

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SEMICONDUCTOR COMPONENTS INDUSTRIES, LLC,
Petitioner,
v.

GREENTHREAD, LLC,
Patent Owner

IPR2024-00264
U.S. Patent No. 10,734,481

**PETITIONER'S AUTHORIZED RESPONSE TO
DIRECTOR REVIEW REQUEST**

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Patent Owner Greenthread, LLC presents no sound basis for disturbing the Board’s thorough Final Written Decision (Paper 77, “FWD”). Across more than a dozen IPRs on patents in this same family, the Board has consistently concluded that the challenged claims only require a graded dopant concentration that is capable of aiding carrier movement in the recited direction. The claims do not recite and do not require affirmatively moving any specific carrier. The Board’s well-reasoned claim construction—across all of these decisions—should be allowed to stand.

If this was not enough, the Board also correctly recognized that the Kawagoe reference discloses the required “graded dopant concentration,” even under Patent Owner’s construction requiring that a carrier actually move. FWD, 78-79. Kawagoe expressly says that electrons “are attracted to the substrate body” by the graded dopant concentration in question. EX1007, 16:7-9. The verb tense here is key: Kawagoe does not say that electrons “may be” or “could be” or “sometimes are” attracted—Kawagoe says that the electrons *are* attracted to the substrate. So, even if the Board’s claim construction was mistaken (and it was not), Kawagoe still renders the claims obvious.

I. BACKGROUND

A. The Parties’ Arguments About “To Aid Carrier Movement”

To show a “graded dopant concentration to aid carrier movement,” the Petition identifies semiconductor devices where the concentration of dopants

decreases along the depth of the device. Paper 1 (“Petition”), 19-24 and 51-55. As explained by Petitioner’s expert, these decreasing (e.g., “graded”) concentrations of dopants result in a forces that push electrons towards the substrate, as claimed. See EX1003, ¶¶91-95 and ¶¶147-53; EX2058 (Pet. Expert Dep.), 77:7-9 (“[T]he concentration gradient leads to a force on the carriers that moves them toward the substrate.”). Later in the IPR, Patent Owner’s *own expert agreed* that the graded dopant concentrations in the prior art would generate an electric field “pushing electrons down.” EX1056 (Patent Owner Expert Dep.), 113:12-16; EX1069, 56 (Petitioner demonstrative, below).

There is an electric field in Kawagoe pushing electrons downward

Kawagoe EX1007, Figs. 17, 23; 15:26-36
 Reply, Paper 38 (-00263), 16;
 Reply, Paper 39 (-00264), 16;
 Reply, Paper 39 (-00265), 14-15;
 Reply, Paper 41 (-00266), 15.

Q So throughout the depth in Kawagoe from 0 past WW, there is an electric field pushing electrons downward?

A. **Yes**, there's that field shown in Figure 17.

EX1056 (-00263, -00264)/
 EX1063 (-00265)/
 EX1054 (-00266),
 113:12-16

Because there could be no dispute that the graded dopant concentrations result in a force on electrons in the claimed direction, Patent Owner instead attempted to distinguish the prior art by presenting a narrow interpretation of “to aid carrier

movement.” Paper 32 (“POR”), 10-11. Specifically, according to Patent Owner, a device only has a “graded dopant concentration to aid carrier movement,” if a carrier is actually moved by the graded dopant concentration. *Id.*; *see also* Paper 79 (“Request”), 4. Relying on this narrow construction, Patent Owner argued that Petitioner needed to compare the magnitude of the prior art graded dopant concentrations to other unspecified forces and resistances that could interfere with the motion of actual carriers. *See* POR, 16-17. Because Petitioner did not conduct this analysis, Patent Owner contended that Petitioner “fail[ed] to establish that the disclosed gradients would ‘aid carrier movement.’” *Id.*

B. The Board’s Claim Construction

The Board correctly rejected Patent Owner’s construction of a “graded dopant concentration to aid carrier movement,” recognizing that the claims only require a graded dopant concentration that is capable of moving a carrier in the claimed direction. FWD, 72-78. To reach this conclusion, the Board considered the plain language of the claims, and thoroughly analyzed both the prosecution history, and statements made by district courts concerning related claims. *Id.* The Board also pointed out that the ’481 patent’s specification does not include the type of analysis regarding other forces that Patent Owner now alleges to be necessary. *Id.*, 74-75.

