UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF TEXAS
WACO DIVISION

Greenthread, LLC *Plaintiff*, *v*. Intel Corporation; Dell Inc.; and Dell Technologies Inc. *Defendants*.	Civil Action No. 6:22-cv-105-ADA JURY TRIAL DEMANDED

GREENTHREAD'S RESPONSIVE CLAIM CONSTRUCTION BRIEF

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Exhibit	Description
1	Declaration of Dr. Konstantinos P. Giapis ("Giapis declaration")
2	U.S. Patent No. 8,421,195 to G.R. Mohan Rao (GREENTHREAD-WDTX-000027-000040) ("195 patent")
3	U.S. Patent No. 10,510,842 to G.R. Mohan Rao (GREENTHREAD-WDTX-000070-000084) ("842 patent")
4	Excerpts from Chen, J. Y., CMOS Devices and Technology for VLSI, Prentice-Hall (1990) (GREENTHREAD-WDTX-007426–007682) ("Chen")
5	*Greenthread, LLC v. Samsung Elecs. Co., Ltd.*, No. 2:19-cv-00147-JRG, Dkt. 67 (Claim Construction Memorandum Opinion and Order), E.D. Tex. Apr. 20, 2020 (GREENTHEAD-WDTX-002761-002792) ("EDTX *Markman* Order")
6	*Samsung Elecs. Co., Ltd. v. Greenthread, LLC*, IPR2020-00289, Ex. 1003 (Apr. 14, 2020) (GREENTHREAD-WDTX-003869–003959) ("Smith declaration")
7	The American Heritage Dictionary of the English Language, Third Edition (2002), at 1792 (defining "substrate") (GREENTHREAD-WDTX-007794–007797)
8	Excerpts from Webster's Third New International Dictionary of the English Language Unabridged, Merriam-Webster, Inc. (1992) (GREENTHREAD-WDTX-002826–002834, GREENTHREAD-WDTX-007793)
9	Excerpts from Baker, R. J., CMOS Circuit Design, Layout, and Simulation, IEEE (1998) (GREENTHREAD-WDTX-002674–002715) ("Baker")
10	Defendants' Preliminary Claim Constructions, No. 6:22-cv-105-ADA (W.D. Tex.) (served Sept. 19, 2022)
11	File History of U.S. Patent No. 10,510,842 (GREENTHREAD-WDTX-001059-1246) ("842 file history")
12	Excerpts from Howe, R. T., Microelectronics: An Integrated Approach, Prentice-Hall (1997) ("Howe") (GREENTHREAD-WDTX-002793–2813)
13	Excerpts from Wolf S., Silicon Processing for the VLSI Era Volume 2: Process Integration, Lattice Press (1990)
14	Excerpts from Wolf S., Silicon Processing for the VLSI Era Volume 3: The Submicron MOSFET, Lattice Press (1995) (GREENTHREAD-WDTX-002877–2883)

[1] When possible, Greenthread has cited to the exhibits previously attached to Defendants' Opening *Markman* Brief (Dkt. 82). Unless otherwise indicated, all docket numbers refer to the present case, *Greenthread, LLC v. Intel Corp. et al.*, No. 6:22-cv-105-ADA (W.D. Tex.), and all citations to page numbers of CM/ECF documents refer to the page number at the top of the page in the CM/ECF header.

EXEMPLARY CLAIMS 195:1 & 842:1

Term	U.S. Patent No. 8,421,195, Claim 1 (195:1)
1	A CMOS Semiconductor device comprising: a **surface layer**;
2	a **substrate**;
3	an **active region** including a source and a drain, disposed on one surface of said surface layer;
4 5	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
6	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.

Term	U.S. Patent No. 10,510,842, Claim 1 (842:1)
7	A semiconductor device, comprising: a substrate of a first doping type at a first doping level having first and second surfaces; a first **active region** disposed adjacent the first surface of the substrate with a second doping type opposite in conductivity to the first doping type and **within which transistors can be formed**; a second active region separate from the first active region disposed adjacent to the first active region and within which transistors can be formed; transistors formed in at least one of the first active region or second active region; and at least a portion of at least one of the first and second active regions having at least one graded dopant concentration to aid carrier movement from the first surface to the second surface of the substrate.

DISPUTED CLAIM CONSTRUCTIONS

#	Claim(s)	Terms[2]	Greenthread	Defendants
1	195:1 502:7 222:44	"surface layer" and related terms	Plain and ordinary meaning, where the plain and ordinary meaning is "a layer at the surface"	Indefinite
2	195:1 502:7 842:1, 9 481:1, 20 222:1, 21, 39, 41, 42, 44 014:1, 21	"substrate"	Plain and ordinary meaning, where the plain and ordinary meaning is an "underlying layer"	"the initial material within which or on which the semiconductor device is fabricated"
3	195:1 502:7 842:1, 9 481:1, 20 222:1, 21, 39, 41, 42, 44 014:1, 21	"active region"	Plain and ordinary meaning	"region that forms the current path of a device"
4	195:1 502:7 222:44	"said [drift layer further/well region …] having a [first/second] static unidirectional electric drift field"	Plain and ordinary meaning	"said [drift layer further/well region …] having a [first/second] static electric drift field that is unidirectional over the [drift layer/well region"
		"said [drift layer further/well region] having a graded concentration of dopants generating a [first/second] static unidirectional electric drift field"		"said [drift layer further/well region] having a graded concentration of dopants generating a [first/second] static electric drift field that is unidirectional over the [drift layer/well region]"

[2] All 7 terms were identified by Defendants.

DISPUTED CLAIM CONSTRUCTIONS (continued)

#	Claim(s)	Terms	Greenthread	Defendants
5	195:1 502:7 842:1, 9 481:1, 20 222:1, 21, 39, 41, 42, 44 014:1, 21	"to aid the movement of minority carriers from ... to …"	Plain and ordinary meaning	Indefinite Alternative construction: "to sweep the minority carriers from … to …
		"to aid carrier movement from ... [to/towards]"		Indefinite Alternative construction: "to sweep the carriers from … [to/towards] …
6	195:1 502:7 842:1, 9 481:1, 20 222:1, 21, 39, 41, 42, 44 014:1, 21	"well region"	Plain and ordinary meaning, where portions of a well are not well regions.	"A well, whether formed by single or multiple implants. Portions of a well are not well regions."
7	842:1, 9 481:1, 20 222:1, 21, 39, 41, 42 014:1, 21	"active region … within which transistors can be formed"	Plain and ordinary meaning	Indefinite

AGREED CLAIM CONSTRUCTIONS

#	Claim(s)	Terms	Agreed Construction
8	842:1, 9 481:1, 20 222:1, 21, 39, 41, 42 014:1, 21	"a substrate of a first doping type"	"a substrate with either p-type doping or n-type doping"
9	842:1, 9 481:1, 20 222:1, 21, 39, 41, 42 014:1, 21	"disposed adjacent"	Plain and ordinary meaning
10	842:7, 15 481:6, 26 222:6, 27 014:6, 27	"isolation region"	Plain and ordinary meaning

I. INTRODUCTION

Greenthread's complaint asserts six patents that improve the performance of semiconductor devices. All six patents claim priority to an application filed by Dr. Mohan Rao on September 3, 2004. Dr. Rao is one of the pioneers in the semiconductor industry. He is an award winning inventor, and his inventions are featured in the Smithsonian museum. When he filed his application in 2004, he used terms that those skilled in the art would readily understand. He did not coin any new terms, and he did not disclaim the full scope of the plain meaning. Therefore, it is not surprising that plain meaning is the proper construction for all seven disputed claim terms.

For terms 2-4 and 6, Defendants attempt to limit the full scope of the plain meaning by reading in unnecessary limitations. As is often the case, Defendants are attempting to manufacture noninfringement arguments, when there was no clear disavowal, disclaimer, or estoppel. Defendants criticize Greenthread for proposing "plain meaning." Yet for two of the three agreed constructions, it was Defendants that proposed "plain meaning." Thus, Defendants recognize that not all terms need to be construed, and "plain meaning" is often the best construction.

For the remaining terms, Defendants argue that certain phrases are indefinite. But when these terms are read in light of the specification and prosecution history, they are abundantly clear. The superficiality of Defendants' arguments is highlighted by Greenthread's previous litigation against Samsung. There Samsung was represented by the same counsel as here. In the *Samsung* litigation, Defendants' counsel did not argue that "to aid the movement of minority carriers" or "surface layer" were indefinite or not disclosed by the specification. Instead Intel's counsel agreed with Greenthread that the terms did not need construction. Moreover, Samsung filed IPRs where Samsung's expert testified that he understood the terms and they should be given their ordinary meaning. The fact that Samsung's expert understood the terms confirms they are not indefinite.

II. BACKGROUND

A. Dopants

Silicon is an example of a semiconductor. In its pure form it is typically an insulator but it can become an electrical conductor when impurities called "dopants" are added into the silicon crystal. These dopants are usually phosphorous or boron atoms that have one more or one less valence electron than a silicon atom. If the dopant has one less valence electron, then it creates what is called a "hole," which is a positive unit of charge. The extra electrons or holes disturb the local charge equilibrium in the silicon and can become mobile in response to electric fields. Thus, the electrons and holes are called "charge carriers." Ex. 1 (Giapis declaration), ¶15; *id.*, ¶¶1-14.

