petitioner intended to direct us to § VII.A.1.c–d of the Petition, where Petitioner discusses the formation of the nMOS 4N and pMOS 4P transistors. Similar errors occur throughout the Petition. *See, e.g.*, Pet. 30, 31, 38, 56, 65, 71, 73. For similar reasons, we treat these errors the same way.

discussed above. Ex. 1007, 8:66–9:3, 9:47–50, Fig. 23. At this stage of the proceeding, Petitioner has shown sufficiently that Kawagoe teaches limitation 1.4 of claim 1.

f. [1.5] “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”

Petitioner argues that Kawagoe teaches this limitation. Pet. 19–24. Kawagoe discloses its wells “hav[ing] their impurity concentrations gradually lowered in the depthwise direction from the principal surface . . . of the epitaxial layer 2E.” Ex. 1007, 15:62–16:2, Figs. 17, 23. Petitioner directs us to evidence, including statements made by the inventors during prosecution, that tends to show that these depthwise variations in impurity concentrations include the channel regions of each active region and that such variations in impurity concentrations sweep carriers down into the substrate, away from any active regions. Pet. 20, 23–24; Ex. 1003 ¶ 91; Ex. 1007, Figs. 17, 23; Ex. 1016, 289–90.

Upon considering the parties’ arguments and evidence as discussed below (*see infra* § IV.D.3–4), we determine that at this stage of the proceeding, Petitioner has shown sufficiently that Kawagoe teaches limitation 1.5 of claim 1.

g. [1.6] “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”

Petitioner argues that Kawagoe teaches this limitation. Pet. 24–29. Kawagoe discloses its wells “hav[ing] their impurity concentrations gradually lowered in the depthwise direction from the principal surface . . . of the epitaxial layer 2E.” Ex. 1007, 15:62–16:2, Figs. 17, 23. Petitioner directs us to evidence, including statements made by the inventors during prosecution, that tends to show that these depthwise variations in impurity concentrations sweep carriers down into the substrate, away from any active regions. Pet. 24–26; Ex. 1007, Figs. 17, 23; Ex. 1016, 289–90.

Upon considering the parties’ arguments and evidence as discussed below (*see infra* § IV.D.3–4), we determine that at this stage of the proceeding, Petitioner has shown sufficiently that Kawagoe teaches limitation 1.6 of claim 1.

h. [1.7] “wherein at least some of the transistors form digital logic of the VLSI semiconductor device”

Petitioner argues that Kawagoe teaches this limitation. Pet. 29. Patent Owner does not dispute this argument. Prelim. Resp. 1–40. Kawagoe discloses a “semiconductor integrated circuit device” that can be a “DRAM,” “a flash memory,” or “a logic circuit.” Ex. 1003 ¶ 108; Ex. 1007, 20:1–33, 22:10–29, 24:28–31. At this stage of the proceeding, Petitioner has shown sufficiently that Kawagoe teaches limitation 1.7 of claim 1.

3. Patent Owner's Arguments for Claim 1

Patent Owner argues that Petitioner fails to establish that the asserted references teach or render obvious “at least the ‘aid carrier movement’ limitation (Elements [1.5]/[21.5]/[39.5]/[41.5]/[42.5] and [1.6]/[21.6] of the challenged independent claims).” Prelim. Resp. 3. According to Patent Owner:

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 4–5 (quoting Ex. 1020, 38) (emphasis added). With respect to the prosecution history statement cited by Petitioner—that “a downward-sloping graded dopant concentration was known in the prior art to create an ‘inherent “built-in” unidirectional electric field’ that sweeps carriers down,”—Patent Owner asserts that Petitioner’s quotation of this statement is incomplete. *Id.* at 5–6 (citing Pet. 23; Ex. 1016, 286, 289). Patent Owner takes the position that it also argued “that the movement of carriers ‘[d]epend[s] on the particular slope of the graded concentration of dopant[s]’” and this statement was made in response “to an Office Action regarding a claim that required a ‘single static unidirectional electric drift field to aid the movement of carriers.’” *Id.*

