

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INFINEON TECHNOLOGIES AG,
Petitioner,

v.

ARIGNA TECHNOLOGY LTD.,
Patent Owner.

IPR2021-01382
Patent 8,247,867 B2

Before GARTH D. BAER, SHARON FENICK, and IFTIKHAR AHMED,
Administrative Patent Judges.

BAER, *Administrative Patent Judge.*

JUDGMENT
Final Written Decision
Determining No Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

Infineon Technologies AG (“Petitioner”) filed a Petition (Paper 2, “Pet.”), requesting an *inter partes* review of claims 8 and 9 of U.S. Patent No. 8,247,867 B2 (Ex. 1001, “the ’867 patent”). Arigna Technology Ltd. (“Patent Owner”) filed a Preliminary Response to the Petition. Paper 8. Following institution, Patent Owner filed a Response. Paper 16 (“PO Resp.”). Subsequently, Petitioner filed a Reply to Patent Owner’s Response (Paper 18, “Pet. Reply”), and Patent Owner filed a Sur-reply (Paper 20, “PO Sur-reply”). On November 22, 2022, we held an oral hearing. A transcript of the hearing is included in the record. Paper 27 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This decision is a Final Written Decision issued pursuant to 35 U.S.C. § 318(a). For the reasons we discuss below, we determine that Petitioner has not proven by a preponderance of the evidence that claims 8 and 9 of the ’867 patent are unpatentable.

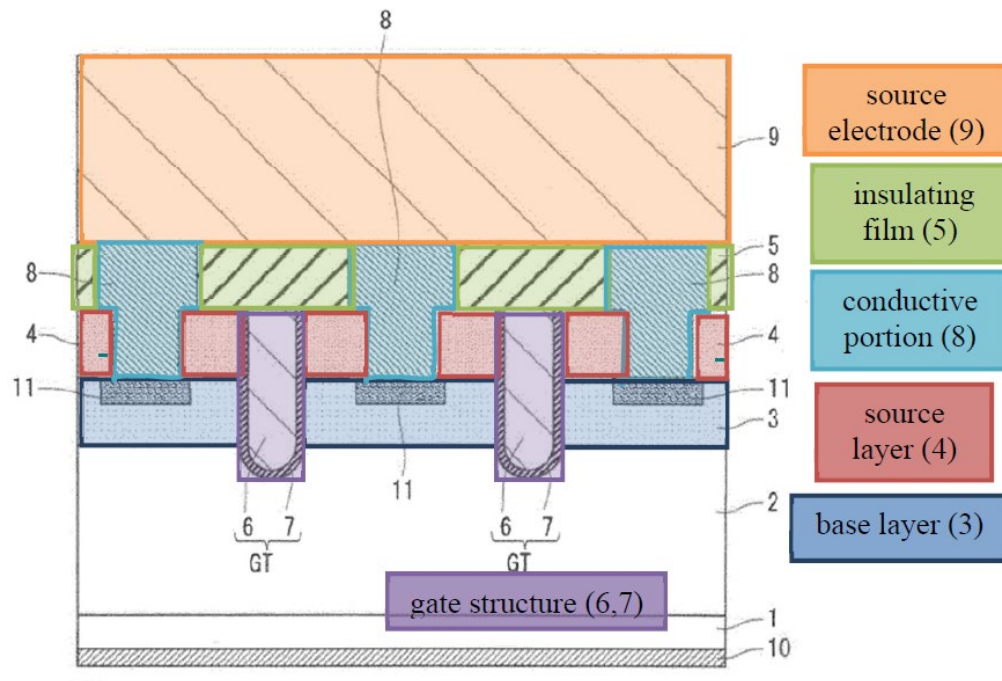
II. BACKGROUND

A. RELATED MATTERS

The ’867 patent is at issue in *Arigna Technology Limited v. Volkswagen AG et al.*, No. 2:21-cv-00054-JRG-RSP (E.D. Tex.); ITC Proceeding 337-TA-1267; and IPR2021-01321 (the “Volkswagen IPR”).

B. THE ’867 PATENT

The ’867 patent is directed to a semiconductor device. Ex. 1001, code (54). The ’867 patent’s Figure 1, with Petitioner’s annotations, is reproduced below.



Ex. 1001, Figure 1 (annotated)

Pet. 5. Figure 1 illustrates a cross section of a semiconductor device.