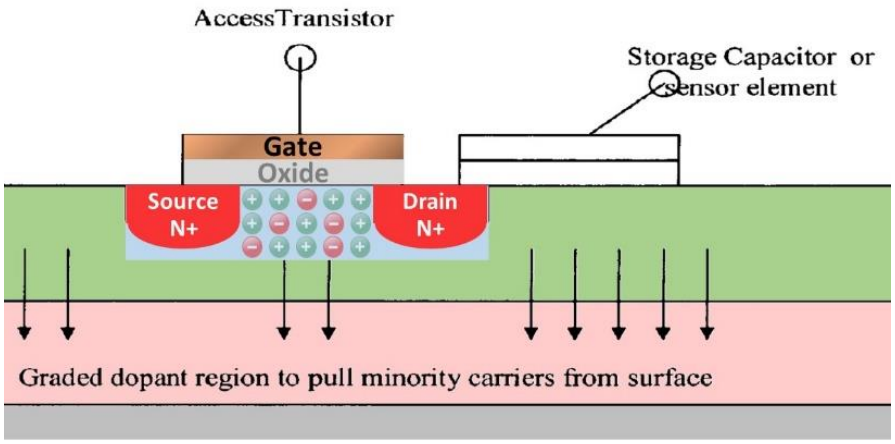
These dopants can also change the net electrical charge distribution in the surrounding silicon, which can influence the motion of other charge carriers passing by. When the dopant concentration is graded in a particular direction, other charge carriers will move in the gradient direction (or opposite direction) depending on the charge carrier's polarity. This phenomenon is called "carrier drift." *Id.*, ¶16.

B. Overview of Dr. Rao's Invention

At the time of Dr. Rao's invention, most semiconductor devices relied on uniform concentrations of dopants. Ex. 2 (195 patent), Abstract; 1:36-40, 50-51. Dr. Rao recognized, however, that graded concentrations of dopants can be used to improve the performance of transistors and other semiconductor devices. *Id.*, Abstract; 3:3-13, 33-35. His invention is clearly disclosed in Figs. 5B-C of his patents, and the corresponding parts of the specification. Ex. 1, ¶17.

A surface-channel MOSFET is a common type of transistor capable of controlling current flow at or along the surface of the semiconductor substrate. Ex. 4 (Chen), 27 ("carriers propagate

at the semiconductor surface"). Figure 5B shows an n-channel MOS (NMOS)[3] transistor that is formed in a p-type surface layer. The transistor comprises (1) a gate; (2) a thin oxide separating the gate from the surface layer; and (3) two doped regions called the source and drain (shaded red). Ex. 2, 3:10-11 ("electrons can be swept from source to drain"); 3:42-43 ("accelerate majority carriers towards the drain"). In Fig. 5B, the N+ means these regions are heavily doped with an n-type dopant that creates a surplus of negative carriers (*i.e.*, electrons).[4] The specification explains that the NMOS transistor in Fig. 5B can be a surface-channel MOSFET. Ex. 1, ¶¶18-21.



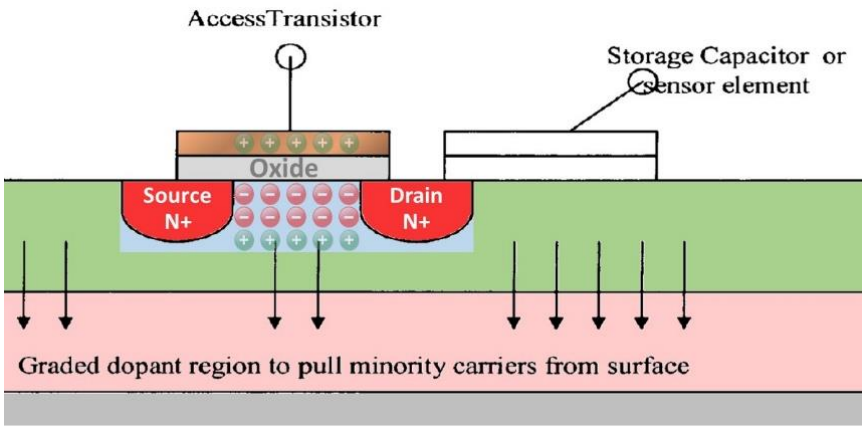
Ex. 1, ¶21 (explaining Fig. 5B above); Ex. 2:41-43. Meanwhile, the p-type silicon between the source and drain (shaded blue) has an abundance of positively charged holes (green circles). When the holes separate the source's electrons from the drain's electrons, current cannot flow through the transistor, and the transistor is in an "off" state. Ex. 1, ¶¶21-22.

When a positive voltage is applied to the gate, an electric field forms in the oxide. *Id.* This electric field repels the holes downwards, while the electrons (red circles) are attracted to move into the blue surface layer. When enough electrons have accumulated in the surface layer below

[3] MOS stands for "metal oxide semiconductor," where **m**etal and **o**xide layers are formed on a **s**emiconductor (*e.g.*, silicon). Ex. 1, ¶21 n.3; Ex. 4, 10.

[4] An "N" region or layer has more electrons, and thus a "**n**egative charge." A "P" layer has more holes, and a "**p**ositive charge." A "+" or "-" means heavily or lightly doped. Ex. 1, ¶21 n.4.

the oxide, they form a conductive channel between the source and the drain, and current can begin to flow through the transistor.

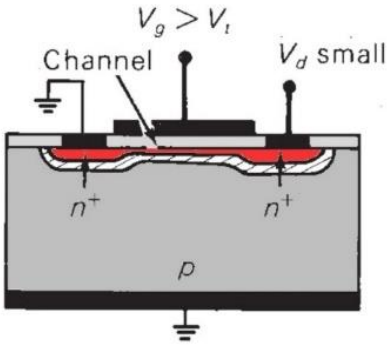


Ex. 1. ¶22.[5] In order to turn the transistor "off," the positive voltage is removed from the gate and the channel disappears as the holes return to the surface layer. *Id.*

POSITAs normally use the term "well region" to describe the doped silicon that surrounds the source and drain. *Id.*, ¶23. Dr. Rao recognized that by using graded concentrations of dopants in the well region and a drift layer (shaded pink), it is possible to "pull" carriers from the silicon's surface. Ex. 2, Fig. 5B. In this example, pulling the holes from the surface layer when a positive voltage is applied to the gate, allows the transistor to turn "on" more quickly. This improves the speed and performance of the transistor. Ex. 1, ¶24; Ex. 2, 3:8-13.

As its name suggests, the channel in a surface channel MOSFET forms along the surface. But it is slightly more complicated than that. The figure below shows that the n-channel starts at the source (on the left) and expands towards the drain (on the right) as the voltage applied to the gate increases. There is a thin layer below the surface (shaded red) where the channel actually forms. Ex. 1, ¶25.

[5] Because the channel is formed by electrons with a **n**egative charge, the MOSFET is referred to as an **n**-channel MOSFET. In an n-channel MOSFET, the electrons are referred to as the "majority carriers," and the "minority carriers" are holes. Ex. 1, ¶22 n.5.



Ex. 1, ¶25; Ex. 4, 19 (shaded). The cross-hatched region underneath is known as the depletion region. As shown above, the n-channel does not actually form on the surface but rather in the layer just below the surface (*i.e.*, the surface layer). Ex. 1, ¶25.

C. Exemplary Claim 195:1

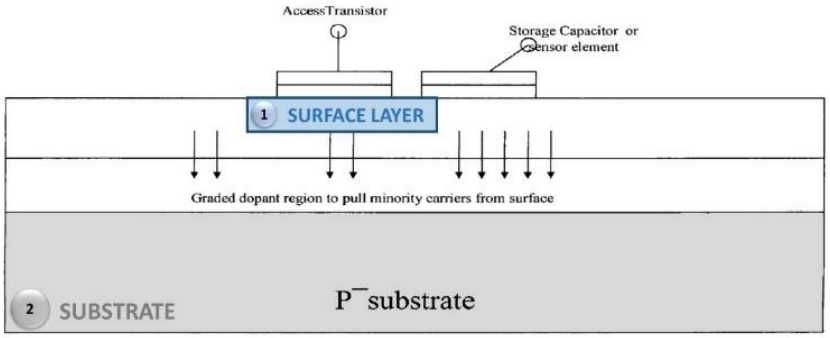
Six of the seven disputed claim terms can be found in exemplary claim 195:1. These six claim terms are numbered and color coded below.

Term	U.S. Patent No. 8,421,195, Claim 1 (195:1)
1	A CMOS Semiconductor device comprising: a **surface layer**;
2	a **substrate**;
3	an **active region** including a source and a drain, disposed on one surface of said surface layer;
4 5	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
6	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.

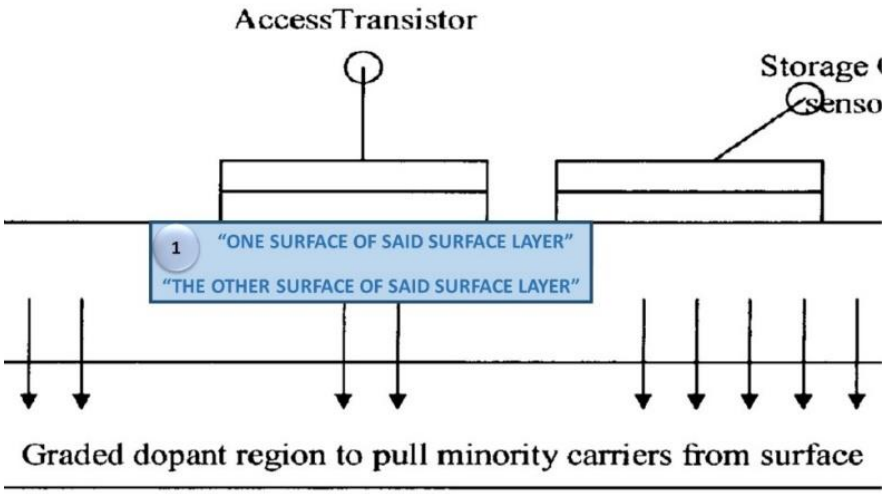
Far from being indefinite, claim 195:1 lines up exactly with Fig. 5B and the corresponding parts of the specification. Ex. 1, ¶¶26-27. Fig. 5B confirms exactly what is meant by each claim term. As the preamble states, Fig. 5B illustrates a CMOS device with metal and oxide layers on a silicon substrate. Ex. 2, 2:27-31; 3:41-43. The specification specifically mentions that the device may be

a surface channel MOSFET. *Id.*, 3:41-43; *see also* 1:43-45.