Pointing to the Examiner’s findings during prosecution of the U.S. Patent Application No. 11/622,496, filed on Jan. 12, 2007, which matured

into parent U.S. Patent No. 8,421,195 (“the ’195 patent”),¹² Patent Owner contends that Dr. Blalock examined only the direction of the slope and “did not look at the magnitude of the slope or other possible forces acting on a carrier.” Prelim. Resp. 11 (citing Ex. 2022, 91–92, 191–192). Patent Owner asserts that “the mere direction of the gradient is *not* sufficient to determine whether there is a ‘net force.’” *Id.* According to Patent Owner, Kawagoe teaches the following:

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 in case the MIS memory of the DRAM or the like is formed in the p-well 6p.

Id. at 14 (quoting Ex. 1007, 16:7–11 (emphases omitted)). In view of this disclosure, Patent Owner contends that Kawagoe teaches inhibiting carrier movement, not aiding carrier movement. *Id.* According to Patent Owner, Dr. Blalock admitted “that, according to Kawagoe, SEUs generate ‘electrons produced in the large substrate body below the wells’—far below the active regions.” *Id.* at 15 (citing Ex. 1003 ¶ 94 n.6). Patent Owner further contends that “Kawagoe does not address carriers in the ‘active region’” and “does not ‘aid carrier movement *from the first surface*’ because Kawagoe’s carriers are nowhere near what Petitioner identifies as the ‘first surface.’” *Id.*

¹² Patent Owner contends that “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.” Prelim. Resp. 6 (citing Ex. 1016, 270).

According to Patent Owner, Dr. Blalock's testimony cites Wang, "a document whose public availability Petitioner has not established" and has a publication date of 2008, which is four years after the '222 patent's earliest possible priority date of September 3, 2004. *Id.* at 16 (citing Ex. 1003 ¶¶ 94–95, 106; Pet. v; Ex. 1009, 429). Even setting aside the potential issues of public availability and contemporaneity, Patent Owner asserts that Wang does not provide one of ordinary skill in the art "a reason to use Kawagoe in the active region" because Wang also indicates that carriers "are primarily generated deep in the device." *Id.* at 16. According to Patent Owner, "Wang shows some carriers in the active region, but never says that they are known to be a problem." *Id.* (emphasis omitted).

During prosecution of the '195 patent, 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. 1016, 289 (emphasis added). Patent Owner 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. Patent Owner further argued that the Examiner’s finding

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,” Patent Owner amended claims to eliminate reference to “*all* carriers” and instead, refer to “carriers.”¹³ *Id.* at 290.

4. Analysis of Claim 1

At this stage of the proceeding, we determine that Patent Owner’s statements made during prosecution of the ’195 patent contradict its arguments in the present proceeding. *See generally* Prelim. Resp. Based on the present record, Patent Owner’s statements during prosecution support a preliminary finding that a graded dopant concentration is enough to teach

¹³ The examined claims of the ’195 patent generally recited “a unidirectional drift field drawing all minority carriers from said surface layer to said substrate.” Ex. 1016, 286. Patent Owner amended the claims of the ’195 patent 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.*

aiding carrier movement in a particular direction. Patent Owner does not dispute that Kawagoe has a graded dopant concentration in the active region at this stage of the proceeding. *See generally* Prelim. Resp. Patent Owner also does not dispute that Kawagoe’s transistor has carriers in the active region or that the graded dopant concentration of Kawagoe is lowered from the surface to the bottom substrate (Ex. 1007, Fig. 17). *See generally* Prelim. Resp. At this stage of the proceeding, Petitioner has the better position.

