

Oral Hearing: Petitioner's Demonstrative Exhibits

IPR2024-00093

Patent No. 7,629,634

Inergy Technology, Inc. v. Force Mos Technology Co., Ltd.

February 21, 2025

Demonstrative Only - Not Evidence

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INSTITUTED GROUNDS

Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1	1, 2, 6	102(b) ²	Hirler ³
2	3–5, 7–9	103(a)	Hirler, Kobayashi ⁴
3	1, 2	102(b)	Shiraishi ⁵
4	1–9	103(a)	Kobayashi, Shiraishi ⁶

Paper 13, Institution Decision, at 6

CLAIM CONSTRUCTION

Paper 1, Petition, at 15-19

Paper 27, Reply, at 1-9

Demonstrative Only – Not Evidence



CLAIM CONSTRUCTION – “LATERAL CONTACT LAYER”

a plurality of source contact trenches formed on the top of said interlayer oxide film extending downwardly through said source layer to a portion of said base layer; wherein the sidewalls of said trenches in said base layer are covered by **the lateral contact layer**; wherein the bottom base of said trenches in said base layer are covered by the base contact layer.

Ex. 1001 at 6:11-17

CLAIM CONSTRUCTION – “LATERAL CONTACT LAYER”

In its Institution Decision, the Board correctly rejected Patent Owner’s proposed construction for the phrase “lateral contact layer” for reading limitations into the claim from the specification. Paper 13 at 8-13. Patent Owner’s Response, however, ignores the Board’s guidance and attempts once again to improperly import the dopant implantation and concentration features into the claim.

Paper 27, Reply, at 1

CLAIM CONSTRUCTION – “LATERAL CONTACT LAYER”

1. **Express construction is not required**
2. Dopant concentration is not required
3. Dopant implantation is not required

CLAIM CONSTRUCTION – “LATERAL CONTACT LAYER”

First, Petitioner’s application of “lateral contact layer” is neither vague nor inconsistent. Paper 25 at 10. Petitioner’s application of the term merely reflects the fact that the phrase is broad on its face and covers both Hirler’s “body amplification zone” and of Shiraishi’s “layer 14.”

Paper 27, Reply, at 2

CLAIM CONSTRUCTION – “LATERAL CONTACT LAYER”

Second, Patent Owner incorrectly argues that “lateral contact layer” is a “coined term” the meaning of which can only be determined from the specification.

Paper 27, Reply, at 2

CLAIM CONSTRUCTION – “LATERAL CONTACT LAYER”



Nor do we see how the specification provides a controlling definition for the term “lateral contact layer.” A special definition must be set forth in the specification with reasonable clarity, deliberateness, and precision. *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1249 (Fed. Cir. 1998).

Paper 13, Institution Decision, at 10

CLAIM CONSTRUCTION – “LATERAL CONTACT LAYER”

As the Federal Circuit has explained, it is appropriate to construe a term by looking to the meaning of the individual words in the context of the patent, not merely what is known in the art. *See Malvern*, 85 F.4th at 1374-75; *see also Littelfuse, Inc. v. Mersen USA EP Corp.*, 29 F.4th 1376, 1381 (Fed. Cir. 2022) (“[T]he district court was correct in seeking to give meaning to the term ‘fastening stem’ by looking to the meaning of the words ‘fastening’ and ‘stem’ as used in the patent.”).

Paper 27, Reply, at 3

CLAIM CONSTRUCTION – “LATERAL CONTACT LAYER”

Here, Patent Owner does not argue that “lateral contact layer” lacks meaning when read as the words of the claim as used in the patent.

Paper 27, Reply, at 3

CLAIM CONSTRUCTION – “LATERAL CONTACT LAYER”



We find especially significant, on the point of ambiguity, that Patent Owner admits that the plain and ordinary meaning of “‘layer’ on its own is quite broad, meaning ‘a region having unique electrical properties (e.g., n layer).’” *Id.* at 5. Against that backdrop, we are hard pressed to discern any ambiguity in the meaning of the term “lateral contact layer,” which plainly indicates a lateral contact region having unique electrical properties.

Paper 13, Institution Decision, at 10

CLAIM CONSTRUCTION – “LATERAL CONTACT LAYER”

Third, Patent Owner incorrectly argues that an express construction is needed to distinguish the “lateral contact layer” from other regions and layers because “claim 1 provides no guidance what those differences are.”

Paper 27, Reply, at 4

CLAIM CONSTRUCTION – “LATERAL CONTACT LAYER”



⁷ The definitional and notice function of a patent claim is so central to patent law that, when a claim’s meaning is contested and the claim drafter can amend the claim to state expressly what the drafter contends it says implicitly, the burden is properly on the drafter to amend rather than to shift the burden onto anyone else — a patent examiner, a competitor, the public generally, or the courts — to guess about the claim’s meaning. *In re Morris*, 127 F.3d 1048, 1054, 1057 (Fed. Cir. 1997); *White*, 119 U.S. at 51–52.

Paper 13, Institution Decision, at 11 n. 7

CLAIM CONSTRUCTION – “LATERAL CONTACT LAYER”

1. Express construction is not required
- 2. Dopant concentration is not required**
3. Dopant implantation is not required

CLAIM CONSTRUCTION – “LATERAL CONTACT LAYER”

Simply put, the examples of P* and N* doping from the specification remain insufficient to provide definitional language or serve as a disclaimer of claim scope. Indeed, as the Board correctly noted, “[c]laims 2 and 6 show that the patentee knew how to use words in a claim to impose a dopant concentration limitation on the lateral contact layer, but included no such language in claim 1.” Paper 13 at 11.

Paper 27, Reply, at 5

CLAIM CONSTRUCTION – “LATERAL CONTACT LAYER”

In its Institution Decision, the Board also found Patent Owner’s construction of “lateral contact layer” violates the principle of claim differentiation by rendering dependent claims 2 and 6 redundant. Paper 13 at 11-12. Patent Owner’s Response fails to show that the Board erred in its finding. Paper 25 at 17-19.

Paper 27, Reply, at 5

CLAIM CONSTRUCTION – “LATERAL CONTACT LAYER”

1. Express construction is not required
2. Dopant concentration is not required
- 3. Dopant implantation is not required**

CLAIM CONSTRUCTION – “LATERAL CONTACT LAYER”

In its Institution Decision, the Board correctly noted that “[c]onstruing ‘lateral contact layer’ to import from the specification the dopant implantation limitation advanced by Patent Owner would blur the distinction between claim and disclosure, and violate the well-settled principle that ‘the name of the game is the claim.’” Paper 13 at 13 (citing at *In re Hiniker Co.*, 150 F.3d 1362, 1369 (Fed. Cir. 1998)).

Paper 27, Reply, at 6-7

CLAIM CONSTRUCTION – “LATERAL CONTACT LAYER”

On the contrary, Petitioner’s expert Dr. Neikirk acknowledged at his deposition that a P or N layer may be formed by different doping processes, such as “doping dot by diffusion, doping by ion implantation, doping during material growth are just specific.” Ex. 1018 (Neikirk Tr.) at 32:12-33:6. And in particular, Dr. Neikirk admitted that ion implantation “is an example of a process for creating this lateral contact layer in terms of adding dopants,” and that the term “lateral contact layer” is “not limited to a specific process.” *Id.* at 34:13-35:19.

Paper 27, Reply, at 7

CLAIM CONSTRUCTION – “SIDEWALLS OF SAID TRENCHES IN SAID BASE LAYER”

a plurality of source contact trenches formed on the top of said interlayer oxide film extending downwardly through said source layer to a portion of said base layer; wherein the sidewalls of said trenches in said base layer are covered by the lateral contact layer; wherein the bottom base of said trenches in said base layer are covered by the base contact layer.