As seen below, the CMOS device comprises a surface layer (blue) and a substrate (gray). *Id.*, 3:30-45. The substrate is lightly doped with holes (P-), and the surface layer is a layer at the surface of the silicon. As explained below, the invention is concerned with moving minority carriers from this surface layer to the substrate.

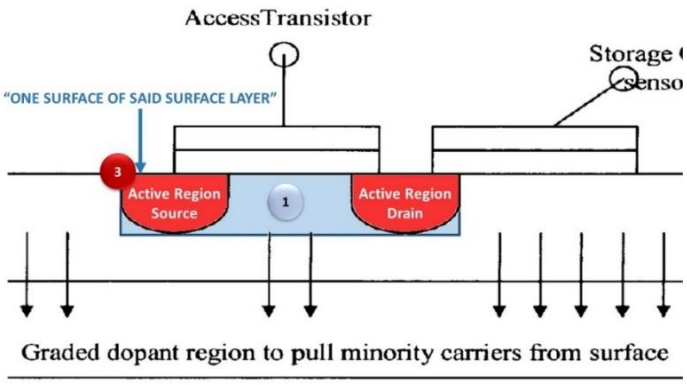


Ex. 1, ¶28.[6] The surface layer has at least two surfaces, which claim 195:1 refers to as the "one surface of said surface layer" and "the other surface of said surface layer."

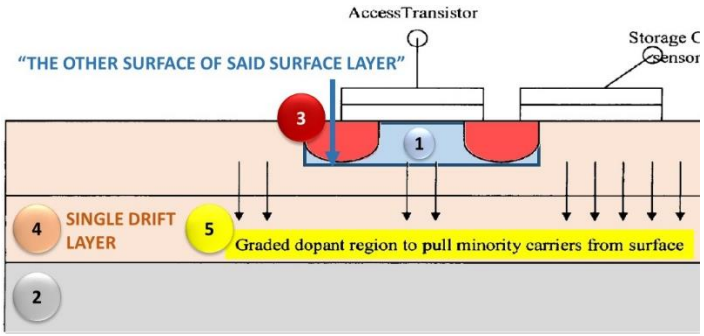


Ex. 1, ¶29; Ex. 2, 4:16-19. Next, the claim specifies an active region with a source and drain. *Id.*, 4:16-17. Fig. 5B shows how the active region is "disposed on one surface of said surface layer."

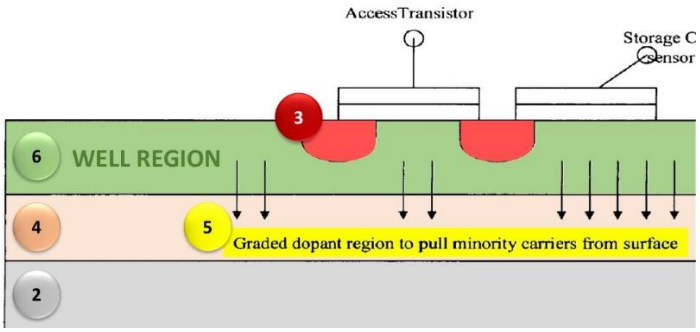
[6] As explained below, "substrate" is a relative term, and Dr. Rao sometimes used it to refer to the bottom layer, and other times he used it to refer to the wells that are underneath the surface layer and active region. In both cases, the "substrate" is an "underlying layer." Ex. 1, ¶28 n.6.



Ex. 1, ¶30. The "active region" is a doped region where a transistor can be formed. *Id.*, ¶31; Ex. 2, 1:61-63; 2:18-23; 3:1-3, 30-33. Next, the claim specifies there is a single drift layer disposed between "the other surface of said surface layer" and the substrate. The single drift layer has a graded concentration of dopants. Ex. 1, ¶32.



The graded dopants create an electric field that aids the movement of minority carriers (holes in the example shown in Fig. 5B) from the surface layer to the substrate. Ex. 1, ¶¶32-33; Ex. 2, 3:17-20, 30-37. Finally, the claim specifies there is a well region disposed in the single drift layer, and this well region creates a second electric field that also aids the movement of minority carriers.



Ex. 1, ¶34; Ex. 2, 2:27-28; 3:37-40.

D. Exemplary Claim 842:1

According to claim 195:1, the "active region" includes the heavily doped regions called the "source" and the "drain." Exemplary claim 842:1 sheds additional light on the "active region" when it specifies the "active region" is a region "within which transistors can be formed."

Term	U.S. Patent No. 10,510,842, Claim 1 (842:1)
8	A semiconductor device, comprising: a substrate of a first doping type at a first doping level having first and second surfaces; a first **active region** disposed adjacent the first surface of the substrate with a second doping type opposite in conductivity to the first doping type and **within which transistors can be formed**; a second active region separate from the first active region disposed adjacent to the first active region and within which transistors can be formed; transistors formed in at least one of the first active region or second active region; and at least a portion of at least one of the first and second active regions having at least one graded dopant concentration to aid carrier movement from the first surface to the second surface of the substrate.

According to claim 842:1, there may be multiple active regions (*i.e.*, the first and second active regions), where a transistor is formed in at least one of them (*i.e.*, transistors formed in at least one of the active regions). Ex. 1, ¶¶35-36; Ex. 3, 4:48-56.

III. DISPUTED CLAIM TERMS

For terms 2-4 and 6, Defendants ignore the well-accepted plain and ordinary meaning of the terms. The terms—substrate, active region, unidirectional, and well region—are simple terms that don't need construction. Instead of giving them the full scope of their plain meaning, Defendants seek to add self-serving limitations that are inconsistent with the intrinisic record.

Defendants' indefiniteness arguments ignore the specification and misapply the law. When the specification is properly read through the eyes of a POSITA[7], Defendants cannot meet their

[7] Dr. Giapis explains the qualifications for a POSITA. Ex. 1, ¶¶1-14. When Dr. Rao conceived his inventions, he had not one, but two Ph.D.s and had been working in the industry for more than forty years. Dkt. 1, ¶¶37-39.

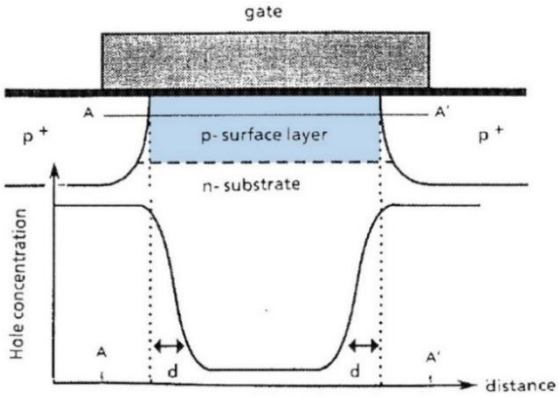
heavy burden of proving the terms are indefinite. In fact, Intel's counsel argued in the *Samsung* litigation that many of these terms should be given their plain meaning, and Samsung's expert opined that he understood the terms.

A. Claim Terms Found in Exemplary Claim 195:1

1. "surface layer" terms (195:1; 502:7; 222:44)

Greenthread	Defendants
Plain and ordinary meaning, where the plain and ordinary meaning is "a layer at the surface"	Indefinite

Far from being indefinite, "surface layer" is a lay term that is understood by skilled artisans and lay people alike. Ex. 1, ¶¶46-63. Whether it is the surface layer of the ocean, skin, soil in a backyard garden, or a semiconductor device, it is referring to the same thing: a layer at the surface. Even the Wolf textbooks cited by Defendants confirm that a "surface layer" is a layer at the surface of the semiconductor device where the active region is located. *Id.*, ¶46.



Ex. 1, ¶46; Dkt. 82-17 (Wolf Vol. 3), 11 (describing MOSFET with source and drain); Dkt. 82-18 (Wolf Vol. 4), 7, 10 (describing "surface layer" of MOSFET as doped silicon near surface).

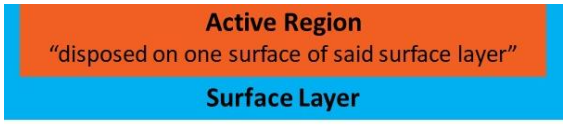
Defendants' indefiniteness arguments are fundamentally flawed because (1) they ignore the realities of surface-channel MOSFETs and the preferred embodiment disclosed in Fig. 5B, and (2) they wrongly assume the surface layer is "disposed ***under*** the active region." Ex. 1, ¶47. Dkt. 82, 14 (emphasis in original). The claims ***never*** use the words "disposed under." It is a fiction

Defendants created. When Defendants say it is "paradoxical" that the "surface layer" is not at the surface of the semiconductor device, it is not paradoxical; it is simply wrong.

The test for indefiniteness is whether the claims, viewed in light of the specification and prosecution history, inform those skilled in the art about the scope of the invention with reasonable certainty. *Nautilus, Inc. v. Biosig Instruments*, 572 U.S. 898, 910 (2014). The test is not whether the words "surface layer" appear in the specification, but whether a POSITA would have known what was meant by the term after reading the intrinsic record. Here, the claims, specification, and prosecution history confirm that the "surface layer" is the layer at the surface of the silicon. This is not surprising given this is how the term is normally used in the art. Ex. 1, ¶¶47-48.

The claim language confirms that the "surface layer" is a layer at the surface of the semiconductor device. First, a POSITA would readily understand that a "surface layer" is a layer at the surface of the semiconductor device. *Id.*, ¶48. This is because it is customary to refer to layers by their relative position. For example, a "bottom layer" is at the bottom; a "middle layer" is at the middle; and a "surface layer" is at the surface. Defendants do not contend that it is unclear what is meant by the "surface" of a CMOS device. It is the doped silicon where the active region is located, and where the channel forms in a surface-channel MOSFET. Therefore, it should go without saying that a "surface layer" is a layer at the surface of the semiconductor device.

