**IN THE UNITED STATES DISTRICT COURT**
**FOR THE EASTERN DISTRICT OF TEXAS**
**MARSHALL DIVISION**

GREENTHREAD, LLC,

*Plaintiff,*

v.

SAMSUNG ELECTRONICS CO., LTD. ET AL.,

*Defendants.*

Case No. 2:19-cv-00147-JRG

# CLAIM CONSTRUCTION MEMORANDUM OPINION AND ORDER

Before the Court is the opening claim construction brief of Greenthread, LLC ("Plaintiff") (Dkt. No. 46, filed on February 19, 2020),[1] the response of Samsung Electronics Co., Ltd., Samsung Semiconductor Inc., Samsung Electronics America, Inc., and Samsung Austin Semiconductor, LLC (collectively "Defendants") (Dkt. No. 50, filed on March 4, 2020), and Plaintiff's reply (Dkt. No. 52, filed on March 11, 2020). The Court held a hearing on the issues of claim construction and claim definiteness on April 2, 2020. Having considered the arguments and evidence presented by the parties at the hearing and in their briefing, the Court issues this Order.

[1] Citations to the parties' filings are to the filing's number in the docket (Dkt. No.) and pin cites are to the page numbers assigned through ECF.

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## I. BACKGROUND

Plaintiff alleges infringement of four U.S. Patents: No. 8,106,481 (the "'481 Patent"), No. 8,421,195 (the "'195 Patent"), No. 9,190,502 (the "'502 Patent"), and No. 9,647,070 (the "'070 Patent") (collectively, the "Asserted Patents"). The patents are related through priority claims: the '481 Patent purports to be a continuation-in-part of U.S. Patent Application No. 10/934,915 (the "'915 Application"), the '195 Patent purports to be a divisional of the '915 Application, and the '502 and '070 are related to the '195 Patent through a chain of continuation applications. The '915 Application was filed on September 3, 2004.

In general, the Asserted Patents are directed to technology for improving the function of a variety of semiconductor devices. The abstracts of the Asserted Patents are identical and provide:

> Most semiconductor devices manufactured today, have uniform dopant concentration, either in the lateral or vertical device active (and isolation) regions. By grading the dopant concentration, the performance in various semiconductor devices can be significantly improved. Performance improvements can be obtained in application specific areas like increase in frequency of operation for digital logic, various power MOSFET and IGBT ICS, improvement in refresh time for DRAM's, decrease in programming time for nonvolatile memory, better visual quality including pixel resolution and color sensitivity for imaging ICs, better sensitivity for varactors in tunable filters, higher drive capabilities for JFET's, and a host of other applications.

The following are exemplary claims from each of the Asserted Patents, with claim language in dispute emphasized:

> **'481 Patent Claim 1**. A CMOS IC device comprising:
> a non-epitaxial substrate having a surface area;
> a plurality of well regions fabricated on said non-epitaxial substrate and arranged in said surface area, each one of said plurality of well regions comprising 2-way graded dopants ***disposed therein*** and at least one of said plurality of well regions further comprising at least one first isolation region disposed therein;
> at least one second isolation region fabricated on said non-epitaxial substrate ***separating said plurality of well regions***; and
> wherein in each one of said plurality of well regions said 2-way graded dopants create a plurality of electric fields for aiding the movement of a first plurality

of carriers up towards said surface area and a second plurality of carriers down towards said substrate.

**'195 Patent Claim 1**. A CMOS Semiconductor device comprising:
a surface layer;
a substrate;
an active region including a source and a drain, disposed on one surface of said surface layer;
a ***single drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate, said drift layer further having a first static unidirectional electric drift field*** to aid the movement of minority carriers from said surface layer to said substrate; and
at least one well region disposed in said single drift layer, said well region having a graded concentration of dopants and a second static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate.

**'502 Patent Claim 7.** A semiconductor device comprising:
a surface layer;
a substrate;
an active region including a source and a drain, disposed on one surface of said surface layer;
a ***single drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants generating a first static unidirectional electric drift field*** to aid the movement of minority carriers from said surface layer to said substrate; and
at least one well region disposed in said single drift layer, said well region having a graded concentration of dopants generating a second static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate.

**'070 Patent Claim 1**. A semiconductor device, comprising:
a substrate of a first doping type at a first doping level having first and second surfaces;
an active region disposed adjacent the first surface of the substrate with a second doping type opposite in conductivity to the first doping type;
circuitry formed in a portion of the active region disposed away from the first surface of the substrate and having at least one region of higher conductivity of the second doping type relative to the doping level in the remainder of the active region proximate the at least one region;
at least a portion of the active region proximate the first surface of the substrate and not containing the at least one region defined with a graded dopant concentration, to aid carrier movement from an ***emitter*** in the active region to a ***collector*** in the substrate, the graded dopant concentration greater proximate the first surface of the substrate.

## II. LEGAL PRINCIPLES

### A. Claim Construction

"It is a 'bedrock principle' of patent law that 'the claims of a patent define the invention to which the patentee is entitled the right to exclude.'" *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc) (quoting *Innova/Pure Water Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1115 (Fed. Cir. 2004)). To determine the meaning of the claims, courts start by considering the intrinsic evidence. *Id.* at 1313; *C.R. Bard, Inc. v. U.S. Surgical Corp.*, 388 F.3d 858, 861 (Fed. Cir. 2004); *Bell Atl. Network Servs., Inc. v. Covad Commc'ns Group, Inc.*, 262 F.3d 1258, 1267 (Fed. Cir. 2001). The intrinsic evidence includes the claims themselves, the specification, and the prosecution history. *Phillips*, 415 F.3d at 1314; *C.R. Bard, Inc.*, 388 F.3d at 861. The general rule—subject to certain specific exceptions discussed *infra*—is that each claim term is construed according to its ordinary and accustomed meaning as understood by one of ordinary skill in the art at the time of the invention in the context of the patent. *Phillips*, 415 F.3d at 1312–13; *Alloc, Inc. v. Int'l Trade Comm'n*, 342 F.3d 1361, 1368 (Fed. Cir. 2003); *Azure Networks, LLC v. CSR PLC*, 771 F.3d 1336, 1347 (Fed. Cir. 2014) ("There is a heavy presumption that claim terms carry their accustomed meaning in the relevant community at the relevant time.") (vacated on other grounds).

"The claim construction inquiry … begins and ends in all cases with the actual words of the claim." *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1248 (Fed. Cir. 1998). "[I]n all aspects of claim construction, 'the name of the game is the claim.'" *Apple Inc. v. Motorola, Inc.*, 757 F.3d 1286, 1298 (Fed. Cir. 2014) (quoting *In re Hiniker Co.*, 150 F.3d 1362, 1369 (Fed. Cir. 1998)). First, a term's context in the asserted claim can be instructive. *Phillips*, 415 F.3d at 1314. Other asserted or unasserted claims can also aid in determining the claim's meaning, because claim terms are typically used consistently throughout the patent. *Id.* Differences among the claim

terms can also assist in understanding a term's meaning. *Id*. For example, when a dependent claim adds a limitation to an independent claim, it is presumed that the independent claim does not include the limitation. *Id*. at 1314–15.