Regarding the claims themselves, the Board recognized that the challenged claims are **not** method claims, with active steps—these are apparatus claims. *Id.*

And as the Federal Circuit has instructed: “[a]pparatus claims cover what a device *is*, not what a device *does*.” FWD, 75 (alterations and emphasis in original, quoting *ParkerVision, Inc. v. Qualcomm Inc.*, 903 F.3d 1354, 1361 (Fed. Cir. 2018)). As such, the Board correctly concluded that “Petitioner must show ‘a graded dopant concentration’ that is *capable* of ‘aid[ing] carrier movement from the first surface to the second surface of the substrate.’” *Id.* (alterations and emphasis in original).

The Board also cited statements made by Patent Owner during prosecution of a related earlier patent, confirming it was unnecessary to compare the graded dopant concentration to other hypothetical forces. FWD, 72-74. In particular, Patent Owner assertion in prosecution that “the graded dopant concentration itself creates a ‘built-in’ electric field that forces the movement of carriers into a particular direction[.]” *Id.*, 73 (quoting EX1016, 289 (emphasis by Patent Owner)). The Board concluded that Patent Owner’s statements “were clear, unambiguous, and indicate that [...] the mere presence of a graded dopant concentration creating a ‘unidirectional drift field, facing in the appropriate direction, will ‘aid the movement of minority carriers from’ the surface layer to the substrate.” FWD, 73-74 (quoting Ex. 1016, 270, 289–290). “The public is entitled to rely on these clear and unambiguous statements when considering the scope of the challenged claims.” *Id.* citing *Hockerson-Halberstadt v. Avia Group Int’l*, 222 F.3d 951, 957 (Fed. Cir. 2000).

The Board also rejected Patent Owner’s arguments about prior district court claim construction orders. FWD, 75-78. The Board recognized that each of the district court orders that Patent Owner cited—which did not involve Petitioner—did not address the meaning of “to aid carrier movement.” *Id.* The Western District of Texas decision cited by Patent Owner instead addressed whether “graded dopant concentration” was indefinite. *Id.*, 76. The Eastern District of Texas decision involved the construction of the phrase “single drift layer . . . having a graded concentration of dopants generating a first static unidirectional drift field.” *Id.*, 77-78. Neither of these decisions involved a determination that the phrase “to aid carrier movement” requires actually moving a specific carrier.

C. The Board’s Analysis of the Prior Art.

After rejecting Patent Owner’s claim construction, the Board also agreed with Petitioner that the prior art discloses a “graded dopant concentration to aid carrier movement from the first surface to the second surface of the substrate.” FWD, 78-82 and 101. For Kawagoe, the Board agreed with Petitioner that “the prior art graded dopant concentrations are all capable of aiding the movement of carriers in the claimed direction, notwithstanding hypothetical forces or resistances that could sometimes prevent motion.” *Id.*, 79 (quoting Paper 35 (“Reply”), 10). Similarly, for the Wiezorek-Wolf combination, the Board reiterated that “no particular magnitude or specific numerical value of slope must be shown in order to satisfy the

claims,” and thus the Board concluded “the combination of Wieczorek and Wolf teaches the relative slope encompassed by the scope of independent claim 1.” *Id.*, 101. Notably Patent Owner’s Request for Director Review does not challenge the Board’s conclusion that—under the Board’s claim construction—the prior art discloses a “graded dopant concentration to aid carrier movement.”

The Board also agreed with Petitioner that Kawagoe would satisfy the “aid carrier movement” limitation even under Patent Owner’s narrow construction. *Id.* 78-79. Kawagoe specifically describes that the graded dopant concentration in Figure 17 is “given such a gradient” that electrons are both “attracted to the substrate” and “prevented from entering the p-well.” EX1007, 16:2-11 (emphasis added). The Board agreed with Petitioner that this language means “that the graded dopant concentration in Kawagoe is ‘given such a gradient’ that the electrons would affirmatively move, notwithstanding any unstated external forces.” *Id.* (internal alterations omitted, quoting Reply, 7). The Board also found that carriers being prevented from entering the p-well is “strong (let alone sufficient) evidence that the downward facing electric field is not negated or reversed by other fields or forces.” *Id.* So, even if the graded dopant concentration must be sufficiently strong to overpower unidentified other forces—as Patent Owner argues now—Kawagoe discloses a graded dopant concentration that is sufficiently strong. *Id.*