Second, the claim specifies that the "surface layer" has two surfaces and that the "active region" is "disposed on one surface of the said surface layer." From this claim language, Defendants create the "straw man" shown below.

Defendants' "Straw Man"	Correct Interpretation
	

Dkt. 82, 11. Defendants' rendering ignores that the "active region" is part of the "surface layer," just like the "well region" is part of the "single drift layer." When the claim says the "active region" is "disposed on one surface of said layer," it is not saying it is a separate layer on top of the "surface layer." Rather it is specifying where in the "surface layer" the "active region" is located. Instead of being anywhere in the surface layer, the "active region" is disposed on the top surface of the surface layer, as shown in the right hand column above. Ex. 1, ¶¶49-50.

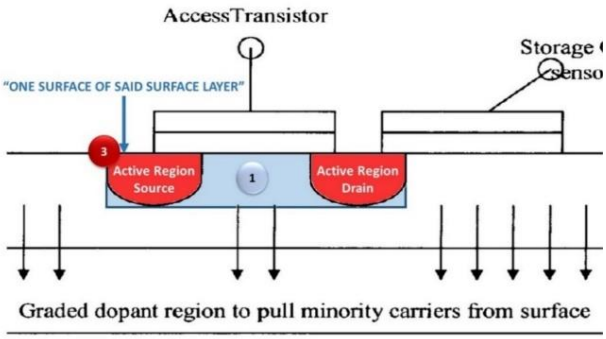
By analogy, if a room has two surfaces—a floor and a ceiling—and a ceiling fan is disposed on the ceiling of the room, it does not mean the ceiling fan is spinning around like a propeller on the roof of the house. Instead it means that the ceiling fan is hanging from the ceiling ***inside*** the room. The same is true about the active region and the surface layer. *Id.*, ¶51. When the claim says the active region is "disposed on one surface of the surface layer," it means the active region is located on the "ceiling" of the silicon ***inside*** the silicon. The claim never says the "surface layer" is "disposed ***under*** the active region," as Defendants falsely claim in their brief. *See* Dkt. 82, 14.

Finally, the claim specifies that the "active region" includes a source and drain. A POSITA would have realized that these doped silicon regions have to be part of the surface layer beneath the silicon's surface. Otherwise they could not be used to form a transistor. Ex. 1, ¶52.

The specification further confirms that the "surface layer" is a layer at the surface. Defendants do not dispute what is meant by the "surface" of the CMOS semiconductor device. This is a term of art that is readily understood by POSITAs to mean the surface of the silicon where the source and drain are located. Ex. 1, ¶53. This is how the term "surface" is consistently used throughout the specification and figures. *See* Ex. 2, 1:43-45 (explaining MOS devices are majority carrier devices and "the channel can be a surface in one plane in planar devices"); 3:30-33 (explaining how Dr. Rao's invention sweeps unwanted minority carriers "from the active circuitry

at the surface"); 3:38-43 (explaining how graded dopants "sweep those carriers away from the surface" and that the invention may be used "in surface channel MOS devices to accelerate majority carriers towards the drain"); 3:43-45 (when programming devices, "carriers should be accelerated towards the surface"); 3:53-55 ("minority carriers can be channeled to the surface"); Fig. 5A ("Graded dopant region to pull minority carriers from surface"); and Fig. 5B ("Graded dopant region [a]ccelerates carriers towards surface during programming"). In every single instance, the specification is referring to the surface layer at the surface of the semiconductor device where the active region is located. Ex. 1, ¶53.

A POSITA would have known that the carriers-of-interest are actually in the thin layer of silicon just below the silicon's surface (*i.e.*, the "surface layer"). *Id.*, ¶54. Armed with this knowledge, "surface" is frequently used as a shorthand for "surface layer." *Id.* While POSITAs know what is meant by carriers "at the surface," it is actually more precise to refer to them as carriers "in the surface layer," like the Wolf textbooks do. *Id.*; Dkt. 82-17, 11; Dkt. 82-18, 7, 10. Turning back to Fig. 5B, this surface layer is also shown in blue. We know from the surrounding claim language that the source and drain are disposed on "one surface of the surface layer."



When the specification refers to a surface channel MOSFET, the channel forms along the upper surface of this blue region. Furthermore, when the specification refers to "pull[ing] minority carriers from surface" or "accelerat[ing] minority carriers towards the surface," it refers to this same blue area. Thus, the specification consistently confirms that the "surface layer" is a layer at

the surface of the semiconductor device where the active region is located. Ex. 1, ¶¶55-56.

Defendants' interpretation (*i.e.*, surface layer disposed ***under*** the active region) would exclude the preferred embodiments in Fig. 5B. *Id.*, ¶57. "A claim construction that 'excludes the preferred embodiment is rarely, if ever, correct and would require highly persuasive evidentiary support.'" *SynQor, Inc. v. Artesyn Techs., Inc.*, 709 F.3d 1365, 1378-79 (Fed. Cir. 2013) (quoting *Adams Respiratory Therapeutics, Inc. v. Perrigo Co.*, 616 F.3d 1283, 1290 (Fed. Cir. 2010)).

The prosecution history further confirms that the surface layer is the top layer of the silicon. During prosecution of the 195 application, Applicant elected claims directed to the embodiment shown in Figs. 5B-C. Dkt. 82-8 (195 file history), 49. These claims, which were part of the original priority application, referred to the "active surface regions." *Id.*, 9. Applicant subsequently amended the claims to change "surface region" to "surface layer," and specified that the "active region" is "disposed on one surface of said surface layer." *Id.*, 165. In the next office action, the Examiner asserted that reference 23 in Fig. 2 of Kamins is a "surface layer." *Id.*, 183; Dkt. 82-10 (Kamins), 3. Notably, the Examiner identified the layer at the surface of the silicon as the "surface layer," and not the oxide layer on top of the silicon. This confirms that the Examiner understood the "surface layer" to be a layer at the surface of the silicon. Ex. 1, ¶58.

All of Defendants' arguments fail. First, Defendants argue there is nothing in the intrinsic record to describe what a "surface layer" means. Dkt. 82, 3. This is not true. The claims, specification, and prosecution history all confirm that it is a layer at the surface of the silicon. *See supra*. ***Second***, Defendants argue there is no commonly understood meaning. *Id*. Again not true. The Wolf textbooks cited by Defendants show how the term is ordinarily used in the art. Ex. 1, ¶59; Dkt. 82-17, 11; Dkt. 82-18, 7, 10. ***Third***, Defendants argue that "surface layer" does not appear in the specification. Dkt. 82, 4. But this is not the test, and as Dr. Giapis explains "surface"

is often used as a shorthand for "surface layer." Ex. 1, ¶59. ***Fourth***, Defendants argue the active region is on top of the surface layer. *Id*. This "straw man" is based on a misreading of the claim that would exclude the preferred embodiment. *See supra*. ***Fifth***, Defendants wrongly claim in both their summary judgment brief (Dkt. 81) and here that no "surface layer" is disclosed in the specification. Dkt. 82, 5. This is not true. While the specification may not expressly use the words "surface layer," the specification fully describes the layer at the surface of the semiconductor device where the active region is located, and the channel that is formed in a surface channel MOSFET. *See, e.g.*, Ex. 2, 1:43-45; 3:30-33, 38-45, 53-55; Figs. 5A-B. The Wolf textbooks confirm that this layer is referred to as a "surface layer." Dkt. 82-17, 11; Dkt. 82-18, 7, 10. Therefore, the specification does, in fact, disclose a surface layer. ***Sixth***, Defendants rely on four volumes of Wolf textbooks to argue that in some contexts the term "surface layer" is used to refer to an oxide or other non-silicon layer. Dkt. 82, 6-7. But then Defendants concede that in the MOSFET context, it is used to refer to the layer at the surface of the silicon where the active region is located. *Id*., 7. This is exactly how the term is used in the preferred embodiment in Dr. Rao's patents. The Federal Circuit has cautioned that when using extrinsic evidence, the Court should use the definition that "is most consistent with the use of the words by the inventor." *Tehrani v. Hamilton Medical, Inc.*, 331 F.3d 1355, 1361 (Fed. Cir. 2003). ***Seventh***, Defendants argue that surface layer cannot mean "layer at the surface" because the claim language "paradoxically requires the '***surface*** layer' to be disposed ***under*** the active region." Dkt. 82, 14. As explained above, this is not paradoxical; it is simply wrong. The claims make clear that the active region is part of the surface layer and there is nothing in the claim that says otherwise. ***Finally***, Defendants argue there is no discernible structure or boundaries for the "surface layer." Dkt. 82, 15. But the Wolf textbooks show how the term is ordinarily used in the art. This is how the term is consistently

used in the preferred embodiment and throughout the intrinsic record. Ex. 1, ¶¶60-62.

The superficiality of Defendants' arguments is highlighted by Greenthread's previous lawsuit against Samsung. The 195 and 502 patents were previously asserted against Samsung in the Eastern District of Texas. In that litigation, Samsung was represented by the same counsel as here. During the *Markman* process in the *Samsung* litigation, Defendants' counsel never argued that "surface layer" was indefinite or not disclosed in the specification. In fact, Defendants' counsel agreed with Greenthread that the term "unidirectional electric drift field to aid the movement of minority carriers from said ***surface layer*** to said substrate" did not require construction, and the Court entered this construction. Ex. 5 (EDTX *Markman* Order), 32.

Moreover, in an IPR filed by Samsung against the 195 patent (*see* Dkt. 82-19, 13), Samsung's expert recognized "the term most related to 'surface layer' found in the specification is 'surface.'" Ex. 6 (Smith Declaration), ¶46. Dr. Smith went on to opine that: "the 'surface layer' may correspond to a region at and along a portion of the surface of the CMOS device, as its ordinary meaning would also suggest." *Id.*, ¶49. The fact that Dr. Smith was able to determine what is meant by "surface layer" is compelling evidence that it is not indefinite. Ex. 1, ¶63.