Ex. 1001, 3:35–54. The device has n+ type substrate 1 (*id.* at 4:4–5); n- type drift layer 2 (*id.* at 4:6–10); p- type base 3 (*id.* at 4:13–14); n+ type source 4 (*id.* at 4:14–16); insulating film 5 (*id.* at 4:31–32); gate electrode 6 (*id.* at 4:19–30); gate insulating film 7 (*id.* at 4:19–30); conductive portion 8 (*id.* at 4:32–33); source electrode 9 (*id.* at 4:59–67); drain electrode 10 (*id.* at 4:5–6); and p+ type contact region 11 in base 3 (*id.* at 4:39–46).

C. CHALLENGED CLAIMS

Petitioner challenges claims 8 and 9. Claim 8 is independent and reproduced below:

8. A semiconductor device, comprising:
- a base layer having a first conductivity type;
 - a source layer formed on said base layer and having a second conductivity type;

an insulating film formed on said source layer;
a plurality of gate structures penetrating said base layer;
a conductive portion penetrating said insulating film and said source layer, being in contact with an upper surface of said source layer, and electrically connected to said source layer and said base layer; and
a source electrode formed on said insulating film and electrically connected to said conductive portion,
wherein a dimension of a part in which the upper surface of said source layer and said conductive portion are in contact with each other is 10 nm or more and 40 nm or less.

Ex. 1001, 14:1–16.

D. ASSERTED GROUNDS OF UNPATENTABILITY

Petitioner asserts the following grounds of unpatentability. Pet. 1.

Challenged Claims	Basis (35 U.S.C. §)¹	Reference(s)
8, 9	102	Fujii ²
8, 9	103	Fujii
8, 9	103	Inagawa ³ , Hebert ⁴

Petitioner also relies on a declaration from Dr. Jack Lee (Ex. 1002).

¹ Because the parties agree that the challenged claims of the '867 patent have an effective filing date before March 16, 2013, we apply the pre-AIA (America Invents Act) version of §§ 102 and 103. Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 285–88 (2011).

² US 6,872,653 B2, Mar. 29, 2005 (Ex. 1005, “Fujii”).

³ US 6,858,896 B2, Feb. 22, 2005 (Ex. 1006, “Inagawa”).

⁴ US 2009/0218619 A1, Published Sep. 3, 2009 (Ex. 1007, “Hebert”).

III. PRELIMINARY MATTERS

A. LEVEL OF SKILL IN THE ART

Petitioner contends a person of ordinary skill in the art “would be a person with a master’s degree in electrical engineering (or a related degree) and at least three to five years of experience in the area of miniaturization, optimization, and fabrication processes of semiconductor devices used in integrated circuits.” Pet. 8. Further, “[a] person with less education, but more relevant practical experience, is also a person of ordinary skill in the art.” *Id.* Patent Owner does not provide a description of the person of ordinary skill. *See* PO Resp. 18.

Petitioner’s description is consistent with the prior art and patent specification before us and is supported by credible expert testimony. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (prior art itself may reflect an appropriate level of skill). We adopt Petitioner’s description.

