

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MONOLITHIC POWER SYSTEMS, INC.,
Petitioner,

v.

GREENTHREAD, LLC,
Patent Owner.

Case: IPR2024-00469
U.S. Patent No. 9,190,502

PATENT OWNER'S REQUEST FOR DIRECTOR REVIEW

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I. INTRODUCTION

Across a set of seven IPRs, Petitioner has advocated for claim constructions completely divorced from the claims’ plain language, specification, prosecution history, prior *Markman* rulings, its own expert’s technical analysis, and, most alarmingly, positions it later took before the district court. Petitioner’s expansive construction of “graded dopant concentration” eviscerates the claims’ requirements that charge carriers are not only moved, but moved from the surface of the semiconductor to its substrate. Petitioner also crafted a *post hoc* understanding of “minority carrier” at odds with how the term is used in the patent, been understood across multiple rounds of litigation, and Petitioner’s own technical admissions regarding MOSFET devices. In adopting these positions, the Board lowered Petitioner’s burden to prove that the references actually teach moving *minority* carriers from the required location and in the required direction. Director Review is warranted to correct the Board’s errors and prevent the PTAB from devolving into a forum where inconsistent positions may be taken to challenge patents’ validity.

II. BACKGROUND

As explained in previous Requests, the technical dispute hinges on how the following limitations are construed:

said single drift layer having a graded concentration of dopants [GDC] generating a first static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate
EX1001, 4:58-62 (limitation [7.5]).

Before the Board, Petitioner took the position that “[n]o terms need[ed] to be construed,” while also noting multiple instances where the claims had been construed by district courts. Pet. (Paper 1), 5-7. However, before PO even filed its preliminary response in this IPR, Petitioner served its responsive claim construction positions in the underlying Delaware district court litigation, where it argued that the “aid the movement” terms in Greenthread’s patents were indefinite. EX2029, 44-45.

In district court, Petitioner *alternatively* argued the disputed limitations “should be construed as ‘cause [minority] carriers to move downward.’” *Id.*, 42. According to Petitioner then, the specification and prosecution history support the position that “the doping gradient *must* sweep carriers from the surface to the substrate.” *Id.*, 41.¹ Petitioner then argued that “a POSITA has no way to be reasonably certain that minority carrier movement has been aided if minority carriers need not actually move.” *Id.*, 45. But before the Board, Petitioner took the opposite position—that “physical movement of a ‘minority carrier’ ... is not required by the claims or to establish obviousness” and that PO “improperly injects limitations requiring minority carrier movement.” Reply (Paper 42), 1, 2; *see also* Tr. (Paper 89), 19:7-14 (“there doesn’t need to be any proof that the carriers actually move”).

Aside from arguing that carrier movement is not required by the claims, Petitioner then argued that as long as a reference discloses a GDC with a “downward

¹ All emphases added unless otherwise noted.

force,” then “it would affect an electron’s movement.” Reply, 1. However, Petitioner’s expert explained that only “an electric field that is *properly constructed* will push the minority carriers away from the surface.” EX1003, ¶32. According to the expert, to be “properly constructed,” the field’s “direction has to be correct” and must “have a sufficient electric field intensity to prevent most of the carriers from being collected by the drain.” EX2058, 34:1-14; *see also* EX2085, 62:1-2 (“The electric field is a vector. It has an intensity and a direction.”). Dr. Campbell confirmed that the GDC-generated electric field only “provide[s] a force that would *tend to move* [carriers],” since “[t]here may be other forces acting upon the carriers” and carrier movement is “dependent on the sum of all forces.” *Id.*, 42:12-22, 154:15-18 (same). Understanding the net force matters because if “there is a weak electric field ... it may not have enough force to prevent [a] minority carrier” from interfering with circuitry at the surface. *Id.*, 46:18-47:1. Despite this importance, Petitioner’s expert admitted he “didn’t calculate the electric field for any of the prior art.” EX2058, 20:7-10. But Petitioner never addressed these glaring admissions from its expert, and, instead, accused PO of “apply[ing] a rigid test requiring all forces be calculated.” Reply, 12. PO’s position has not been that each and every force must be meticulously calculated, but that Petitioner’s analysis is deficient because it never even considered or acknowledged the other forces its own expert explained would affect minority carrier movement. *See generally* POR (Paper 35), 8-13.

Despite these glaring holes in Petitioner’s analysis, the Board sidestepped this issue because it “rest[ed] on the flawed premise that the claims require actually moving a carrier.” FWD (Paper 93), 62. As it has across the other sets of IPRs challenging PO’s patents, the Board simply avoided issues like these to reinforce its incorrect claim construction and obviousness determinations.