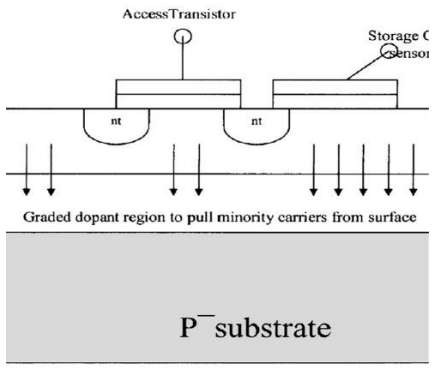
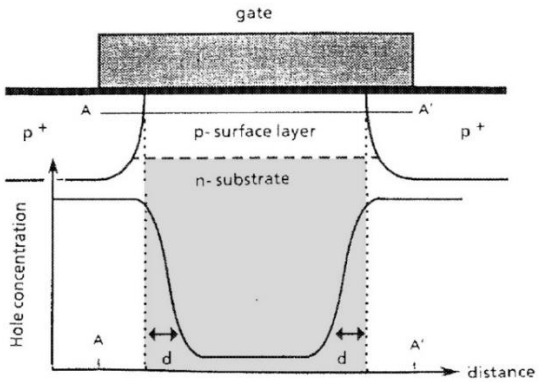
2. "substrate" (195:1; 502:7; 842:1, 9; 481:1, 20; 222:1, 21, 39, 41, 42, 44; 014:1, 21)

Greenthread	Defendants
Plain and ordinary meaning, where the plain and ordinary meaning is "an underlying layer"	"the initial material within which or on which the semiconductor device is fabricated

"Substrate" is a term that is readily understood by POSITAs and easy to explain to jurors. A substrate is simply an "underlying layer." *See* Ex. 7 (American Heritage Dict.) (defining "substrate" as "an underlying layer"); Ex. 8 (Webster's Dict.) (explaining "substrate" is synomous with its latin origin "substratum," which means "underlying structure, layer, or part"). This is how

the term is consistently used in the claims, specification, and prosecution history. This term does not require construction, and it should be given the full scope of its plain meaning. Ex. 1, ¶64.

In Fig. 5B, the "P- substrate" (shaded gray) is an "underlying layer." In the Wolf textbook, the "n- substrate" (shaded gray) is also an "underlying layer." Dkt. 82-17, 11. This is how the term "substrate" is ordinarily used in the art. Ex. 1, ¶65.

195 Patent, Fig. 5B	Wolf
	

Id. There is nothing in the intrinsic record that departs from the term's plain meaning. Every time "substrate" is used in the specification or prosecution history, it is merely referring to an "underlying layer." *Id.*, ¶66; Ex. 2, 1:50, 62 ("twin well substrate"); 2:18-23, 27-28 ("a MOS silicon substrate with two wells, and, an underlying layer"); 3:31-32 ("sweep these unwanted minority carriers into the substrate"); 3:35 ("deep into the substrate"); Figs. 2, 3A-D, 4, 5A-C (all showing substrate as an underlying layer).

In its brief, Defendants misrepresent Greenthread's position when they state that Greenthread only takes issue with the word "initial." *See* Dkt. 82, 9. To be clear, Greenthread's position is that "substrate" is a simple term that does not need construction. Defendants' definition adds ambiguity that could be used to confuse the jury with or without the term "initial."

Defendants have not identified any definition or disavowal (nor can they) that would justify limiting the ordinary meaning of the term "substrate" to Defendants' unduly narrow construction.

See Hill-Rom Servs., Inc. v. Stryker Corp., 755 F.3d 1367, 1371 (Fed. Cir. 2014). There is no intrinsic or extrinsic evidence that defines "substrate," like Defendants do. Rather it is a definition that Defendants coined. All three of Defendants' arguments come up short. ***First***, Defendants start by pointing out that the claims require a substrate, active region, well region, drift layer, and surface layer. This part is true. But then Defendants make the unsupported, *non sequitur* leap that these structures must be formed in a particular order with the substrate being the "initial" layer, and the other structures being "subsequent" structures. Dkt. 82, 6. But the claims never say the substrate has to be made first. In fact, the specification states that "[d]ifferent layers of dopan[t] regions can be transferred through wafer to wafer bonding (or other similar transfer mechanisms) for eventual device fabrication." Ex. 2, 3:1-3; 3:35-37 ("One or more of such layers can also be implanted through wafer to wafer bondings or similar 'transfer' mechanisms."). Therefore, the specification contemplates that the substrate could be fabricated ***after*** the other layers and bonded to the other layers when the device is actually fabricated. Ex. 1, ¶67. Furthermore, Defendants imply that the substrate and other structures must be mutually exclusive. While each of the structures must be present in the claimed device, the claim never says the well region and drift layer cannot be part of the substrate. In fact, the specification says the opposite when it specifically mentions a "MOS silicon substrate with two wells, and the underlying layer." Ex. 2, 2:27-28. In this scenario, the two wells and underlying layer can all be part of the substrate. Ex. 1, ¶68.

Second, Defendants misquote the following sentence to argue the claimed substrate must be the initial material, and the substrate must be different from the wells, layers, and transistor. Dkt. 82, 9. The full sentence reads:

> FIG. 3(a) shows a typical CMOS VLSI device employing a twin well substrate, on which active devices are subsequently fabricated.

Ex. 2, 1:61-63. To begin, this sentence is referring to a prior art figure that is not claimed. Next, the sentence does not say that in the claimed invention the substrate ***must be*** fabricated before the other layers. Furthermore, the specification expressly says the layers can be individually formed and subsequently bonded together. *Id.*, 3:1-3, 35-37. Finally, this sentence does not say the substrate is different from the wells and other layers. In fact, it says the opposite. More specifically, it says the substrate is a "twin well substrate," which means the two wells are part of the substrate (*i.e.*, the underlying layer on which the active devices are subseqently fabricated). Ex. 1, ¶69. Next, Defendants cite a handful of other references to argue that the initial substrate ***can be*** a "uniformly doped 'bulk' silicon substrate." Dkt. 82, 17. But these citations carry little, if any, weight when the 195 specification specifically teaches that (1) the substrate can be a twin-well substrate, which means that it is not uniformly doped; and (2) the layers may be separately formed and then bonded together. Ex. 1, ¶60; Ex. 2, 1:61-63; 3:1-3, 35-37.

Third, Defendants misrepresent certain statements from an IPR filed against the 195 patent. Greenthread never came close to saying the claimed substrate was "just the intial matter," as Defendants wrongly suggest. Dkt. 82, 17. Regarding the first figure, Greenthread was discussing two prior art references (Rhodes and Payne), not the 195 patent. Dkt. 82-20 (195 POPR), 37. Regarding the next two figures, Greenthread was addressing the correct claim construction of "well region." Greenthread never made any statements about the claimed "substrate." *Id.*, 54-55.

Finally, the superficiality of Defendants' arguments is highlighted by the *Samsung* litigation. There, Defendants' counsel agreed with Greenthread that the term "unidirectional electric drift field to aid the movement of minority carriers from surface layer to said ***substrate***" did not require construction, and the Court entered this construction. Ex. 5, 32. For two other terms, Defendants' counsel agreed that "substrate" did not need to be construed. *Id.*

3. "active region" (195:1; 502:7; 842:1, 9; 481:1, 20; 222:1, 21, 39, 41, 42, 44; 014:1, 21)

Greenthread	Defendants
Plain and ordinary meaning	"region that forms the current path of a device"

"Active region" is a term that POSITAs readily understand and can easily explain to jurors. A POSITA reading the claims and intrinsic record would understand that an active region is a doped silicon region at the surface of a semiconductor device where a transistor can be formed. Ex. 1, ¶¶71-75. This is how the term is used in the relevant claims and throughout the intrinsic record. *Id.*, ¶71. There is no need to construe the term, and to do so would only introduce ambiguity where there is none. *Acumed LLC v. Stryker Corp.*, 483 F.3d 800, 805 (Fed. Cir. 2007).

Defendants make a glaring mistake in their opening brief. The term "active region" appears in both claims 195:1 and 842:1, and the term *must* be given the same meaning in both claims. *See NTP, Inc. v. Research in Motion, Ltd.*, 418 F.3d 1282, 1293 (Fed. Cir. 2005) ("Because [plaintiff's] patents all derive from the same parent application and share many common terms, we must interpret the claims consistently across all asserted patents.").

Claim 842:1 states there are two active regions—a "first active region" and a "second active region"—and that transistors are formed "in at least one of the first active region or second active region." Ex. 3, 4:48-56. This means that some, but not necessarily all, of the active regions will form a transistor. If the active region does not form a transistor, then the active region will not necessarily form the current path of a device. Ex. 1, ¶72. This means that Defendants' construction cannot be the correct one.

To form, for example, a CMOS transistor in an active region, terminals must be connected to the source, drain, and gate, and a sufficient voltage must be applied to the gate to turn the transistor "on." Ex. 1, ¶73. Dr. Rao contemplated that the transistors may be formed later. Ex. 2,

1:61-63; 2:18-23 ("subsequently fabricated"); 3:1-3 ("for eventual device fabrication"). Therefore, Defendants' construction would exclude a preferred embodiment. Ex. 1, ¶73.

Defendants cite to extrinsic evidence where "active region" is used to refer to a region that forms the current path of a device. In some contexts, this may be true. But there are plenty of other references where the term active region is used to refer to the source and drain of a MOSFET, and the silicon between the source and drain, regardless of whether current flows between them. In fact, a well-known textbook explains how a MOSFET transistor is built in the active region. *See* Ex. 9 (Baker), 65 ("The active layers are used to make the source and drain regions."). Similarly, another well-known textbook describes forming the source and drain as forming the "active region." *See* Ex. 4 (Chen), 239 ("Active channel regions are first defined by etching windows in a thick field oxide…The boron impurities in the active regions are counter doped…"). This is how active region is used in the claims-at-issue and the intrinsic record. Therefore, in the context of Dr. Rao's inventions, it is more accurate to refer to an active region as a doped silicon region at the surface of a semiconductor device (*e.g.*, the source and drain and silicon between them) where a transistor can be formed. Ex. 1, ¶¶74-75. When, as here, a term may have multiple plain meanings, the one that is most consistent with the asserted patent's context should be used.

