

UNITED STATES INTERNATIONAL TRADE COMMISSION

Washington, D.C.

In the Matter of

**CERTAIN POWER SEMICONDUCTORS,
AND MOBILE DEVICES AND
COMPUTERS CONTAINING SAME**

Inv. No. 337-TA-1308

**ORDER NO. 36: CONSTRUING CERTAIN TERMS OF THE ASSERTED CLAIMS
OF THE PATENT AT ISSUE**

(January 30, 2023)

This order addresses the construction of certain disputed claim terms in U.S. Patent No. 7,183,835 (“the ’835 patent”).

I. BACKGROUND

The Commission instituted this investigation to determine whether certain power semiconductors, and mobile devices and computers containing same infringe certain claims of the ’835 patent. *See* 87 Fed. Reg. 19124-25 (Apr. 1, 2022) (“Notice of Investigation”). As set forth in the Notice of Investigation, the plain language description of the accused products is “power semiconductors with envelope tracking modules, and products such as mobile devices, tablets, and laptop computers containing the same.” *Id.*

The complainant is Arigna Technology Limited (“Complainant” or “Arigna”). *Id.* The respondents are Apple Inc. (“Apple”); and TCL Electronics Holdings Ltd., TTE Technology, Inc., TCT Mobile (US) Inc., and TCL Communication Ltd. (collectively, “TCL”) (collectively,

“Respondents”).¹ *Id.* The Office of Unfair Import Investigations (“Staff”) is also a party in the investigation. *Id.* The claims asserted in this investigation are claims 1 and 2 of the ’835 patent. *Id.*

The undersigned issued ground rules on March 29, 2022 (Order No. 2) and a procedural schedule on May 24, 2022 (Order No. 8). Pursuant to the procedural schedule, the parties filed opening claim construction briefs on August 5, 2022, addressing certain disputed terms. Rebuttal claim construction briefs were filed on August 19, 2022.² The parties filed a Joint Proposed Claim Construction Chart on July 15, 2022. A *Markman* hearing was held on September 28, 2022.³ The parties also filed an Updated Joint Proposed Claim Construction Chart on October 5, 2022.⁴

For ease of reference, the materials submitted by the parties shall be referred to as follows:

CIB	Complainant’s Initial Claim Construction Brief (August 5, 2022) (EDIS Doc. ID 777313)
CRB	Complainant’s Corrected Responsive Claim Construction Brief (August 22, 2022) (EDIS Doc. ID 778393)
RIB	Respondents’ Initial Claim Construction Brief (August 5, 2022) (EDIS Doc. ID 777325)
RRB	Respondents’ Responsive Claim Construction Brief (August 19, 2022) (EDIS Doc. ID 778380)

¹ On November 10, 2022 the undersigned issued Order Nos. 24 and 25 granting the unopposed joint motion to terminate the investigation as to Respondents Samsung Electronics Co., Ltd., Samsung Electronics America Inc., Google LLC, Lenovo Group Ltd., Lenovo (United States) Inc., Motorola Mobility LLC, Microsoft Corporation, and OnePlus Technology (Shenzhen) Co. Ltd. based on settlement. *See* Order Nos. 24 and 25 (Nov. 10, 2022), *unreviewed*, Comm’n Notice (Dec. 8, 2022).

² On August 22, 2022, Arigna filed a motion for leave to file a corrected rebuttal claim construction brief out of time, which was granted. *See* Order No. 17 (Aug. 23, 2022).

³ Pursuant to Order No. 16, the *Markman* hearing was rescheduled to September 28, 2022. *See* Order No. 16 (Aug. 23, 2022).

⁴ Arigna, Apple, TCL, and Staff filed a joint motion to extend the deadline for filing an updated joint claim construction chart to October 5, 2022, which was granted. *See* Order No. 18 (Sept. 15, 2022).

SIB	Staff's Initial Claim Construction Brief (August 5, 2022) (EDIS Doc. ID 777274)
SRB	Staff's Responsive Claim Construction Brief (August 19, 2022) (EDIS Doc. ID 778375)
Joint Chart (July 15, 2022)	July 15, 2022 Joint Proposed Claim Construction Chart (EDIS Doc. ID 775549)
Updated Joint Chart (Oct. 5, 2022)	October 5, 2022 Updated Joint Proposed Claim Construction Chart (EDIS Doc. ID 781756)
Tr.	Transcript of September 28, 2022 claim construction hearing (EDIS Doc. ID 788679)
Compl. <i>Markman</i> Presentation	Complainant's <i>Markman</i> Presentation (EDIS Doc. ID 781271)
Resp. <i>Markman</i> Presentation	Respondents' <i>Markman</i> Presentation (EDIS Doc. ID 781330)
Staff <i>Markman</i> Presentation	Staff's <i>Markman</i> Presentation (EDIS Doc. ID 781244)

II. LEGAL STANDARDS

The scope of a patent claim is defined by the claim language. *Catalina Mktg. Int'l., Inc. v. Coolsavings.com, Inc.*, 289 F.3d 801, 807 (Fed. Cir. 2002). In construing the claims, the court's task is to "ascertain[] the meaning of the claim terms to one of ordinary skill in the art at the time of invention." *Metabolite Labs., Inc. v. Lab. Corp. of Am. Holdings*, 370 F.3d 1354, 1361 (Fed. Cir. 2004). "[O]nly those [claim] terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy." *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999); *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Ltd. Matal*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (same).

To ascertain the meaning of claim terms at issue, courts rely on intrinsic evidence: the claims, specification, and prosecution history for the patent at issue. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313-14 (Fed. Cir. 2005); *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996). The words of a claim "are generally given their ordinary and customary meaning." *Phillips*, 415 F.3d at 1312. This is the meaning "that the term would have to a person

of ordinary skill in the art in question at the time of the invention, i.e., as of the effective filing date of the patent application.” *Id.* at 1313.

Importantly, the person of ordinary skill in the art “is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification.” *Id.* The Federal Circuit has repeatedly confirmed that the specification is “the single best guide to the meaning of a disputed term.” *Id.* at 1315. The specification plays a primary role because it can function as “a concordance for the claims,” explaining the invention and defining the terms used in the claims. *Id.* (citation omitted); *see also id.* (“[C]laims . . . do not stand alone. Rather, they are part of a ‘fully integrated written instrument,’ consisting principally of a specification that concludes with the claims.”) (citation omitted). “Ultimately . . . the construction that stays true to the claim language and most naturally aligns with the patent’s description of the invention will be, in the end, the correct construction.” *Id.* at 1316 (internal quotation and citation omitted).

Claims should also be read in view of the prosecution history, which provides “evidence of how the PTO and the inventor understood the patent.” *Id.* at 1317. “The prosecution history can often inform the meaning of the claim language by demonstrating how the inventor understood the invention and whether the inventor limited the invention in the course of prosecution, making the claim scope narrower than it would otherwise be.” *Id.*

In addition to intrinsic evidence, extrinsic evidence may be considered if necessary to explain scientific principles, technical terms, and terms of art that appear in the patent and prosecution history. Extrinsic evidence consists of all evidence external to the patent and prosecution history, including expert and inventor testimony, dictionaries, and learned treatises. *Vitronics*, 90 F.3d at 1584. Extrinsic evidence in the form of expert testimony “can be useful to

a court for a variety of purposes, such as to provide background on the technology at issue, to explain how an invention works, to ensure that the court’s understanding of the technical aspects of the patent is consistent with that of a person of skill in the art, or to establish that a particular term in the patent . . . has a particular meaning in the pertinent field.” *Phillips*, 415 F.3d at 1318. While not prohibited, extrinsic evidence is less reliable than the patent and its prosecution history. *Id.* Extrinsic evidence in the form of expert testimony that is at odds with the intrinsic evidence must be disregarded. *Network Com., Inc. v. Microsoft Corp.*, 422 F.3d 1353, 1361 (Fed. Cir. 2005).

III. THE ASSERTED PATENT

The ’835 patent is titled “Semiconductor Device Which Realizes a Short-Circuit Protection Function Without Shunt Resistor, and Semiconductor Device Module” and names Hiroshi Sakata and Tomofumi Tanaka as inventors. ’835 patent, cover. The patent issued from an application filed on December 29, 2004, and claims priority to Japanese Patent Application 2004-001057 filed on January 6, 2004 and Japanese Patent Application 2004-262033 filed on September 9, 2004. *Id.*

Arigna asserts claims 1 and 2 of the ’835 patent. Compl. at ¶ 67. In addition, Arigna relies on at least claim 1 for purposes of the domestic industry requirement. *Id.* at ¶ 108, Ex. 48C. Disputed terms addressed in this Order are shown in context below with emphasis.

