UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SEMICONDUCTOR COMPONENTS INDUSTRIES, LLC,
Petitioner,

v.

GREENTHREAD, LLC,
Patent Owner.

IPR2024-00266
U.S. Patent No. 8,421,195

PATENT OWNER'S PRELIMINARY SUR-REPLY

I. INTRODUCTION

Petitioner's preliminary reply brief ignores the examiner's finding that in "a complex electronic device, movement of minority carriers is affected by multiple forces and fields" and that "without knowing other parameters of the device" one cannot say whether the field would aid carrier movement. Paper 13, 6 (citing Ex. 1016 at 270.) Petitioner also admits that "*the prior art does not include any ... forces*" necessary to determine whether the specific dopant gradients they disclose would "aid the movement of minority carriers" (hereafter, "aid carrier movement"). Paper 15, 1 (emphasis added). Indeed, Petitioner admits that its references "do[] not contemplate any such opposing force." *Id.*, 4. Since the prior art gradients do not contain an express teaching of "aiding carrier movement" and do not have the information essential to determine if their gradients have that effect, the Petition fails.

II. Argument

A. "Graded" does not mean "aided."

Petitioner's paid expert, Dr. Blalock, cannot overcome the unrebutted and indisputable fact acknowledged by the examiner that graded does not mean aided. Even the testimony from Dr. Blalock that Petitioner quotes agrees with Greenthread and the examiner. "[I]f you have a downward-sloping graded dopant concentration, … that will create a force, which <u>*tends*</u> to move the carriers." Paper 15, 2 (emphasis

added). Dr. Blalock did not say that a dopant concentration "always and everywhere" moves carriers. A gradient "*tends*" to move carriers, "[*a*]*ll other things being equal*." *Id.*; Ex. 2058, 213 (emphasis added). The Petition fails, because Dr. Blalock did not determine whether "[a]ll other things [*are*] equal" and Petitioner admits that the prior art does not contain the information necessary to make that determination, because the references "do[] not contemplate any … opposing force." Paper 15, 4.

Petitioner tries to take refuge in the doctrine of inherency, without saying so, because it knows that inherency will not work. The "probability or possibility" that a dopant gradient aids carrier movement "is insufficient" absent an express teaching. *In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999). The prior art "must *necessarily* include the unstated limitation." *Transclean Corp. v. Bridgewood Servs., Inc.*, 290 F.3d 1364, 1373 (Fed. Cir. 2002) (emphasis in original). Silence in the prior art does not mean that "[a]ll other things [are] equal," and the fact that a gradient "tends" to move carriers does not mean that it necessarily does. Ex. 2058, 91-92; Paper 15, 2.

B. Petitioner's claim construction arguments are a strawman.

The very word "aid" in the claim shows that there must be *other* forces which the gradient is "aiding." Dr. Rao did not specify a magnitude for the force of the dopant gradient in the claim, because a POSITA would know that the magnitude necessary to "aid carrier movement" will depend on other parameters—the ones Dr.

Blalock ignores. However, the fact that the claims do not *quantify* the force exerted by the gradient, does not mean that magnitude is irrelevant or that any gradient satisfies the limitation. No specific slope is required, but the gradient must point in the right direction and "aid carrier movement," to some degree. Greenthread is not reading a "numerical slope" into the claims. Paper 15, 5. That is Petitioner's strawman.

Petitioner's reading would allow the claim limit to be met *without any movement* or even movement in the opposite direction. Ex. 1030, 38. That makes no sense. Obviously, when the force of a dopant gradient pushes *against* the direction of movement, it is not aiding the movement regardless of how steep or shallow the gradient is. Petitioner ignores this point entirely. *See* Paper 13, 8-9.

Petitioner misreads Greenthread's claim construction brief. Paper 15, 5. In the section Petitioner cites, Greenthread said "[I]f a claim recites: 'pressing a gas pedal to aid movement of the car,' there is no requirement to … say how fast the car must go. … [T]he ultimate speed is beyond the scope of the claim." Ex. 1030, 36. The fact that there is no threshold speed at which the car must move, does not mean that pressing the gas pedal *always* aids the movement of the car. Pressing the gas pedal does not "aid the movement of the car," if the car is in neutral, is out of gas, or stuck in a ditch.

Finally, Petitioner's argument that "slope" in the prosecution history refers *only* to direction of the gradient's slope, fails. According to Petitioner "the applicant identified Figures 5(b) and 5(c) [in the specification] as having a 'particular slope'" without a "numerical assessment" of that slope. Paper 15, 4-5. However, Figures 5(b) and 5(c) are transistor diagrams, not depth versus concentration graphs. They were never intended to show gradient slope.

C. Petitioner's "strong wind" analogy highlights the Petition's deficiency.

Petitioner's statement that carriers in dopant gradients "can be thought of like boats in a *strong* wind" acknowledges that magnitude matters. Paper 15, 7 (emphasis added). Petitioner used a "*strong* wind" instead of regular strength "wind" or "the force created by a passing butterfly," because otherwise its analogy is implausible.