Ex. 1001 at 6:11-17

CLAIM CONSTRUCTION – “SIDEWALLS OF SAID TRENCHES IN SAID BASE LAYER”

The Board need not construe “the sidewalls of said trenches in said base layer” because any dispute is not one of claim scope, but instead about how the term is applied to the prior art.

Paper 27, Reply, at 9

CLAIM CONSTRUCTION – “SIDEWALLS OF SAID TRENCHES IN SAID BASE LAYER”

Patent Owner argues that an express construction is necessary because “the structure that Petitioner identifies in Shiraishi as the “lateral contact layer” does not cover the *entire* sidewalls of the source contact trenches in the base layer.” *Id.* However, in its Preliminary Response, Patent Owner argued against an express construction because it did not dispute that the structure identified by Petitioner as the “lateral contact layer” in Shiraishi covers the entire sidewalls of the source contact trenches in the base layer:

Paper 27, Reply, at 8-9

UNPATENTABILITY: GROUND 1

Hirler Anticipates Claims 1, 2 and 6

Paper 1, Petition, at 21-29

Paper 27, Reply, at 9-15



Demonstrative Only – Not Evidence



GROUND 1 – ANTICIPATION

Hirler (Claims 1, 2 and 6)

A. “Epitaxial Layer Corresponding To Said Drain Region” (Claim 1)

Paper 1, Petition at 23-24; Paper 27, Reply, at 9-11

B. “The Sidewalls of Said Trenches In Said Base Layer Are Covered By The Lateral Contact Layer” (Claim 1)

Paper 1, Petition at 26; Paper 27, Reply, at 11-15

C. Patent Owner only disputes that Hirler anticipates claims 2 and 6 for the same reasons as claim 1

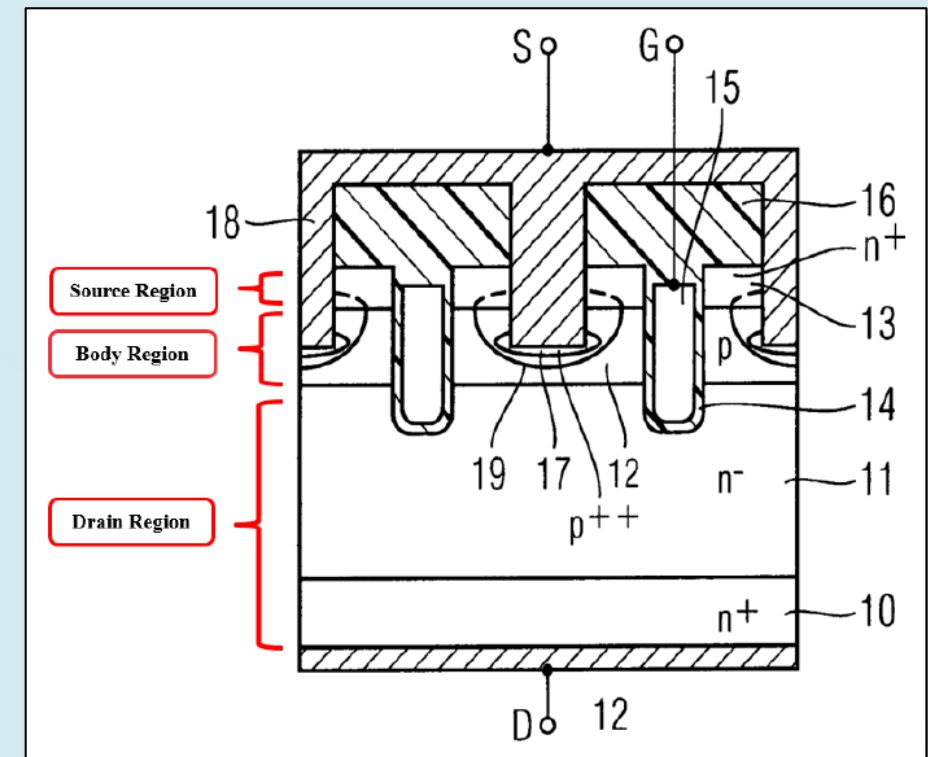
Paper 27, Reply, at 15

GROUND 1 – ANTICIPATION

“Epitaxial Layer Corresponding To Said Drain Region”

As shown in Hirler’s Figure 2F (copied below with color annotations), the disclosed MOSFET has a drain region, a body region, and a source region. Ex. 1005 at Fig. 2F, Fig. 1A; Ex. 1006 at [0018]. Moreover, the drain region is oriented at the bottom of the figure with a silicon substrate (10), an epitaxial layer (11), a body layer (12), and a source layer (13). Ex. 1005 at Fig. 2F, Fig. 1A; Ex. 1006 at [0018]; Ex. 1003 at ¶ 66.

Paper 1, Petition, at 23



Paper 1, Petition, at 24

GROUND 1 – ANTICIPATION

“Epitaxial Layer Corresponding To Said Drain Region”

First, there is no requirement that the prior art use the same words as the claim language to anticipate. The fact that Hirler does not use the word “epitaxial” does not mean that the “n- drift zone 11” is not an epitaxial layer.

Paper 27, Reply, at 10

GROUND 1 – ANTICIPATION

“Epitaxial Layer Corresponding To Said Drain Region”

Second, Patent Owner is wrong that Hirler does not contain any description of how the “n- drift zone 11” was created. Claim 1 of Hirler plainly describes that the “n- drift zone 11” is “successively provided” along with several other zones on a semiconductor substrate:

Paper 27, Reply, at 10; Paper 1, Petition, at 28

GROUND 1 – ANTICIPATION

“Epitaxial Layer Corresponding To Said Drain Region”

Fabrication of the “n- drift zone 11” in this manner falls squarely within Patent Owner’s definition of “epitaxy” as “an ‘ordered deposition’; a process by which thin layer of single crystal material is deposited on single-crystal substrate.” Ex. 2012 ¶109 (citations omitted).

Paper 27, Reply, at 10-11; Paper 1, Petition, at 28

GROUND 1 – ANTICIPATION

“Epitaxial Layer Corresponding To Said Drain Region”

Patent Owner contends that there are other, non-epitaxial, ways the n-drift zone 11 could be created, including by “counter-doping” and “back-side doping.” Paper 25 at 25. However, counter-doping and back-side doping are irrelevant here.

Paper 27, Reply, at 11

GROUND 1 – ANTICIPATION

“The Sidewalls Are ... Covered By The Lateral Contact Layer” – Board’s Preliminary Construction



Patent Owner contends that the phrase “lateral contact layer” in claim 1 requires “a dopant concentration between P and P+ (‘P* doping’) for an N-channel MOSFET or between N and N+ (‘N* doping’) in a P-channel MOSFET.” Prelim. Resp. 8. Patent Owner relies on opinions of Petitioner’s witness, Dr. Lui, elicited in the District Court action. *Id.* Those extrinsic opinions are less probative than the intrinsic words of claim 1, which convey nothing about dopant concentration. *Phillips*, 415 F.3d at 1312–19 (extrinsic evidence is less significant than intrinsic evidence to claim construction).

Paper 13, Institution Decision, at 9

GROUND 1 – ANTICIPATION

“The Sidewalls Are ... Covered By The Lateral Contact Layer” – Board’s Preliminary Construction



We next consider Patent Owner’s view that “the lateral contact layer” of claim 1 requires “a region of dopant which is implanted into sidewalls of the source contact trenches.” Prelim. Resp. 8. We discern no words in claim 1, and the parties identify none, that even remotely touch upon a requirement related to dopant implantation. *See id.* at 7–8; Ex. 1001, 5:37–6:17 (claim 1).