"[C]laims 'must be read in view of the specification, of which they are a part.'" *Id*. (quoting *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed. Cir. 1995) (en banc)). "[T]he specification 'is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term.'" *Id*. (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)); *Teleflex, Inc. v. Ficosa N. Am. Corp.*, 299 F.3d 1313, 1325 (Fed. Cir. 2002). But, "'[a]lthough the specification may aid the court in interpreting the meaning of disputed claim language, particular embodiments and examples appearing in the specification will not generally be read into the claims.'" *Comark Commc'ns, Inc. v. Harris Corp.*, 156 F.3d 1182, 1187 (Fed. Cir. 1998) (quoting *Constant v. Advanced Micro-Devices, Inc.*, 848 F.2d 1560, 1571 (Fed. Cir. 1988)); *see also Phillips*, 415 F.3d at 1323. "[I]t is improper to read limitations from a preferred embodiment described in the specification—even if it is the only embodiment—into the claims absent a clear indication in the intrinsic record that the patentee intended the claims to be so limited." *Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 913 (Fed. Cir. 2004).

The prosecution history is another tool to supply the proper context for claim construction because, like the specification, the prosecution history provides evidence of how the U.S. Patent and Trademark Office ("PTO") and the inventor understood the patent. *Phillips*, 415 F.3d at 1317. However, "because the prosecution history represents an ongoing negotiation between the PTO and the applicant, rather than the final product of that negotiation, it often lacks the clarity of the specification and thus is less useful for claim construction purposes." *Id.* at 1318; *see also Athletic*

*Alternatives, Inc. v. Prince Mfg.*, 73 F.3d 1573, 1580 (Fed. Cir. 1996) (ambiguous prosecution history may be "unhelpful as an interpretive resource").

Although extrinsic evidence can also be useful, it is "'less significant than the intrinsic record in determining the legally operative meaning of claim language.'" *Phillips*, 415 F.3d at 1317 (quoting *C.R. Bard, Inc.*, 388 F.3d at 862). Technical dictionaries and treatises may help a court understand the underlying technology and the manner in which one skilled in the art might use claim terms, but technical dictionaries and treatises may provide definitions that are too broad or may not be indicative of how the term is used in the patent. *Id*. at 1318. Similarly, expert testimony may aid a court in understanding the underlying technology and determining the particular meaning of a term in the pertinent field, but an expert's conclusory, unsupported assertions as to a term's definition are not helpful to a court. *Id*. Extrinsic evidence is "less reliable than the patent and its prosecution history in determining how to read claim terms." *Id*. The Supreme Court has explained the role of extrinsic evidence in claim construction:

> In some cases, however, the district court will need to look beyond the patent's intrinsic evidence and to consult extrinsic evidence in order to understand, for example, the background science or the meaning of a term in the relevant art during the relevant time period. *See, e.g., Seymour v. Osborne*, 11 Wall. 516, 546 (1871) (a patent may be "so interspersed with technical terms and terms of art that the testimony of scientific witnesses is indispensable to a correct understanding of its meaning"). In cases where those subsidiary facts are in dispute, courts will need to make subsidiary factual findings about that extrinsic evidence. These are the "evidentiary underpinnings" of claim construction that we discussed in *Markman*, and this subsidiary factfinding must be reviewed for clear error on appeal.

*Teva Pharm. USA, Inc. v. Sandoz, Inc.*, 574 U.S. 318, 331–32 (2015).

### B. Departing from the Ordinary Meaning of a Claim Term

There are "only two exceptions to [the] general rule" that claim terms are construed according to their plain and ordinary meaning: "1) when a patentee sets out a definition and acts as his own lexicographer, or 2) when the patentee disavows the full scope of the claim term either in the

specification or during prosecution."[2] *Golden Bridge Tech., Inc. v. Apple Inc.*, 758 F.3d 1362, 1365 (Fed. Cir. 2014) (quoting *Thorner v. Sony Comput. Entm't Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012)); *see also GE Lighting Sols., LLC v. AgiLight, Inc.*, 750 F.3d 1304, 1309 (Fed. Cir. 2014) ("[T]he specification and prosecution history only compel departure from the plain meaning in two instances: lexicography and disavowal."). The standards for finding lexicography or disavowal are "exacting." *GE Lighting Sols.*, 750 F.3d at 1309.

To act as his own lexicographer, the patentee must "clearly set forth a definition of the disputed claim term," and "clearly express an intent to define the term." *Id.* (quoting *Thorner*, 669 F.3d at 1365); *see also Renishaw*, 158 F.3d at 1249. The patentee's lexicography must appear "with reasonable clarity, deliberateness, and precision." *Renishaw*, 158 F.3d at 1249.

To disavow or disclaim the full scope of a claim term, the patentee's statements in the specification or prosecution history must amount to a "clear and unmistakable" surrender. *Cordis Corp. v. Boston Sci. Corp.*, 561 F.3d 1319, 1329 (Fed. Cir. 2009); *see also Thorner*, 669 F.3d at 1366 ("The patentee may demonstrate intent to deviate from the ordinary and accustomed meaning of a claim term by including in the specification expressions of manifest exclusion or restriction, representing a clear disavowal of claim scope."). "Where an applicant's statements are amenable to multiple reasonable interpretations, they cannot be deemed clear and unmistakable." *3M Innovative Props. Co. v. Tredegar Corp.*, 725 F.3d 1315, 1326 (Fed. Cir. 2013).

[2] Some cases have characterized other principles of claim construction as "exceptions" to the general rule, such as the statutory requirement that a means-plus-function term is construed to cover the corresponding structure disclosed in the specification. *See, e.g., CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1367 (Fed. Cir. 2002).

## III. AGREED CONSTRUCTIONS

The parties have agreed to the following constructions set forth in their Revised Joint Claim Construction Chart Pursuant to P.R. 4-5 (Dkt. No. 60).

| Term[3] | Agreed Construction |
|---|---|
| "isolation region"<br><br>• '481 Patent Claims 1, 5 | region that electrically isolates |
| "a substrate of a first doping type"<br><br>• '070 Patent Claim 1 | a substrate with either p-type doping or n-type doping |
| "disposed adjacent"<br><br>• '070 Patent Claim 1 | next to or close to |
| "at least a portion of the active region proximate the first surface of the substrate and not containing the at least one region defined with a graded dopant concentration"<br><br>• '070 Patent Claim 1 | at least a portion of the active region that is proximate the first surface of the substrate and has a graded dopant concentration, but that does not contain the at least one region of higher conductivity |
| "2-way graded dopants"<br><br>• '481 Patent Claims 1, 5 | dopants with increasing concentration in one area, and decreasing concentration in a second area |
| "unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate"<br><br>• '195 Patent Claim 1<br>• '502 Patent Claim 7 | no construction necessary |

Having reviewed the intrinsic and extrinsic evidence of record, the Court hereby adopts the parties' agreed constructions.

[3] For all term charts in this order, the claims in which the term is found are listed with the term but: (1) only the highest-level claim in each dependency chain is listed, and (2) only asserted claims identified in the parties' Revised Joint Claim Construction Chart Pursuant to P.R. 4-5 (Dkt. No. 60) are listed.