III. ARGUMENT

Director Review is thus appropriate to correct the Board’s “erroneous conclusions of law,” namely its faulty claim construction positions that conflict with prior district court rulings and the inconsistent positions Petitioner previously advanced in district court. USPTO, Director Review process, §§ 2.B, 5.A; *see, e.g., Infineon Techs. Ams. Corp. v. MOSAID Techs. Inc.*, IPR2025-01171, Paper 27 (PTAB Feb. 19, 2026) (Dir. Squires).

A. The Challenged Claims are “configured to”-type claims, not “reasonably capable”-type claims.

The Board’s effective construction of the ACM limitation eliminated the claims’ requirement that a GDC must actually move minority carriers from the surface to the substrate. This construction defies precedent assigning considerable weight to functional limitations in apparatus claims. *Cf. Vascular Solns., LLC v. Medtronic, Inc.*, 117 F.4th 1361, 1370 (Fed. Cir. 2024). Contrary to the Board’s reasoning, it is “not improper” to “defin[e] a particular term by its function.” *Hill-Rom Servs., Inc. v. Stryker Corp.*, 755 F.3d 1367, 1374-75 (Fed. Cir. 2014).

Instead, the Board recites the out-of-context maxim that “apparatus claims cover what a device *is*, not what a device *does*” to hold that “Petitioner does not need to show that [the references] teach[] actually moving any given minority carrier.” FWD, 62 (citing *ParkerVision, Inc. v. Qualcomm Inc.*, 903 F.3d 1354, 1361 (Fed. Cir. 2018) (“*PV*”). Instead, the Board contends that under *PV*, “Petitioner need only show” a GDC “that is *reasonably capable* of aiding the movement of minority carriers.” *Id.* (cleaned up). But to get here, the Board ignores the middle of *PV*’s operative sentence—“depending on the claim language.”

PV does distinguish between apparatus and method claims, but that is only the first step of a larger inquiry. Using the same language, the Federal Circuit explained that “differences exist between apparatus claims as well, ***depending on the claim language.***” *INVT SPE LLC v. Int’l Trade Comm’n*, 46 F.4th 1361, 1371 (Fed. Cir. 2022). The Court has long “construed some apparatus claims to require an infringing”—or anticipating—“device to actually perform and operate according to the functional terms recited in the claim.” *Id.* *INVT* is not one-off precedent. When using “functional claiming to describe the apparatus, **what the device *does* (and how it does it) is highly relevant to understanding what the device *is*.**” *Rothschild Connected Devices Innovs., LLC v. Coca-Cola Co.*, 2025 WL 2964300, at *2 (Fed. Cir. Oct. 21, 2025); *K-2 Corp. v. Salomon S.A.*, 191 F.3d 1356, 1363 (Fed. Cir. 1999) (“functional language [] informs us of the structural requirements of the claim.”).

“Configured to”-type claims “involve mechanical apparatus claims,” where “actual operation of arranging elements in a particular way was required.” *INVT*, 46 F.4th at 1372. On the other hand, “reasonably capable” claims follow the same or similar structure—a component “for performing” a function. *Id.* at 1373 (discussing “‘for performing’-type claim language”); *see also PV*, 903 F.3d at 1362.

The Challenged Claims recite specific “structural limitations” (*i.e.*, GDC of sufficient magnitude and direction) that were found lacking in *PV*. *See* 903 F.3d at 1362. As the specification explains, this GDC creates a “suitable aiding drift electric field” that “sweep[s] unwanted minority carriers from the active circuitry at the surface into the substrate ... as quickly as possible.” EX1001, 2:46-49, 3:39-42; FIG. 5B (“Graded dopant region to pull minority carriers from the surface”). Further, that the claimed GDC *aids* carrier movement presupposes that minority carrier movement is already required in the claims. Petitioner recognized the same when it argued in district court that “a POSITA has no way [of knowing] that ‘minority carrier movement’ has been aided if minority carriers need not actually move.” EX2029, 45. Thus, the claims, consistent with the specification, **require** the devices’ GDC to have sufficient magnitude and be oriented in the proper direction to **actually move** carriers from the surface of the device to the substrate.