4. "unidirectional electric drift field" terms (195:1; 502:7; 222:44)

Greenthread	Defendants
Plain and ordinary meaning	"said [drift layer further/well region…] having a [first/second] static electric drift field that is unidirectional over the [drift layer/well region]" "said [drift layer/well region] having a graded concentration of dopants generating a [first/second] static electric drift field that is unidirectional over the [drift layer/well region]"

For this term, Defendants contend there was prosecution disclaimer where there was none. Defendants do not contend that "electric drift field" or "unidirectional" need to be construed. Instead, Defendants contend the straight-forward language (on the left) should we rewritten to add

the extraneous limitation "over the drift layer." Dkt. 82, 22. But then Defendants tip their hand that by "over the drift layer" they really mean "over the ***entire*** drift layer."

Claim Language	Defendants' Proposal	Defendants' Real Proposal
said drift layer further having a first static unidirectional electric drift field	said drift layer further having a first static electric drift field <u>that is</u> unidirectional **<u>over the drift layer</u>**	said drift layer further having a first static electric drift field <u>that is</u> unidirectional **<u>over the *entire* drift layer</u>**

Id. Defendants make a similar argument for the "well region." *Id.* There is no justification for rewriting the claim to say the electric field is "unidirectional *over the drift layer*," much less "unidirectional *over the entire drift layer*." A careful review of the prosecution history reveals that there was no clear disavowal, and that Defendants cannot possibly meet the high bar for prosecution disclaimer. *See Cordis Corp. v. Boston Sci. Corp.*, 561 F. 3d 1319, 1329 (Fed. Cir. 2009) ("A disclaimer must be 'clear and unmistakable,' and unclear prosecution history cannot be used to limit claims"). There is no justification anywhere else in the intrinsic record to limit the terms like Defendants suggest. Ex. 1, ¶76. In fact, Defendants' counsel made similar arguments in the *Samsung* litigation, and the court rejected them. Ex. 5, 10-17. The Court should do the same thing here, and give this term the full scope of its plain and ordinary meaning.

To begin, Defendants argue the "claim language itself *implies* a single unidirectional field across the *entire* layer or region." Dkt. 82, 22 (emphasis added). First, the claim says "single drift layer," not "single unidirectional field." There is nothing in the claim preventing additional electric fields. Ex. 1, ¶77. Second, Defendants admit with the word "implies" that the claim does not expressly require that the field be unidirectional over the entire drift layer. Dr. Rao could have certainly added this language. The fact that he did not is compelling evidence that he did not intend it to be a limitation of the claim. Instead he merely said the drift layer has a unidirectional field. The fact that the field may stop before the end of the layer does not mean that the drift layer

does not have a unidirectional field. By comparison, if someone asked whether Waco has a one-way street, nobody would reasonably argue that Franklin Avenue in Waco is not a one-way street. The fact that it stops at MLK Boulevard instead of continuing "across the entire city" is not the test for whether something is one-way or unidirectional.

Next, Defendants grossly misrepresent the specification and figures. Defendants cite to several instances where the specification mentions that a graded concentration of dopants creates an electric field. But nothing in the specification says there is only one field per layer, much less that the field must continue across the entire layer or region. Ex. 1, ¶78. These are fictions that Defendant created. *See* Dkt. 82, 22 (citing to the following); Ex. 2, 1:34-36 (merely says "aiding drift field" without any mention of a layer, direction of the field, or the total number of fields); 2:13-15 (merely says "doping profiles" without *any* mention of a field); 2:35-47 (discussing how a graded dopant concentration "creates a suitable aiding drift electric field" without any mention of a layer, direction of field, or the total number of fields); 3:30-35 (discussing how the graded dopants create a drift field to sweep the minority carriers into the substrate without any mention of the location or duration of the drift field or the total number of fields); Fig. 1 and 5A (showing no field at all). Defendants also cite Figs. 5B-C, which support Greenthread, not Defendants. These figures show multiple fields that traverse only part of the well region, and only part of the drift layer. Defendants' construction would exclude both of these preferred embodiments.

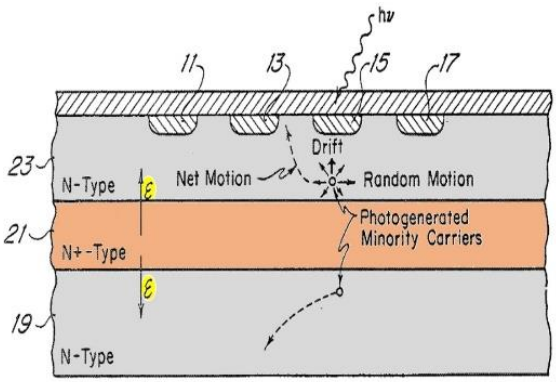
Finally, Defendants argue prosecution disclaimer where there was none. The prosecution history confirms: (1) "unidirectional" was merely added to clarify there was a single layer with a graded dopant (as opposed to two layers with uniform dopants); (2) Applicant never said the claims require the electric field to be unidirectional over any of the layers, much less the entire layer; and (3) Applicant did not need to limit the claims to require that the electric field was unidirectional

over any of the layers, and there would have been no reason for doing so. Ex. 1, ¶79.

During prosecution, Applicant argued that then-pending claim 10 (now claim 1) was patentable over Kamins. Dkt. 82-8, 209-216. At that time, the claim read in relevant part:

> a 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 to create a drift field drawing minority carriers from said surface layer to said substrate.

Id., 212. In the Remarks, Applicant argued that Kamins did not disclose the highlighted language. In doing so, Applicant explained that Kamins did not disclose "a single layer" with graded dopants; instead Kamins has three layers with uniform dopants. *Id.*, 215. Ex. 1, ¶79. As shown below, Kamins has a lightly doped layer 23, a heavily doped layer 21, and a lightly doped layer 19.



Id., ¶80. Dkt. 82-10, Fig. 2 (shading added to show light/heavy doping); 2:39-53. None of these layers have a graded concentration of dopants where the dopants gradually change from heavily doped to lightly doped or *vice versa*. Instead, each layer has a uniform concentration of dopants, where the concentration of dopants abruptly changes where the layers meet. One can readily see how these two scenarios are different. It is like "grading" a backyard to slope away from a house, versus putting in a retaining wall where a flat area abruptly drops off to a lower flat area.

The Examiner did not disagree with Applicants' assessment of Kamins. Dkt. 82-8, 220-229. Instead the Examiner took the position that "single layer" was not a limitation of the claim. *Id.*, 227 ("it is noted that the features upon which applicant relies (i.e., drift layer is required to be

a "single layer"; i.e., the drift layer cannot have multilayer structure) are not recited in the rejected claim(s)."). To clarify this point, Applicant amended the claims to read:

> a single drift layer…, said drift layer having a graded concentration of dopants…to create a unidirectional drift field drawing all[8] minority carriers from said surface layer to said substrate.

Id., 235. Applicant explained that the "claimed 'drift layer' is a single unidirectional layer with a graded dopant concentration…" *Id*., 238. Applicant never distinguished a single layer with multiple electric fields, as Defendants wrongly suggest. This is because there is no single layer in Kamins that creates a unidirectional electric field. In order to create the "up" arrow in Fig. 2, it takes two layers 21 and 23. In order to create the "down" arrow, it takes layers 21 and 19. On the other hand, Dr. Rao's use of graded dopants allows a single layer to create such unidirectional arrows. Hence, it is a "single unidirectional layer," as opposed to Kamins' multiple layers.

Applicant ***never*** said the claims require the electric field to be unidirectional over the entire drift layer. Ex. 1, ¶¶81-82. Also, Applicant never said there cannot be multiple electric fields in any of the layers. Instead, Applicant merely distinguished Kamins, where there are multiple layers with uniform dopant concentrations. This does not meet the high bar for prosecution disclaimer.

Moreover, Applicant did not need to limit the claims to require that the electric field was unidirectional over any of the layers, and there would have been no reason for doing so. Turning back to Kamins' Figure 2, there is no electric field that draws a minority carrier from the surface layer to the substrate. Rather, the top electric field propels a minority carrier from the substrate to the surface layer, and the bottom electric field draws a minority carrier from the substrate to a deeper part of the substrate. Thus, then-pending claim 10 was patentable over Kamins regardless

[8] The word "all" was subsequently removed from the claims, which is evidence that it is not a requirement of the claims. Dkt. 82-8, 286-294.

of whether the electric field is unidirectional over the entire drift layer. Ex. 1, ¶83.

In the *Samsung* litigation, Judge Gilstrap already held that there was no prosecution disclaimer. Ex. 5, 14-17. There, Defendants' counsel argued the prosecution history discussed above required that "the slope of the dopant concentration is of one direction across the layer." *Id*., 11. Having lost that argument, Defendants' counsel have repackaged their prosecution disclaimer argument to argue the electric field must be "unidirectional over the entire layer." But there is nothing in the prosecution history that mandates that the electric field has to be unidirectional "over the entire layer" and that there cannot be multiple electric fields. Ex. 1, ¶84. For these reasons, this term should be given its plain and ordinary meaning.