Paper 13, Institution Decision, at 12

GROUND 1 – ANTICIPATION

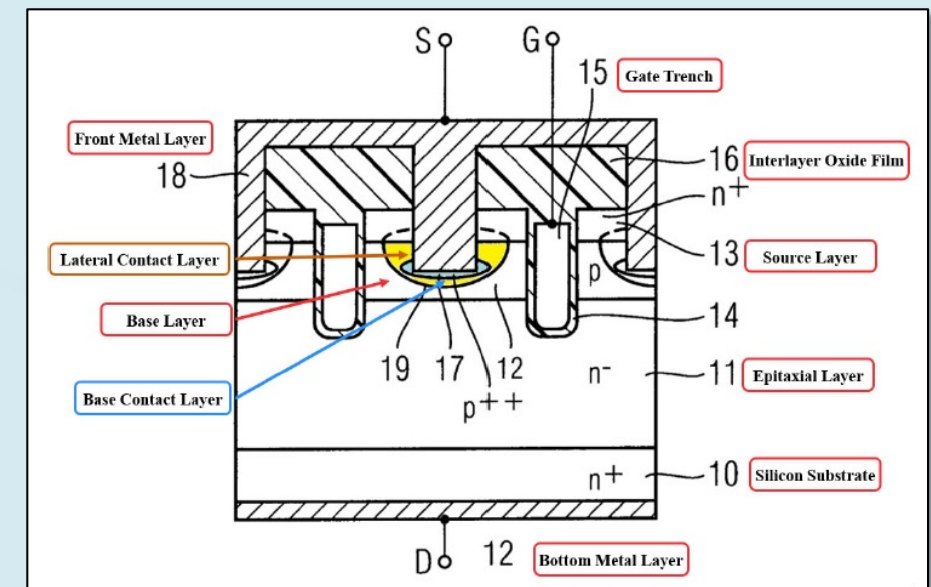
“The Sidewalls Are ... Covered By The Lateral Contact Layer” – Board’s Preliminary Construction

Specifically, Hirler discloses

“body amplification zones” (19) that are implanted along the sidewalls of the contact trench in the base layer. Ex. 1005 at Fig. 2F; Ex. 1006 at [0030], [0033].

The POSITA would understand that the “body amplification zone” or “body enhancement zone” disclosed in Hirler is the “lateral contact layer” in the ’634 Patent.

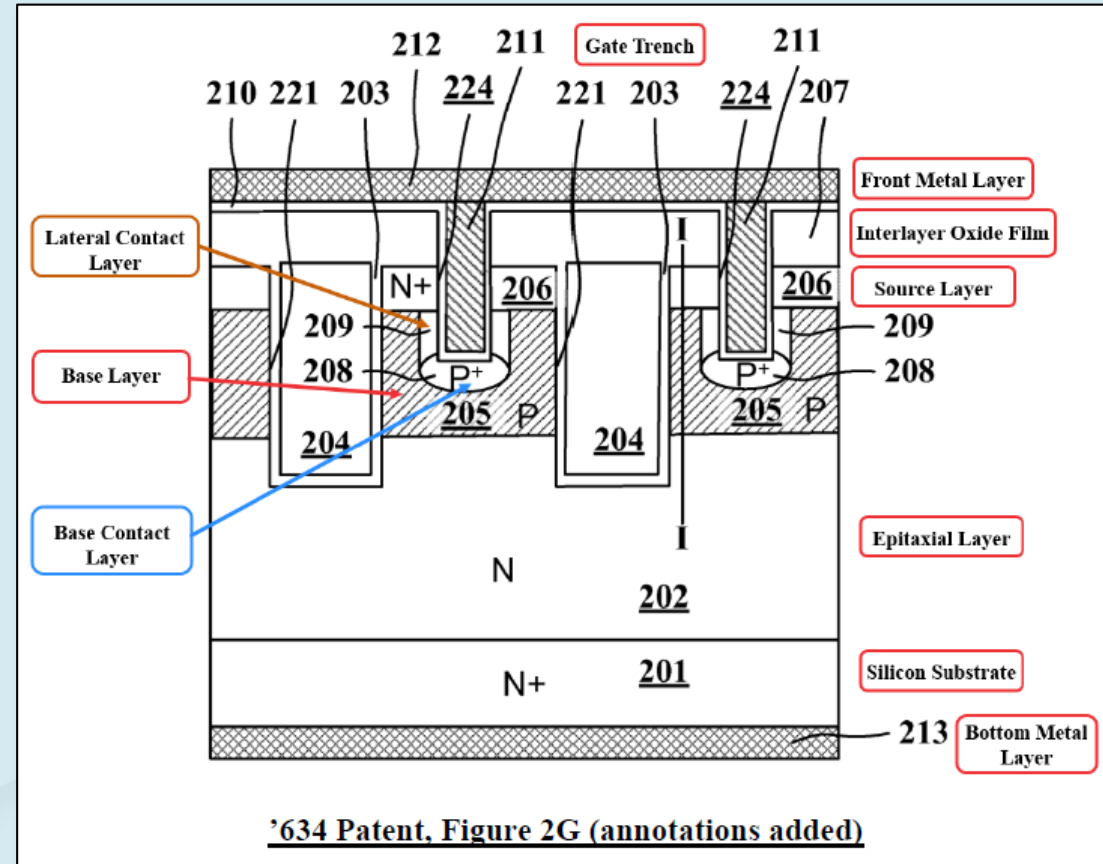
Ex. 1003 at ¶ 73; Paper 1, Petition, at 26



Ex. 1003 at ¶ 63; Paper 1, Petition, at 22

*“The Sidewalls Are ... Covered By The Lateral Contact Layer” –
Board’s Preliminary Construction*

“The Sidewalls Are ... Covered By The Lateral Contact Layer” – Board’s Preliminary Construction



GROUND 1 – ANTICIPATION

“The Sidewalls Are ... Covered By The Lateral Contact Layer” – Rejected Construction (dopant implantation)

First, Patent Owner contends that Hirler fails to disclose a “lateral contact layer” under its proposed construction because “Hirler’s body amplification zone is implanted into the semiconductor material *before* the source contact trench’s sidewalls exist.” Paper 25 at 28. In any case, Patent Owner’s theory fails because it improperly imports a method step (*i.e.*, dopant implantation) into the “lateral contact layer” of apparatus claim 1. *See Cont’l Circuits LLC v. Intel Corp.*, 915 F.3d 788, 799 (Fed. Cir. 2019)

Paper 27, Reply, at 12

GROUND 1 – ANTICIPATION

“The Sidewalls Are ... Covered By The Lateral Contact Layer” – Rejected Construction (dopant concentration)

Second, Patent Owner argues that Hirler fails to disclose a “lateral contact layer” under its proposed construction because Hirler’s body amplification zone has P+ doping rather than P* doping. Paper 25 at 30-31.