1. ***A semiconductor device controlling a drive of an insulated gate transistor by generating a control output signal on a basis of a control input signal, comprising:***
a driver outputting said ***control output signal*** and
a ***short-circuit protection circuit*** detecting said ***control output signal*** and controlling and forcing said driver to stop said ***control output signal*** when a detecting voltage of said ***control output signal*** exceeds a predetermined reference voltage before a predetermined period passes after said ***control output signal indicates a conduction of said insulated gate transistor***, wherein

said *short-circuit protection circuit* includes:

pulse generation circuit receiving said control input signal and outputting a first pulse signal being *significant* only in said predetermined period according to a timing when said control input signal indicates the conduction of said insulated gate transistor;

a comparator receiving the detecting voltage of said *control output signal*, performing a comparison with said reference voltage and outputting a second pulse signal being *significant* during a period when the detecting voltage of said *control output signal* exceeds said reference voltage; and

a logical circuit receiving said first and second pulse signals and outputting a stop signal forcing said driver to stop said *control output signal* when said second pulse signal becomes *significant* during a period when said first pulse signal is *significant*.

2. The semiconductor device according to claim 1, wherein said predetermined period when said first pulse signal is *significant* is set on a basis of a period when a voltage of said *control output signal* is *clamped constantly* when said *insulated gate transistor* normally operates.

'835 patent at cls. 1-2.

IV. LEVEL OF ORDINARY SKILL IN THE ART

Arigna submits that a person of ordinary skill in the art as of the filing date of the Japanese patent application from which the '835 patent claims priority (*i.e.*, January 6, 2004), would have had “(1) a bachelor’s degree in electrical engineering or a similar field, and approximately two years of industry or academic experience designing or analyzing power semiconductor devices or (2) a master’s degree or Ph.D. in electrical engineering or an equivalent field, with coursework, thesis, or dissertation work, or research experience in power semiconductor devices.” CIB at 2.

Respondents submit that a person of ordinary skill in the art would have had “a graduate degree in electrical engineering, or at least a Bachelor of Science in electrical engineering or a similar discipline and at least two years of relevant work experience.” RIB at 13.

Staff contends that a person of ordinary skill in the art would have “at least a bachelor’s degree in electrical engineering or a similar discipline, and two or more years of industry or

additional academic experience in the areas of power semiconductor devices and/or electrical circuit design” and that “[a]dditional relevant work experience could substitute for academic experience and vice versa.” SIB at 15. Staff also states that it “does not expect that any competing definitions proposed by the parties for ‘one of ordinary skill’ are likely to materially affect the construction of the disputed claim terms.”

None of the parties contend that the level of one of ordinary skill in the art materially affects the construction of the disputed terms. Based on the current record, the undersigned finds that one of ordinary skill in the art would have had at least a bachelor’s degree in electrical engineering or a similar discipline, and at least two years of industry or additional academic experience in the areas of power semiconductor devices and/or electrical circuit design. Additional relevant work experience could substitute for academic experience and vice versa.

V. DISPUTED CONSTRUCTIONS⁵

A. Preamble (’835 patent, claim 1)

Arigna	Respondents	Staff
Non-limiting in part	The preamble is limiting	The preamble is limiting

The parties dispute whether the preamble of claim 1 of the ’835 patent is limiting. The preamble reads:

A semiconductor device controlling a drive of an insulated gate transistor by generating a control output signal on a basis of a control input signal, comprising

’835 patent, claim 1 preamble.

Arigna contends that the preamble is non-limiting in part, while Respondents and the Staff contend that the preamble is limiting in its entirety. In particular, Arigna contends that the initial portion of the preamble— “[a] semiconductor device controlling a drive of”—is non-

⁵ The parties’ proposed constructions are taken from the Updated Joint Chart (Oct. 5, 2022).

limiting. Arigna contends that this phrase states only an intended use for the invention. CIB at 3-4. Arigna argues that this phrase does not provide antecedent basis, and that it is only subsequent portions of the preamble that may be limiting. *See* CIB at 4-5. Arigna contends that the Federal Circuit has made clear that a preamble can be limiting in part. *See* CIB at 5. Arigna also argues that the patentee did not rely on the preamble during prosecution to distinguish any prior art. CIB at 5-6; *see also* CRB at 1-3. Arigna argues that the fact that “insulated gate transistor” provides a structural element does not make the preamble’s “statement of intended use” limiting. *See* CRB at 4.

Respondents and the Staff contend that the preamble, including the phrase “a semiconductor device controlling a drive of” is limiting. Respondents argue that the preamble provides antecedent basis for terms in the claim body, and that this strongly supports finding the preamble limiting. *See* RIB at 14-16. Respondents also contend that the preamble recites essential aspects of the claimed invention, including “controlling the drive” of a switching device. RIB at 18-19; *see also* RRB at 4-5. Respondents contend that the preamble “provides information essential to understand the relationship between the control output signal and control input signal,” as well as “how the insulated gate transistor is controlled.” RIB at 19-20; *see also* RRB at 5. Respondents further contend that Arigna’s “attempt to divide the preamble into limiting and non-limiting portions is inappropriate,” and that the portions serving as an antecedent basis for the body of the claim are intertwined with the rest of the preamble. RRB at 2-4.

Staff similarly argues that language of the preamble provides antecedent basis for limitations in the body of the claim and that the preamble is “necessary to give structure and meaning to the claim.” SIB at 15-17; *see also* SRB at 2-5. Staff argues that Complainant’s

proposed construction requires “awkwardly parsing the language of the claim preamble.” SRB at 4-5. Staff argues that, unless the entirety of the claim preamble is limiting, “the elements of the ‘driver’ and ‘short-circuit protection circuit’ in the body of the claim do not themselves form a complete structure for a ‘semiconductor device.’” SRB at 5. Staff argues that reliance on the preamble during prosecution is “only one of several possible indicators” regarding the issue of whether a claim is limiting, and thus Arigna’s argument based on the prosecution history is legally flawed. SRB at 6-7.

Upon review of the parties’ submissions and the evidence of record, the undersigned agrees with Respondents and Staff that the preamble of claim 1 is limiting in full. “In general, a preamble limits the invention if it recites essential structure or steps, or if it is ‘necessary to give life, meaning, and vitality’ to the claim.” *Catalina Mktg. Int’l, Inc. v. Coolsavings.com, Inc.*, 289 F.3d 801, 808 (Fed. Cir. 2002). There is no “litmus test” for determining whether a preamble is limiting. *Id.*; see also *Eli Lilly and Co. v. Teva Pharms. Int’l GmbH*, 8 F.4th 1331, 1340 (Fed. Cir. 2021) (“whether to treat a preamble as a claim limitation is determined on the facts of each case in light of the claim as a whole and the invention described in the patent”) (internal citation omitted). For example, “the preamble may be construed as limiting when it recites particular structure or steps that are highlighted by the specification.” *Proveris Sci. Corp. v. Innovasystems, Inc.*, 739 F.3d 1367, 1372 (Fed. Cir. 2014). Additionally, “when limitations in the body of the claim rely upon and derive antecedent basis from the preamble, then the preamble may act as a necessary component of the claimed invention.” *Id.* (internal quotation omitted).

Here, the preamble is limiting. First, the preamble terms “an insulated gate transistor,” “a control output signal,” and “a control input signal” each serve as antecedent basis for limitations

in the body of the claim. *See* ‘835 patent, claim 1; RIB at 15. Arigna does not dispute that the preamble is limiting as to those terms and certain surrounding language. *See* CIB at 4-6 (arguing only that “[a] semiconductor device controlling a drive of” is non-limiting); CRB at 1; Tr. (Compl.) at 7:24-25 (“[t]he dispute on this term is whether the first phrase of the preamble is limiting”).

Second, the disputed phrase—“a semiconductor device controlling a drive of”—is closely intertwined with words of the preamble providing antecedent bases for the remainder of the claim. This strongly supports a finding that the preamble as a whole is limiting. *See Bio-Rad Labs., Inc. v. 10X Genomics Inc.*, 967 F.3d 1353, 1370-72 (Fed. Cir. 2020) (finding preamble reciting “[a] method for conducting a reaction in plugs in a microfluidic system,” to be limiting in full where “reaction” and “microfluidic systems” provided antecedent basis for limitations in body of claim and “[t]he language relied upon for antecedent basis in the preamble at issue is intertwined with the rest of the preamble”); *id.* at 1371 (“[w]e . . . are disinclined to sanction finding a preamble ‘partially’ limiting by splicing it as the district court did here. The fact that the terms ‘reaction’ and ‘microfluidic systems’ provide antecedent basis for these terms in the body of the claim is a strong indication that the preamble acts as a necessary component of the claimed invention”) (internal citations omitted); *Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 1306 (Fed. Cir. 1999) (finding preamble limiting where it “is intimately meshed with the ensuing language in the claim”).