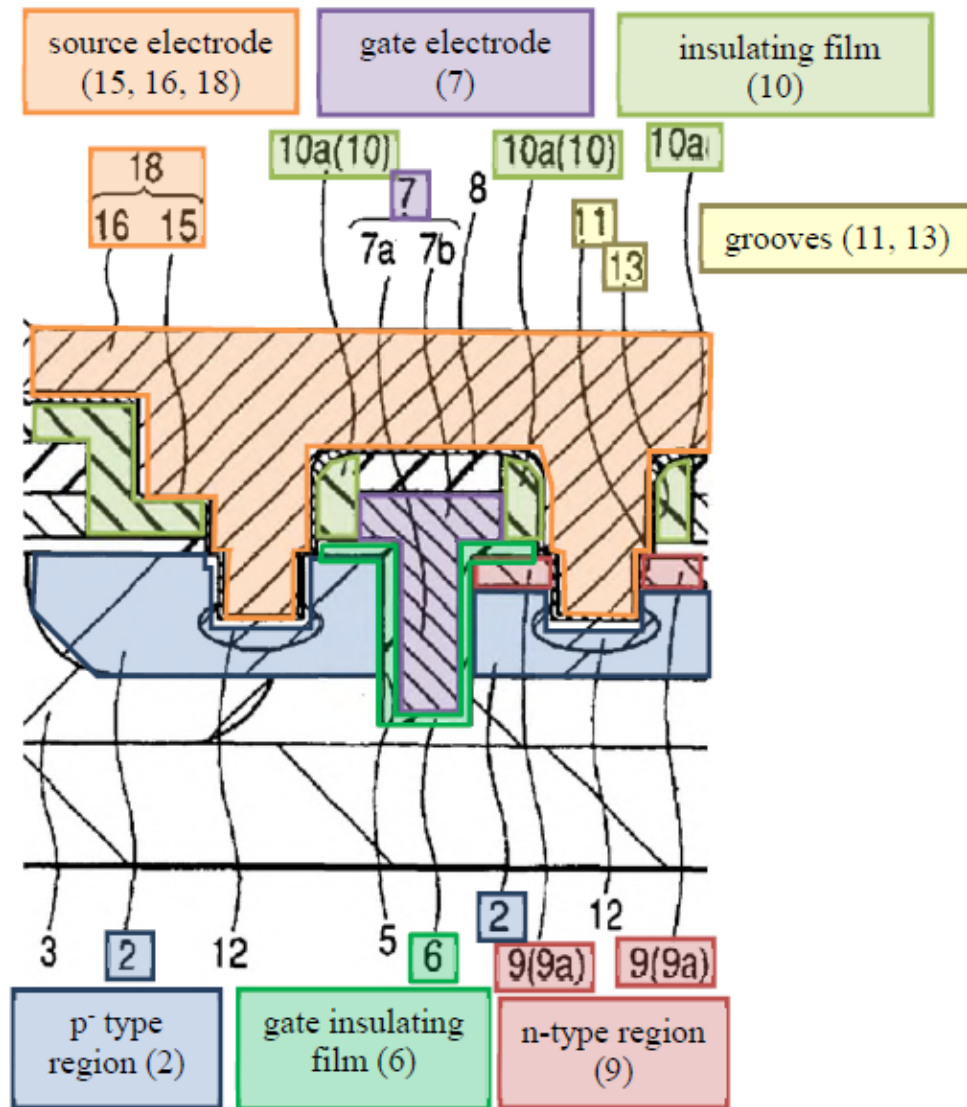
B. CLAIM CONSTRUCTION

We determine we need not explicitly construe any terms to determine unpatentability. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“we need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

C. ASSERTED PRIOR ART

1. Fujii (Ex. 1005)

Fujii discloses a semiconductor device. Ex. 1005, code (54). Petitioner’s excerpt of Figure 14, with Petitioner’s annotations, is reproduced below.

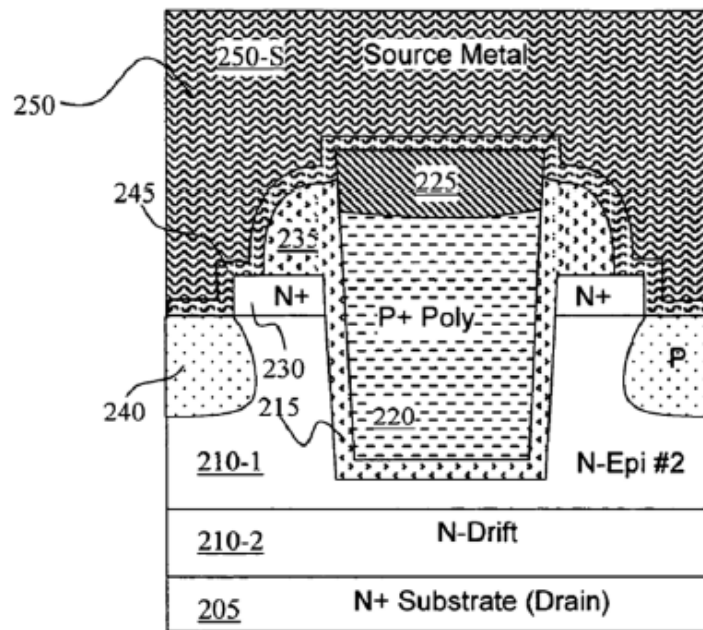


Ex. 1005, Figure 14 (excerpted and annotated)

Pet. 10. Figure 14 is a semiconductor device with p- semiconductor region 2, gate insulating film 6, gate electrode 7, semiconductor region 9, insulating film 10, and conductor films 15, 16. Ex. 1005, 10:66–67, 4:14–15, 4:43–46, 5:18, 5:28, 2:48–50; *see* Ex. 1002 ¶¶ 36–37 (citing Ex. 1005).

2. Inagawa (Ex. 1006)

Inagawa discloses a semiconductor device. Ex. 1006, code (54). Inagawa's Figure 4, with Petitioner's annotations, is reproduced below.



Ex. 1007, Figure 10k

Figure 10k is a cross sectional view of a semiconductor. *Id.* ¶ 19. Hebert discloses that spacers 235 may be etched back “200 Angstroms to 2000 Angstroms.” *Id.* ¶¶ 57–58.