II. ARGUMENT

A. The Board Correctly Interpreted the Claim Language

The logic from the Federal Circuit’s *ParkerVision* decision that the Board cited is sound and applicable: “apparatus claims cover what a device *is*, not what a device *does*.” 903 F.3d at 1361 (emphasis original); FWD, 75 (quoting same). Following this precedent, the Board was correct to recognize that the phrase “to aid carrier movement” is not used as a verb, requiring action. *Id.* The phrase is used as an adjective, describing a characteristic of the claimed “graded dopant concentration.” None of Patent Owner’s arguments overcome this plain reality: the claims recite a thing (a graded dopant concentration) that is *suitable* for an action (to aid carrier movement); the claims do not recite actually performing that action.

Patent Owner’s contrary arguments about Federal Circuit precedent depart notably from the actual construction that it seeks in this matter. *See* Request, 6-7. For example, Patent Owner cites to *Ball Aerosol* to argue that “[a] claim element does not recite capability where an apparatus requires a certain configuration, structure, or function[...].” *Id.* (citing *Ball Aerosol & Specialty Container, Inc. v. Ltd. Brands, Inc.*, 555 F.3d 984 (Fed. Cir. 2009)). But Patent Owner did not argue for a construction based on “configuration, structure, or function”—Patent Owner argued for a construction requiring action; actually moving a carrier.

Nor did the Federal Circuit in *INVT* create a categorical analysis requiring actual operation to practice types of apparatus claims. *Contra* Request, 6-7 (citing *INVT SPE LLC v. Int’l Trade Comm’n*, 46 F.4th 1361, 1371 (Fed. Cir. 2022)). The Federal Circuit in *INVT* specifically determined that the claims at issue **did not** require actual performance to be practiced. *INVT*, 46 F.4th at 1374. So, any statement in *INVT* about different hypothetical claims that might require actual performance is dicta. Moreover, the Federal Circuit in *INVT* continued to emphasize that “whether infringement requires actual performance of the recited functions by the accused device depends on the claim language.” *Id.* at 1371. This focus on the actual claim language contradicts the categorical rule for “mechanical apparatus claims” that Patent Owner advances. *Contra* Request, 7.

Looking at the actual claim language (as instructed in *INVT*), the Board was correct that the claims do not require actually moving any specific carrier. Indeed, the claims **do not recite** “a carrier.” There is also an important linguistic difference between “aiding” movement and “generating” movement. The phrase used in the claims—“to aid carrier movement”—presupposes that a carrier is already moving in the recited direction. This makes sense in terms of describing the capability of the graded dopant concentration: describing the direction in which the graded dopant concentration would “aid carrier movement” tells a POSITA the required orientation of the graded dopant concentration. In contrast, the verb “aid” does not suggest that

the graded dopant concentration must accelerate a specific carrier from a stop into active movement.

B. The Board Correctly Considered the Prosecution History

Patent Owner's arguments about the prosecution history would wrongly flip that history on its head. As the Board correctly described, the Examiner's statement about "multiple forces and fields" was given as a reason for rejecting Patent Owner's proposed claim language more affirmative language: "drawing all minority carriers from said surface layer to said substrate." FWD, 72-73 (citing EX1016, 270 and 289). In response to that rejection, Patent Owner argued that the more affirmative language should have been allowed because "the graded dopant concentration itself creates a 'built-in' electric field that forces the movement of carriers into a particular direction." *Id.*, 73 (quoting EX1016, 289-90). Patent Owner also amended the claims to use the more passive language ("to aid carrier movement") that is in the present claims. *Id.* This history confirms that during prosecution Patent Owner expected its claims to cover any graded dopant concentration that generated a field in the required direction, regardless of the field's magnitude, and whether using the original active language ("drawing all minority carriers") or the more passive amended language ("to aid carrier movement.")