Arigna relies heavily on the Federal Circuit’s decision in *TomTom, Inc. v. Adolph*, 790 F.3d 1315, 1323 (Fed. Cir. 2015), for the proposition that the preamble here is limiting in part. In *TomTom*, however, the preamble was “neatly packaged into two separate portions,” with one portion limiting and the other non-limiting. The Federal Circuit has cautioned against attempting

to splice claims in the manner Arigna supports here. *See Bio-Rad Labs*, 967 F.3d at 1371 (discussing *Tom-Tom*).⁶

Further, the undersigned agrees with Respondents and Staff that “controlling a drive of an insulated gate transistor” is necessary to give meaning to the asserted invention. The phrase “a semiconductor device controlling a drive of” is necessary to explain the structural context of and relationship between the claimed control output signal and claimed insulated gate transistor. *See* RRB at 4-5; SRB at 2-6; Tr. (Resp.) at 81:24-82:2; Tr. (Compl.) at 73:22-24. Moreover, the specification highlights this context as important. *See* ‘835 patent at 1:52-55 (Summary of the Invention) (“[a]n aspect of a semiconductor device according to the present invention is that a semiconductor device controls a drive of an insulated gate transistor by generating a control output signal on a basis of a control input signal”); Part V.C-D *infra*; *Proveris*, 739 F.3d at 1372; *Deere & Co. v. Bush Hog, LLC*, 703 F.3d 1349, 1358 (Fed. Cir. 2012) (finding preamble phrase “rotary cutter deck” limiting where it was “necessary to understand the subject matter encompassed by the claim”).

Accordingly, the preamble of claim 1 of the ‘835 patent is limiting in full.

⁶ Indeed, *Tom-Tom* found certain portions of the preamble intertwined with words providing antecedent basis to be limiting. *See* Tr. (Resp.) at 16:15-17:9. The preamble at issue in *TomTom* recited “[a] method for generating and updating data for use in a destination tracking system of at least one mobile unit.” *TomTom*, 790 F.3d at 1318, 1322. The phrase “at least one mobile unit” provided antecedent basis for claim terms referring to “said mobile unit” and “the mobile unit.” *Id.* at 1322-23. The Federal Circuit agreed with the district court’s assessment that “destination tracking system of at least one mobile unit” was limiting, thus including “destination tracking system of” in the limiting portion. *Id.* at 1323. Here, similarly, the “controlling a drive of” language is intertwined with the remainder of the preamble, including using “of” terminology.

B. “insulated gate transistor” (’835 patent, claims 1, 2)

Arigna	Respondents	Staff
“a transistor whose gate is electrically insulated from the channel”	Plain meaning, <i>i.e.</i> , IGBT (insulated gate bipolar transistor)	“a transistor whose gate is electrically insulated from the channel”

The parties dispute the meaning of “insulated gate transistor.” Arigna and the Staff contend that the term means “a transistor whose gate is electrically insulated from the channel.” *See* CIB at 6-8; SIB at 17-19. Arigna contends that the specification identifies “IGBTs” (insulated gate bipolar transistors) as one type of insulated gate transistor but does not limit the term “insulated gate transistor” to that type. *See* CIB at 6-7. Arigna notes, for example, that the specification discloses “a short-circuit protection function of an insulated gate-type switching device *such as* an IGBT (Insulated Gate Bipolar Transistor) *and so on.*” CIB at 7 (quoting ’835 patent at 1:14-15) (emphasis supplied by Arigna). Arigna submits an IEEE dictionary defining an “insulated gate field-effect transistor” as a “field effect transistor that has one or more gate electrodes that are electrically insulated from the channel,” thus indicating that there are types of transistors, other than IGBTs, that have a gate electrically insulated from the channel. CIB at 8 (citing CIB Diehl Decl. Ex. 1). Arigna argues that Respondents’ extrinsic evidence is “irrelevant and inappropriate because it contradicts the intrinsic record.” CRB at 7.

Staff sets forth similar arguments, arguing that the patent uses the term “insulated gate transistor” as a “broader term that is distinct and separate from the terms ‘Insulated Gate Bipolar Transistor’ and ‘IGBT.’” SIB at 17-18 and Staff Exs. 8-11; *see also* SRB at 7-9. Staff provides extrinsic evidence indicating that metal-oxide-semiconductor field effect transistors (MOSFETs) have a gate electrically insulated from the channel and are also capable of being used as switches. SIB at 17-18 (citing Staff Exs. 9-11). Arigna and the Staff contend that Respondents improperly seek to limit claim language to a preferred embodiment. *See* CIB at 7; SRB at 8.

Respondents contend that the plain and ordinary meaning of “insulated gate transistor” is an IGBT (insulated gate bipolar transistor). RIB at 21. Respondents submit extrinsic evidence that they contend demonstrates that the “initial name of ‘IGBT’ was Insulated Gate Transistor (IGT),” that “[b]y the late 1980’s, the insulated gate transistor was referred to as “Insulated Gate Bipolar Transistors (IGBTs),” and that since then such devices have been “referred to by several names, including both ‘IGBT’ and ‘insulated gate transistor (IGT).’” *Id.* (internal quotations omitted). According to Respondents, “referring to IGBTs using different names does not, by extension, imply that IGT can refer to multiple types of transistors.” *Id.* at 23. Respondents argue that the specification equates the term “insulated gate transistor” with an IGBT because “the only place in the specification” that describes an insulated gate transistor is “transistor 12 in Figure 2” and “[t]here is no dispute that transistor 12 is an IGBT.” *Id.* at 23-24. Respondents argue that Complainant and Staff improperly seek to broaden the meaning of “insulated gate transistor” to mean any insulated gate type switching device and that while the patent disclosures “may have supported a broader claim directed to an ‘insulated gate type switching device,’ the applicant did not seek or receive such broad claims, instead opting to claim only the narrower ‘insulated gate transistor.’” *Id.* at 24-25; *see also* RRB at 5-6.

Upon review of the evidence and the parties’ submissions, the term “insulated gate transistor” shall be construed to mean “a transistor whose gate is electrically insulated from the channel.” As shown by Arigna and Staff, the specification indicates that the invention is not limited to IGBTs, repeatedly referring to insulated gate switching devices including but not limited to IGBTs. *See* ‘835 patent at 1:14-15 (quoted *supra*); *see also id.* at 2:42-51 (under “Description of the Preferred Embodiments,” describing an inverter module “applying the present invention” to include “groups of transistors . . . which are insulated gate type switching

devices *such as an IGBT* (Insulated Gate Bipolar Transistor) *and so on*)” (emphasis added); *id.* at 6:6-7 (referencing “the transistor 12 which is the insulated gate type switching device *such as the IGBT and so on . . .*”) (emphasis added). Indeed, this intrinsic evidence indicates that, even in the preferred embodiment described by the specification involving “transistor 12” (‘835 patent at 6:6-7), the patent contemplates that transistor 12 is not limited to IGBTs.⁷

Further, as pointed out by Staff, the patent repeatedly uses “IGBT” in the specification, suggesting that the patent uses that term (rather than different nomenclature) when intending to refer to an IGBT. *See* SRB at 8-9.⁸ In view of the intrinsic record, Respondents’ extrinsic evidence does not persuasively demonstrate that “insulated gate transistor,” as used in the ‘835 patent, means an IGBT specifically, as opposed to a general description of a transistor whose gate is electrically insulated from the channel. As shown by Arigna and Staff, there are other types of transistors (including transistors that can be used as switching devices) with electrically insulated gates. *See* CIB at 8; CIB Diehl Decl. Ex. 1; SIB at 17-18; Staff Exs. 9-11.

Accordingly, the term “insulated gate transistor” means “a transistor whose gate is electrically insulated from the channel.” *See generally Phillips*, 415 F.3d at 1316 (“The construction that stays true to the claim language and most naturally aligns with the patent’s description of the invention will be, in the end, the correct construction.”).

⁷ In addition, the specification describes transistor 12 at one point as having a “source” and “drain,” which Respondents acknowledge is terminology that does not refer to an IGBT. ‘835 patent at 6:54-56 (referencing “short-circuit . . . between the source and the drain of the transistor 12”); Tr. (Staff) at 68:23-69:9; Tr. (Resp.) at 69:16-24, 70:20-71:2 (“[a] source and drain would refer to some type of FET device that is not an IGBT”).

⁸ The extrinsic evidence highlighted by Respondents, moreover, appears to use the capitalized term “IGT” when referring to an IGBT. *See* RIB at 21-22. Here, the capitalized term is IGBT.

C. “controlling a drive of an insulated gate transistor” (’835 patent, claim 1)

Arigna	Respondents	Staff
Non-limiting preamble Alternatively, plain and ordinary meaning. Alternatively: “controlling the operation of an insulated gate transistor”	“controlling the voltage supplied to the gate of an insulated gate transistor to switch the transistor between ON and OFF states”	“controlling the voltage supplied to the gate of an insulated gate transistor to switch the transistor between ON and OFF states”

The parties dispute the meaning of “controlling a drive of an insulated gate transistor,” as set forth in the preamble of claim 1 of the ’835 patent.

