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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

STMICROELECTRONICS, INC.
Petitioner

v.

THE TRUSTEES OF PURDUE UNIVERSITY
Patent Owner

IPR2022-00252
U.S. Patent No. 7,498,633

PETITIONER'S REQUEST FOR REHEARING

This paper requests rehearing of the Decision on Institution ("DI") issued June 22, 2022 ("Paper 13") because the DI's reliance on Patent Owner's mischaracterizations of the Petition and prior art resulted in a misapprehension of both (1) the motivation to combine articulated in the Petition, and (2) the plain teachings of the prior art itself.

First, the DI misapprehends the motivation to combine *Ryu* and *Williams* as articulated in the Petition. The Petition explains that two design considerations would have motivated a POSITA to combine *Ryu*'s power MOSFET with a configuration disclosed by *Williams*: (1) reducing on-resistance; and (2) maintaining ruggedness. However, after acknowledging the Petition's use of these two motivating design considerations, the DI adopts a ***different*** characterization of the Petition's articulated motivation to combine, ignoring design consideration (1) (reducing on-resistance) and instead focusing entirely on two ways of addressing the same design consideration (2) (maintaining ruggedness). That is, the DI's characterization of the motivation to combine refers to "improved ruggedness" and "suppression of parasitic BJT formation" as if those expressions were distinct design considerations, dropping entirely any analysis of identified design consideration (1) (reducing on-resistance).

Second, the DI relies on Patent Owner's characterization of the *Williams* prior art reference, instead of the disclosure of *Williams* itself, leading to a

misapprehension of *Williams*'s plain teachings. When read without the filter of Patent Owner's Preliminary Response ("POPR"), *Williams* expressly teaches semiconductor configurations that provide trade-offs between reducing on-resistance and increasing ruggedness; not the all-or-nothing "sacrifice" as Patent Owner would have it. Indeed, the choice of configuration proposed in the Petition is entirely consistent *Williams*.

For the foregoing reasons, Petitioner respectfully requests that the Board's decision to deny be reversed and institution of the Petition be granted.

I. Legal Standard

Parties requesting rehearing must show that a decision should be modified by identifying "all matters the party believes the Board misapprehended or overlooked, and the place where each matter was previously addressed in a motion, an opposition, a reply, or a sur-reply." 37 C.F.R. § 42.71(d). The Board reviews requests for rehearing under an abuse of discretion standard. *Id*. § 42.71(c). "An abuse of discretion occurs where the decision is based on an erroneous interpretation of the law, on factual findings that are not supported by substantial evidence, or represents an unreasonable judgment in weighing relevant factors." *Star Fruits S.N.C. v. United States*, 393 F.3d 1277, 1281 (Fed. Cir. 2005).

II. The Decision on Institution Misapprehends the Articulated Motivation to Combine and Overlooks the Documented Importance of Reducing On-Resistance to a POSITA

The Petition expressly identifies two different design considerations that would have motivated a POSITA to combine *Ryu*'s power MOSFET with *Williams*'s source and body contact geometry:

(1) reducing on-resistance; and

(2) maintaining ruggedness (*i.e.*, preventing unwanted activation of parasitic BJT.)

Specifically, the Petition states that a "POSITA would have been motivated to combine elements taught by *Ryu* and *Williams* … because, as *Williams* teaches, such a configuration would ***help reduce on-resistance, while continuing to*** provide the needed connection between the n+ regions 24 and the p-wells via the p+ regions 22 to ***ruggedize Ryu's MOSFET against unwanted activation of the parasitic BJT***." Petition at 70 (emphasis added). The Petition explains that "***a lower on-resistance*** minimizes voltage drop and power dissipation (*i.e.*, power loss), and maximizes the current rating of the MOSFET." Petition at 71 (emphasis added), *citing* EX1019, 18, 74–75.

The DI initially acknowledges the premise set forth in the Petition, citing the same passage in stating that "[a]ccording to Petitioner, the design illustrated in Williams' Figure 19E would have been understood to 'help reduce on-resistance,'

while simultaneously working 'to ruggedize Ryu's MOSFET against unwanted activation of parasitic' bipolar junction transistor ('BJT') formation between the source, body, and drain." DI at 17, *citing* Petition at 70.