## IV. CONSTRUCTION OF DISPUTED TERMS

### A. "single drift layer . . . having a graded concentration of dopants [. . . said drift layer further having / generating] a first static unidirectional electric drift field"

| Disputed Term | Plaintiff's Proposed Construction | Defendants' Proposed Construction |
|---|---|---|
| "single drift layer … having a graded concentration of dopants … said drift layer further having a first static unidirectional electric drift field"<br><br>• '195 Patent Claim 1 | no construction necessary | single layer whose concentration of dopants either increases across the layer or decreases across the layer |
| "single drift layer … having a graded concentration of dopants generating a first static unidirectional electric drift field"<br><br>• '502 Patent Claim 7 | | |

Because the parties' arguments and proposed constructions with respect to these terms are related, the Court addresses the terms together.

**The Parties' Positions**

Plaintiff submits: These terms are understandable without construction when taken in the context of the surrounding claim language. For example, the claims require a "well region disposed in" the single drift layer. In order for the drift layer to include a well region, the "graded concentration of dopants" of the drift layer is necessarily not only increasing or only decreasing, the graded concentration has both increasing and decreasing components. The Asserted Patents also describe exemplary grading that includes both increasing and decreasing dopant-concentration components, such as retrograding and quasilinear grading. As explained in the Asserted Patents, the recited "unidirectional" character of these terms explicitly refers to the

"electric drift field," not to the "graded concentration of dopants." The slope of the graded concentration need not be solely decreasing or solely increasing to yield the recited "unidirectional electric drift field." Further, the claims allow for more than one "unidirectional electric drift field" and in fact specify a second "unidirectional electric drift field" in the well region disposed in the "drift layer." Finally, the "single drift layer" necessarily allows for another layer in that the claims require the well region in the drift layer. Dkt. No. 46 at 8–16.

In addition to the claims themselves, Plaintiff cites the following intrinsic and extrinsic evidence to support its position: **Intrinsic evidence**: '195 Patent col.2 ll.40–42, col.3 ll.38–40, col.3 ll.55–58; '195 Patent File Wrapper January 26, 2011 Response to Notice of Non-Compliant Amendment at 6–7 (Plaintiff's Ex. 8, Dkt. No. 46-9 at 7–8), October 12, 2011 Request for Continued Examination Amendment D at 3 (Plaintiff's Ex. 9, Dkt. No. 46-10 at 5), October 15, 2012 Response Pursuant to 37 CFR 1.114 Amendment F at 3, 6–7 (Plaintiff's Ex. 10, Dkt. No. 46-11 at 4, 7–8); *Kamins*[4] (Plaintiff's Ex. 7, Dkt. No. 46-8). **Extrinsic evidence**: Glew Report[5] ¶¶ 33–39, 42, 44–46, 70–71 (Plaintiff's Ex. 5, Dkt. No. 46-6); Shanfield Decl.[6] ¶¶ 39, 41–42, 46 (Plaintiff's Ex. 6, Dkt. No. 46-7).

Defendants respond: The "single drift layer" terms are not terms of art but rather were coined during prosecution and therefore should be construed. During prosecution, the patentee clarified that the single drift layer is a single unidirectional layer, meaning the slope of the dopant concentration is of one direction across the layer. In fact, as the patentee explained during prosecution, the "'direction' of the electric field . . . depends solely on the slope of the graded concentration of dopant[s]"; therefore, the dopant concentration must be solely increasing or solely

[4] U.S. Patent No. 4,160,985.
[5] Expert Report of Alexander D. Glew, Ph.D. Regarding Claim Construction.
[6] Declaration of Stanley Shanfield Regarding Claim Construction.

decreasing to yield the recited unidirectional electric drift field (quoting '195 Patent File Wrapper April 17, 2012 Response Pursuant to 37 CFR 1.114 Amendment E at 6–7, Dkt. No. 50-12 at 59–60 (Defendants' modifications)). That the claims recite a well region disposed in the drift layer does not require both an increasing and decreasing dopant concentration in the drift layer as the well region may have the same doping type as the drift layer. Further, as explained in prior-art of record in the '195 Patent's file wrapper, "a retrograded well means a doped region with 'a vertically graded dopant concentration that is lowest at the substrate surface [], and highest at the bottom of the well,'" and a "'p-well is retrograded so that the doping concentration increases with depth'" (quoting *Rhodes*[7] at ¶ [0055] and *Harris*[8] at col.4 ll.37–39). This means that the Asserted Patents, though they disclose a retrograded concentration, do not disclose a graded concentration of dopants that includes both increasing and decreasing dopant concentration. Dkt. No. 50 at 7–16.

In addition to the claims themselves, Defendants cite the following intrinsic and extrinsic evidence to support their position: **Intrinsic evidence**: '195 Patent col.3 ll.30–33; '195 Patent File Wrapper July 28, 2008 Office Action (Defendants' Ex. 36, Dkt. No. 50-36), June 13, 2011 Response to Final Office Action Amendment C[9] at 3, 6 (Defendants' Ex. 11, Dkt. No. 50-12 at 36, 39), April 17, 2012 Response Pursuant to 37 CFR 1.114 Amendment E[10] at 6–7 (Defendants' Ex.

[7] U.S. Patent Application Publication No. 2003/0042511 (Defendants' Ex. 20, Dkt. No. 50-21). Defendants cite the abstract, but quote a passage found in paragraph [0055] but not in the abstract.
[8] U.S. Patent No. 6,465,862 (Defendants' Ex. 34, Dkt. No. 50-34).
[9] Defendants present this document as "Amend. & Remarks," but the only document dated June 13, 2011 that is part of the file-wrapper excerpts submitted by Defendants as their Exhibit 11 is entitled Response to Final Office Action Amendment C. This response is at pages 34–41 of Dkt. No. 50-12.
[10] Defendants present this document as "Amend. & Remarks" and do not provide a pin cite within their Exhibit 11, which is a collection of excerpts from the file wrapper. The exhibit does not include a document facially dated April 17, 2012. With cross-reference to the file wrapper accessible to the public on the USPTO's Public Pair site (https://portal.uspto.gov/pair/PublicPair),

11, Dkt. No. 50-12 at 59–60); *Rhodes*, at [57] Abstract (Defendants' Ex. 20, Dkt. No. 50-21 at 2); *Harris*[11] col.4 ll.37–39 (Defendants' Ex. 34, Dkt. No. 50-34); *Kamins* figs.2–3 (Plaintiff's Ex. 7, Dkt. No. 46-8). **Extrinsic evidence**: Shanfield Decl.[12] ¶¶ 24–29, 42–43, 74 (Defendants' Ex. 39, Dkt. No. 50-39).

Plaintiff replies: The prosecution history does not suggest a disclaimer of multi-directional grading of dopant concentration. Rather, the patentee stated that the electric field and carrier movement in the drift layer is unidirectional. This unidirectional field and carrier movement may be accomplished with a graded concentration of dopants that includes both increasing and decreasing portions. Further, "[t]he claim as written already requires a 'single' layer . . . [and] [t]here is no need to drop 'drift' from 'single drift layer' to convey this point." Dkt. No. 52 at 4–8.

Plaintiff cites further **extrinsic evidence** to support its position: '195 Patent File Wrapper October 12, 2011 Request for Continued Examination Amendment D at 6 (Plaintiff's Ex. 9, Dkt. No. 46-10 at 8), April 17, 2012 Response Pursuant to 37 CFR 1.114 Amendment E at 6–7 (Defendants' Ex. 11, Dkt. No. 50-12 at 59–60); *Rhodes* (Defendants' Ex. 20, Dkt. No. 50-21).