5. "to aid the movement" terms (195:1; 502:7; 842:1, 9; 481:1, 20; 222:1, 21, 39, 41, 42, 44; 014:1, 21)

Greenthread	Defendants
Plain and ordinary meaning	Indefinite. Alternative constructions: "to sweep the minority carriers from…to…" or "to sweep the carriers from…[to/towards]…"

There is no dispute what is meant by minority carriers. The only dispute is what is meant by "to aid the movement" in the phrase "*to aid the movement* of minority carriers from said surface layer to said substrate" or similar language in other claims. "To aid the movement" is a simple term that is readily understood by POSITAs and lay persons alike. Ex. 1, ¶85. Any one that has put a little WD40 on a rusty hinge, or stretched before exercising, knows what it means "to aid the movement" of something. Likewise, nobody would dispute that a wheelchair ramp "aids the movement" of someone in a wheelchair.

Turning to the claims themselves, the claims specify exactly ***who*** and ***what*** is "aiding the movement," and ***where*** and ***when*** the movement occurs. *Id.*, ¶86. Moreover, the specification provides specific examples of each of these, and the prosecution history confirms these examples.

When as, here, the patent has claimed with particularity and provided specific example, the claim is not indefinite. *Enzo Biochem, Inc. v. Applera Corp.*, 599 F.3d 1325, 1336 (Fed. Cir. 2010) (holding not indefinite because POSITA could use "the examples in the specification"). Defendants, on the other hand, have contorted the law to create a bar that would mean that most, if not all, claims are indefinite. Obviously this cannot be the correct test for indefiniteness.

The face of the claim and the preferred embodiment in Fig. 5B explain exactly what is meant by "to aid the movement of the minority carriers from the surface layer to the substrate." Claim 195:1 reads in relevant part:

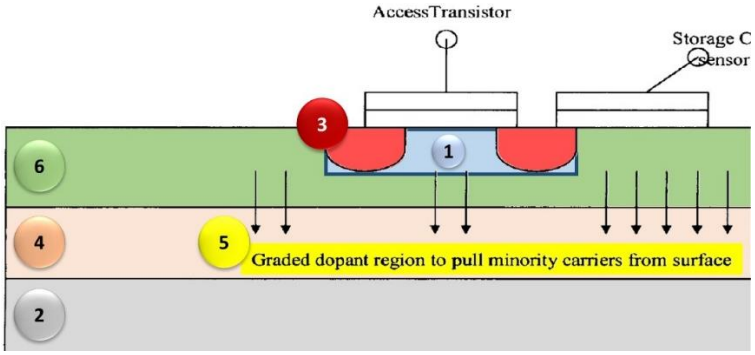
> a single drift layer disposed between the other surface of said surface layer and said substrate, said single drift layer having a graded concentration of dopants extending between said surface layer and said substrate, said drift layer further having a **first static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate**;

Ex. 2, 4:18-24. The claim contains similar language for the well region. *Id.*, 25-29. The claim language above explains ***who*** is aiding the movement: it is the single drift layer, and more specifically the graded dopants in the single drift layer. Next, it explains ***what*** is aiding the movement: it is the first static unidirectional electric drift field. The claim even says where the movement occurs: it is in the drift layer, and the carriers move downward. Finally, the claim specifies when it occurs: when the minority carriers are exposed to the electric field. Ex. 1, ¶87.

It is not like Dr. Rao claimed "to aid movement" in a vacuum. Rather he claimed a specific drift layer with graded dopants that create a particular type of electric field. By the time the claim gets to the phrase "to aid movement," it is merely clarifying what the electric field does. Any question about what is meant by "to aid the movement" is answered by the preceding claim language. Electric drift fields are a well-known phenomenon that cause carriers to move, and a POSITA would have readily recognized that when a "static unidirectional electric drift field" is present that it aids the movement of the minority carriers. If it isn't present, then it doesn't. The

claim turns on the presence of the "unidirectional electric drift field," and the phrase "to aid the movement of minority carriers" merely states what the "unidirectional electric drift field" does. The drift field points to one direction and charge carriers, when free to move, respond to the drift field by moving in one direction or the other depending on their charge polarity. Ex. 1, ¶88.

This is exactly what is shown in Fig. 5B and the corresponding parts of the specification.



Ex. 1, ¶89. The specification confirms how the unidirectional electric field aids movement of the carriers. Ex. 2, 2:40-47, 3:30-35. The prosecution history further confirms this. Dkt. 82-8, 57, 82-83, 113-114. Thus, a POSITA reading the claims in light of the intrinsic record would have readily understood what is meant by "to aid the movement of the minority carriers." Ex. 1, ¶90.

Defendants misapply the law. There is no requirement that a claim answer every question, and there certainly is no requirement to answer questions that are readily understood by POSITAs or that are beyond the scope of the claim. For example, if a claim recites: "pressing a gas pedal to aid movement of the car," there is no requirement to explain how to press the gas pedal, or say how fast the car must go. Any car driver would know how to press the gas pedal, and the ultimate speed is beyond the scope of the claim. The same is true here. There is no requirement to explain how an electric field works, and certain details like the speed of the movement are not necessary to determine the bounds of the invention. To use another example, if a claim recites: a wheelchair ramp to aid movement of a wheel chair from a first level to a ground level. There is no requirement that the claim specify the length or slope of the ramp as long as it allows the wheelchair user to get

to ground level. Again the same is true here. When the claims specify what is providing the movement, and the direction of the movement, nothing more is required.

All of Defendants' arguments misapply the law and come up short. ***"Aid carrier movement" is not subjective.*** To begin, "aid carrier movement" is not "purely subjective," as Defendants wrongly suggest. The Federal Circuit has reserved that label for terms like "aesthetically pleasing" and "unobtrusive," where the term turns on the "eye of beholder." *See Datamize, LLC v. Plumtree Software, Inc.*, 417 F.3d 1342, 1350 (Fed. Cir. 2005) (holding that "aesthetically pleasing" depends "on the unpredictable vagaries of any one person's opinion"); *Interval Licensing*, 766 F.3d at 1371 (holding that "unobtrusive" depends on "the preferences of the particular user"). That is *not* the case here. Whether something moves more easily is *not* going to depend on the "preferences of a particular user." Grasping at straws, Defendants cite a district court decision from the Eastern District of Arkansas, but that case can easily be distinguished because there the term presumed a gap existed, while the prosecution history said otherwise. *Perfectvision*, 2014 WL 4285786, at *21. Here, there is no such confusion. The intrinsic record consistently confirms that the electric fields aid the movement of the carriers. ***Second***, Defendants make much ado that carriers move in active devices. Dkt. 82, 26. But this is irrelevant. The claim is not referring to any movement. Rather it requires the movement of carriers away from the surface layer. Ex. 1, ¶90. ***Third***, Defendants argue that the claims do not recite a range of doping, a particular doping profile, or a particular result. But this is not the test for indefiniteness. While the claims require that the graded dopants create an electric field that aids movement of the carriers, they do not require a specific range of doping, a particular doping field, or a particular result, and this information is not necessary to understand the scope of Dr. Rao's invention.

The intrinsic record confirms the claim scope. As explained above, the scope of the claim

is clear on its face, and the intrinsic record confirms what is claimed. The claim specifies the graded dopants create an electric field that aids movement of the carriers away from the surface layer. Defendants assert that the specification does not provide guidance on how to assess or measure carrier movement. This is not true. The claims and the specification make clear that the electric field must move the carriers in a particular direction (from the surface layer to the substrate). Whether the carrier movement has a particular speed or acceleration is beyond the scope of the claim, as long as it meets the other limitations of the claim.

"To aid movement" is not a term of degree, like "high pressure," "extended duration of time," "optimized path," or "improve a precision ratio." All of the cases cited by Defendants can easily be distinguished in Greenthread's favor. In *USWS*, this Court held that "high pressure" was indefinite because the specification did not explain the difference between "high pressure" and "not high pressure." 2022 WL 819548, *7. Here, the claims do not require such a distinction. Instead, they specify a particular direction of movement. The same is true for the *Evicam*, *Nabors*, and *JobDiva* cases cited by Defendants. Here, the claims do not require movement for an unspecified period of time, an unspecified path, and they certainly don't require determining the accuracy of an online database using an unspecified test.

The superficiality of Defendants' arguments is highlighted by the Samsung litigation. There, Defendants' counsel agreed with Greenthread that the term "unidirectional electric drift field ***to aid the movement of minority carriers from surface layer to said substrate***" did not require construction, and the Court entered this construction. Ex. 5, 32. Moreover, Samsung's expert understood what was meant by "to aid movement" and explained:

> The resulting induced electric field aids minority carriers movement from the surface layer towards the substrate. This is consistent with my knowledge and understanding of the impact of implementing a graded dopant concentration in a MOS device.

Ex. 6, ¶ 91. The fact that Samsung's expert was able to determine what is meant by "to aid

movement" is compelling evidence that it is not indefinite.

Defendants' alternative construction suggests that Defendants are not convinced by their indefiniteness arguments. There is no reason to replace the three simple words "to aid movement" with the new words "to sweep." While the word "sweep" is used in the specification, the words "to aid movement" should be given the full scope of their plain meaning. Defendants tip their hand that they intend to use the word "sweep" to argue that the electric field must remove ***all*** of the minority carriers. Dkt. 82, 25. But this is not what the claim says, and there is no justification in the intrinsic record to limit the claim in this manner. Defendants have not identified any definition or disavowal (nor can they) that would justify limiting the ordinary meaning of the term "to aid movement" to Defendants' unduly narrow construction.

6. "well region" (195:1; 502:7; 842:1, 9; 481:1, 20; 222:1, 21, 39, 41, 42, 44; 014:1, 21)

Greenthread	Defendants
Plain and ordinary meaning, where portions of a well are not well regions.	"A well, whether formed by single or multiple implants. Portions of a well are not well regions."