Paper 27, Reply, at 13

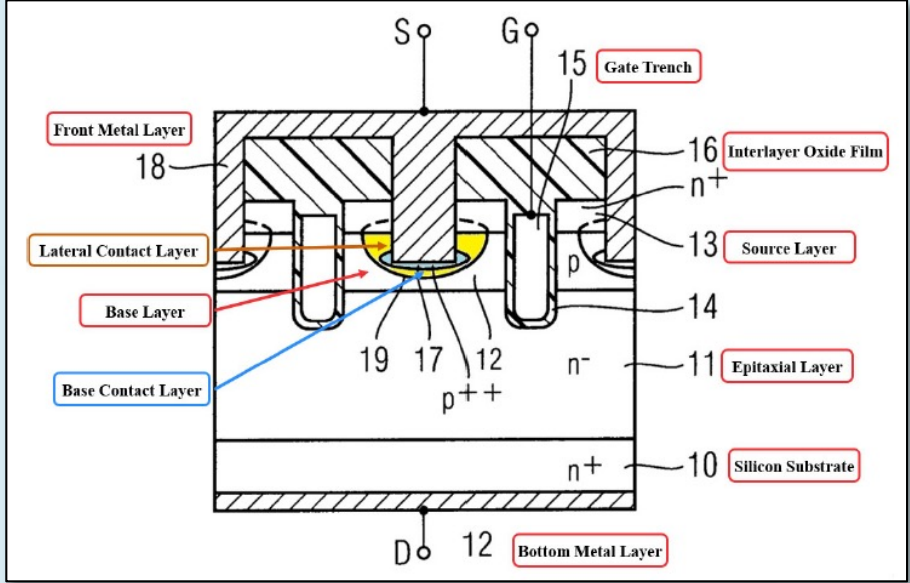
Hirler’s disclosure of the body amplification zone (19) having a P+ doping concentration between P and P++ directly corresponds to the “lateral contact layer” having a P* dopant concentration between P and P+. As Dr. Liu testified, P* is not a term of art, but rather simply denotes a relative doping concentration between the doping concentration of a base contact layer and the doping concentration of a base layer. Ex. 2014, 16:8-16.

Paper 27, Reply, at 13

*“The Sidewalls Are ... Covered By The Lateral Contact Layer” –
Rejected Construction (covering the “entire” sidewalls)*

Third, Patent Owner argues that Hirler fails, under its proposed construction, to disclose that the lateral contact layer cover the “entire” sidewalls of the source contact trench in the base layer. Paper 25 at 31. Patent Owner is wrong. As Hirler showed in Fig. 2F, the body amplification zone (19) corresponding to the “lateral contact layer” covers the entire sidewalls of the source contact trench in the p-body zone areas (12) corresponding to the “base layer.” Ex. 1003 at ¶63.

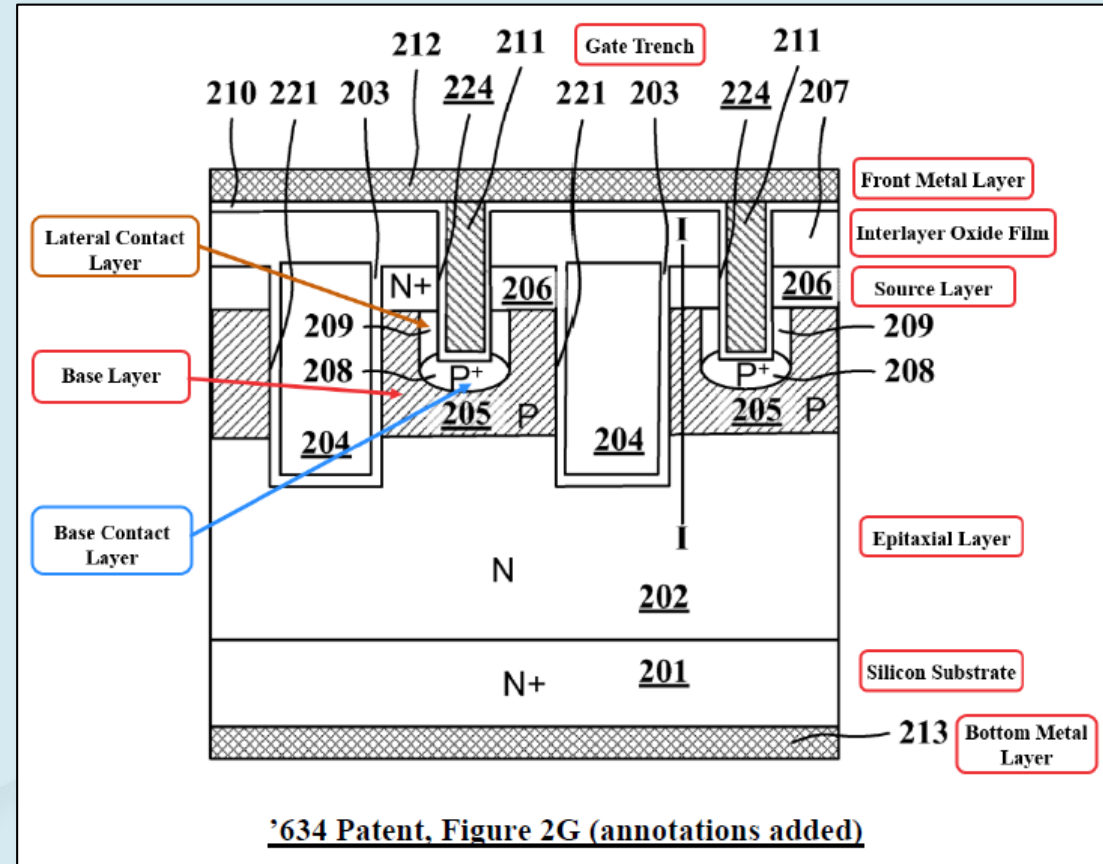
Paper 27, Reply, at 14



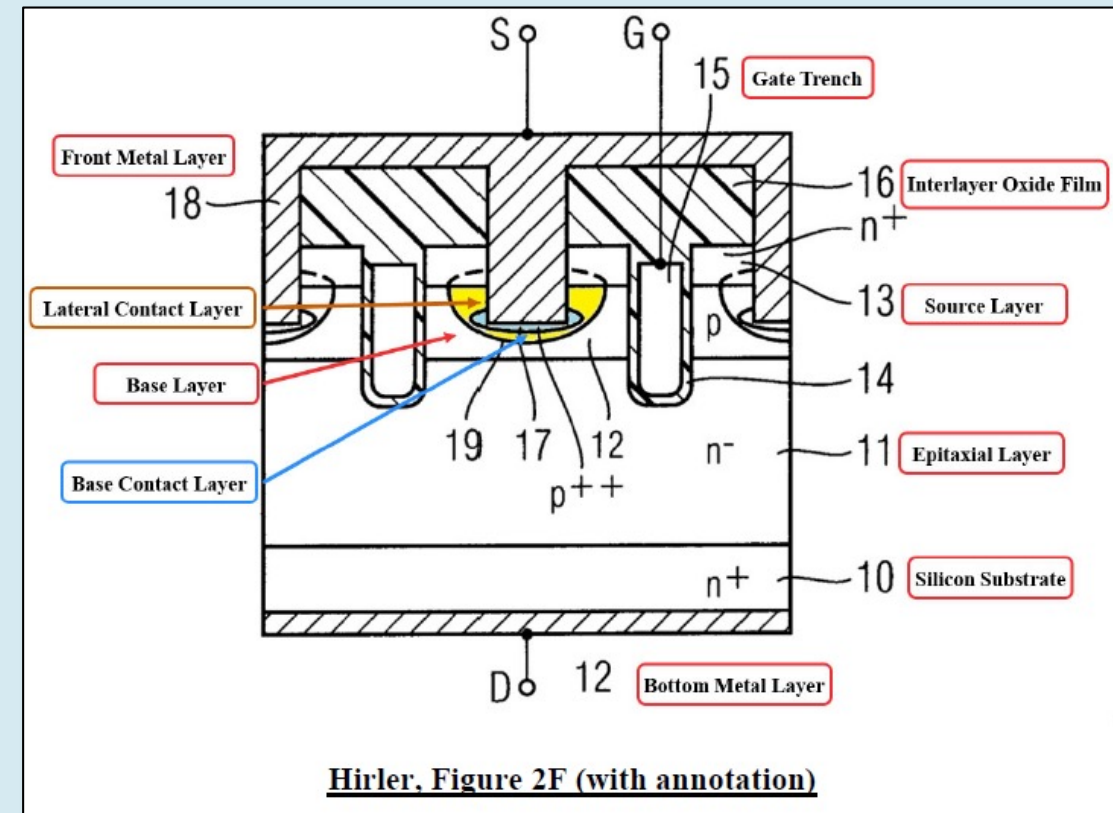
Paper 27, Reply, at 14

GROUND 1 – ANTICIPATION

“The Sidewalls Are ... Covered By The Lateral Contact Layer” – Board’s Preliminary Construction