5. *Remaining Claims*

In view of our determination that Petitioner establishes a reasonable likelihood for claim 1, and because Petitioner’s arguments and evidence for remaining independent claims 21, 39, 41, and 42 are similar to Petitioner’s arguments and evidence for claim 1 (Pet. 6–30), and because Petitioner’s arguments and evidence for dependent claims 2–9, 13, 14, 16–20, 23–28, 32–38, and 40 (Pet. 30–45) are unopposed at this stage by Patent Owner, we determine that it is unnecessary to provide an explicit analysis of Petitioner’s challenges to the remaining claims in order to provide guidance to the parties for the upcoming trial. Consolidated Trial Practice Guide November 2019 (“CTPG”)¹⁴ at 64; *see* 37 C.F.R. § 42.108(a) (“When instituting *inter partes* review, the Board will authorize the review to proceed on all of the challenged claims and on all grounds of unpatentability asserted for each claim.”); *see also SAS Institute Inc. v. Iancu*, 138 S. Ct. at 1359–60 (holding that 35 U.S.C. § 314 forbids the Board’s prior “partial institution” practice).

For this same reason, we further determine that we need not provide an explicit analysis of the remaining grounds presented by Petitioner.

¹⁴ Available at <https://www.uspto.gov/TralPracticeGuideConsolidated>.

In view of the foregoing, we determine that Petitioner has demonstrated sufficiently under 35 U.S.C. § 315(c) that institution of an *inter partes* review is warranted under 35 U.S.C. § 314(a).

B. Whether to Join Petitioner as a Party to the 1242IPR

Joinder may be authorized when warranted, but the decision to grant joinder is discretionary. *See* 35 U.S.C. § 315(c); 37 C.F.R. § 42.122. A motion for joinder should (1) set forth reasons why joinder is appropriate; (2) identify any new grounds of unpatentability asserted in the petition; (3) explain what impact (if any) joinder would have on the trial schedule for the existing review; and (4) address specifically how briefing and discovery may be simplified. *See, e.g., Kyocera Corp. v. Softview LLC*, IPR2013-00004, Paper 15 (PTAB April 24, 2013). As the moving party, Petitioner bears the burden of proving that it is entitled to the requested relief. 37 C.F.R. § 42.20(c).

As an initial matter, the Motion for Joinder meets the requirements of 37 C.F.R. § 42.122(b) because Petitioner filed it within one month after the 1242IPR was instituted on February 12, 2024. Mot. 3–4.

Petitioner asserts that the above-mentioned four factors favor joinder here because Petitioner seeks to join the 1242IPR in an understudy role. Mot. 4, 6–8. Petitioner explains that the joinder will have no impact on the pending schedule for the 1242IPR. *Id.* at 6. Petitioner further provides the following conditions it would abide by as long as Semiconductor Components Industries, LLC (“the 1242 Petitioner”) remains an active party to the 1242IPR:

- (a) [Petitioner] shall not make any substantive filing and shall be bound by the filings of the [1242] Petitioner, unless a filing

concerns termination and settlement, or issues solely involving [Petitioner];

(b) [Petitioner] shall not present any argument or make any presentation at oral hearing unless an issue solely involves [Petitioner], or when addressing Board-approved motions that do not affect the [1242] Petitioner, or its respective position;

(c) [Petitioner] shall not seek to cross-examine or defend the cross-examination of any witness, unless the topic of cross-examination concerns issues solely involving [Petitioner];

(d) [Petitioner] shall not seek discovery from Patent Owner on issues not solely involving [Petitioner];

(e) [Petitioner] will not rely on expert testimony beyond that submitted by the [1242] Petitioner unless the [1242] Petitioner is terminated from the case. If the [1242] Petitioner is not terminated from the case, [Petitioner] agrees to rely entirely on, and be bound by, the expert declarations and depositions in the [1242] IPR. Unless and until the current petitioner in IPR2023-01242 ceases to participate in the instituted [1242] IPR, [Petitioner] will not assume an active role.

Id. at 7–8. Petitioner contends that “due to [Petitioner] taking only an ‘understudy’ role, Patent Owner and the [1242] Petitioner will only need to respond to one principal set of papers, will not require additional time to address additional arguments raised by [Petitioner], and can thus proceed with the existing trial schedule,” and “[t]hese steps will minimize or eliminate any potential complications or delay that could potentially result from joinder.” *Id.* at 8.