However, when turning to its analysis of that stated motivation to combine—thereafter guided by Patent Owner's arguments instead of the Petition itself—the DI ***drops entirely*** the important design consideration (1) of reducing on-resistance. Instead, the DI's analysis goes on to treat "improved ruggedness" and "suppression of parasitic BJT formation" as the only considerations relevant to the proposed motivation to combine. *See, e.g.*, DI at 18 ("Petitioner repeatedly asserts that an ordinarily skilled artisan would have combined the disclosures of Ryu and Williams in the manner claimed in pursuit of ***improved ruggedness*** and ***suppression of parasitic BJT formation***.") (emphasis added). While the DI's stated considerations ("improved ruggedness" and "suppression of parasitic BJT formation") are two ways of addressing the same design consideration (2), the DI omits entirely any analysis of design consideration (1), *i.e.*, reducing on-resistance.

The Petition clearly describes (1) reducing on-resistance and (2) maintaining ruggedness as the two ***distinct*** design considerations motivating the combination of *Ryu* and *Williams*. First, in the section of the Technology Background titled "On-Resistance" (Section VI.C.), the Petition explains that "[t]he minimization of the ON-state voltage drop is an important consideration in power devices." Petition at

10, *citing* EX1019, 18. Indeed, the *Williams* reference itself expressly states that "[t]he primary design goal for a power MOSFET used as a switch is to achieve the lowest on-resistance by simultaneously minimizing each of its resistive constituents." Petition at 10, *citing* EX1004 (*Williams*), 1:50–52.

Second, in a separate section of the Technology Background titled "Unwanted Activation of Parasitic Components—Latch Up" (Section VI.D.), the Petition explains a ***different*** phenomenon in which "parasitic BJT 'may be activated, and this can seriously degrade the overall performance of the MOSFET.'" Petition at 12, *citing* EX1019, 81 and EX1007, ¶¶ 6–7. As the Petition identifies, "a MOSFET may be ***ruggedized against inadvertent activation of the parasitic BJT*** by having p+ diffusion in the p-type body region to reduce the resistance $R_{bb'}$ and keep the ohmic voltage drop low." Petition at 16 (emphasis added), *citing* EX1004 (*Williams*), 16:32–34.

After having set forth that background, and as noted above and acknowledged in the DI, the Petition clearly articulates that ***both*** design considerations motivate the combination: "POSITA would have been motivated to combine elements taught by *Ryu* and *Williams* … because, as *Williams* teaches, such a configuration would help reduce on-resistance **[*i.e.,* design consideration (1)]**, while continuing to provide the needed connection between the n+ regions 24 and the p-wells via the p+ regions 22 to ruggedize *Ryu*'s MOSFET against

unwanted activation of the parasitic BJT **[*i.e.*, design consideration (2)]**." Petition at 70 (emphasis added); DI at 17. As such, the DI's analysis of motivation to combine is based on its misapprehension of the motivating design considerations that were actually articulated in the Petition.

The DI's failure to evaluate design consideration (1)—the reduction of on-resistance—at all in its analysis of the stated motivation to combine further undermines its sole basis for denying institution. The Petition is replete with evidence demonstrating the importance of reducing on-resistance in power MOSFETs, all well within the knowledge of a POSITA and motivating the specific combination of *Ryu* and *Williams* presented in the Petition.

For example, the Petition explains that *Williams* teaches that "[t]he ***primary design goal for a power MOSFET*** used as a switch is to ***achieve the lowest on-resistance*** by simultaneously minimizing each of its resistive constituents." Petition at 10, 37, *citing* EX1004 (*Williams*), 1:50–52. Likewise, the Petition explains that *Ryu* discloses vertical power MOSFETs having designs that "may ***reduce on-state resistance***" compared to conventional vertical MOSFETs. Petition at 51-52, 65, *citing* EX1003 (*Ryu*), ¶¶6, 9, 39, Figure 1.

Consistent with those teachings, the Petition advances a motivation to combine *Ryu* and *Williams* premised on the well-known goal of reducing on-resistance: "both references are directed to vertical MOSFETs and ***aim at reducing***

on-resistance." Petition at 52, 65. The Petition then explains the rationale for choosing *Williams*'s Figure 19E configuration, identifying that, "as *Williams* teaches, ***such a configuration would help reduce on-resistance*** [design consideration (1)], while continuing to provide the needed connection between the n+ regions 24 and the p-wells 20 via the p+ regions 22 to ruggedize *Ryu*'s MOSFET against unwanted activation of the parasitic BJT [design consideration (2)]." Petition at 70, *citing* EX1004 (*Williams*), 17:18 ("better N+ contact resistance"). The Petition further explains that "a lower on-resistance minimizes voltage drop and power dissipation (*i.e.*, power loss), and maximizes the current rating of the MOSFET." Petition at 71, *citing* EX1019, 18, 74–75.