Ex. 1003 at ¶ 29; Paper 1, Petition, at 8



Ex. 1003 at ¶ 63; Paper 1, Petition, at 22

UNPATENTABILITY: GROUND 2

Hirler in view of Kobayashi and the Knowledge of a POSITA Render Obvious Claims 3-5 and 7-9

Paper 1, Petition, at 29-36

Paper 27, Reply, at 15-16



Demonstrative Only – Not Evidence



GROUND 2 – OBVIOUSNESS

Hirler in view of Kobayashi and Knowledge of POSITA (Claims 3-5 and 7-9)

A. Combination of Hirler and Kobayashi discloses all elements of Claims 3-5 and 7-9

Ex. 1003 at ¶¶ 81-87; Paper 1, Petition, at 29-32

B. Obvious to Combine Hirler, Kobayashi and Knowledge of POSITA

Ex. 1003 at ¶¶ 88-94; Paper 1, Petition, at 32-36

GROUND 2 – OBVIOUSNESS

Obvious to Combine Hirler, Kobayashi and Knowledge of POSITA

Patent Owner challenges the combination of Hirler in view of Kobayashi and the knowledge of a POSITA on the basis that Hirler allegedly fails to disclose each limitation of claim 1. Paper 25 at 36-37. This argument fails for the same reasons discussed above with respect to claim 1 in Ground 1.

Paper 27, Reply, at 15

GROUND 2 – OBVIOUSNESS

Obvious to Combine Hirler, Kobayashi and Knowledge of POSITA

Hirler discloses that the source contact trenches can be “filled with a conductive stopper”—*i.e.*, **contact metal plugs**. Ex. 1006 at [0023]. The use of a barrier metal layer is generally known to the POSITA. Moreover, Kobayashi discloses the use of **a barrier metal layer** deposited in the contact trenches and atop the interlayer oxide layer. Ex. 1008 at Fig. 6A, [0052]-[0053], [0062].

Ex. 1003 at ¶ 81; Paper 1, Petition, at 29

GROUND 2 – OBVIOUSNESS

Obvious to Combine Hirler, Kobayashi and Knowledge of POSITA

In general, a POSITA would know that the use of a barrier metal layer, made of materials such as Ti and TiN, would help to promote the adhesion of the tungsten contact plug expressly taught in Hirler to the contact area. Ti and TiN also serve as a barrier layer to prevent unwanted elements, such as fluorine from the deposition process of W, seeping into the underlying silicon surface, which would degrade the performance of the transistor. Thus, the POSITA would be motivated to apply a known solution (the barrier layer) to a known problem (unwanted seeping of fluorine into the silicon surface) to yield predictable results. Ex. 1003 at ¶¶ 90-93.

Paper 1, Petition, at 33; Ex. 1003 at ¶¶ 90-93

UNPATENTABILITY: GROUND 3

Shiraishi Anticipates Claims 1 and 2

Paper 1, Petition, at 37-42

Paper 27, Reply, at 16-22



Demonstrative Only – Not Evidence



GROUND 3 – ANTICIPATION

Shiraishi (Claims 1 and 2)

A. “A Source Layer Corresponding To Said Source Region Disposed On The Top Of Said Base Layer” (Claim 1)

Paper 1, Petition at 37-38; Paper 27, Reply, at 16-18

B. “The Sidewalls of Said Trenches In Said Base Layer Are Covered By The Lateral Contact Layer” (Claim 1)

Paper 1, Petition at 40; Paper 27, Reply, at 18-21

C. Patent Owner only disputes that Shiraishi anticipates claim 2 for the same reasons as claim 1

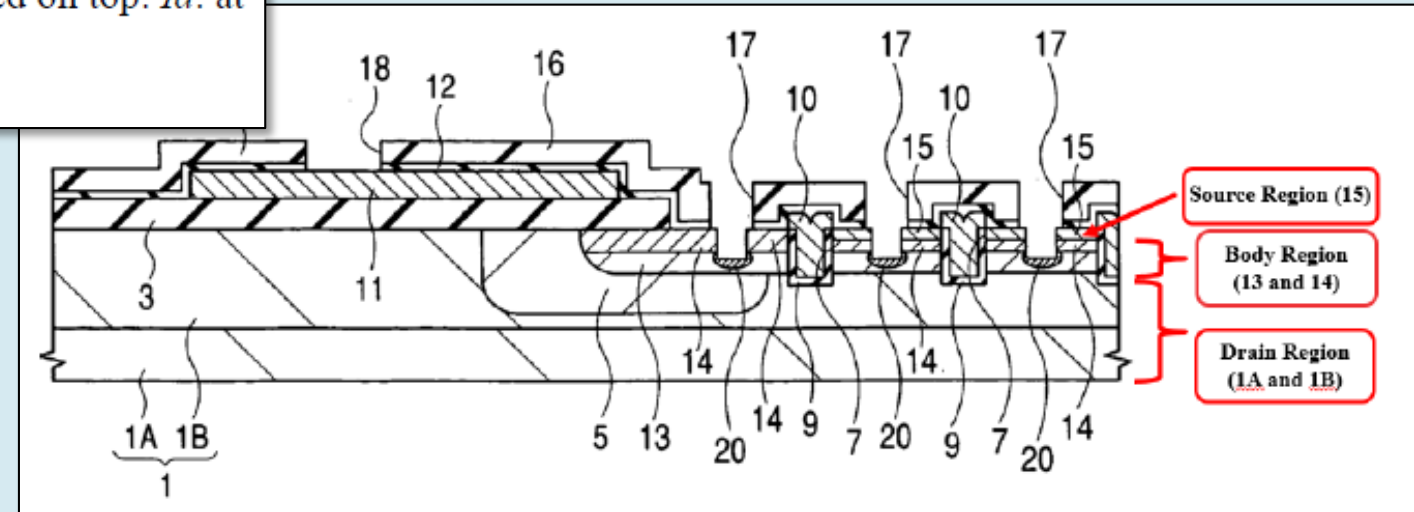
Paper 27, Reply, at 22

“A Source Layer ... Disposed On The Top Of Said Base Layer”

98. As shown in Shiraishi's Figure 8 (copied below with color annotations), the disclosed MISFET has a drain region, a body region, and a source region. Ex. 1009 at Fig. 8; Fig. 35, [0012], [0067], [0072], [00073].

drain region is oriented at the bottom of the figure with a silicon substrate (1A), an epitaxial layer (1B), a body layer (13), and a source layer (15) layered on top. *Id.* at Fig. 8, Fig. 35, [0067], Claim 22.