IV. UNPATENTABILITY ANALYSIS

A. OBVIOUSNESS OF CLAIMS 8 AND 9 BASED ON INAGAWA AND HEBERT

Petitioner contends claims 8 and 9 would have been obvious over Inagawa and Hebert. Pet. 57–83. Based on Petitioner’s analysis and for the reasons explained below, we find Petitioner has not proven by a preponderance of the evidence that claims 8 and 9 would have been obvious over Inagawa and Hebert.

Claim 8 (and, by dependence, claim 9) requires “a dimension of a part in which the upper surface of said source layer and said conductive portion are in contact with each other is 10 nm or more and 40 nm or less.”

Ex. 1001, 14:13–16. Petitioner asserts this limitation would have been obvious because Hebert teaches stair-step dimensions between 20 and 200

nm, which overlaps the claimed range. *See* Pet. 78–79; Pet. Reply 21–22. Petitioner does not dispute that Hebert teaches only a 20–200 nm range of stair-steps, rather than discrete values within the claimed 10–40 nm range. *See* Pet. 79; Pet. Reply 21–22. However, according to Petitioner, Hebert’s 20–200 nm range overlaps the claimed range, and thus creates a presumption of obviousness. Pet. 79; Pet. Reply 1 (citing *Genentech, Inc. v. Hospira, Inc.*, 946 F.3d 1333, 1338 (Fed. Cir. 2020)).

As the court in *E.I. DuPont* recognized, an overlapping range in the prior art is sufficient for obviousness “in the absence of evidence indicating that there is something special or critical about the claimed range.” *E.I. DuPont de Nemours & Co. v. Synvina C.V.*, 904 F.3d 996, 1008 (Fed. Cir. 2018). Petitioner asserts Patent Owner “failed to present such [criticality] evidence.” Pet. Reply 1–2. We disagree. Instead, we agree with Patent Owner that the claimed 10–40 nm range is critical (and thus not obvious) because it “provide[s] an optimal balance between cell size and short circuit defect rate.” PO. Resp. 63. This criticality is reflected in the ’867 patent’s Figure 8, which shows that dimensions below 10 nm result in significant increases in short-circuit defect rate, while dimensions above 40 nm undesirably increase size without further reducing short-circuit defect rate. Ex. 1001, 11:20–32, Fig. 8.

Petitioner raises several arguments in contesting that the claimed range is critical, none of which we find persuasive. *See* Pet. Reply 2–8. For example, Petitioner argues the claimed range lacks criticality because Figure 8 does not reflect defect rates in devices that are commensurate in scope with the claims. *Id.* at 3–4. We disagree. Although the Federal Circuit has discounted alleged critical results when they apply to only a

single value within a claimed range, here, Figure 8 demonstrates that the desirable feature (balancing cell size and short circuit defect rate) applies across the entire claimed 10–40 nm range. *See E.I. DuPont*, 904 F.3d at 1012; *In re Greenfield*, 571 F.2d 1185, 1189 (CCPA 1978). Absent evidence showing some other unclaimed feature was responsible for the desired outcome, we agree with Patent Owner that “Figure 8 shows that the claimed 10–40nm range *is* commensurate with the unexpected results: below the lower bound the defect rate increases markedly, and above the upper bound miniaturization may be impacted with no corresponding improvement in defect rate.” PO Sur-reply 6.

Petitioner also asserts the unexpected results are not surprising “relative to the prior art ranges” because Figure 8 shows small defect rates for “the entire 20–200nm range in Hebert,” and miniaturization has been a well-known driving force in the semiconductor industry for the last 50 years. Pet. Reply 4–5. We disagree with this argument because it considers the two alleged benefits in isolation, whereas the asserted critical results come from balancing those features, as the ’867 patent and Patent Owner explain. *See* Ex. 1001, 11:20–32; PO Sur-reply 10. Last, we also disagree with Petitioner’s characterization of the decreased defect rate due to short circuits as solely an issue of “improvement to manufacturing,” as opposed to improving device operation or function. *See* Pet. 49–51 (citing *Ineos USA LLC v. Berry Plastics Corp.*, 783 F.3d 865, 870–71 (Fed. Cir. 2015)); Pet. Reply 5–6. Instead, we agree with Patent Owner that short circuits relate directly to device function because “a product may pass testing and yet ‘fail after the product left the factory.’” PO Sur-reply 11 (quoting Ex. 1010, 86:17–21).

For these reasons, we agree with Patent Owner that the claimed 10–40 nm stair step is critical, and therefore would not have been obvious in light of Hebert. Thus, we find Petitioner has not proven by a preponderance of the evidence that claims 8 and 9 would have been obvious over Inagawa and Hebert.