Arigna argues that, to the extent this preamble phrase is limiting, the phrase should be given its plain and ordinary meaning, and that there is “no reason to add the limitation ‘to switch the transistor between ON and OFF states.’” CIB at 10.⁹ Arigna also argues that this phrase does not appear in the specification, and that the specification “nowhere suggests that [ON and OFF] are the only two possible states.” *Id.*; *see also* CRB at 10-11 (arguing that “modes of transistors include ‘saturation,’ ‘cut-off,’ ‘active,’ and ‘reverse-active.’”). Arigna argues that the patentee chose not to use the term “switching device,” and thus the claims should not be limited to transistors operating as switches. CRB at 11-12. Complainant argues that the proposed construction would narrowly entail “switching a transistor from ON to OFF, or OFF to ON, rather than controlling it in a manner that maintains a single state or multiple states.” *Id.* Arigna contends that controlling a drive of a transistor can consist of maintaining an ON condition in appropriate circumstances. CIB at 10 (citing ’835 patent at 6:47-49). Arigna further argues that there is no reason to construe the term “a drive of” to mean “the voltage supplied to the gate of.” *Id.* at 10-11. Arigna contends that the specification refers to a “control output signal,” not to a voltage, and that “in many cases in integrated circuit design, a current can be a controlling

⁹ As held *supra*, the preamble of claim 1 of the ’835 patent is limiting.

signal.” CIB at 10-11; *see also* CRB at 10-12. Arigna similarly contends that no language regarding a “gate” is “found in the claim language and to import it from the specification is improper.” CIB at 11.

Respondents argue that “controlling a drive of an insulated gate transistor” necessarily requires that “the voltage of a signal—not just a signal—is supplied to the gate of an insulated gate transistor to control the drive of the transistor.” RIB at 27. Respondents argue that a crucial aspect of “controlling a drive of an insulated gate transistor,” involves switching the transistor between ON and OFF states. RIB at 28-29. Respondents further argue that Arigna earlier argued that the plain and ordinary meaning of this term was “e.g., controlling the signal applied to the gate of an insulated gate transistor” and that Arigna improperly omitted this example in its initial Markman brief. RRB at 9. Respondents argue that their construction properly reflects “key intrinsic disclosures” of the patent. RRB at 10-13.

Staff agrees with Respondents regarding the appropriate construction of “controlling a drive of an insulated gate transistor.” Staff contends that the ‘835 patent “always describes an insulated gate transistor that is used as a switching device.” SIB at 19; *see also* SRB at 9-11. Staff notes that the Arigna’s Amended Complaint states that “the ‘835 patent generally *claims* a semiconductor device and semiconductor device module that provide short-circuit protection for insulated gate type *switching devices*.” SIB at 22 (citing Am. Complaint ¶ 39, emphasis added by Staff). Staff further contends that the control circuitry of the semiconductor device in the ‘835 patent always operates to drive the transistor by “controlling *the voltage* supplied to the gate of an insulated gate transistor to switch the transistor between ON and OFF states.” SIB at 20 (citing ‘835 patent at 5:52-6:5) (emphasis added by Staff); *see also* SRB at 11-12. Staff argues that “there is no discernable way to practice the invention described in the ‘835 Patent and

provide for its accompanying short-circuit protection function using something that is not a voltage.” SIB at 21. Staff also argues that “to hold that the disputed limitation does not call for controlling a transistor as a switch would be a tremendous distortion of the invention described and claimed in the ‘835 Patent.” SIB at 22.

Given the technical nature of the underlying subject matter, the undersigned will defer final resolution of these claim construction issues until after the evidentiary hearing.¹⁰ Preliminarily, however, the evidence of record indicates that the term “controlling a drive of an insulated gate transistor”¹¹ requires controlling whether the claimed transistor is in a conducting or non-conducting state. As explained by Respondents and Staff, the specification repeatedly describes the short-circuit protection provided by the invention in terms of controlling whether the transistor is in an ON or OFF state—that is, controlling whether the transistor is in a conducting or non- conducting state. *See* ‘835 patent at 5:60-6:5 (describing conditions for transistor to be in ON and OFF states); *id.* at 6:41-49 (describing conditions for maintenance of the ON state); *id.* at 6:65-7:23 (describing short-circuit protection leading to the transistor being “forced to be in OFF state”); *id.* at 10:26-61 (discussing transistor forced to OFF state in short-circuit conditions); RIB at 28-29 (“In the event of a short-circuit, the claimed semiconductor device must be able to force the transistor to an OFF state via the control output signal.”); RRB

¹⁰ *See Pfizer, Inc. v. Teva Pharms., USA, Inc.*, 429 F.3d 1364, 1377 (Fed. Cir. 2005) (courts “may engage in rolling claim construction, in which the court revisits and alters its interpretation of the claim terms as its understanding of the technology evolves”); *see also Ballard Med. Prods. v. Allegiance Healthcare Corp.*, 268 F.3d 1352, 1358 (Fed. Cir. 2001). While preliminary guidance is provided here, the parties are not precluded from presenting evidence and argument under their alternative constructions at the hearing and in post-hearing briefs.

¹¹ The parties appear to agree that “a drive” of an insulated gate transistor refers to a type of action or use (e.g., “a driving”), not to a physical structure. *See* Tr. (Compl.) at 116:20-117:6; Tr. (Resp.) at 82:3-9, 93:5-10; Tr. (Staff) at 124:13-19.

at 11-13; Tr. (Staff) at 124:16-18 (“[h]ere controlling a drive means controlling whether this particular insulated gate transistor is on or off”).¹²

This requirement is also supported by the contextual language of the claim, which refers to a predetermined period “after” the control output signal “indicates a conduction of said insulated gate transistor” (thus indicating a change of the transistor to a conducting state from a non-conducting state). The claim language also refers to the requirement for the claimed driver to “stop said control output signal” as part of the claimed short-circuit protection (thus indicating a change of the transistor to a non-conducting state). See ‘835 patent, claim 1 at 11:43-45, 11:46-48, 11:62-64.¹³

¹² The meaning of “conduction” is discussed below and, at present, is construed to have its plain and ordinary meaning. See Part V.E *infra*. It appears undisputed that the “ON” state described in the patent is at least an example of a conducting state and that the “OFF” state is a non-conducting state. See Part V.E *infra* (Respondents and Staff equate “conduction” with “ON”); Tr. (Resp.) at 161:23-25 (suggesting agreement that “no conduction can occur in the off state”); CIB at 12-13 (not disputing that the “ON” state described in the patent is an example of a conducting state, but arguing only that the “ON state” should not be imported into the claims). The parties do dispute, however, how the “ON” terminology may apply to various modes of a transistor (e.g., “active” and “reverse-active”) if it operates as an amplifier and/or whether the claimed transistor can be used as an amplifier. See, e.g., Tr. (Compl.) at 115:1-20; Tr. (Resp.) at 121:11-22, 122:2-18; Tr. (Staff) at 123:15-124:6; SIB Ex. 2. To avoid potential confusion on this matter, the preliminary guidance provided here uses the word “conducting” (*i.e.*, following the “conduction” language of the claim and Summary of the Invention), rather than “on” or “ON.” See ‘835 patent at 11:46-48; *id.* at 1:60-62, 2:1-5; Part V.E *infra*. Based on statements made by Respondents’ counsel at the *Markman* hearing, for purposes of this investigation it may not be necessary to resolve whether “controlling a drive of an insulated gate transistor” involves controlling a transistor operating as a switch vs. as an amplifier. See Tr. (Resp.) at 122:2-5 (“our construction is agnostic to whether the transistor is used only as a switch or a power amplifier”); *id.* at 122:11-20; *Vivid Techs., Inc. v. Am. Science & Eng’g*, 200 F.3d 795, 803 (Fed. Cir. 1999) (terms need to be construed “only to the extent necessary to resolve the controversy”).

¹³ It appears undisputed that the “control output signal” is the mechanism for the claimed “controlling a drive of an insulated gate transistor.” See claim 1, preamble (“A semiconductor device **controlling a drive of an insulated gate transistor by generating a control output signal** on a basis of a control input signal”); Tr. (Compl.) at 73:22-24 (“the insulated gate transistor is controlled through the control output signal”); CRB at 20 (“purpose of the invention in the ‘835 patent is to use the ‘control output signal’ to control the insulated gate transistor”); CIB at 20 (proposing construction of “control output signal” as “output signal that is controlling an insulated gate transistor”). The specification shows that the control output signal controls the conducting status of the insulated gate transistor, and that it is stopped in order to turn the transistor off. See RIB at 28-29; ‘835 patent at 5:60-67 (“when a voltage of the control output signal S3 exceeds a threshold value of the transistor 12, the transistor 12 comes to be in ON state”); *id.* at 6:47-49 (where “the control output signal S3 is maintained . . . the ON state in the transistor 12 is

Moreover, this understanding does not appear to be significantly disputed by Complainant. *See* Tr. at 111:18-112:6 (Compl.) (stating that “the patent in claim 1 is about a short-circuit protection circuit” and that “[w]hen [the insulated gate transistor] is operating normally, it controls it by maintaining the on state. When it’s not operating normally, it shuts it off”); *id.* at 116:20-117:6 (“what you’re doing is you’re controlling the operation of the insulated gate transistor by maintaining it as on when everything is fine and turning it off when you have a short-circuit protection state”); CRB at 20 (the “purpose of the invention in the ‘835 patent is to use the ‘control output signal’ to control the insulated gate transistor, which means let the insulated gate transistor operate according to a control input signal if in a normal state and stop the insulated gate transistor from operating if in a short-circuit state.”).