Ex. 1003 at ¶ 98; Paper 1, Petition, at 37-38



Ex. 1003 at ¶ 98; Paper 1, Petition, at 38

GROUND 3 – ANTICIPATION

“A Source Layer ... Disposed On The Top Of Said Base Layer”

The POSITA

would understand that the additional semiconductor layer (14) is part of the body layer (13 and 14). Ex. 1009 at [0073] (“the p-type semiconductor region 14 inside the p-type semiconductor region 13”), [0092] (“the p-type semiconductor region 14 may be implemented in the p-type semiconductor region 13”). A body layer is defined by the layers with opposite conductivity to the source and drain regions.

Ex. 1003 at ¶ 106

GROUND 3 – ANTICIPATION

“A Source Layer ... Disposed On The Top Of Said Base Layer”

More specifically, Shiraishi describes that “the p-type semiconductor region 13 may serve as a channel layer for the respective power MISFETs” and “the localized formation of the p- type semiconductor region 14 may be implemented in the p-type semiconductor region 13.” Paper 1 at 38; Ex. 1009 at [0072] and [0092].

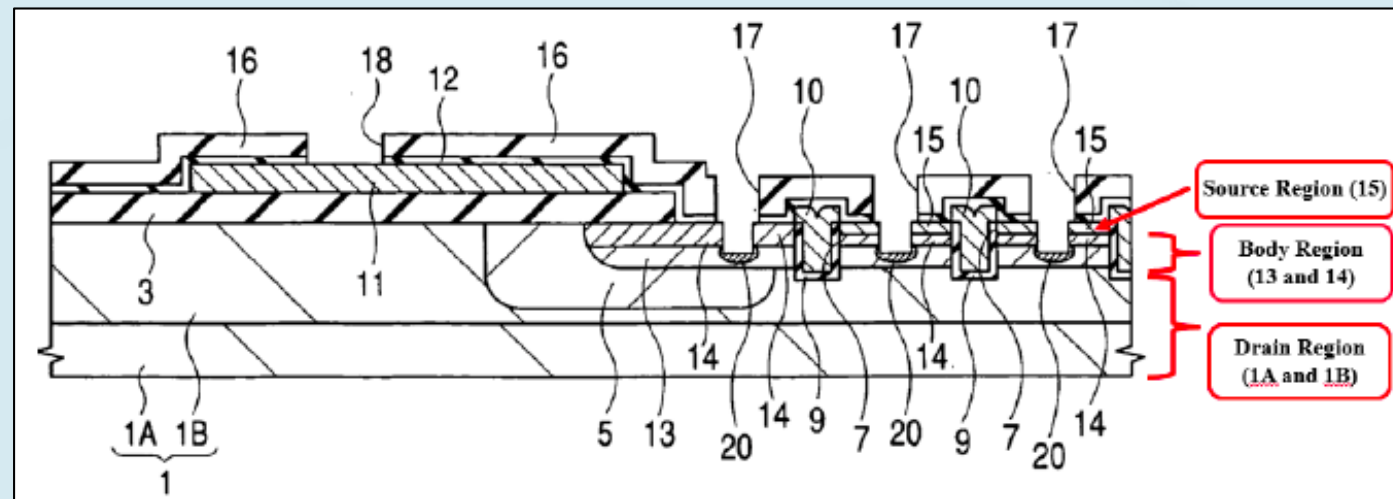
Paper 27, Reply, at 17

GROUND 3 – ANTICIPATION

“A Source Layer ... Disposed On The Top Of Said Base Layer”

Shiraishi further discloses **region 15**, which forms a source layer corresponding to a source region, **disposed on the top of region 14**, which is part of the **region 13** that forms the base layer corresponding to the body region.

Paper 27, Reply, at 17



GROUND 3 – ANTICIPATION

“The Sidewalls Are ... Covered By The Lateral Contact Layer” – Board’s Preliminary Construction



Patent Owner contends that the phrase “lateral contact layer” in claim 1 requires “a dopant concentration between P and P+ (‘P* doping’) for an N-channel MOSFET or between N and N+ (‘N* doping’) in a P-channel MOSFET.” Prelim. Resp. 8. Patent Owner relies on opinions of Petitioner’s witness, Dr. Lui, elicited in the District Court action. *Id.* Those extrinsic opinions are less probative than the intrinsic words of claim 1, which convey nothing about dopant concentration. *Phillips*, 415 F.3d at 1312–19 (extrinsic evidence is less significant than intrinsic evidence to claim construction).

Paper 13, Institution Decision, at 9

GROUND 3 – ANTICIPATION

“The Sidewalls Are ... Covered By The Lateral Contact Layer” – Board’s Preliminary Construction



We next consider Patent Owner’s view that “the lateral contact layer” of claim 1 requires “a region of dopant which is implanted into sidewalls of the source contact trenches.” Prelim. Resp. 8. We discern no words in claim 1, and the parties identify none, that even remotely touch upon a requirement related to dopant implantation. *See id.* at 7–8; Ex. 1001, 5:37–6:17 (claim 1).

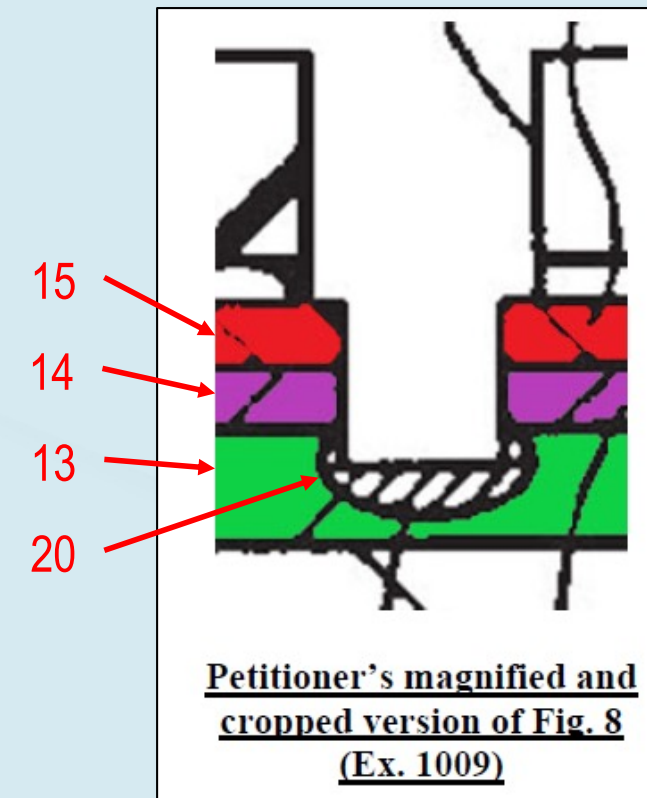
Paper 13, Institution Decision, at 12

GROUND 3 – ANTICIPATION

“The Sidewalls Are ... Covered By The Lateral Contact Layer” – Board’s Preliminary Construction

Specifically, as shown in Figure 8, Shiraishi discloses an additional semiconductor layer (14) along the sidewalls of the contact trench. Ex. 1009 at Fig. 8; [0073], [0080], [0084]-[0085], [0092] (“The localized formation of the p-type semiconductor region 14 may be implemented in the p-type semiconductor region 13, as discussed herein throughout *[sic]*.”) . Shiraishi discloses and the POSITA would understand that this region acts as a lateral contact layer to prevent punch-through. Ex. 1009 at [0073].