**Analysis**

The dispute distills to two issues. First, whether "graded concentration of dopants" necessarily means the concentration only decreases or only increases across the layer. It does not (subject to the other claim limitations, such as the static unidirectional electric drift field to aid movement of minority carriers from the surface layer to the substrate). Second, whether the "single drift layer"

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the Court understands the document identified by Defendants is the response at pages 54–63 of Dkt. No. 50-12.

[11] Defendants present this as "extrinsic evidence," but this reference is cited on the face of the'070 Patent and thus is "intrinsic evidence." '070 Patent, at [56] References Cited; *V-Formation, Inc. v. Benetton Grp. SpA*, 401 F.3d 1307, 1311 (Fed. Cir. 2005).

[12] This is the same declaration as submitted by Plaintiff at Dkt. No. 46-7.

is necessarily a single layer. It is, but this is plain from "single drift layer" and the parties agree that it is a single layer; thus, this does not need to be clarified through claim construction.

The Court is not convinced that "graded concentration" should be construed to require that the concentration is only increasing or only decreasing. The prosecution history does not mandate such a construction. During prosecution of the '195 Patent, the patentee stated:

> Claim 10 stands rejected as obvious in view of the combined teachings of Kamins-Pat. No. 4,160,985 and Bamji-Pub. No. 2002/0084430. Kamins discloses a photosensing device in which selective doping of a semiconductor substrate of the device produces electric fields in the substrate which accelerate photogenerated charge carriers toward or away from the surface of the device. Abstract, Fig. 3. In particular, Kamins' disclosure further states that "[t]he carriers therefore tend to be accelerated either toward the nearest photosensor or away from the surface. More specifically, carriers created below the maximum dopant concentration are accelerated into the substrate [ . . . ], while carriers created above the maximum dopant concentration are accelerated toward the surface [ . . . ]." Col. 3, Lines 6-13, Fig. 2 (showing minority carries accelerated into the substrate and the surface layer, depending on the location of the carriers relative to the maximum dopant concentration within the "buried layer" 21) and Fig. 3 (showing two electrical fields with opposing directions, away from the area of maximum dopant concentration towards both the surface layer and the substrate, respectively).
>
> The amendments to claim 10 further clarify that Applicant's claimed "drift layer" is a single unidirectional layer with a graded dopant concentration which draws all minority carriers away from the surface layer to the substrate - none of the carriers is drawn from the substrate to the surface layer. The amendments to claim 18 further clarify that Applicant's claimed "drift layer" is a single unidirectional layer with a graded dopant concentration that, which draws all minority carriers away from the substrate to the surface layer - none of the carriers is drawn from the surface layer to the substrate.

'195 Patent File Wrapper June 13, 2011 Response to Final Office Action Amendment C at 6–7, Dkt. No. 50-12 at 39–40. In context, the Court agrees with Plaintiff that "unidirectional layer" refers to the direction of the drift electric field and the movement of the carriers rather than the slope of the dopant concentration. In another prosecution-history statement, the patentee provided:

> Applicant respectfully disagrees with this position because (as previously argued by Applicant) a unidirectional drift (electric) field necessarily affects all the present minority carriers in the same way - moving all minority carriers in the same direction because of the unidirectional drift due to the existence of the electric field.

> *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).
>
> The Office Action also states that "such a unidirectional drift field may attempt to apply a force on all minority carriers in a specific direction, it does not appear to ensure (without knowing other parameters of the device) that it will draw 'all' minority carriers . . ." Yet, this argument 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, *see*, e.g., Jastrzebski (US 4,481,522) col. 5, lines 11-13 (cited in Office Action). Applicant respectfully submits that 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.

'195 Patent File Wrapper April 17, 2012 Response Pursuant to 37 CFR 1.114 Amendment E at 6–7, Dkt. No. 50-12 at 59–60. Taken in context, that the direction of the electrical field and the carrier movement "depends solely on the slope of the graded concentration of dopant" does not mandate that the slope must be only increasing or only decreasing to maintain a unidirectional drift field. For example, the 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 graded concentration of dopant. This is not justified by the prosecution history statements that Defendant cites. In fact, the *Grove* reference cited by the patentee in the above-quoted statement includes Figure 7.13 (reproduced and annotated below) which depicts a dopant concentration that both increases and decreases in the "graded base region" that provides an "electric field . . . of such direction as to aid the motion of injected holes." A.S. Grove, *Physics and Technology of Semiconductor Devices* 224–25 (1967), Dkt. No. 50-13 at 22–23. In other words, the patentee cited

*Grove* to support that a graded dopant concentration will provide a unidirectional electric drift field to move the minority carriers in a single direction and *Grove* discloses a dopant concentration that both increases and decreases in the drift layer. The prosecution history does not state that the dopant concentration must only increase or only decrease across the drift layer.

The technical disclosures of the Asserted Patents also do not mandate that the dopant concentration must only increase or only decrease across the drift layer. For example, the patents describe a drift layer with a concentration higher at one layer interface than at the other layer interface. *See, e.g.*, '195 Patent col.2 ll.35–40 ("In graded base p-n-p transistors, the donor dopant concentration may be 10 to 100x at the emitter-base junction, relative to the base-collector junction (lx)."). The patents do not describe this variance of concentration as unidirectional. Rather, the

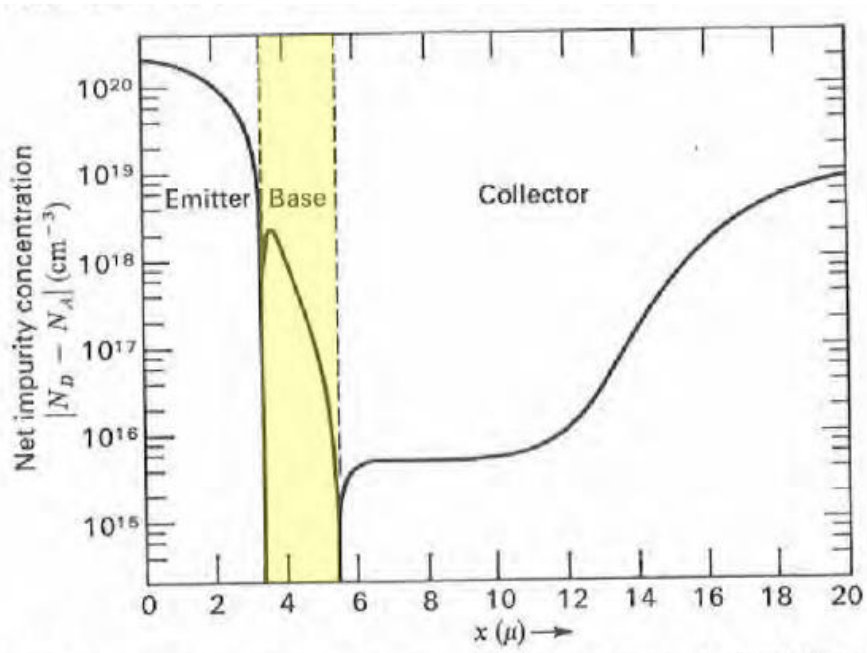


**Fig. 7.13** The impurity distribution in the *pnp* transistor. (Estimated on the basis of diffusion conditions.)

"relative slope of the donor concentration . . . creates a suitable aiding drift electric field." '195 Patent col.2 ll.42–44. Thus, the patents suggest that the graded concentration requires a higher concentration at one layer interface than at the other layer interface and that the electric drift field

depends on the "relative slope" of concentration. This comports with Figure 7.13 of *Grove*. This does not clearly foreclose a situation in which the slope of the concentration may be both increasing and decreasing in the drift layer, so long as the drift layer has the unidirectional electric drift field required by the claims.