B. ANTICIPATION AND OBVIOUSNESS BASED ON FUJII

Petitioner contends Fujii anticipates or, in the alternative, renders obvious claims 8 and 9. Pet. 24–56. For the reasons explained below, we find that Petitioner has not made an adequate showing that Fujii anticipates or renders obvious claims 8 and 9.

As noted above, claim 8 requires “a dimension of a part in which the upper surface of said source layer and said conductive portion are in contact with each other is 10 nm or more and 40 nm or less.” Ex. 1001, 14:13–16. Petitioner asserts that Fujii teaches the claimed 10–40 nm range because it discloses three specific example widths: 0 nm, 100 nm, and 150 nm. Pet. 46–47. In addition, according to Petitioner, because Fujii elsewhere discloses ledge widths “greater than” 0 nm and that “values smaller than or larger than the respective specified values may also be within the scope of the invention,” *id.* at 47 (quoting Ex. 1005, 3:26–29, 16:11–12), a skilled artisan “would understand that Fujii teaches that the length of the contact area can be in the range of 0–150 nm.” *Id.* at 47. Thus, Petitioner asserts, “the claimed range of 10–40 nm is a species of the 0–150 nm genus disclosed by Fujii.” *Id.* at 48.

Petitioner notes further that “[t]he Federal Circuit has recognized that prior art discloses such a range in an analogous situation.” *Id.* at 47 (citing *Iron Grip Barbell Co. v. USA Sports, Inc.*, 392 F.3d 1317, 1320–21 (Fed.

Cir. 2004) (“*Iron Grip*”). In *Iron Grip*, the claimed invention was a plate with 3 handles, and the prior art disclosed a plate with 1, 2, and 4 handles. *Iron Grip*, 392 F.3d at 1321–22. The Federal Circuit reasoned that because the prior art disclosed a range of 1–4 handles, the claimed invention with 3 handles was presumptively obvious. *Id.* According to the court, a “narrower range may be obvious” when “the difference in range or value is minor.” *Id.*

We find Fujii’s disclosure insufficient for either anticipation or obviousness. First, we agree with Patent Owner that Fujii does not disclose a range that overlaps the claimed range. All of the discrete values Petitioner cites (i.e., 0, 100, and 150 nm) fall outside of the claimed range. *See* Pet. 46. Fujii’s general statement that smaller/larger values than those specified “may” be within the scope of the invention is not specific enough to translate the discrete values into a range of values. As Patent Owner notes, were that the case, “*all* potential values would fall within the range of ‘values smaller than or larger than the respective specified values,’ meaning the disclosure of any value would disclose an unbounded range.” PO Resp. 30. For the same reason, Fujii’s recognition that the step can be greater than zero, *see* Ex. 1005, 16:11–12, is not specific enough to disclose what would otherwise be an unbound range.

Moreover, even if Fujii did disclose a range, we agree with Patent Owner that this case is distinguishable from *Iron Grip*. *See* PO Resp. 30–33. Unlike in *Iron Grip*, where the claimed value (three handles) was relatively close to what was in the prior art (one, two, and four handles), here, as Patent Owner notes, “the difference between the first disclosed value in Fujii (0 nm) and the third disclosed value (150 nm) is 500% larger than the

claimed 30 nm range.” *Id.* at 30. We agree with Patent Owner that “[t]his is not a ‘minor’ difference in range, as was the case in *Iron Grip*.” *Id.*

This case is also distinguishable from *Iron Grip* because, as the court recognized, a broader range disclosure will not render obvious a narrower range when “there are new and unexpected results relative to the prior art.” *Iron Grip*, 392 F.3d at 1322. We agree with Patent Owner that the claimed 10–40 nm range yields new and unexpected results because, as explained above, it critically allows for small cell size while still maintaining the desired low short circuit defect rate. PO Resp. 31–38; *see* Ex. 1001, 11:20–32, Fig. 8. Petitioner does not dispute that the prior art “did not teach any connection between a defect rate and ledge size,” much less the claimed sweet spot that balances short-circuit defect rate and small cell size. *See* Tr. 16:15–18.

Given the deficiencies outlined above, we find that Petitioner has not shown sufficiently that claims 8 or 9 are either anticipated or obvious over Fujii.

V. CONCLUSION

For the foregoing reasons, we determine Petitioner has not demonstrated by a preponderance of the evidence that claims 8 and 9 of the ’867 patent are unpatentable. Our conclusion is summarized in the following table.

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
8, 9	102	Fujii		8, 9
8, 9	103	Fujii		8, 9

8, 9	103	Inagawa, Hebert		8, 9
Overall Outcome				8, 9

VI. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner has not shown claims 8 and 9 of the '867 are unpatentable;
and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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