Ex. 1003 at ¶ 107; Paper 1, Petition, at 40



Paper 27, Reply, at 19

GROUND 3 – ANTICIPATION

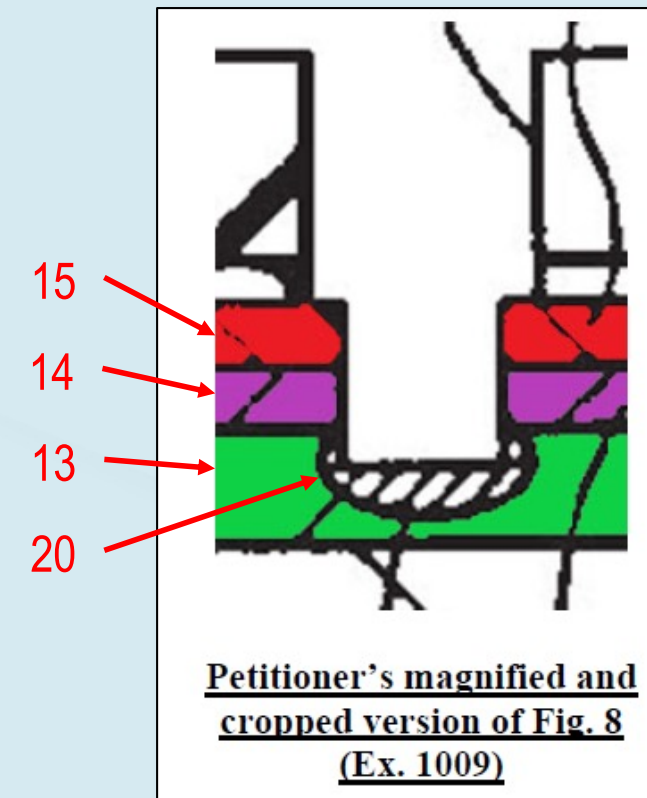
“The Sidewalls Are ... Covered By The Lateral Contact Layer” – Rejected Construction (covering the “entire” sidewalls)

First, Patent Owner argues that assuming Shiraishi’s region or layer 14 is part of the “base layer,” Shiraishi does not disclose that region 14 is a “lateral contact layer” covering the “entire” sidewalls of the source contact trench in the base layer, as required by Petitioner construction. Patent Owner is wrong.

Paper 27, Reply, at 19

A properly annotated version of Shiraishi’s Fig. 8 (reproduced on the right above) clearly shows region 14 corresponding to the “lateral contact layer” covering the entire sidewalls of the source contact trench in the base layer between the source layer 15 and the base contact layer 20.

Paper 27, Reply, at 19



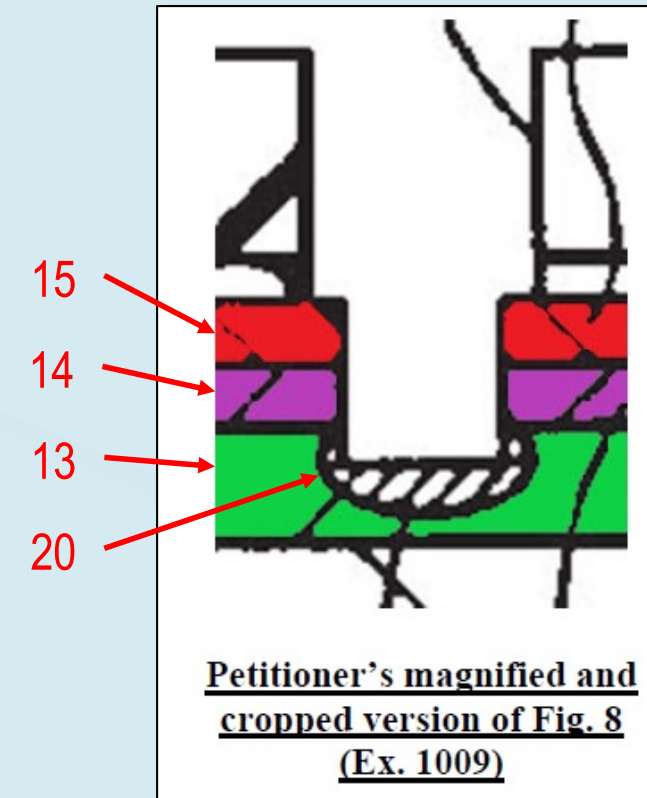
Paper 27, Reply, at 19

GROUND 3 – ANTICIPATION

*“The Sidewalls Are ... Covered By The Lateral Contact Layer” –
Rejected Construction (covering the “entire” sidewalls)*

Indeed, this part of the Shiraishi figure is very similar to the '634 Patent and its depiction of the lateral contact layer 209 covering the entire sidewalls of the trench 224 in the base layer 205 between the source layer 206 and the base contact layer 208:

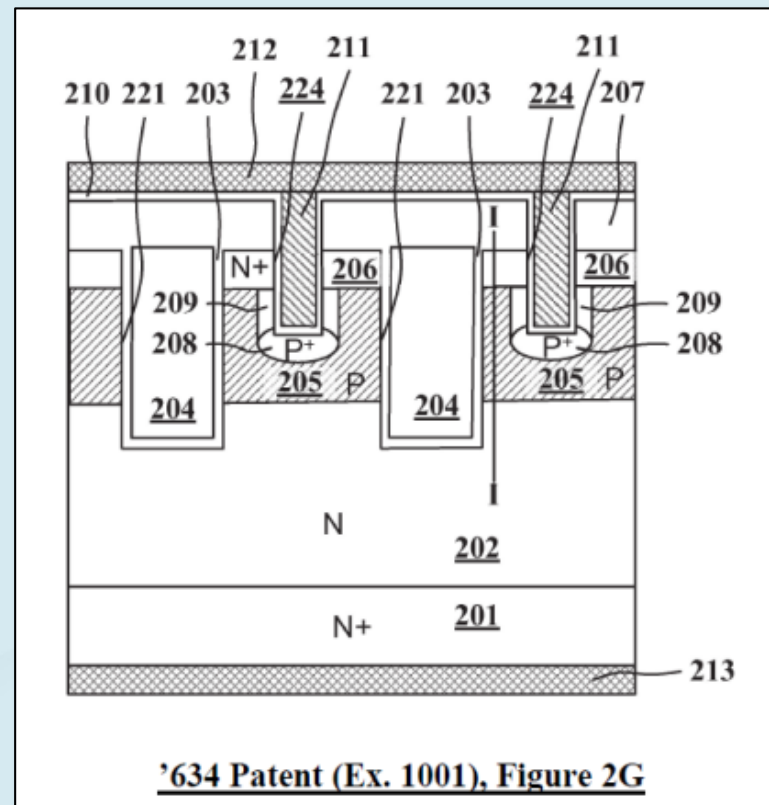
Paper 27, Reply, at 19



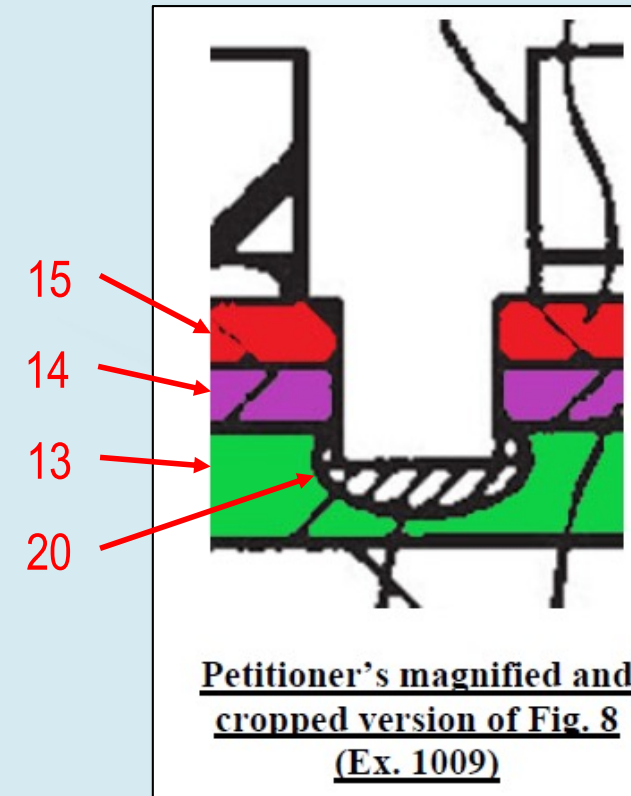
Paper 27, Reply, at 19

GROUND 3 – ANTICIPATION

*“The Sidewalls Are ... Covered By The Lateral Contact Layer” –
Rejected Construction (covering the “entire” sidewalls)*