“[A] patent’s express purpose of the invention” is supposed to “inform[] the proper construction of claim terms.” *Sequoia Tech., LLC v. Dell, Inc.*, 66 F.4th 1317,

1326 (Fed. Cir. 2023). At the district court, Petitioner put forth the same position and agreed that the “purported novelty lies in sweeping minority carriers from the surface into the substrate via the [GDC].” EX2029, 39-40 (citing *Sequoia*); *see also id.*, 44 (“applicant emphasized carrier movement as a point of novelty”). So when mechanical apparatus claims require a specific structure to perform a specific function (*i.e.*, the invention’s purpose), a petitioner must prove that the cited references **actually perform** the claimed limitation. *See INVT*, 46 F.4th at 1371. Petitioner has not done that here and, instead, relies upon a construction that “eviscerate[s] the stated purpose of the claimed invention.” *KEYnetik, Inc. v. Samsung Elecs. Co., Ltd.*, 837 Fed.Appx. 786, 792 (Fed. Cir. 2020). In adopting this “reasonably capable” standard, the Board commits the same error and thereby lowers Petitioner’s burden of proving that the Challenged Claims would have been obvious.

B. The Board’s adopted construction is at odds with two different district courts who have previously ruled on the same claim terms.

The position taken by Petitioner in the underlying litigation—and the tacit admissions of its technical expert—find further support in the reasoning offered by two different district courts. Generally, both courts recognized that a GDC by itself, even if pointing in the proper direction, is insufficient to satisfy the ACM limitation. Given this history and the “importance of uniformity in the treatment of a given patent,” the Board would have been “remiss to overlook a[] district court’s construction of the same claim terms.” *Finisar Corp. v. DirecTV Grp., Inc.*, 523 F.3d

1323, 1329 (Fed. Cir. 2008). Not only did the Board overlook these orders, but it substituted its *own* judgment, offered its own “reasonabl[e] interpret[ation]” of one order, and discredited the accepted understanding of the disputed terms. FWD, 60.

In 2024, Judge Gilliland of the Western District of Texas² held that only “sufficiently graded” GDCs will create a field that aids movement:

The Court concludes that a person of skill would understand that the [GDC] has to be **sufficiently graded** to result in a “static unidirectional electric drift field to aid the movement of minority carriers.” This establishes a **minimum [GDC]**, *i.e.*, a [GDC] ... below this minimum will not aid the movement of minority carriers and thus is not graded.

EX2074, 39-40. And in 2020, Judge Gilstrap of the Eastern District of Texas recognized that the mere direction a GDC points is not enough to determine whether the GDC induces an electric field that aid the movement of minority carriers:

[T]he slope has both a direction and a **magnitude** and Defendant suggests that the direction of the drift electric field depends solely on **the direction** of the slope of the [GDC]. This is not justified by the prosecution history statements that Defendant cites.

EX2075, 15. Further, Judge Gilstrap rejected the very prosecution-based arguments the Board adopted here. *Id.*; *see also* FWD, 57 (PO’s prosecution statements “were clear, unambiguous, and indicate that ... the mere presence of a [GDC] ... facing in

² Like MPS, Cirrus Logic (WDTX defendant who also filed IPRs against PO’s patents) inconsistently argued that GDC is indefinite and that the ACM limitation should be construed as “to aid the movement of minority carriers **starting from ... and reaching ...**” *See* EX2074, 32, 50-51. CL’s position was that “minority carriers must traverse the entire path from the surface to the substrate.” *Id.*, 51.

the appropriate direction, will [ACM].”). In fact, the prosecution history confirms that a GDC must have sufficient magnitude to overcome other forces and fields acting within the device to actually move carriers. *See* EX1002, 270 (Examiner: “movement of minority 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”). Yet the Board turned prosecution against PO, even though prosecution statements “cannot enlarge” claim scope beyond the plain language. *Biogen, Inc. v. Berlex Lab’ys, Inc.*, 318 F.3d 1132, 1140 (Fed. Cir. 2003).

Neither *Markman* order required a specific magnitude to be quantified, and, contrary to Petitioner and the Board, PO has never advanced such a strict position. Instead, PO maintains (consistent with both rulings) that for a GDC to meet the claimed limitations, it must have a **sufficient** magnitude to actually move minority carriers from the surface to the substrate. Neither court understood the claims to mean that *any* GDC would aid carrier movement. The Board’s adopted construction diverges from these established rulings and undermines the Patent Office’s objective to promote stability and certainty in the patent system.

C. The asserted references do not teach the claimed limitations under the proper constructions.

This Petition fails because none of the references discuss the critical functional limitation of moving carriers from the surface to the substrate nor disclose a GDC with sufficient magnitude or account for other counteracting forces and fields.

Petitioner’s analysis is entirely devoid of such considerations or detail.