Petitioner's analogy also shows why other forces matter. Currents, tides, waves, the ship's engines, and other factors affect a ship's movement and may overwhelm or push opposite to the wind. The net effect of all of these forces determines a ship's speed and direction, just as the "net force" determines carrier movement in a semiconductor device. Ex. 2058, 187-188. The Petition fails, because—to continue Petitioner's analogy—the Petition does not distinguish a "strong wind" from a passing butterfly and does not mention currents, tides, waves, or the ship's engine. If sailors knows *only* wind direction they do not know whether

or where their ship will move, and if a semiconductor designer knows *only* the direction of a dopant gradient, she does not know whether or where carriers will move.

Finally, even if Petitioner's analogy had any force, it is pure attorney argument, unsupported by any citation, and does not appear in the Petition.

D. Petitioner cannot save Kawagoe.

Petitioner tries to salvage the Kawagoe reference, but fails. *First*, Petitioner *again* selectively quotes Kawagoe to hide the same language that Petitioner skipped over in the Petition. Petitioner quotes a sentence from Kawagoe stating that its dopant gradient is "at 'the surface of the epitaxial layer...'" Paper 15, 7-8. But, the very next sentence of Kawagoe—which Petitioner does not quote—is the one Petitioner edited to omit Kawagoe's statement that its gradient "*prevent*[*s*] [*electrons*] *from entering the p-well 6p*…." Ex. 1007, 28 (emphasis added). Since Kawagoe's electrons are below and never enter the p-well, they are nowhere near the active region.[1] Nothing in Kawagoe discusses using dopant gradients to affect carriers in the active region.

[1] Petitioner admits that Kawagoe is discussing carriers below the p-well. Paper 1, 23 n.9.

Second, Petitioner asserts that "the electric field from Kawagoe's graded concentration would impact carriers both in the substrate and anywhere in the graded dopant region." Paper 15, 7. But Petitioner points to nothing for support of this statement. Indeed, the only citation in that entire paragraph is to *Greenthread's* preliminary response. Nowhere does the Petition analyze Kawagoe's "graded dopant" in the active region except to say that it exists. Kawagoe never says that its graded dopant concentration has any effect at all on carriers in the active region.

Third, Kawagoe's transistor, like any transistor, will have carriers in the active region. The fact that every transistor has carriers in the active region, however, does not mean that Kawagoe teaches the use of graded dopants in the active region to aid carrier movement. Kawagoe does not come close to saying that.

Kawagoe's teaching relates to carriers generated by alpha rays. There is no evidence that a POSITA would have even been *aware* of alpha rays generating carriers in the active region in the prior art as of Greenthread's priority date. Petitioner's statement that "cosmic radiation" was "discovered over one hundred years ago," is not supported by any citation. Paper 15, 8. It is also beside the point. What astronomers knew "one hundred years ago" doesn't have anything to do with what electrical engineers knew or cared about in 2004. *Id.*

Furthermore, alpha rays are not aimed to only hit a substrate of a semiconductor device. Alpha rays are random. But, the possibility that an alpha ray

may hit the active region (assuming a POSITA thought about that possibility) does not mean that the alpha ray would generate carriers in the active region in detectable quantities. Kawagoe was addressing the problems of single event upsets ("SEUs") caused by "electrons produced in the large substrate body below the wells," not the active region. Paper 1, 23 n.9. There is no evidence in the record—either before or after Greenthread's priority date—that carriers generated by alpha rays in the active region cause SEUs or are otherwise noticeable. As Greenthread has pointed out in Petitioner's other IPRs, the relatively small mass of the active region means that alpha rays do not generate sufficient carriers there to affect the operation of semiconductor devices. IPR2023-1242, Paper 47 at 27. Therefore, there is no reason a POSITA would think that Kawagoe had anything to teach regarding the active region of a semiconductor device.

Finally, Petitioner provides no motivation for a POSITA to modify Kawagoe to move minority carriers as claimed. But, nothing in Kawagoe says that its doping gradients in the active region were designed to move carriers from there downwards or that the disclosed gradients would have that effect. Petitioner points to nothing other than the mere downward slope at the very top of a not-to-scale figure to show that they would. *See* Paper 1, 61. Since the Petition includes nothing discussing that tiny slice of Kawagoe, it fails.

E. The Petition is untimely.

Petitioner's arguments regarding the timeliness of its Petition fails. It is undisputed that a customer-supplier relationship can create privity and that Petitioner has such a relationship with time-barred parties. Paper 13, 21. The evidence Greenthread submitted of Petitioner's customer-supplier relationships therefore is evidence of privity. *See Worlds Inc. v. Bungie, Inc.,* 903 F.3d 1237, 1242–44 (Fed. Cir. 2018). Petitioner's assertion that Greenthread has no evidence is false and the cases it cites, *WesternGeco* and *Samsung*, examined actual evidence the Petitioner produced. Paper 13, 24-25. Petitioner has yet to put in any evidence to support the timeliness of its Petitions, and, as the party with the burden of proof, must lose. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378–79 (Fed. Cir. 2015).

Petitioner also misunderstands how a license works. The fact that Petitioner's sales of a product to a licensed party are licensed, does not mean that its sales of those products to other parties are licensed. Petitioner has elected to become a limited sublicensee by designing and selling to Products for Licensees. That was Petitioner's choice, not Greenthread's.

III. CONCLUSION

For the foregoing reasons, institution of the Petition should be denied.

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Respectfully submitted,

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CERTIFICATION OF SERVICE

The undersigned hereby certifies that a copy of this **PATENT OWNER'S PRELIMINARY SUR-REPLY** has been served on Petitioner via email on the following counsel of record for Petitioner:

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