Patent Owner argues that Petitioner’s Motion for Joinder should be denied because joinder would be prejudicial to Patent Owner and contrary to public policy favoring settlement. Opp. Mot. Join. 3–5. Patent Owner also argues that joinder is unavailable if Patent Owner prevails on Director Review in the 1242IPR. *Id.* at 5–8.

Patent Owner's first argument is not persuasive because it is based on speculation, without any evidence, that Petitioner "is trying to block settlement with *any* of these defendants unless [Patent Owner] *also* settles with" Petitioner. Opp. Mot. Join. 5. As discussed below, we determine that Patent Owner will not be prejudiced unduly by the joinder. Moreover, we note that even in a situation where the petitioner and patent owner in the proceeding to be joined had settled (*Code200 v. Bright Data Ltd.*, IPR2022-00861, Paper 17 at 5 (PTAB July 25, 2022) (vacated)), the Director nevertheless vacated a decision to deny a motion for joinder. *Code200 v. Bright Data Ltd.*, IPR2022-00861, Paper 18 at 7 (Office of the Director of the USPTO Aug. 23, 2022) (precedential); *see also eBay, Inc. v. Lexos Media IP, LLC*, IPR2024-00336, Paper 11 at 13–15 (PTAB Feb. 23, 2024).

Patent Owner's second argument is moot because Patent Owner's Request for Director Review has been denied. 1242IPR, Paper 44 (PTAB Apr. 24, 2024).

Based on the facts and circumstances discussed above, having reviewed the briefings of both parties, we determine Petitioner has established good cause for joining the 1242IPR. Specifically, we find that joining Petitioner to the 1242IPR is unlikely to require any delay or modification to the scheduling order already in place for the 1242IPR. We also determine that Patent Owner will not be prejudiced unduly by the joinder of this proceeding. Thus, we determine that granting the Motion for Joinder under these circumstances would help "secure the just, speedy, and inexpensive resolution" of these proceedings. *See* 37 C.F.R. § 42.1(b). For the above reasons, we grant Petitioner's Motion for Joinder and join Petitioner as a party to the 1242IPR.

V. CONCLUSION

For the reasons given above, 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. Accordingly, we institute an *inter partes* review of all challenged claims based on the grounds asserted in the Petition. In addition, having reviewed the briefings of both parties, we grant Petitioner's Motion for Joinder. Patent Owner's argument that the Petition is time-barred under 35 U.S.C. § 315(b) is moot because it is accompanied by a request for joinder to an instituted proceeding, which we grant.

VI. ORDER

For the reasons given, it is:

ORDERED that pursuant to 35 U.S.C. § 314(a), an *inter partes* review is hereby instituted as to claims 1–9, 13–28, and 32–42 of the '222 patent on the grounds set forth in the Petition;

FURTHER ORDERED that Petitioner's Motion for Joinder is *granted*, and Petitioner is joined as a petitioner in IPR2023-01242;

FURTHER ORDERED that Petitioner shall have an “understudy” role in the 1242IPR under the conditions reproduced above (*see* Mot. 7–8);

FURTHER ORDERED that all further filings in the joined proceeding shall be made in IPR2023-01242, and that no further filings shall be made in IPR2024-00673;

FURTHER ORDERED that the Scheduling Order in IPR2023-01242, and any modifications thereto, shall govern the joined proceeding;

FURTHER ORDERED that a copy of this Decision shall be entered in IPR2023-01242; and

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FURTHER ORDERED that the case caption in IPR2023-01242 shall be modified to reflect Petitioner's joinder in accordance with the attached example.

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Example Caption for Joined Proceeding

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SEMICONDUCTOR COMPONENTS INDUSTRIES, LLC and
TEXAS INSTRUMENTS INCORPORATED,
Petitioner,

v.

GREENTHREAD, LLC,
Patent Owner.

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¹ Texas Instruments Incorporated, which filed a petition in IPR2024-00673, has been joined as a petitioner in this proceeding.