As explained above, Petitioner’s expert admitted that only “properly constructed” electric fields—where “the direction has to be correct” and with “sufficient electric field intensity”—would aid carrier movement. *See* EX1003, ¶32; EX2058, 34:1-14. However, he did not calculate any of the references’ fields nor accounted for the effects of “other forces acting upon the carriers,” even though carrier movement depends “on the sum of all forces.” EX2058, 20:7-10; EX2085, 42:12-22. Petitioner focused solely on the direction of the references’ doping profiles, which is inconsistent with the approach taken by the two *Markman* orders.

Petitioner relies on Figure 17 of Kawagoe (EX1007), contending that Kawagoe’s GDC “results in ‘electrons ... [being] attracted to the substrate body 2S by [a] concentration gradient.’” Pet., 67 (citing EX1007, 16:2-11). However, Petitioner’s use of ellipsis omits the fact that Kawagoe’s GDC is concerned with “prevent[ing]” electrons “from entering the p-well 6p.” EX1007, 16:7-9. Simply put, preventing electrons from entering the well-region from *below* the substrate is different than moving electrons from the surface, *through* the well-region, and *toward* the substrate. *See* EX2058, 43:8-20 (Petitioner’s expert confirming Kawagoe’s “focus” was “reducing the carrier flow in an upward direction ... from the substrate”). Petitioner’s argument that inhibiting in one direction implies aiding in the other simply distracts from Kawagoe’s critical flaw—it never mentions

carriers at the surface, and it is unclear what effect, if any, Figure 17's GDC would have on a carrier at the surface. *See, e.g.*, EX2057, ¶68. In fact, it would not have made sense to move an electron from the surface, since these electrons are needed for the transistor to work properly. *See id.*, ¶36; POR, 24; Paper 47 ("Sur-Reply"), 6-12. For Kawagoe to meet this limitation, it must ignore the requirement that carriers move from a specific location to another specific location.

Petitioner's reliance on Figure 11 of Onoda (EX1042) suffers a similar fate. Onoda is silent about moving carriers from the surface to the substrate; Petitioner relies entirely on its annotations and a wrong understanding of supposed "admissions" made by PO during prosecution. *See* POR, 17-19; Sur-Reply, 12-17. In district court, Petitioner argued that the GDC must "start[] at the surface layer and extends to the substrate." EX2029, 39. However, Payne's doping profile starts *below* the surface layer; in fact, it is *uniform* in the surface layer and only begins to "fall[] off smoothly" "between the third well region 105a and the second semiconductor layer 102." EX1042, [0052]. Petitioner's expert testified that he could not "say exactly where [Onoda's] active area [or surface layer] would end." EX2058, 52:2-20, 55:9-56:6 (Onoda "doesn't have any numbers on it"). Onoda does not disclose a "[GDC] *from* the surface layer to the substrate." Reply, 17. Like Kawagoe, Onoda is only concerned with "reducing the carrier flow ... Upwards from the substrate"). EX2058, 43:8-20. And since Onoda's GDC is *flat* in the surface layer, it is not even

“reasonably capable” to aid movement of minority carriers from the surface. *See* Sur-Reply, 12-15. The Board did not even address these arguments in its FWD.

Giving weight to all claim terms, Petitioner must point to references that actually move minority carriers *from* the surface, and neither Payne nor Kawagoe meet that requirement. This is inconsistent with Rule 104(b)(4)’s requirement that an IPR petition “must specify where each element of the claim is found *in the prior art patents or printed publications*.” Instead, Petitioner relies on a faulty claim construction and supposed admissions to fill in the gaps of its obviousness theories.

D. The Board did not hold Petitioner to its burden of proving that the references’ dopant profiles move *minority* carriers from the surface.

To make matters worse, the Board failed to hold Petitioner to its burden of demonstrating that the asserted references GDCs aid the movement of *minority* carriers from the surface to the substrate. It is axiomatic that the Board must always “consider the claims in light of the specification and teachings in the underlying patent.” *In re Power Integrations, Inc.*, 884 F.3d 1370, 1375 (Fed. Cir. 2018). So when trying to discern what constitutes a minority carrier, the specification is the “best source for understanding [this] technical term.” *Multiform Desiccants, Inc. v. Medzam, Ltd.*, 133 F.3d 1473, 1478 (Fed. Cir. 1998); *see also Sequoia*, 66 F.4th at 1324 (“Our decision rests solely on the intrinsic evidence. We are unpersuaded by [] arguments to the contrary, which rest on extrinsic evidence.”).