Having responded and amended its claims, Patent Owner cannot now use the Examiner's initial rejection argument to narrow the issued claims. *Contra*

Request, 8. Even if Patent Owner now wishes that it had adopted the Examiner's position, that is not what happened. It is too late for Patent Owner to recant arguments it made to **overcome** the Examiner's rejection. Moreover, Patent Owner's subsequent amendment to make claim language more passive ("to aid carrier movement") undermines any possible reliance on the Examiner's initial interpretation. The Board was right to credit Patent Owner's responsive arguments and amendments over the Examiner's initial statements. FWD, 73-74.

Read in context, the reference to a "particular slope" in the prosecution history also cannot be interpreted as referring to a particular slope *magnitude*. *Contra* Request, 9. This is not about "middle-school math" (*id.*), this is about reading comprehension. The full phrase in question establishes a directional dichotomy: "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)." EX1016, 289. This dichotomy makes sense if "particular slope" refers to the particular direction: based on the direction in which the slope points, the resulting force would push all carriers either up or down. In contrast, there is no logical dichotomy under Patent Owner's interpretation that "particular slope" refers to a particular magnitude. Because (according to Patent Owner) some carriers may not move if the slope magnitude is too small, the reference to "all carries" potentially going up or down does not make sense.

Patent Owner's assertion that it "has never argued that a GDC is all that matters" is form over substance. Request, 10. As the Board pointed out, Patent Owner argued in district court litigation (not involving Petitioner) that "a POSITA would have readily recognized that when a 'static unidirectional electric drift field' is present that it aids the movement of the minority carriers. If it isn't present, then it doesn't." FWD, 80 (quoting EX1020, 26). Here, there is no dispute that the prior art graded dopant concentrations generate electric fields; the only dispute is whether the electric fields would "aid carrier movement." *Supra*, 2 (showing testimony from Patent Owner's expert that Kawagoe generates an electric field); EX1056, 113:12-16; EX1007, Fig. 17. So, in view of Patent Owner's categorical statements about electric fields, Patent Owner's protest is hollow. Patent Owner still argued that something found in the prior art is sufficient to aid carrier movement.

Patent Owner's more recent prosecution statements about "relative slope" further confirm that there no specific magnitude is required. EX1058, 12; *contra* Request, 10-11. Patent Owner's description of "relative slope" in subsequent prosecution is relevant because the only disclosure in the specification that describes "aiding" the movement of carriers uses this language. EX1001, 3:6-9. And while this passage describes a BJT transistor, Patent Owner and its expert pointed to this passage to argue that slope *magnitude* was needed to determine if a graded dopant concentration would aid carrier movement. *See* POR, 14-15. Patent Owner's

statements in parallel prosecution undermined this argument. Instead of considering slope *magnitude*, Patent Owner took the position in prosecution that relative slope “means nothing more than the fact that one-side is relatively lower than the other side.” EX1058, 12. Patent Owner’s position on relative slope thus confirms that nothing in the specification (or prosecution history) uses slope magnitude to determine if a dopant concentration will “aid carrier movement.”

C. The Board Correctly Analyzed Prior Claim Construction Orders

The Board also correctly rejected Greenthread’s arguments based on prior district court claim constructions.¹ FWD, 75-78. The claim construction orders cited by Greenthread do not actually construe the phrase “to aid carrier movement.” Instead, the decisions involved (1) a conclusion by the Western District of Texas that “graded” was not indefinite (*id.* 76-77), and (2) a construction by the Eastern

¹ In another proceeding involving this patent, the Director recently denied Patent Owner’s Request for Director Review based on this same issue. *Cirrus Logic, Inc. et al. v. Greenthread, LLC*, IPR2024-00001, Paper 120 (February 3, 2026) and Paper 116 (November 25, 2025) at 7-9. The Director denied a similar request in other proceedings between Patent Owner and Petitioner on related patents. *See e.g., Semiconductor Components Industries, LLC et al. v. Greenthread, LLC*, IPR2023-01242, Paper 138 (February 3, 2026) and Paper 129 (November 10, 2025) at 9-11.

District of Texas of the term “single drift layer . . . having a graded concentration of dopants generating a first static unidirectional drift field.” (*id.* 77-78). Neither court construed “to aid carrier movement” to require affirmatively moving a carrier.