Ultimately, the record does not establish as a matter of claim construction that the concentration is necessarily only increasing or only decreasing through the drift layer. If the physics mandates a unidirectional dopant gradient based on other expressed claim language, there is no need to incorporate such a limitation into the construction of "graded concentration of dopants."

Accordingly, the Court construes these terms as follows:

- "single drift layer . . . having a graded concentration of dopants . . . said drift layer further having a first static unidirectional electric drift field" means "single drift layer . . . having a concentration of dopants at the interface of the single drift layer and surface layer that is different than the concentration of dopants at the interface of the single drift layer and the substrate . . . said drift layer further having a first static unidirectional electric drift field";
- "single drift layer … having a graded concentration of dopants generating a first static unidirectional electric drift field" means "single drift layer … having a concentration of dopants at the interface of the single drift layer and surface layer that is different than the concentration of dopants at the interface of the single drift layer and the substrate generating a first static unidirectional electric drift field."

### B. "disposed therein"

| Disputed Term | Plaintiff's Proposed Construction | Defendants' Proposed Construction |
|---|---|---|
| "disposed therein"<br>• '481 Patent Claims 1, 5 | no construction necessary | formed at least partially in |

**The Parties' Positions**

Plaintiff submits: This term "is straightforward claim language that needs no construction." While it does not mean "formed entirely within," it should not be construed as Defendants propose. Defendants intend their construction to improperly equate isolation regions that are between well regions with isolation regions that are disposed in a well region. Such a construction would improperly render superfluous a limitation expressly directed to a second isolation region separating well regions, as all isolation regions separating well regions are between well regions and would be "formed at least partially in" the well regions under Defendants' construction. This would remove the distinction between the recited second isolation region and the first isolation region disposed in at least one of the well regions. Dkt. No. 46 at 23–26.

In addition to the claims themselves, Plaintiff cites the following intrinsic and extrinsic evidence to support its position: **Intrinsic evidence**: '481 Patent figs.6–13; '481 Patent File Wrapper August 1, 2011 Response to Final Office Action Amendment B at 8 (Plaintiff's Ex. 16, Dkt. No. 46-17 at 9); *Matsuoka*[13] fig.5E (Plaintiff's Ex. 18, Dkt. No. 46-19). **Extrinsic evidence**: Shanfield Decl. ¶¶ 60–63 (Plaintiff's Ex. 6, Dkt. No. 46-7); Glew Report ¶ 58 (Plaintiff's Ex. 5, Dkt. No. 46-6); Japanese Laid-Open Patent Application No. 2003-51551[14] fig.5 (Plaintiff's Ex. 19, Dkt. No. 46-20).

[13] U.S. Patent Application Publication No. 2001/0028097.
[14] Plaintiff submitted a certified translation of the Japanese-language document.

Defendants respond: During prosecution of the '195 Patent the patentee admitted that a prior-art reference, *Matsuoka*,[15] which discloses an isolation region that is formed partially in a well region, satisfies the limitation of a well region with an isolation region disposed therein. Thus, "it is beyond any reasonable dispute that 'disposed therein' means 'formed at least partially in.'" This does not render any claim limitation superfluous, as an isolation region may be between well regions without being formed at least partially in a well region (citing '481 Patent fig.12). Dkt. No. 50 at 27–29.

In addition to the claims themselves, Defendants cite the following intrinsic and extrinsic evidence to support their position: **Intrinsic evidence**: '481 Patent fig.12; '481 Patent File Wrapper August 1, 2011 Response to Final Office Action Amendment B[16] at 8 (Defendants' Ex. 18, Dkt. No. 50-19 at 30); *Matsuoka* at fig.5E, ¶ [0018]. **Extrinsic evidence**: Shanfield Decl. ¶¶ 59–64 (Defendants' Ex. 39, Dkt. No. 50-39).

Plaintiff replies: "To 'dispose' something is simply to 'put [it] in place or order'" (quoting *Webster's Third New International Dictionary of the English Language* 654 (2002)). This does not need to be construed to be understood. Defendants' proposed construction would broaden the meaning of the readily understood "disposed therein" to improperly encompass "even the slightest degree of overlap." Notably, the '481 Patent does not disclose an isolation region that extends beyond the boundary of the well region in which it is formed. Similarly, the isolation regions in *Matsuoka* do not extend beyond the boundary of the substrate in which they are formed. Thus, the

[15] U.S. Patent Application Publication No. 2001/0028097 (Defendants' Ex. 17, Dkt. No. 50-18). This is the same document as submitted by Plaintiff at Dkt. No. 46-19.

[16] Defendants present this document as "Amend. & Response," but the only document dated August 1, 2011 that is part of the file-wrapper excerpts submitted by Defendants as their Exhibit 18 is entitled Response to Final Office Action Amendment B. This response is at pages 23–34 of Dkt. No. 50-19.

prosecution-history recognition that "Matsuoka discloses (STI) isolation structures disposed in the substrate and/or in well regions" does not redefine what it means to be "disposed" in a substrate or well region. Dkt. No. 52 at 9–11.

Plaintiff cites further intrinsic and extrinsic evidence to support its position: **Intrinsic evidence**: *Matsuoka* ¶ [0062] (Plaintiff's Ex. 18, Dkt. No. 46-19). **Extrinsic evidence**: *Webster's Third New International Dictionary of the English Language* 654 (2002), "dispose," (Plaintiff's Ex. 25, Dkt. No. 52-2 at 5).

**Analysis**

The issue in dispute is whether "disposed therein" necessarily means "formed at least partially in." While "disposed therein" does not mean "formed entirely in," it also does not mean "formed at least partially in." Stated another way, while all structures "disposed" in a region are necessarily "at least partially in" the region, not all structures that are "at least partially in" a region are necessarily "disposed" in the region.

The prosecution history that Defendants rely upon does not support Defendants' proposal to redefine "disposed therein" as "formed at least partially in." Notably, the patentee did not use the phrase "formed at least partially in" when characterizing *Matsuoka* or the claim language at issue here. Rather, the patentee stated:

> Claims 9-12 stand rejected under 35 U.S.C. 103(a) as being obvious over Rhodes (US 2003/0042511) ("Rhodes") in view of Matsuoka (US 2001/0028097) ("Matsuoka"). Rhodes discloses a CMOS imager having multiple well regions comprising graded dopants, in particular, where the concentration of dopants is lower at the top of the well and highest at the bottom of the well *(see e.g.*, Rhodes at p.4, ¶0049). ***Matsuoka discloses (STI) isolation structures disposed in the substrate and/or in well regions*** **(see e.g.,** ***Matsuoka at p.2, ¶0018)***.