Accordingly, the current evidence of record indicates that “controlling a drive of an insulated gate transistor” requires controlling whether the insulated gate transistor is in a conducting or non-conducting state. A final construction of this claim term (including resolution of the disputed issues regarding “controlling a voltage” and “supplied to the gate”), however, is deferred until after the evidentiary hearing.¹⁴

maintained”); *id.* at 7:13-30 (in the event of a short-circuit, “the control output signal S3 comes to be in the “L” state and the transistor 12 is forced to be in OFF state”); *id.* (under short-circuit condition, “the control output signal S3 is forced to stop”).

¹⁴ As discussed in Part V.D below, the undersigned preliminarily agrees with Respondents and Staff that the term “control output signal” refers to a signal applied to the gate of the insulated gate transistor.

D. “control output signal” (’835 patent, claims 1, 2)

Arigna	Respondents	Staff
No construction necessary. To the extent a construction is necessary, then the plain and ordinary meaning, e.g., “output signal that is controlling an insulated gate transistor”	“signal supplied to the gate of an insulated gate transistor to switch the transistor between ON and OFF states”	“signal supplied to the gate of an insulated gate transistor to switch the transistor between ON and OFF states”

The parties also disagree regarding the meaning of “control output signal.”

Arigna contends that the term “control output signal” is “clear on its face and thus needs no construction.” CIB at 18. Arigna states that, to the extent a construction is required, it should be “output signal that is controlling an insulated gate transistor.” CIB at 20. Arigna contends that the claim explicitly provides the required characteristics of the claimed control output signal, in particular, that it is “generated on the basis of a control input signal,” that it is “outputted by a driver,” that it is “detected by a short-circuit protection circuit,” that it “may be stopped by the driver under certain conditions,” and that it “has a detecting voltage.” CIB at 19. Arigna contends that any requirement that the control output signal switches the transistor “between ON and OFF states,” or that it must be “supplied to the gate of an insulated gate transistor” improperly imports limitations from the specification into the claims. *See* CRB at 19-21.

Respondents argue that the term “control output signal” is “closely related to the term ‘controlling a drive of an insulated gate transistor,’ as the voltage of the ‘control output signal’ is supplied to the gate of the insulated gate transistor to control its drive.” RIB at 39. For reasons similar to those provided for the “controlling a drive” term, Respondents contend that their construction “accurately reflects the disclosures of the patent specification.” RIB at 40. Respondents argue that the “merely supplying some signal to the gate of the transistor is not enough to ‘control[] the drive’ of the transistor,” but rather that the ability to switch the transistor

between ON and OFF is “critical to the purpose of the alleged invention.” RIB at 41.

Respondents contend that Arigna’s description of the control output signals’ functionality “ignores a critical aspect of the ‘control output signal’—what it is supposed to do in the context of the claimed invention.” RRB at 21 (emphasis omitted).

Staff similarly argues that “[t]he ‘835 Patent is entirely clear that the ‘control output signal’ is a ‘signal supplied to the gate of an insulated gate transistor,’” and that the transistor is a “switch where the purpose or function of the ‘control output signal’ is ‘to switch the transistor between ON and OFF states.” SIB at 32. Staff contends that its construction is supported by the patent’s examiner’s reference to a “control output signal” as “(i.e. the unlabeled signal applied to the gate of transistor 11)” when discussing a prior art rejection. SIB at 33. Staff states that “[b]y not requiring that the disputed signal must be supplied to the gate of the transistor,” Complainant’s construction “could potentially be read onto a power source provided to a transistor short-circuit protection function that disconnects the power source rather than the gate signal.” SIB at 34. Staff also argues that “by not specifying how the disputed signal is ‘controlling’ the transistor, Complainant’s construction might potentially be read onto a transistor being used as a power amplifier when the patent is only ever concerned with a transistor used as a switch.” SIB at 34. Staff contends that the term “control output signal” has no clear “plain and ordinary meaning” outside the context of the ‘835 patent. SRB at 22; *see also* SIB at 32-33.

For reasons similar to those discussed in connection with the “controlling a drive” term, final resolution of this claim term’s construction is deferred based on the technical nature of the underlying disputes. *See* n.10 *supra*. Based on the current record, however, the evidence indicates that the claimed “control output signal” refers to an output signal that is controlling the

drive of the insulated gate transistor. See ‘835 patent, claim 1 preamble (“A semiconductor device *controlling a drive of an insulated gate transistor by generating a control output signal* on a basis of a control input signal”); n.13 *supra*.¹⁵

Further, the evidence of record indicates that the claimed “control output signal” is supplied to the gate electrode of the claimed transistor. When describing the Figure 2 embodiment, the specification states that the control output signal is “supplied to the gate electrode of the transistor 12,” that the control output signal is “influenced when that transistor is short-circuited” such that “a signal waveform different from that in a normal operating state occurs,” and that “[t]he present invention is focused on this phenomenon”:

As shown in Fig. 2, *the control output signal is supplied to the gate electrode of the transistor 12* from the control signal output terminal U_{OUT} of the control device LIC, however, with regard to the insulated gate transistor, *the control output signal is also influenced when that transistor is short-circuited, and a signal waveform different from that in a normal operating state occurs. The present invention is focused on this phenomenon, and it detects the short-circuit by monitoring the control output signal* of the insulated gate transistor, and in case of the short-circuit, the short-circuit protection of the insulated gate transistor is performed by forcing the control LIC to stop the control output signal.

‘835 patent at 4:14-26 (emphasis added); see Tr. (Resp.) at 94:12-95:17.¹⁶ The Abstract of the Invention provides a similar description, also stating that the control output signal “is supplied to a gate electrode” and that short-circuit protection occurs through monitoring that signal to determine whether there is a “waveform different from that in a normal operating state”:

¹⁵ Arigna’s own proposed construction (“output signal that is controlling an insulated gate transistor”) similarly includes a requirement relating to control of the insulated gate transistor. See CIB at 18, 20; RIB at 40; see also Tr. (Compl.) at 73:22-24 (“the insulated gate transistor is controlled through the control output signal”)

¹⁶ The specification indicates that the second preferred embodiment operates according to the same principle. When describing “Preferred Embodiment 2,” the specification states: “a waveform of the control output signal S13 when the transistor 11 normally operates and also when it is short-circuited is identical with that of the control output signal S3 described in the preferred embodiment 1, thus the description is omitted.” ‘835 patent at 9:63-67; see also *id.* at 7:57-59 (“reference potential VS is supplied as a control output signal S13 to the gate electrode of the transistor 11”); *id.* at 5:60-65 and Fig. 5 (showing control output signal S3 in preferred embodiment 1).

A control output signal is supplied to a gate electrode of an insulated gate transistor from a control signal output terminal of a control device, however, with regard to the insulated gate transistor, *a control output signal is also influenced when that transistor is short-circuited, and a signal waveform different from that in a normal operating state occurs. The short circuit is detected by monitoring the control output signal of the insulated gate transistor*, and in case of the short-circuit, the short-circuit protection of the insulated gate transistor is performed by forcing the control device to stop that control output signal.

‘835 patent, Abstract (emphasis added). These passages indicate that the provision of the control output signal to the gate electrode is integral to the phenomenon on which claimed invention as a whole is based—not just part of a preferred embodiment. *See GLG Farms LLC v. Brandt Agricultural Prods., Ltd.*, 741 Fed. Appx. 794, 797-98 (Fed. Cir. 2018) (affirming district court construction regarding placement of claimed drive assemblies based on “present invention” language in specification); *cf. Regents of University of Minnesota v. AGA Med. Corp.*, 717 F.3d 929, 936 (Fed. Cir. 2013).¹⁷

In addition, the evidence shows that the specification repeatedly and consistently refers to the output control signal as a signal provided to the gate electrode, with no discussion of a “control output signal” supplied elsewhere. *See* ‘835 patent at 3:3-7, 3:36-40, 4:14-20, 4:28-33, 7:57-59, RIB at 39-40; SIB at 32; Tr. (Resp.) at 87:8-89:20 and Resp. *Markman* Presentation at 37-40. This intrinsic evidence, particularly combined with specification descriptions discussed above, further shows that the claimed output control signal is provided to the gate electrode. *Cf. Intel Corp. v. Qualcomm Inc.*, 21 F.4th 784, 790-94 (Fed. Cir. 2021) (construing “radio frequency input signal” to mean “a signal centered at a carrier frequency at which the signal was transmitted/received” in view of contextual claim language and the “specification’s repeated use

¹⁷ Consistent with these descriptions, the current record indicates that the gate electrode of an insulated gate transistor is structurally and functionally distinct from other elements or terminals of the transistor. *See, e.g.*, CRB at 8 (relying on CRB Suppl. Decl. Diehl Ex. 5 and SIB Exs. 9-11); CRB Suppl. Decl. Diehl Ex. 5 (describing structure of “MOS insulated-gate field-effect transistor”); Staff Exs. 9-11 (describing structure of MOSFETs and IGBTs).

of the disputed phrase to reference incoming carrier signals before downconversion”); *Arista Networks, Inc. v. Cisco Systems, Inc.*, 908 F.3d 792, 797-798 (Fed. Cir. 2018) (construing “broadcast” to mean “a transmission to one or more devices using a multicast address” in view of the “specification’s consistent focus on broadcasting via a multicast address”); *United Access Technologies, LLC v. AT&T Corp.*, 757 Fed. Appx. 960, 965-67 (Fed. Cir. 2019) (affirming construction of “signal interface” as “limited to a device located on the local side of the public trunk line” where “references in the specification clarify where the signal interface must be located”).