Here, the specification explains that “MOS devices”—the patent’s preferred

embodiment depicted in Figure 5—“are majority carrier devices for conduction. The conduction is channel dominated.” EX1001, 1:47-49. That portion of the specification demonstrates that the “inventor[] chose to be their own lexicographer[] and expressly defined” majority and minority carriers. *Sequoia*, 66 F.4th at 1324. Nowhere does the patent offer conflicting definitions or posit that what constitutes a minority carrier changes as carriers move between the active and well regions.

Further, PO’s expert understood this. *See* EX2057, ¶36 n.3 (“Because the channel [of FIG. 5(b)] is formed by electrons with a negative charge, the MOSFET is referred to as an n-channel MOSFET, and the ‘minority carriers’ are holes.”). This has also been PO’s position in prior litigation. *See* EX1030, 4 n.5, 7 (“minority carriers (holes in ... Fig. 5B)”), 11 (“MOS devices are majority carrier devices”). Petitioner’s expert agrees: “With the CMOS technology, there are two device flavors, NMOS and PMOS. The N and the P refer to the charge on the carriers in the channel when the device is on.” EX2085, 67:9-15. Up until the present series of IPRs, “[t]here [had been] no dispute what is meant by minority carriers.” EX1030, 25.

The specification is equally clear as to *why* this understanding of what constitutes a minority carrier is critical, explaining how “[s]purious minority carriers” interfere with the “active circuitry at the surface” of a semiconductor device. EX1001, 3:25-42. PO’s expert explained how, in an NMOS transistor like Figure 5(b), “[w]hen enough electrons have accumulated ..., they form a conductive

channel ... of electrons between the source and the drain, and current can begin to flow through the transistor.” EX2064, ¶36.³ Holes interfere with and prevent the channel from forming. *See id.* (“the channel disappears as the holes return to the surface layer”). Since claims are understood according to the “express purpose of the invention,” it is minority carriers (*i.e.*, holes in NMOS) that must be “[s]wept ... into the substrate as quickly as possible.” *Sequoia*, 66 F.4th at 1326.

This is not the understanding of minority carrier that Petitioner adopted. Petitioner’s expert relies on the type of doping within a *region* to define the majority and minority charge carrier. EX1003, ¶32 (contending that “minority carriers [are] electrons in a p-type region”). For the Onoda-based grounds, he identifies electrons as “minority carriers” in an NMOS device because they move in the “opposite direction” of the field. *Id.*, ¶72; *see also id.*, ¶¶89-90 (“Onoda is ... concerned with electrons moving into the circuit Onoda uses a graded doping profile to control electron movement.”). For Kawagoe, he adopts the “well region” understanding and concludes that “electrons are minority carriers in the p-well.” *Id.*, ¶¶111, 117; *see also* Tr., 25:6-8 (Petitioner’s counsel: “the electron has been consistently defined

³ Petitioner’s own data sheet confirms that “[i]n an N-channel enhancement-type MOSFET, ... a critical number of electrons accumulate to form a virtual n-channel, thereby enabling the flow of current from the drain to the source. The functioning of a P-channel is analogous...” *See* <https://www.monolithicpower.com/en/learning/mpscholar/power-electronics/power-semiconductor-devices/mosfets?srsId=AfmBOogpfNBxm75Kx6rFDhRl635xIsvXPo6hHw39KYm9jfHcpL311-l>

as the minority carrier in the petition and all the filings in all the prior art briefing.”).

At this alone, the Board “should [have] discount[ed] expert testimony that [was] clearly at odds with the claim construction mandated by ... the written record of the patent.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1318 (Fed. Cir. 2005). Only later did Dr. Campbell admit that in an NMOS device, the minority carrier would be holes. *See* EX2085, 98:16-99:5; *see also id.*, 109:12-19 (agreeing that “the electric field shown in Figure 5B would cause holes to move in a downward direction”). But again, this is not the understanding that he or Petitioner adopted.

As a result, Petitioner has failed to point to any teachings or disclosure in the references demonstrating that their respective dopant profiles move *minority* carriers as understood in the patent. But again, the Board failed to hold Petitioner’s grounds to account and treated this defect with the same dismissiveness it has for all other arguments that oppose the positions the Board adopted in the first set of institution decisions. This stands as an independent reason why Director Review is warranted.

IV. CONCLUSION

Because Petitioner has not met its burden of proving that the Challenged Claims would have been obvious under the proper constructions, the Director should reverse the Board’s FWD and hold the Challenged Claims not unpatentable.

Dated: March 23, 2026

Respectfully submitted,

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