'481 Patent File Wrapper August 1, 2011 Response to Final Office Action Amendment B at 8 (emphasis added), Dkt. No. 50-19 at 30. This suggests simply that at least one isolation structure in *Matsuoka* qualifies as an isolation structure disposed in a substrate and/or well region. This does

not equate "disposed therein" with a particular aspect of a particular *Matsuoka* isolation structure nor does it clearly state that every isolation region in *Matsuoka* qualifies as "disposed" in a substrate or well region. For example, Paragraph 18 of the *Matsuoka* reference provides:

> In order to achieve the above-described object of the present invention, there is provided a semiconductor device having a ***buried-type element isolation structure***, comprising: a substrate or well region, of a first conductivity type; a ***buried element isolation trench formed in the substrate or well region*** of the first conductivity type; a high-concentration impurity region of the first conductivity type, formed in a section of the substrate or well region of the first conductivity type, which is located near a bottom surface of the buried-type element isolation trench; an element isolation structure portion formed within the buried-type element isolation trench; a diffusion layer region of a second conductivity, formed in a surface portion of the substrate or well region of the first conductivity type, except for a region where the element isolation structure portion is formed; an interlayer film deposited on the substrate or well region of the first conductivity type; and a contact section pierced through the interlayer film, to be connected to the diffusion layer region; wherein the element isolation structure portion is formed by burying an insulating film having an etching selectivity ratio to the interlayer film, in at least a side wall portion of the buried element isolation trench, the high-concentration impurity region is formed selectively lower than the bottom surface of the buried element isolation trench, at a predetermined distance from an end portion of the bottom surface of the buried element isolation trench, and the contact section is formed to extend over the diffusion layer region and the element isolation structure portion.

Dkt. No. 50-18 at 9 (emphasis added). This passage does not equate the isolation structures in the substrate to something "formed at least partially in" the substrate. Rather, this passage notes that the *Matsuoka* isolation structure identified during prosecution of the '481 Patent is a "buried-type element isolation structure." This "buried" nature of *Matsuoka's* isolation structure suggests something more than "formed at least partially in" a substrate or well region. In fact, all of the embodiments in *Matsuoka* appear to be placed significantly within the substrate or well region in a very specific way, more than simply "formed at least partially." *See, e.g.*, *Matsuoka* figs.5A–5E, 6, ¶¶ [0054]–[0066] (specifying the placement of the isolation structure), Dkt. No. 50-18 at 5–6, 12–13.

While *Matsuoka* may disclose isolation structures "disposed" in the substrate or well region, it does so under the plain meaning of "dispose," which suggests a purposeful and significant placement rather than something simply formed "at least partially in." *See, e.g.*, *Webster's Third New International Dictionary of the English Language* 654 (2002) (providing the following definitions of "dispose": "to set in order," "to put into a condition (as for a particular action) : make ready : prepare" and "to place, distribute, or arrange esp. in an orderly or systematic way (as according to a pattern)"), Dkt. No. 52-2 at 5. Ultimately, what Defendants have identified does not rise to the exacting standard of lexicography or disclaimer such that the plain meaning of "disposed therein" should be overwritten with "formed at least partially in."

Accordingly, the Court rejects Defendants' proposed construction and determines that "disposed therein" has its plain and ordinary meaning without the need for further construction.

### C. "separating said plurality of well regions"

| Disputed Term | Plaintiff's Proposed Construction | Defendants' Proposed Construction |
|---|---|---|
| "separating said plurality of well regions"<br><br>• '481 Patent Claims 1, 5 | no construction necessary | keeping apart the plurality of well regions from each other |

**The Parties' Positions**

Plaintiff submits: The meaning of "separating," and thus this term, is plain without construction. Defendants' proposed construction is simply "a longer, more confusing phrase that seems to mean the same thing." Dkt. No. 46 at 26–27.

In addition to the claims themselves, Plaintiff cites the following intrinsic and extrinsic evidence to support its position: **Intrinsic evidence**: '481 Patent col.2 ll.40–42. **Extrinsic evidence**: Glew Report ¶ 59 (Plaintiff's Ex. 5, Dkt. No. 46-6); Shanfield Decl. ¶ 79 (Plaintiff's Ex. 6, Dkt. No. 46-7).

Defendants respond: This term should be construed to clarify that "separating" well regions means that the well regions do not physically touch each other. This is the customary meaning of "separating" and gives effect to both "isolation" and "separating" in the claim recitations of "isolation region . . . separating said plurality of well regions." In other words, separating is not simply electrically isolating. Dkt. No. 50 at 29–31.

In addition to the claims themselves, Defendants cite the following intrinsic and extrinsic evidence to support their position: **Intrinsic evidence**: '481 Patent col.2 ll.40–42. **Extrinsic evidence**: Shanfield Decl. ¶¶ 77–78 (Defendants' Ex. 39, Dkt. No. 50-39); *Merriam-Webster Dictionary* 666 (1997), "separate," (Defendants' Ex. 21, Dkt. No. 50-22 at 9); *Webster's II New College Dictionary* 1007 (1999), "separate," (Defendants' Ex. 22, Dkt. No. 50-23 at 9); *The American Heritage College Dictionary* 1264 (4th ed. 2004), "separate," (Defendants' Ex. 23, Dkt. No. 50-24 at 9); *The American Heritage Dictionary of the English Language* 1587 (4th ed. 2000) (Defendants' Ex. 24, Dkt. No. 50-25 at 8).

Plaintiff replies: In the context of the claims, which recite "second isolation region fabricated on said non-epitaxial substrate separating said plurality of well regions," the "separating" is not necessarily physical, it is electrical. In fact, Defendants recognized that the claims do not require complete physical separation of the well regions in their invalidity contentions. Dkt. No. 52 at 11–13.

Plaintiff cites further **extrinsic evidence** to support its position: Japanese Laid-Open Patent Application No. 2003-51551 fig.5 (Plaintiff's Ex. 19, Dkt. No. 46-20).

**Analysis**

The issue in dispute is whether "separating said plurality of well regions" necessarily refers to physically separating such that there is no contact between the well regions. It does not. It refers to electrical separation.

This term appears in Claims 1 and 5 of the '481 Patent in the following phrase "at least one second isolation region fabricated on said non-epitaxial substrate separating said plurality of well regions." '481 Patent col.5 ll.37–39 (Claim 1), col.6 ll.1–3 (Claim 5). The parties agree that "isolation region" refers to a "region that electrically isolates." Exhibit A – Revised Joint Claim Construction Chart Pursuant to Pater Rule 4-5 at 8, Dkt. No. 60-1 at 8. Thus, "isolation region" alone does not specify what is electrically isolated. The natural reading of the claim language in dispute here is that the "separating" clause specifies what is electrically separated by the isolation region.

The technical disclosure of the '481 Patent does not clearly require complete physical separation of the plurality of well regions. While the figures of the patent depict cross-sectional views of devices having well regions with isolation structures interposed between them, the patent does not describe that these structures necessarily completely physically separate the well regions, such that the regions do not touch each other at any point. Rather, the patent explains, "[t]he wells are separated by a STI (Shallow Trench Isolation) ***for isolation***." *Id*. at col.2 ll.40–42 (emphasis added). In other words, the physical separation of the well regions is sufficient for electrical separation of the regions.