"Well region" is a term that is readily understood by POSITAs and easy to explain to jurors. The term is commonly used to refer to a doped region that surrounds the active region of a semiconductor device. Ex. 1, ¶91 (citing Dkt. 82-16, 17-19). This is how the term is consistently used in the claims, specification, and prosecution history. This term does not require construction, and it should be given the full scope of its plain meaning. There are two parts to Defendants' proposed construction. Greenthread agrees with Defendants that it would be helpful to clarify for the jury that "[p]ortions of a well are not well regions," and has adopted the second part of Defendants' construction. The first part, however, is unnecessary and introduces ambiguity where there is none. The parties appear to agree that the "well region" is a doped region. But to construe

the term to mean the well is "formed by single or multiple implants" is unnecessary and just begs the question what is meant by "single or multiple implants." Ex. 1, ¶¶92-93. In cases, like this one, it is better to leave the claim untouched. *See W. Union Co. v. MoneyGram Int'l, Inc.*, 2008 U.S. Dist. LEXIS 108129, at *15-16 (W.D. Tex. Nov. 6, 2008) (citing *O2 Micro Int'l Ltd. v. Beyond Innovation Tech. Co.*, 521 F.3d 1351, 1362 (Fed. Cir. 2008)) ("A Court may refuse to construe a commonly understood term if the proposed construction would create ambiguity or confuse the jury.") (cleaned up).

B. Claim Term Found in Exemplary Claim 842:1

7. "active region…within which transistors can be formed" (842:1, 9; 481:1, 20; 222:1, 21, 39, 41, 42; 014:1, 21)

Greenthread	Defendants
Plain and ordinary meaning	Indefinite

As explained in Section III.A.3 *supra*, a POSITA reading the claims and intrinsic record would understand this term means exactly what it says: an active region (*i.e.*, a doped region at the surface of a semiconductor device) where a transistor can be formed. Ex. 1, ¶94. Claim 195:1 specifies, for example, that an active region includes a source and drain (two doped regions at the surface of a semiconductor device where a transistor can be formed).

Defendants' indefiniteness arguments start with the unsupported premise that an active region is where currently flows. Then Defendants mistakenly argue that the specification and prosecution history for the earlier 195 and 502 patents say the same, while the prosecution history for the later patents conflate the "active region" with the surrounding "well region." This is *not* true. In the specification and entire prosecution history, Dr. Rao consistently used "active region" to refer to the doped regions at the surface of a semiconductor device (*e.g.*, the source and drain) where, for example, a MOSFET transistor is built or can be built. As Dr. Giapis explains in his

declaration, the term "well region" can be used to refer to the doped silicon that surrounds the "active region" where the source and drain are formed. Defendants, on the other hand, confuse the two. While the active region may be "located within" or "surrounded by" the well region, Dr. Rao made it clear that the active region is where the transistors are built or may be built. When the term "active region…within which transistors can be formed" is properly viewed in this context through the eyes of a POSITA, there is nothing indefinite about it. Ex. 1, ¶95.

An "active region" does not require current flow. Defendants baldly claim without any support that "a region is 'active' when an existing device is formed there causing electrical current to flow." Dkt. 82, 31. This is not true. An active region does not have to be "electrified" to form a channel between a source and drain in order to qualify as an active region. Ex. 1, ¶96. For example, in order for a channel to form in a MOSFET, terminals must be attached to the source, drain, and gate, and a voltage must be applied to the gate to repel the minority carriers away from the surface layer. The fact that the transistor is not "electrically active" such that current is not flowing through the transistor does not mean that an active region does not exist. *Id*.

The specification confirms that an "active region" is a doped region at the surface of a semiconductor device where a transistor can be built. *Id.*, ¶97. Defendants' citations support Greenthread, not Defendants. *See* Dkt. 82, 37 n18 (citing the following); Abstract (referring to "active region" without mention of current flow); 2:16-18 (referring to "active devices," not "active regions"); 2:25-26 (referring to Figs. 3B-D, where the "active regions" are shown as doped regions at the surface where transistors are built; none of the figures show a current flow); 3:62-63 (referring to "active circuitry," not "active regions"); Fig. 3A, 5A (referring to "active devices," not "active regions"); Figs. 3C, 5B-C (all showing active regions has doped regions at the surface where transistors are built); claim 5 (merely saying a particular type of transistor can be built in

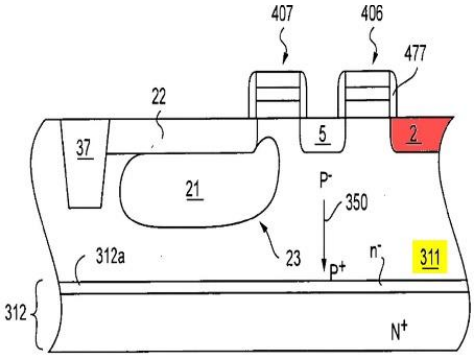
the active regions); claim 7 (merely saying the active regions are separated by an isolation regions; claim 18 (merely saying the transistor that can be built in the active region is a typical MOSFET).

Defendants falsely claim that the specification never describes a regions that is both an "active region," and a "region…within which transistors can be formed." Dkt. 82, 38. Defendants' argument misses the obvious. The 842 patent repeatedly describes active regions where transistors ***are*** built. Ex. 2, 2:24-27, 3:10-13; Fig. 3C, 5B-5C. This is proof that these "active regions" are "regions…within which transistors can be formed." Ex. 1, ¶98. Defendants' argument is like arguing that real estate zoned for commercial use (*i.e.*, real estate where commercial property can be built), is no longer commercial real estate once a commercial building is built there.

The earlier prosecution history confirms that "active region" is a doped region where a transistor can be built. *Id.*, ¶¶99-100. Defendants falsely claim that Greenthread referred to the claimed "active region" as the current path of an existing transistor. Dkt. 82, 38. This is not true. Defendants' citations to the prosecution history actually support Greenthread, not Defendants. ***First***, Defendants cite to where Applicant mentions "active and well regions," and then states an "active element" (*i.e.*, a pair of transistors) "can be active when a voltage (or current) is applied." This statement confirms that an "active region" is an "active region" regardless of whether the "active element" is turned "on." ***Second***, Defendants cite to a prior art reference's use of the term "electrically active." *Id.* (citing Dkt. 82-13 (Rhodes)). But "electrically active" (as opposed to "active") confirms that an "active region" does ***not*** have to have an electrical current. If an "active region" necessarily required an electrical current, then it would be redundant to say "electrically active." ***Finally***, as Defendants correctly note, Applicants have identified the "active region" as the doped region at the surface where the transistor is built. Dkt. 82, 38. Ex. 1, ¶¶100-101.

The later prosecution history also confirms that "active region" is a doped region at the

surface where a transistor can be built. Any confusion was created by the Examiner, not Dr. Rao. To compound the confusion, Defendants have falsely accused Dr. Rao of agreeing with the Examiner's incorrect positions. This is not true. Rather Dr. Rao was merely explaining that even under the Examiner's incorrect construction, his invention is still patentable over the prior art. During prosecution, the Examiner relied on Fig. 4D from Hong to reject then-pending claim 1.



Ex. 1, ¶102; Ex. 11 (842 file history), 107-115; Dkt. 82-14 (Hong), Fig. 4D. Hong makes clear that 311 is the substrate, *id*., [0030]; and 2 is the "source/drain region," *id*., [0040]. Ex. 1, ¶103. Nonetheless, the Examiner took the position that "311, which includes wells such as 21, 22, 5, 2" could be the "first active region"; and "source/drain region 2" could be the "second active region." Obviously this rejection was flawed. But this is the rejection that Dr. Rao was responding to. Ex. 11, 124-132. In doing so, Dr. Rao *never* said that numeral 311 was an active region, as Defendants wrongly suggest. Rather Dr. Rao was merely explaining that even under the Examiner's incorrect rejection Figure 4B did not meet the limitations of the pending claim. This is why he wrote:

> The Examiner has referred to the first active region as the region 311, but has referred to the regions 21, 22, 5 and 2 as "wells." As discussed in the prior Response, there is no support for such a construction, as the term "wells" in semiconductor technology typically refers to a region formed in a substrate within which active components are formed. The Examiner has referred to the second active region as being that defined by the source/drain region 2 or the regions 2 or 5 or 22 of the pixel cell.

Id., 129-130. With the use of suspect bracketing and ellipses, Defendants omitted the highlighted portions to hide that Dr. Rao did not agree with the Examiner's construction for the "first active

region." Meanwhile, he did not dispute that a source/drain region could be an active region. Thus, the prosecution history supports Greenthread, not Defendants. Ex. 1, ¶¶104-105.

All of Defendants' questions can be answered in Greenthread's favor. The remainder of Defendants' argument is long on question marks, and short on substance. ***First***, Defendants ask whether the "active region" is the current path in an existing transistor, or the area where a transistor can be formed? The answer is the latter. To be more precise, the "active region" is a doped region at the surface where a transistor can be formed. Claim 842:1 confirms this when it specifies the "first active region" is (1) disposed adjacent the first surface of the substrate, (2) with a second doping type; and (3) "within which transistors can be formed." Therefore, the face of the claim answers this question. ***Second***, Defendants ask if the "active region" is the current path, how can additional transistors be formed in that existing device? As explained above, an "active region" does not necessarily have a current path, and Defendants' own question explains why their assertion that an "active region" must provide a current path is wrong. ***Third***, Defendants ask if the "active region" is the surrounding region where current does not flow, what makes that region "active"? If by "surrounding region," Defendants mean the "well region" that surrounds the "active region," as opposed to the "active region" where a transistor can be built, then it would not necessarily be "active." ***Fourth***, Defendants ask what is the difference between the "active region" and other regions where transistors can be formed? It should go without saying the "active region" must meet the other claim limitations, and this is what differentiates it from other regions where transistors can be formed. As seen above, all of the questions can easily be answered in Greenthread's favor, and there is nothing confusing about the record. Ex. 1, ¶¶106-109.

IV. CONCLUSION

For the reasons above, terms 1, 5, and 7 are not indefinite, and all of the terms should be given their plain and ordinary meaning.

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CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the above and foregoing document has been served on all counsel of record via the Court's ECF system on October 31, 2022.

/s/ *Alan L. Whitehurst*
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