By overlooking the stated design consideration (1) of reducing on-resistance—as articulated by the Petition and confirmed in the prior art references themselves—the DI's analysis is incomplete and, accordingly, reaches a conclusion that is contrary to the pre-institution record.

III. Patent Owner's Mischaracterization of *Williams* Guides the Decision on Institution to an Incorrect Interpretation of the Art

With its analysis erroneously focused ***only*** on design consideration (2), *i.e.,* ruggedization against unwanted activation of the parasitic BJT, the DI then follows Patent Owner's characterization of *Williams*, leading to its misapprehension of *Williams*'s plain teachings.

Specifically, Patent Owner asserts that "a proper reading of Williams would have led a POSITA to Williams' Figure 19C, not Figure 19E, to increase ruggedness." POPR at 43. Agreeing with Patent Owner, the DI found that *Williams*'s Figure 19E configuration "***sacrifice[s] ruggedness*** for better N+ contact resistance," and that, instead, "Williams improves ruggedness and suppresses parasitic BJT formation, not by the design shown in Figure 19E, but by a different design illustrated in Figure 19C." DI at 18, *citing* POPR at 41–42; *see also* DI at 20, *citing* POPR at 42–43.

Contrary to Patent Owner's assertion, however, *Williams* does ***not*** demand that ***only one*** design consideration be favored at the "***sacrifice***" of ***all other*** design considerations in selecting from its different geometric configurations in Figures 19A-19F. *Williams* never even uses the word "sacrifice" in describing the trade-offs between its configurations illustrated in Figures 19A–19F. Indeed, *Williams* plainly describes the results achieved by each of its different configurations as trade-offs or compromises:

- About its Figure 19C configuration, *Williams* explains: "The segmented N+ source design of ***FIG. 19C*** reduces the N+ contact and the channel perimeter further, ***compromising on-resistance to achieve enhanced ruggedness***." EX1004 (*Williams*), 16:63-65 (emphasis added); *see also* DI at 12–13.

- About its Figure 19E configuration, *Williams* explains: "The window and strapped window based designs of FIGS. ***19E*** and 19F have similar geometric features to the corrugated and strapped corrugated designs of FIGS. 19A and 19B, respectively, but ***with better N+ contact resistance and less P+ contact area (less rugged)***." *Id.* at 17:15-19 (emphasis added); *see also* DI at 13–14 (recognizing the same).

In other words, *Williams* explicitly teaches that: Figure 19C increases ruggedness (*i.e.,* design consideration (2)) at the compromise of increasing on-resistance (*i.e.,* design consideration (1)); whereas Figure 19E decreases on-resistance (*i.e.,* design consideration (1)) at the compromise of decreasing ruggedness (*i.e.,* design consideration (2)). Moreover, the decreased ruggedness of *Williams*'s Figure 19E configuration is relative to that of its Figures 19A and 19B. That is, all of *Williams*'s Figures 19A-19F provide ruggedness, just at different levels. For a POSITA concerned with optimizing both design considerations—(1) reducing on-resistance and (2) maintaining ruggedness, as articulated in the Petition—neither Figure 19C nor Figure 19E taught by *Williams* stands out as the ***one-and-only*** configuration to use. Petition at 74 ("Such modifications were expected to be performed when optimizing the on-resistance and ruggedness of power MOSFETs."), *citing* EX1004 (*Williams*), 16:28–17:19.

Rather, each configuration represents a trade-off. In view of the premise that the Petition sets out (*i.e.*, that a POSITA would be concerned with addressing ***both*** design considerations of (1) on-resistance and (2) ruggedness), the selection of the Figure 19E configuration is well-supported by the Petition and *Williams* itself because *Williams* expressly states that such a configuration provides "better N+ contact resistance" (*i.e.,* design consideration (1)), while still providing the P+ contact area to provide ruggedness (*i.e.,* design consideration (2)), even if "less" than some of *Williams*'s alternative configurations. Petition at 70, *citing* EX1004 (*Williams*), 17:15-19; *see also* DI at 13–14 (recognizing the same). In contrast, the Figure 19C configuration that Patent Owner leads the analysis towards "compromis[es] on-resistance to achieve enhanced ruggedness." EX1004, 16:63-65; *see also* DI at 12–13. However, ***neither option*** stands apart as the best, optimal, or ***only*** viable choice for a POSITA seeking to address ***both*** design considerations identified by the Petition: *Williams*'s options of Figures 19C and 19E are ***alternatives*** in achieving that same end. Contrary to the finding expressed in the DI, the reasons motivating the combination of *Ryu* and *Williams* articulated in the Petition do ***not*** "run counter to clear disclosures within the four corners of the asserted prior art" at all. DI at 18 (finding the opposite when applying the misapprehended motivation to combine that evaluates ***only one of the two*** described design considerations).