Paper 27, Reply, at 20



Paper 27, Reply, at 19

GROUND 3 – ANTICIPATION

“The Sidewalls Are ... Covered By The Lateral Contact Layer” – Rejected Construction (dopant implantation)

Second, Patent Owner contends that Shiraishi fails to disclose a “lateral contact layer” under Patent Owner’s proposed construction requiring “a region of dopant which is implanted into sidewalls of the source contact trenches” because “Shiraishi’s layer 14 is implanted across the entire active region of the semiconductor surface *prior to* the sidewalls of a source contact trench existing.”¹ Paper 25 at 45. As with Hirler, Patent Owner’s theory fails because it improperly imports a method limitation, *i.e.*, implantation of the “lateral contact layer” must occur only after the source contact trenches are etched, into apparatus claim 1.

Paper 27, Reply, at 20

GROUND 3 – ANTICIPATION

“The Sidewalls Are ... Covered By The Lateral Contact Layer” – Rejected Construction (dopant concentration)

Patent Owner concedes that Shiraishi describes the (P-) doping concentration of the contact layer 14 is larger than the (P-) doping concentration of the body layer 13, but smaller than the (P+) doping concentration of the base contact layer 20.

Paper 25 at 48. As explained above with respect claim 1, Ground 1, Dr. Liu testified that P* is not a term of art, but rather simply denotes a relative doping concentration between the doping concentration of a base contact layer and the doping concentration of a base layer. Ex. 2014, 16:8-16.

Paper 27, Reply, at 21; Paper 25, Response, at 48

UNPATENTABILITY: GROUND 4

Shiraishi in view of Kobayashi and the Knowledge of a POSITA Render Obvious Claims 3-9

Paper 1, Petition, at 42-51

Paper 27, Reply, at 22-23



Demonstrative Only – Not Evidence



GROUND 4 – OBVIOUSNESS

Shiraishi in view of Kobayashi and Knowledge of POSITA (Claims 3-9)

A. Combination of Shiraishi and Kobayashi discloses all elements of Claims 3-9

Ex. 1003 at ¶¶ 112-124; Paper 1, Petition, at 42-46

B. Obvious to Combine Hirler, Kobayashi and Knowledge of POSITA

Ex. 1003 at ¶¶ 125-134; Paper 1, Petition, at 46-51

GROUND 4 – OBVIOUSNESS

Combination of Shiraishi, Kobayashi and Knowledge of POSITA

Shiraishi

discloses a “TiW (titanium tungsten) film serving as a barrier conductor film”

Ex. 1009 at [0076]. Kobayashi discloses the use of a plurality of contact metal plugs. Ex. 1008 at [0052], [0066], Fig. 5A, Claim 4. The use of contact metal plugs and the barrier metal layer are generally known to the POSITA.

Ex. 1003 at ¶ 112; Paper 1, Petition, at 42-43

GROUND 2 – OBVIOUSNESS

Motivation to Combine Hirler, Kobayashi and Knowledge of POSITA

In particular, the POSITA would have been motivated to combine the metal contact plug and barrier metal layer of Kobayashi with a reasonable likelihood of success to arrive at the subject matter of Claims 3-5. In addition, the POSITA would have been motivated to combine the disclosure of Kobayashi to invert the P/N types of Shiraishi to arrive at the subject matter of Claims 6-9. Ex. 1003 at ¶¶ 125-134.

Paper 1, Petition, at 46-47; Ex. 1003 at ¶¶ 125-132

UNPATENTABILITY: GROUND 5

Kobayashi in view of Shiraishi and the Knowledge of a POSITA Render Obvious Claims 1-9

Paper 1, Petition, at 52-66

Paper 27, Reply, at 23-24



Demonstrative Only – Not Evidence



GROUND 5 – OBVIOUSNESS

Kobayashi in view of Shiraishi and Knowledge of POSITA (Claims 1-9)

A. Combination of Kobayashi, Shiraishi and Knowledge of POSITA discloses all elements of Claims 1-9

Ex. 1003 at ¶¶ 135-163; Paper 1, Petition, at 52-61

B. Obvious to Combine Kobayashi, Shiraishi and Knowledge of POSITA

Ex. 1003 at ¶¶ 164-170; Paper 1, Petition, at 62-66

GROUND 4 – OBVIOUSNESS

Combination of Kobayashi, Shiraishi and Knowledge of POSITA

Patent Owner's remaining arguments for claim 1, including limitations 1[a] and 1[g], are based on the same arguments and so fail for the reasons discussed in connection with anticipation based on Shiraishi (Ground 3).

Paper 27, Reply, at 24

Similarly, Patent Owner's remaining arguments for claim 3-5 and 7-9 are based on the same arguments and so fail for the reasons discussed in connection with the combination of Shiraishi and Kobayashi (Grounds 4 and 5).

Paper 27, Reply, at 24

GROUND 2 – OBVIOUSNESS

Motivation to Combine Kobayashi, Shiraishi and Knowledge of POSITA

First, Kobayashi, Shiraishi, and the '634 Patent are analogous art that seek to solve similar problems. Kobayashi, Shiraishi, and the '634 Patent are in the same field of endeavor, *i.e.*, Vertical Power MOSFET structures, and the methods to improve the performance tradeoff in the ON-state (ON-Resistance and speed), and OFF-state (breakdown voltage). Moreover, Kobayashi, Shiraishi and the '634 Patent disclose a similar doping concentration engineering technique,

Ex. 1003 at ¶ 166; Paper 1, Petition, at 62

GROUND 2 – OBVIOUSNESS

Motivation to Combine Kobayashi, Shiraishi and Knowledge of POSITA

Second, Shiraishi expressly teaches a lateral contact layer along the entire sidewalls of the contact trench in the base layer that serves as “a punch-through stopper layer.” Ex. 1009 at Fig. 8; [0073], [0080], [0084]-[0085]. The POSITA would thus be motivated to combine the distinct lateral contact layer of Shiraishi with P doping concentration that is greater than the P-type doping concentration of the underlying base layer but less than the P-type concentration of the base contact layer with the disclosure of Kobayashi to optimize the MOSFET and prevent punch-through.

Ex. 1003 at ¶ 167; Paper 1, Petition, at 63

GROUND 2 – OBVIOUSNESS

Motivation to Combine Kobayashi, Shiraishi and Knowledge of POSITA

Third, Shiraishi expressly teaches the doping concentration profiles of the lateral contact layer and base contact layer that would prevent punch-through.

Ex 1009 at Abstract, [0073]. Thus, the POSITA would be motivated to try these doping concentration profiles, as opposed to the doping dosing as disclosed in Kobayashi, to achieve an anti-punch-through result.

Ex. 1003 at ¶ 168; Paper 1, Petition, at 63