Based on the record, electrical separation of regions may not technologically require complete physical separation of the regions. For example, one prior-art reference of record depicts "a semiconductor substrate and semiconductor area having a field effect transistor formed on the

main surface thereof, a semiconductor area with a conductivity type opposite that of the semiconductor area is provided therebetween to isolate the semiconductor substrate and semiconductor area." Japanese Laid-Open Patent Application No. 2003-51551 at ¶ [0010], Dkt. No. 46-20 at 7. An embodiment of this is depicted in Figure 4 of the reference, which shows a partitioning part (2) that is interposed between two well regions (NWL, PWL) to electrically separate the regions but allows the two well regions to touch. *Id*. at fig.4, ¶¶ [0033]–[0037]; Defendants' Invalidity Contentions[17] at 18–23 ("under Greenthread's apparent claim constructions applied in its infringement contentions, the second isolation [(2)] region separates the n-well (NWL) from the p-well (PWL)"), Dkt. No. 46-21 at 19–24.

Finally, the customary meaning of "separate" does not mandate complete physical separation. For example, one dictionary provides the following definitions of "separate": "[t]o set or keep apart; disunite" and "[t]o differentiate or discriminate between; distinguish." *The American Heritage College Dictionary* 1264 (4th ed. 2004), Dkt. No. 50-24 at 9. This suggests that the meaning of "separation" is more about distinction than about the complete lack of touching. Thus, regions may be distinct from each other, that is, separated from each other, by the fact that they are electrically isolated from each other.

Accordingly, the Court construes "separating said plurality of well regions" as follows:

- "separating said plurality of well regions" means "electrically separating said plurality of well regions."

[17] Invalidity of U.S. Patent No. 8,106,481—Exhibit 2 of Appendix A.

### D. "emitter" and "collector"

| Disputed Term | Plaintiff's Proposed Construction | Defendants' Proposed Construction |
|---|---|---|
| "emitter"<br>• '070 Patent Claim 1 | emitter of carriers | a transistor region that emits carriers into a base |
| "collector"<br>• '070 Patent Claim 1 | collector of carriers | a transistor region that collects carriers from a base |

Because the parties' arguments and proposed constructions with respect to these terms are related, the Court addresses the terms together.

**The Parties' Positions**

Plaintiff submits: The '070 is not limited to the particular BJT and IGBT transistor devices required by Defendants' proposed construction. The terms "emitter" and "collector" are used in the claims without reference to a "base" and inclusion of "base" in the construction would improperly limit the claims to exemplary embodiments (BJT and IGBT). During the prosecution of a related application (the "'319 Application"[18]), the patentee was clear that "emitter" and "collector" were not necessarily components of transistors but were also components of other semiconductor devices like diodes. In fact, "base" is recited in some claims of the '319 Application along with "emitter" and "collector" but is not recited in others that include "emitter" and "collector"; thus, "base" should not be read into claims that recite only "emitter" or "collector." Further, the term "collector" was used in prior art of record (*Gibbons*[19]) and by the patentee during prosecution of the '915 Application to describe a p-n junction in a photovoltaic cell, and thus "collector" is not limited to transistors. Ultimately, the terms "emitter" and "collector" are used consistently in the intrinsic record to broadly denote emitters and collectors of carriers, which

[18] U.S. Patent Application No. 13/854,319.
[19] U.S. Patent No. 4,001,864.

includes transistor emitters and collectors but is not limited to transistor emitters and collectors. Dkt. No. 46 at 28–33.

In addition to the claims themselves, Plaintiff cites the following intrinsic and extrinsic evidence to support its position: **Intrinsic evidence**: '070 Patent, at [57] Abstract, col.1 ll.7–25, col.1 ll.29–36, col.2 ll.2–3; '915 Application File Wrapper September 3, 2004 Application at 7 (Plaintiff's Ex. 12, Dkt. No. 46-13 at 8), September 18, 2006 Corrected Amendment and Response at 7 (Plaintiff's Ex. 24, Dkt. No. 46-25 at 8); '319 Application File Wrapper November 6, 2013 Amendment A at 3, 5–7 (Plaintiff's Ex. 21, Dkt. No. 46-22 at 4, 6–8); '070 Patent File Wrapper November 3, 2015 Application at 9 (Plaintiff's Ex. 22, Dkt. No. 46-23 at 10); *Gibbons*[20] (Plaintiff's Ex. 23, Dkt. No. 46-24). **Extrinsic evidence**: Glew Report ¶¶ 76–78, 83, 85 (Plaintiff's Ex. 5, Dkt. No. 46-6); Shanfield Decl. ¶¶ 84, 101 (Plaintiff's Ex. 6, Dkt. No. 46-7).

Defendants respond: Under their plain and ordinary meanings, "emitter" and "collector" refer to components of a transistor. These are their customary meanings in the art and they are used consistent with these meaning in the intrinsic record. For example, the only use of "emitter" and "collector" in the '070 Patent is in the context of describing two transistors, each having a base (BJTs and IGBTs). This is consistent with the patentee's use of the terms during prosecution of the '319 Application. There, the claims were amended to clarify that the claimed semiconductor device with an emitter and collector included components such as diodes in addition to the emitter and collector, rather than being a non-transistor device with an emitter and collector. Finally, while the *Gibbons* reference considered during prosecution of the '915 Application uses the term "collector" to describe a component of a diode, it does not also use the term "emitter," and thus

[20] U.S. Patent No. 4,001,864.

provides a different context than the claims at issue here. Notably, the then-pending claims of the '915 Application did not recite a collector or emitter. Dkt. No. 50 at 31–35.

In addition to the claims themselves, Defendants cite the following intrinsic and extrinsic evidence to support their position: **Intrinsic evidence**: '070 Patent col.2 ll.32–36, col.2 ll.54–64, col.3 l.3 – col.4 l.3; '915 Application File Wrapper September 6, 2006 Amendment and Response at 3 (Defendants' Ex. 38, Dkt. No. 50-38 at 4); '195 Patent File Wrapper May 13, 2008 Election Under 35 U.S.C. § 121[21] at 2 (Defendants' Ex. 11, Dkt. No. 50-12 at 3); '319 Application File Wrapper April 29, 2014 Amendment B at 17 (Defendants' Ex. 37, Dkt. No. 50-37 at 18). **Extrinsic evidence**: Shanfield Decl. ¶¶ 32–34, 86, 100–101 (Defendants' Ex. 39, Dkt. No. 50-39); Glew Report ¶ 77 (Plaintiff's Ex. 5, Dkt. No. 46-6); *Dictionary of Computer and Internet Terms* 75, 126 (5th ed. 1996), "collector" and "emitter," (Defendants' Ex. 26, Dkt. No. 50-27 at 4–5); *IEEE 100: The Authoritative Dictionary of IEEE Standard Terms* 378 (7th ed. 2000), "emitter," (Defendants' Ex. 27, Dkt. No. 50-28 at 5); *McGraw-Hill Dictionary of Electrical and Computer Engineering* 98 (2004), "collector," (Defendants' Ex. 28, Dkt. No. 50-29 at 4).

Plaintiff replies: The terms "emitter" and "collector" are used broadly in the intrinsic record to refer to components independent of a transistor "base" and the terms should be appropriately construed. Dkt. No. 52 at 13.