Moreover, the Western District of Texas equated “graded” and “aided,” in a manner that contradicts Patent Owner’s view of the claims. Patent Owner wrongly suggests that by saying a concentration must be “sufficiently graded,” the Court found some graded dopant concentrations aid carrier movement and some do not. Request, 12. That is not an accurate characterization of the Court’s conclusion. The Court held that “graded dopant concentration” was not indefinite because the phrase “to aid carrier movement” defined the minimum amount of grading needed ***to qualify as*** a “graded dopant concentration.” EX2080, 39-40. In other words, the Court held that everything that qualifies as a “graded dopant concentration” (as that term is used in the claims) must necessarily “aid carrier movement.” To be clear, Petitioner has not adopted the WDTX Court’s interpretation (which, again, was not a construction of “to aid carrier movement”). But it remains wrong for Patent Owner to suggest the WDTX Court’s position contradicts the Board’s construction. If anything, the WDTX Court’s conclusion contradicts Patent Owner’s position that some graded dopant concentrations do not “aid carrier movement.”

Lastly, Patent Owner’s reference to *Revvo Techs., Inc. v. Cerebrum Sensor Techs., Inc.*, is erroneous. Request, 4 (citing IPR2025-00632, Paper 20 (PTAB Nov.

3, 2025) (precedential) (“*Revvo*”). *Revvo* addresses circumstances where a petitioner advances potentially contradictory claim constructions in district court litigation and before the PTAB. *See Revvo*, 4-5. That concern has no application to this matter because Petitioner was not involved in the Texas district court cases that Patent Owner cites. Patent Owner has never identified any inconsistency between Petitioner’s positions in these IPRs and Petitioner’s district court litigation.

D. The Board Correctly Recognized that Kawagoe Meets Patent Owner’s Narrow Construction

Patent Owner’s allegation that Petitioner “has not pointed to any teachings or disclosure that demonstrate the claimed limitations” is incorrect. Request, 15. Even applying Patent Owner’s narrow construction of “to aid carrier movement,” the Board agreed with Petitioner that Kawagoe discloses a “graded dopant concentration to aid carrier movement.” FWD, 78-79.

The Board agreed that the active language in Kawagoe (“electrons ... are attracted”) confirms that electrons impacted by the gradient in Kawagoe actually move. *Id.* (citing EX1007, 16:2-11). The further confirmation in Kawagoe that electrons in the substrate are “prevented from entering the p-well” strengthens the Board’s conclusion. *Contra*, Request 13-14. Logically, if there were any stronger forces in Kawagoe, pushing in the opposite direction from the graded dopant concentration, then electrons would not be “prevented from entering the p-well.”

This “prevention” thus confirms that the electric field from the graded dopant concentration in Kawagoe must be stronger than any other (unspecified) forces.

Patent Owner’s arguments about the location of the graded dopant concentration and location of the carriers in Kawagoe are also misguided. Request, 14. There is no dispute that electrons are in the active region of Kawagoe. *See* Paper 18 at 6. And Patent Owner’s expert confirmed that the graded dopant concentration shown in Figure 17 of Kawagoe extends to the surface of the device, through the active region. *See* EX1056, 113:12-16 (confirming graded dopant concentration “from 0 [the surface] past WW [the depth of the well].”).

Thus, it does not matter that Kawagoe describes the activity of the graded dopant concentration with respect to preventing electrons generated by alpha ray strikes from moving “up” into the well. The alpha ray strike is just an illustration; the configuration of the graded dopant concentration does not change based on the presence (or absence) of an alpha ray strike. And as a matter of physics—confirmed by Patent Owner’s expert—an electric field that “impedes” electron movement up also “aids” movement down. *See* EX1056, 109:6-14. This aligns perfectly with what Kawagoe says: electrons “are attracted to the substrate” (aided going down), and “prevented from entering the p-well” (impeded going up). *See* FWD, 80.

III. Conclusion

The Board’s Final Written Decision should not be disturbed.

Dated: March 6, 2026

Respectfully submitted,

/Roger Fulghum/

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Reg. No. 39,678

Counsel for Petitioner

Semiconductor Components

Industries, LLC

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), I certify that on this 6th day of March 2026,
PETITIONER'S AUTHORIZED RESPONSE TO DIRECTOR REVIEW REQUEST was served by email on the following counsel for Patent Owner and the
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