Accordingly, the current evidence of record supports a construction of “control output signal” to mean “output signal supplied to the gate of the insulated gate transistor to control the drive of the insulated gate transistor.”^{18 19} Given the technical nature of the underlying subject matter, however, final resolution of the claim construction for this term is deferred until after the evidentiary hearing.

E. “indicates a conduction of said insulated gate transistor” (’835 patent, claim 1)

Arigna	Respondents	Staff
Plain and ordinary meaning, e.g., “indicates that said insulated gate transistor is turned on.”	“indicates that said insulated gate transistor is in the ON state”	“indicates that said insulated gate transistor is in the ON state”
Alternatively: “indicates that electricity is flowing through said insulated gate transistor”	Alternatively: “indicates that electricity is flowing through said insulated gate transistor to downstream components”	Alternatively: “indicates that electricity is flowing through said insulated gate transistor to downstream components”

¹⁸ Respondents’ and Staff’s proposed construction, unlike Arigna’s, does not include the word “output.” There does not appear to be a dispute regarding the “output” aspect of the “control output signal” term, but there is no clear justification for omitting this concept from the construction.

¹⁹ Preliminary guidance regarding the meaning of “controlling a drive of an insulated gate transistor” is provided in Part V.C., *supra*, and thus is not repeated within this preliminary construction for “control output signal.”

The parties dispute the meaning of “indicates a conduction of said insulated gate transistor,” as used in claim 1.

Arigna contends that the term should have its plain and ordinary meaning, and that the “[f]undamental difference [among the parties’ constructions] is whether to use the phrase ‘is turned on’ (which Complainant submits is correct) or ‘is in the ON state’ (as Respondents propose).” Arigna contends that it is inappropriate to suggest that “there must be a specific ‘ON state’ condition in the transistor.” CIB at 12. Arigna also agrees that the term can be construed to mean “indicates that electricity is flowing through said insulated gate transistor.” Arigna contends that the use of a requirement for an “ON state” is an attempt “to narrowly limit the scope of Claim 1 to insulated gate transistors being used as switching devices, and not amplifiers, which is unfounded.” CRB at 13. Arigna argues that there can be states of a transistor other than ON and OFF. Tr. (Compl. counsel) at 115 (“[t]raditionally there are four states, on off, active, and reverse active”) (referencing SIB Ex. 2).

Respondents argue that the term “ON” state is the terminology used in the patent specification, and that Respondents’ and Staff’s proposal more accurately reflects the intrinsic record. RIB at 29-30. Respondents contend that the “ON state” is “the condition in which current flows through the transistor.” RRB at 15. Respondents argue, agreeing with Staff, that Arigna’s construction may leave open the argument that a transistor is “turned on” even if the signal input is below the “saturation threshold needed to switch the transistor to” its ON state. *Id.* at 15. Respondents contend that to the extent a transistor can go through ‘active and reverse active’ modes, these count as the transistor being “on.” Tr. (Resp.) at 161. Respondents also state that their understanding of an “on” state and an “off state” relates to whether current is flowing through the transistor or not. Tr. (Resp.) at 122:12-18.

Staff argues that the insulated gate transistor of the claimed invention is being used as a switch, and that a transistor used as a switch “has only two states: ON and OFF.” SIB at 13. Staff argues that Complainant’s proposal “disregards that the insulated gate transistor is being used as a switch.” *Id.* at 14. Staff further argues that it is “not clear precisely what Complainant means by ‘transistor is turned on.’” SRB at 23.

With respect to this term, it is unclear whether the parties have a substantive disagreement and the contours of any disagreement. First, it is unclear if there is a difference between an insulated gate transistor being “turned on” as opposed to being in the “ON state” and, if so, what that difference entails.²⁰ With respect to the parties’ alternative constructions, it is similarly unclear whether there is a substantive difference between electricity “flowing through said insulated gate transistor” and “flowing through said insulated gate transistor to downstream components” and, if so, what that difference entails.²¹ At the present time, the term “indicates a conduction of said insulated gate transistor” is construed to have its plain and ordinary meaning. *See* Tr. (Compl.) at 171:23-24 (“a POSITA would know what conduction means”); Tr. (Resp.) at 161:23-35, 162:13-18 (discussing scenarios involving “no conduction” and where “[t]he transistor is conducting”); Tr. (Staff) at 170:14 (term is “pretty clear on its face”). The undersigned may revisit this issue upon consideration of the full evidentiary record if underlying substantive disputes regarding the scope of this claim term become clear.

²⁰ *See* n.12 *supra*.

²¹ The parties’ disputes appear largely motivated by general concerns about how differing claim constructions might be interpreted. *See, e.g.*, Tr. (Resp.) at 162:23-163:3, 168:15-169:7; Tr. (Staff) at 170:14-18; Tr. (Compl.) at 170:22-171:22. This is not a sufficient basis to discern substantive claim construction disputes among the parties. Moreover, the issue of whether the claims are limited to transistors acting as switches, rather than amplifiers, will be resolved (to the extent necessary) after the evidentiary hearing. *See* n.12 *supra*.

F. “significant” (’835 patent, claims 1, 2)

Arigna	Respondents	Staff
No construction necessary. To the extent a construction is necessary, then the plain and ordinary meaning, e.g., “active.” Alternatively: “having meaning” or “conveying meaning” or “meaningful.”	Plain meaning, <i>i.e.</i>, “large or important enough to have a meaningful effect, <i>e.g.</i> a HIGH potential state” Alternatively: “active-high or active-low state indicating a condition is met, where active-high indicates a condition is met when low is the baseline condition, and active-low indicates a condition is met when high is the baseline condition” Alternatively: “active-high or active-low state indicating a (non-baseline logic) condition is met”	“HIGH or LOW state indicating a non-baseline logic condition is met” Alternatively: “active-high or active-low state indicating a condition is met, where active-high indicates a condition is met when low is the baseline condition, and active-low indicates a condition is met when high is the baseline condition”

The parties dispute whether the term “significant” requires a construction and, if so, what that construction should be. Complainant contends that no construction is needed. Complainant also state that a signal is significant “when it is ‘active’ or not at the default status.” CIB at 15. Complainant contends that “active” or “having meaning” conveys the meaning of “significant” as used in the specification. *Id.* at 16.

Respondents argue that “significant” should have its plain meaning, which means “large or important enough to have a meaningful effect, e.g., a HIGH potential state.” RIB at 30. Respondents contend that the term “significant,” as used in the claims, refers to a “significant condition of the claimed signal, not merely an active signal.” *Id.* at 31. Respondents originally argued that the terms “active-high” and “active-low” in Staff’s construction are “not found in the patent and appear to inject additional ambiguity regarding the meaning of those terms.” *Id.* at 33. However, Respondents in their reply brief stated that it would not object to modifying the

Staff's construction to be "active-high or active-low state indicating a condition is met, where active-high indicates a condition is met when active-low is the baseline condition, and active-low indicates a condition is met when active-high is the baseline condition." RRB at 17. At the *Markman* hearing, Respondents argued that their construction represents the following three characteristics: "(1) In a given signal, HIGH or LOW may be significant, but not both."; "(2) A signal's default or baseline state is not significant."; and "(3) A significant signal has or conveys meaning." Tr. (Resp.) at 183:6-184:1, 190:19-191:1 and Resp. *Markman* Presentation at 71.

Staff contends that the term "significant" was a "central part of the patent examiner's stated reasons for allowance of the asserted patent claims." SIB at 24. Staff contends that the term "significant" refers to "one of two possible logic states for a digital (logic) signal." *Id.* at 25. Staff contends that, in the context of the claims, "significant" is also used to refer to a pulse signal." *Id.* Staff further contends that the "significant" condition for pulse signals represents "a change from the baseline (HIGH or LOW) condition that directly correlates to a particular condition or event having occurred." *Id.* at 26. Staff states that the terms "active-high" and "active-low" refers to a pulse signal's "non-baseline state." *Id.* at 27. Staff argues that Respondents' construction "problematically" limits the term to being "large" in size or always the HIGH potential state. *Id.* Staff emphasizes the need to tie the importance of a "significant" signal to its role in being "indicative of a logic state." *Id.* at 28. Staff contends that Complainant's proposed construction is insufficiently clear because it does not specify that the term "significant" is used in reference to one of two possible logic states. *Id.*

The term "significant" is used within the context of claim 1 to refer to the state of a "first pulse signal" and "second pulse signal" generated by, respectively, a "pulse generation circuit"

and a “comparator.”²² A “logical circuit” receives both the first and second pulse signals and outputs a stop signal “when said pulse signal becomes significant during a period when said first pulse signal is significant.”²³ The parties do not appear to substantively dispute that the term “significant” refers to a non-baseline condition of the pulse signal, and this is supported by the specification. *See* ‘835 patent at 6:11-49 and Fig. 5 (discussing pulse signal S2 and comparison result signal S4 each being “significant” when moved to “high potential” state); SIB at 26-27; Tr. (Compl.) at 195:19-22 (“we’re in some agreement as with respect to baseline or not baseline and having some meaning”); *id.* at 196:3-4, 200:25-201:7; SRB at 15 (“significant” is “not the default or baseline state”).²⁴

The parties disagree regarding, at least, whether it is appropriate to include Staff’s proposal that significance indicates a “condition is met,” and whether to include Respondents’ argument that, for a given system, both “HIGH” and “LOW” designations for the claimed pulse signal cannot be significant. At least at this stage of the investigation, such elaboration appears unnecessary, given that the claim language itself defines the relevant conditions under which the signal at issue should be “significant,” and given the parties’ apparent agreement that a

²² *See* ‘835 patent at 11:50-54 (referring to a “pulse generation circuit . . . outputting a first pulse signal being significant only in said predetermined period according to a timing when said control input signal indicates the conduction of said insulated gate transistor”); *id.* at 11:55-60 (“referring to “a comparator receiving the detecting voltage of said control output signal, performing a comparison with said reference voltage and outputting a second pulse signal being significant during when the detecting voltage of said control output signal exceeds said reference voltage”).