Plaintiff cites further **intrinsic evidence** to support its position: '319 Application File Wrapper April 29, 2014 Amendment B at 17 (Defendants' Ex. 37, Dkt. No. 50-37 at 18).

[21] Defendants present this document as "Response to Election/Restriction Filed," but the only document dated May 13, 2008 that is part of the file-wrapper excerpts submitted by Defendants as their Exhibit 11 is entitled Election Under 35 U.S.C. § 121. This document is at pages 2–4 of Dkt. No. 50-12.

**Analysis**

The issue in dispute appears to be whether "emitter" and "collector" as used in the '070 Patent necessarily require a transistor "base." While the Court understands "emitter" and "collector" to be used in accord with their customary meanings in the art, namely, to refer to components of a transistor, it is not clear that this meaning necessarily requires the "base" Defendants propose.

The terms "emitter" and "collector" are terms of art and were not redefined in the Asserted Patents to have other than their customary meanings. These terms are to be interpreted from the perspective of one of ordinary skill in the art, who is "deemed to read the words used in the patent documents with an understanding of their meaning in the field, and to have knowledge of any special meaning and usage in the field." *Multiform Desiccants, Inc. v. Medzam Ltd.*, 133 F.3d 1473, 1477 (Fed. Cir. 1998). Here, the Court agrees with Defendants that "emitter" and "collector" are terms of art and carry a customary meaning to one of skill in the art as transistor components. *Dictionary of Computer and Internet Terms* 75, 126 (5th ed. 1996), Dkt. No. 50-27 at 4–5; *IEEE 100: The Authoritative Dictionary of IEEE Standard Terms* 188, 378 (7th ed. 2000), Dkt. No. 50-28 at 4–5; *McGraw-Hill Dictionary of Electrical and Computer Engineering* 98, 204 (2004), Dkt. No. 50-29 at 4–5. To stray from this customary meaning, an alternate meaning must be "clearly" set forth in the intrinsic record. *GE Lighting Sols., LLC v. AgiLight, Inc.*, 750 F.3d 1304, 1309 (Fed. Cir. 2014). This is an "exacting standard." *Id*. Here, the intrinsic record at most indicates a vacillating use of "emitter" and "collector" in prosecution of a related, and abandoned, application to at one point refer to a component that may be within a non-transistor device only to later be changed to refer to a component of a device that may also include a non-transistor component. '319 Application File Wrapper November 6, 2013 Amendment A at 3, 5–7, Dkt. No. 46-22 at 4, 6–8; '319 Application File Wrapper April 29, 2014 Amendment B at 17, Dkt. No.

50-37 at 18. The use of "emitter" and "collector" in the '481 Patent comports with the customary meaning of the terms, referring to transistor components. *See, e.g.*, '481 Patent col.3 ll.45–60 ("emitter" and "collector" as components of a BJT), col.3 l.61 – col.4 l.24 ("emitter" and "collector" as components of an IGBT). This record does not meet the exacting standard required to stray from the customary meanings of "emitter" and "collector."

The Court declines to define the "emitter" and "collector" with the unrecited and undefined term "base." The extrinsic evidence of record suggests that that the terms "emitter," "collector," and "base" may refer to the electrodes connected to the corresponding region. *See, e.g.*, *McGraw-Hill Dictionary of Electrical and Computer Engineering* 98 (2004) (noting that "collector" may refer to "the electrode or terminal connected to [the collector] region"), Dkt. No. 50-29 at 4–5; *Dictionary of Computer and Internet Terms* 381–82 (5th ed. 1996) (depicting the "emitter," "collector," and "base" of NPN and PNP transistors as terminals), Dkt. No. 50-27 at 6–7. In the '481 Patent, the IGBT, which is described with an "emitter" and "collector," does not have a terminal that corresponds to a "base." *See, e.g.*, '481 Patent figs.2, 4, col.2 ll.18–19, col.2 ll.30–32, col.3 l.61 –c ol.4 l.24. As the parties did not submit any evidence or argument regarding the definition of "base" from which the Court can discern the meaning of "base" in Defendants' proposed construction, the Court declines to include "base" in the construction.

Accordingly, the Court construes "emitter" and "collector" as follows:

- "emitter" means "transistor region that emits carriers;" and
- "collector" means "transistor region that collects carriers."

## V. CONCLUSION

The Court adopts the constructions set forth above, as summarized in the following table. The parties are **ORDERED** that they may not refer, directly or indirectly, to each other's claim-

construction positions in the presence of the jury. Likewise, the parties are **ORDERED** to refrain from mentioning any portion of this opinion, other than the actual definitions adopted by the Court, in the presence of the jury. Any reference to claim-construction proceedings is limited to informing the jury of the definitions adopted by the Court.

The parties are hereby **ORDERED** to file a Joint Notice within fourteen (14) days of the issuance of this Memorandum Opinion and Order indicating whether the case should be referred for mediation. If the Parties disagree about whether mediation is appropriate, the Parties should set forth a brief statement of their competing positions in the Joint Notice.

| Section | Term | Construction |
|---|---|---|
| **A** | "single drift layer … having a graded concentration of dopants … said drift layer further having a first static unidirectional electric drift field"<br><br>• '195 Patent Claim 1 | single drift layer … having a concentration of dopants at the interface of the single drift layer and surface layer that is different than the concentration of dopants at the interface of the single drift layer and the substrate … said drift layer further having a first static unidirectional electric drift field |
| | "single drift layer … having a graded concentration of dopants generating a first static unidirectional electric drift field"<br><br>• '502 Patent Claim 7 | single drift layer … having a concentration of dopants at the interface of the single drift layer and surface layer that is different than the concentration of dopants at the interface of the single drift layer and the substrate generating a first static unidirectional electric drift field |
| **B** | "disposed therein"<br><br>• '481 Patent Claims 1, 5 | plain and ordinary meaning |
| **C** | "separating said plurality of well regions"<br><br>• '481 Patent Claims 1, 5 | electrically separating said plurality of well regions |

| Section | Term | Construction |
|---|---|---|
| **D** | "emitter"<br><br>• '070 Patent Claim 1 | transistor region that emits carriers |
| | "collector"<br><br>• '070 Patent Claim 1 | transistor region that collects carriers |
| **AGREED** | "isolation region"<br><br>• '481 Patent Claims 1, 5 | region that electrically isolates |
| | "a substrate of a first doping type"<br><br>• '070 Patent Claim 1 | a substrate with either p-type doping or n-type doping |
| | "disposed adjacent"<br><br>• '070 Patent Claim 1 | next to or close to |
| | "at least a portion of the active region proximate the first surface of the substrate and not containing the at least one region defined with a graded dopant concentration"<br><br>• '070 Patent Claim 1 | at least a portion of the active region that is proximate the first surface of the substrate and has a graded dopant concentration, but that does not contain the at least one region of higher conductivity |
| | "2-way graded dopants"<br><br>• '481 Patent Claims 1, 5 | dopants with increasing concentration in one area, and decreasing concentration in a second area |
| | "unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate"<br><br>• '195 Patent Claim 1<br>• '502 Patent Claim 7 | no construction necessary |

**So ORDERED and SIGNED this 20th day of April, 2020.**

RODNEY GILSTRAP
UNITED STATES DISTRICT JUDGE