The DI's result is contrary not only to the motivation to combine described by the Petition and the alternative design choices plainly disclosed by *Williams*, but also to the law on obviousness. Even if *Williams*'s Figure 19C option ***were*** more desirable than *Williams*'s Figure 19E option to a POSITA motivated by both of the design considerations (1) and (2) as articulated in the Petition—and there is no evidence of record suggesting that to be so—the "law does not require that a particular combination must be the preferred, or the most desirable, combination described in the prior art in order to provide motivation for the current invention." *In re Fulton*, 391 F.3d 1195, 1200 (Fed. Cir. 2004) ("'[T]he question is whether there is something in the prior art as a whole to suggest the *desirability,* and thus the obviousness, of making the combination,' not whether there is something in the prior art as a whole to suggest that the combination is the *most desirable* combination available. *See In re Beattie,* 974 F.2d at 1311 (internal quotation omitted; emphasis added).").

Although Patent Owner guides the Board to *Williams*'s Figure 19C option as being an allegedly more desirable alternative design to *Williams*'s Figure 19E option, the mere presence of an alternative does not defeat a *prima facie* case of obviousness, even if the proposed combination is "inferior." *See In re Mouttet*, 686 F.3d 1322, 1333-34 (Fed. Cir. 2012) (holding that "just because better alternatives exist in the prior art does not mean that an inferior combination is inapt

for obviousness purposes . . . ."). Indeed, absent a teaching away—and there is also no such teaching away on the present record—the proposed motivation to combine need ***not*** be the "best option." *PAR Pharm., Inc. v. TWI Pharm., Inc.,* 773 F.3d 1186, 1197–98 (Fed. Cir. 2014) ("Our precedent ... does not require that the motivation be the best option, only that it be a suitable option from which the prior art did not teach away.")

To be sure, however, ***neither option*** in *Williams* is presented as the better, preferred, or more desirable option in view of the Petition's stated motivation to combine *Ryu* with *Williams* as properly apprehended. Nor does the option set forth in the proposed combination ***need to be*** the better, preferred, or more desirable option in view of the controlling obviousness law. Accordingly, the plain language of *Williams* is consistent with and supports the rationale articulated in the Petition explaining why a POSITA would be motivated by both design considerations (1) and (2) to combine *Ryu* with *Williams*'s Figure 19E configuration.

IV. Petitioner Has Met Its Burden for Institution of *Inter Partes* Review

At a minimum, material issues of fact remain in Petitioner's challenge that the Board should reserve for trial. Petitioner has presented evidence—including prior art references, extensive background materials describing the relevant technology, and expert testimony—all demonstrating a reasonable likelihood of success of establishing that a POSITA would be motivated to combine *Ryu* and

Williams in the manner articulated in the Petition. While the Patent Owner responded with attorney argument in its Preliminary Response, it has presented no testimony or other evidence of record to support its contrary position. Indeed, when read completely, the Petition and supporting evidence of record support only the conclusion that a POSITA would be motivated to combine *Ryu* and *Williams* as presented.

Even if Patent Owner's showing were to rise to the level of a genuine dispute of a material fact, that underlying dispute of material fact should be resolved through an instituted proceeding where the Board would have the benefit of a full record developed during trial, not a Decision on Institution in which the Petitioner has not had an opportunity to respond to the Patent Owner's attorney argument and mischaracterization of the prior art. Instituting trials to address disputes where the merits of the grounds are otherwise met aims to "secure the just, speedy, and inexpensive resolution." 37 C.F.R. § 42.1(b). AIA trials provide a timely, cost-effective alternative to litigating the validity of patents in district court. 77 Fed. Reg. at 48,680 (Aug. 14, 2012). Denying institution over a material factual dispute, as the Board has done in this case—if Patent Owner's argument is credited at all—overlooks the purpose and intent of AIA trials.

V. Conclusion

For the foregoing reasons, Petitioner respectfully requests that the Board grant rehearing and institute *inter partes* review of the challenged claims of the '633 patent.

Respectfully submitted,

Dated: July 21, 2022

By: /Scott Bertulli/

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CERTIFICATE OF SERVICE

I hereby certify that on July 21, 2022, I caused a true and correct copy of the foregoing Petitioner's Request for Rehearing to be served electronically to the following lead and backup counsel for Patent Owner to the following email addresses:

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