²³ *See* ‘835 patent at 11:61-65.

²⁴ Arigna stated that while it would agree that a “significant” signal is not at a baseline condition, or that a “significant” signal is “meaningful,” it would not necessarily agree to both. *See* Tr. (Compl.) at 200:25-201:7; Respondents’ *Markman* Presentation at 71. However, Arigna provided no substantive objection to adopting both requirements, stating only that this seemed “to overcomplicate” the word. *See id.* at 201:9-23.

“significant” condition is not a default or baseline condition. *See* discussion *supra*.²⁵ Based on the current evidence of record, the term “significant” is construed to have its plain meaning, which requires a non-baseline condition of the pulse signal.²⁶ The undersigned may revisit this issue upon consideration of the full evidentiary record if underlying substantive disputes regarding the scope of this claim term become clear.

G. “clamped constantly” (‘835 patent, claim 2)

Arigna	Respondents	Staff
“held at a constant voltage”	“clamped to a certain voltage for a determined period by a Miller effect”	“held at a constant voltage”

The parties disagree regarding the meaning of “clamped constantly,” which appears in dependent claim 2 of the ‘835 patent: “The semiconductor device according to claim 1 wherein said predetermined period when said first pulse signal is significant is set on a basis of a period when a voltage of said control output signal is clamped constantly when said insulated gate transistor normally operates.” ‘835 patent, cl. 2. Arigna and the Staff propose that the term means “held at a constant voltage.” Respondents contend that the term means “clamped to a certain voltage for a determined period by a Miller effect.”

²⁵ Staff appears to be concerned about the degree of correlation between a signal’s “significant” state and the conditions defined in the claims. *See* Tr. (Staff) at 203:12-204:5, 208:2-17. At least at this point in the investigation, it is unclear why this would be an issue of construing “significant” rather than a factual issue of infringement/non-infringement of the claim. With respect to whether “HIGH” or “LOW” could both be “significant” (per Respondents’ proposal), it is similarly unclear how this goes beyond the agreed-upon view that a “significant” pulse signal is in a non-baseline state. As with the “indicates a conduction” term discussed above, at this time the parties’ disputes appear to reflect general concerns about how differing claim constructions might be interpreted rather than clear substantive disputes. *See* Tr. (Resp.) at 210:24-211:25; Tr. (Staff) at 208:2-17.

²⁶ This plain meaning construction does not mean that a non-baseline signal is necessarily sufficient to confer “significance,” only that non-baseline condition is required. While Respondents have proposed construing the term to add a “meaningful” requirement, it is unclear how “meaningful” differs from the plain and ordinary meaning of “significant.”

Arigna states that the meaning of “clamped constantly” should be interpreted according to Figure 5’s depiction of control signal S3, which Arigna indicates shows the signal held at a constant voltage. Arigna states that there is no basis for further construing “clamped constantly” to include the description of Figure 5 in the specification, which states “a voltage of the control output signal S3 is clamped to a certain voltage for a determined period by a mirror effect.” CIB at 17 (quoting ‘835 patent at 5:60-6:5). Staff provides a similar argument, and also notes that the specification’s second preferred embodiment includes clamping to a constant voltage but does not “specif[y] how the clamping is done,” and that the patent elsewhere discusses a means of obtaining a reference voltage by clamping using a “Zener diode method.” SIB at 31; *see also* SRB at 18-21.

Respondents argue that “clamped constantly” requires holding voltage at a certain level by a Miller effect. Relying on the specification’s description of Figure 5, Respondents argue that the “time period of the Miller effect and resulting plateau are . . . critical to the alleged invention’s ability to detect a short circuit when monitoring the control output signal.” RIB at 37. Respondents further argue that the “Miller effect” is well-known in the art of electrical engineering, and that the specification’s reference to “mirror effect” reflects a mistranslation that occurred when the ‘835 patent specification was translated from the foreign priority applications of the patent. *Id.* at 38.²⁷ Respondents contend that the specification only discloses “one way to clamp constantly . . . when said insulated gate transistor normally operates” (as required by claim 2) and that Respondents’ construction corresponds to the invention as described in the specification. *See* RRB at 17-29.

²⁷ Arigna states that while the patent refers to “mirror effect,” it is “possible that the original Japanese should be translated as ‘Miller effect’ (as Respondents argue)” but that regardless of this issue, “this effect is not necessary to construe the term.” CIB at 17 n.2. Staff also does not specifically dispute that the Japanese priority applications refer to a “Miller effect.” *See* SRB at 20.

Upon review of the parties' arguments and evidence of record, the undersigned finds that the term "clamped constantly" means "held at a constant voltage." *See* CIB at 16-17; SIB at 29-30 (discussing Figs. 5 and 7). Respondents' proposal that the construction should include a reference to a "Miller effect" is not adopted. At the least, Respondents have not provided persuasive evidence of an error that the Commission may correct. The Federal Circuit has held that district courts can correct errors "only if, among other things, the error is evident from the face of the patent." *H-W Tech, L.C. v. Overstock.com, Inc.*, 758 F.3d 1329, 1333 (Fed. Cir. 2014); *see also* *Novo Indus., L.P. v. Micro Molds Corp.*, 350 F.3d 1348, 1357 (Fed. Cir. 2003); *Certain Multiple Mode Outdoor Grills and Parts Thereof*, Inv. No. 337-TA-895, Comm'n Op., 2019 WL 10631341, at *101, 116 (Feb. 20, 2015). Errors evident only through the prosecution history are not eligible for such correction. *H-W Tech*, 759 F.3d at 1334. Respondents provided no expert declaration or other evidence showing that one of skill in the art would have found it evident from the face of the patent that the specification's "mirror effect" reference was an error. *See* RIB at 35 (asserting, with no supporting evidence, that the phrase "mirror effect" makes "no sense" and is not "comprehensible to a POSITA"). Rather, Respondents' argument relies primarily on the foreign priority application translations and a 1920 article. *See* RIB at 35-39; RIB Exs. 15-17.

Accordingly, the term "clamped constantly" is construed to mean "held at a constant voltage."

H. “short-circuit protection circuit” (’835 patent, claim 1)

Arigna	Respondents	Staff
No construction necessary. To the extent a construction is necessary, then the plain and ordinary meaning, e.g., “circuit that performs function of short-circuit protection”	“circuit that performs short-circuit protection without a shunt resistor”	“circuit that performs short-circuit protection without a shunt resistor”

The parties dispute whether the term “short-circuit protection circuit,” as used in claim 1 of the ’835 patent, requires construction. Complainant contends that the “claim itself provides the full definition of ‘short-circuit protection circuit.’” CIB at 20. Complainant contends that including the negative limitation “without a shunt resistor” is inappropriate and that the specification and file history fail to meet the standard for disclaimer. *See* CRB at 21-25.

Respondents and the Staff argue that the claimed “short circuit protection circuit” provides short-circuit protection without using a shunt resistor. In particular, Respondents and Staff rely on statements in the specification of the patent, including various descriptions in the specification indicating the lack of a shunt resistor as well as the title. *See* RIB at 43-46 (citing ‘835 patent at Title; *id.* at 1:17-20, 1:20-25, 1:32-40, 1:37-40, 7:23-31, 7:32-43, 10:55-11:11). Respondents contend that “[t]he specification’s consistent and repeated disparaging of the prior art ‘shunt resistor’ feature and characterization of the invention as a circuit that performs a short-circuit protection ‘without a shunt resistor’ limits the scope of the ‘835 Patent’s claims.” *Id.* at 45; *see also* RRB at 23-25. Staff similarly argues that the proper construction of “short-circuit protection circuit” requires performance without a shunt resistor. *See* SIB at 34-36 (citing ‘835 patent at 1:47-51, 1:63-2:5, 3:65-4:2, 7:22-43, 10:55-11:11); *see also* SRB at 23-25. Staff notes that its proposed construction “only precludes a shunt resistor from being part of the” claimed circuit and does not preclude the use of a shunt resistor in the claimed device as a whole. SRB at

23; Tr. (Staff) at 258:7-11. Respondents and Staff also point to the examiner’s objection to the original title (“Semiconductor Device and Semiconductor Device Module”) and requirement that the applicants submit a new title “indicative of the invention to which the claims are directed.” SIB at 35 (citing SIB Ex. 13 (7/7/2006 Non-Final Office Action)). In response, applicant provided the current title, “Semiconductor Device Which Realizes a Short-Circuit Protection Function Without Shunt Resistor, and Semiconductor Device Module.” SIB at 35 (citing SIB Ex. 14 (10/10/2006 Amendment and Response); *see also* RIB at 43. Respondents further argue that, under Complainant’s approach, the words “short circuit” are superfluous. Tr. (Respondents) at 259:21-260:6.

Upon review of the evidence of record and the parties’ arguments, the undersigned finds that the proper construction of “short-circuit protection circuit” is a “circuit that performs short-circuit protection without a shunt resistor.” The undersigned agrees with Respondents’ and Staff’s arguments that the statements in the specification, as well as the patent title, show that the claimed “short circuit protection circuit” operates without using a shunt resistor.

First, the Summary of the Invention, particularly when read in view of the Background section, indicates that the invention set forth in the patent involves short circuit protection without a shunt resistor. The Background of the Invention discusses a “conventional” Intelligent Power Module (IPM) in which short-circuit protection is performed “*by connecting a shunt resistor* detecting a main current flowing between main power terminals of the switching device outside the package and monitoring the main current.” ‘835 patent at 1:16-25 (emphasis added). This section goes on to discuss the prior art conventional systems using a shunt resistor, including disadvantages of such operation. *See id.* at 1:36-40 (“Moreover, it is necessary to set a filter circuit . . . to remove a noise entering the shunt resistor and the current detecting terminal,

and there is a possibility that a device becomes massive.”); *id.* at 1:40-45 (“Moreover, when a length of a wiring from a ground main electrode to a ground terminal of the switching device becomes long by setting the shunt resistor, a voltage surge according to a switching of the switching device becomes large, and there is also a possibility than an error occurs.”).

Immediately following this section, the first sentence of the “Summary of the Invention” section describes the provision of short-circuit protection “without a shunt resistor”: “A semiconductor device ***which realizes a short-circuit protection function without a shunt resistor*** and an IPM in which the semiconductor devices is built are provided.” *Id.* at 1:49-51. This characterization of a device, under the “Summary of the Invention,” supports a finding that the asserted invention operates “without a shunt resistor.”

Second, the specification repeatedly describes embodiments of the invention as providing short-circuit protection without a shunt resistor and favorably distinguishes these embodiments from prior art using a shunt resistor. *See id.* at 3:65-4:3 (“The inverter module 100 described above has a composition that ***a shunt resistor and a current detecting terminal connecting the shunt resistor which are conventionally necessary are not included*** but the LVIC or the HVIC in the module includes the short-circuit protection function.”) (emphasis added); *id.* col. 7:23-44 (“Effect” of Preferred Embodiment 1) (“thus it is not necessary for the inverter module 100 to set the shunt resistor outside of the package PG . . . differing from the conventional IPM . . . the shunt resistor is not necessary, thus the length of the wiring from the ground main potential to the ground terminal of the switching device can be made to be short, and the voltage surge according to the switching of the switching device can be reduced”); *id.* at 10:55-11:10 (similar for Preferred Embodiment 2). These descriptions also indicate that the asserted invention operates without a shunt resistor.

Third, the title of the patent specifically calls out the lack of a shunt resistor in the short-circuit protection provided by the patent: “Semiconductor Device Which Realizes a **Short-Circuit Protection Function Without Shunt Resistor**, and Semiconductor Device Module.” Title (emphasis added). The Federal Circuit has held that the title of a patent may be considered as part of the evidence relating to claim construction issues. See *UltimatePointer, LLC v. Nintendo Co., Ltd.*, 816 F.3d 816, 823 (Fed. Cir. 2016).²⁸ Here, the title was amended by applicant to include the “without shunt resistor” language after the examiner required a new title “indicative of the invention to which the claims are directed.” SIB Ex. 13 at 4 (7/7/2006 Non-Final Office Action); RIB Ex. 19 at 2, 15 (Oct. 10, 2006 Applicant Amendments) (providing amended title and stating that “[t]he title has been amended per the Examiner’s request to make it more specific”); see also ‘835 FH at 249, 261 (Appendix A1 to the Complaint, EDIS Doc. ID 763129, PDF pagination) (Oct. 12, 2006 Notice of Allowability) (indicating approval of new title by Examiner). The title’s language and related prosecution history activities further confirm a finding that the asserted invention operates without a shunt resistor.

Given: (1) the description provided by the “Summary of the Invention” of “realiz[ing] a short-circuit protection function without a shunt resistor,” particularly in context of the immediately preceding Background section describing disadvantages of a shunt resistor; (2) the

²⁸ Relying on the Federal Circuit’s decision in *Pitney Bowes*, Complainant argues that the law “is fairly, if not unequivocally, clear . . . that [the] patent title is nearly irrelevant to claim construction and it’s entirely unimportant to claim construction.” Tr. (Compl.) at 244:12-246:13; Compl. *Markman* presentation at 90-92; *Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298 (Fed. Cir. 1999). *Pitney-Bowes*, unlike the case here, involved an examiner-drafted amendment to a title. See 182 F.3d at 1311-12; Tr. (Resp.) at 234:3-20. In any event, following *Pitney Bowes*, the Federal Circuit has made clear that the patent title can be considered as one factor in the claim construction analysis. See *UltimatePointer, LLC v. Nintendo Co., Ltd.*, 816 F.3d 816, 823-24 (Fed. Cir. 2016) (relying in part on title to construe claim, citing *Exxon Chem. Pats., Inc. v. Lubrizol Corp.*, 64 F.3d 1553, 1557 (Fed. Cir. 1995)); *Ruckus Wireless, Inc. v. Innovative Wireless Sols., LLC*, 824 F.3d 999, 1003 n.2 (Fed. Cir. 2016) (“[w]e have used the title of a patent to aid in claim construction”); *Forest Labs, LLC v. Sigmapharm Labs., LLC*, 918 F.3d 928, 933 (Fed. Cir. 2019) (relying in part on patent title to construe claim); *Wastow Enters., LLC v. Truckmovers.com*, 855 Fed. Appx. 748, 752 (Fed. Cir. 2021) (consideration of the patent title is consistent with *Pitney Bowes* so long as it does not carry “too much weight”).

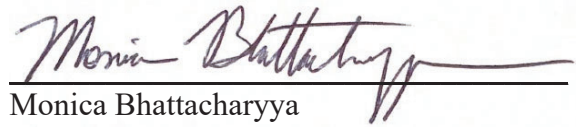
specification’s repeated descriptions of the embodiments of the invention as providing short-circuit protection without a shunt resistor, including favorably comparing such embodiments to prior art conventional systems using a shunt resistor; and (3) the title of the patent and related prosecution history activities—the intrinsic evidence clearly indicates that the claimed “short circuit protection circuit” operates without a shunt resistor. *Cf. UltimatePointer, LLC v. Nintendo Co., Ltd.*, 816 F.3d 816, 823-24 (Fed. Cir. 2016) (affirming district court construction of “handheld device” to be limited to a “direct-pointing device” in view of “the repeated description of the invention as a direct-pointing system, the repeated extolling of the virtues of direct pointing, and the repeated criticism of indirect pointing,” including consideration of the patent title); *Invidior Inc. v. Dr. Reddy’s Lab ’ys, S.A.*, 930 F.3d 1325, 1332, 1337 (Fed. Cir. 2019) (affirming district court construction of “capable of being dried without loss of substantial uniformity of the active” to disclaim “conventional top air drying” in view of the specification “repeatedly disparaging it”); *Techtronic Indus. Co. Ltd. v. Int’l Trade Comm’n*, 944 F.3d 901, 907 (Fed. Cir. 2019) (stating that “disavowal must be clear, but it need not be explicit” and that “[d]isavowal may be inferred from clear limiting descriptions of the invention in the specification or prosecution history”); *Openwave Sys., Inc. v. Apple Inc.*, 808 F.3d 509, 511, 514-17 (Fed. Cir. 2015) (construing “mobile device” to exclude mobile devices containing “computer modules” based, *inter alia*, on specification statements distinguishing mobile devices with computer modules and those without, and describing problems with use of computer modules).

Accordingly, the term “short circuit protection circuit” is construed to mean a “circuit that performs short-circuit protection without a shunt resistor.”

To the extent any party believes that any limited supplemental expert disclosures or other procedures are necessary to address any holdings in this Order that the parties were not

reasonably able to address previously, the parties should meet and confer. If necessary, the parties should jointly submit a proposed schedule for any such disclosures or procedures consistent with the hearing schedule (including any disputes related thereto), as well as justification therefor and a specific description of any proposed supplemental disclosures, by February 3, 2023.

SO ORDERED.



Monica Bhattacharyya
Administrative Law Judge