

**UNITED STATES PATENT AND TRADEMARK OFFICE**

---

**BEFORE THE PATENT TRIAL AND APPEAL BOARD**

---

MICRON TECHNOLOGY, INC.,  
Petitioner

v.

YANGTZE MEMORY TECHNOLOGIES COMPANY, LTD.,  
Patent Owner

---

Case No.: IPR2024-00790  
U.S. Patent No. 10,868,031  
Issue Date: December 15, 2020

Title: MULTIPLE-STACK THREE-DIMENSIONAL MEMORY DEVICE  
AND FABRICATION METHOD THEREOF

---

**PETITIONER'S REQUEST FOR DIRECTOR REVIEW OF THE BOARD'S  
FINAL WRITTEN DECISION**

|                                                                                                                                                                       | <b><u>Page</u></b> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| <b><u>TABLE OF CONTENTS</u></b>                                                                                                                                       |                    |
| I. INTRODUCTION .....                                                                                                                                                 | 1                  |
| II. THE BOARD’S APPLICATION OF AN INCORRECT<br>OBVIOUSNESS STANDARD LED TO ITS ERRONEOUS<br>CONCLUSION THAT CLAIM 4 IS NOT UNPATENTABLE .....                         | 3                  |
| III. EVEN UNDER THE BOARD’S ERRONEOUS, HEIGHTENED<br>OBVIOUSNESS STANDARD, THE BOARD COMMITTED<br>ERROR IN FINDING CLAIM 4 NOT UNPATENTABLE<br>(GROUNDS 1 AND 3)..... | 7                  |
| A. A Skilled Artisan Would Read Kim Itself To Suggest The<br>Proposed Modification .....                                                                              | 8                  |
| B. A Skilled Artisan Would Have Understood That Supporting<br>Pillars With A Conductive Core Would Improve Kim .....                                                  | 9                  |
| IV. CONCLUSION.....                                                                                                                                                   | 12                 |

## **TABLE OF AUTHORITIES**

### **Page(s)**

#### **Cases**

|                                                                                                                            |            |
|----------------------------------------------------------------------------------------------------------------------------|------------|
| <i>Agrizap, Inc. v. Woodstream Corp.</i> ,<br>520 F.3d 1337 (Fed. Cir. 2008) .....                                         | 5          |
| <i>DyStar Textilfarben GmbH &amp; Co. Deutschland KG v. C.H. Patrick<br/>Co.</i> ,<br>464 F.3d 1356 (Fed. Cir. 2006) ..... | 9          |
| <i>In re Fulton</i> ,<br>391 F.3d 1195 (Fed. Cir. 2007) .....                                                              | 8          |
| <i>Intel Corp. v. PACT XPP Schweiz AG</i> ,<br>61 F.4th 1373 (Fed. Cir. 2023) .....                                        | 4, 5       |
| <i>KSR Int’l Co. v. Teleflex Inc.</i> ,<br>550 U.S. 398 (2007).....                                                        | 1, 2, 4, 5 |
| <i>Realtime Data, LLC v. Iancu</i> ,<br>912 F.3d 1368 (Fed. Cir. 2019) .....                                               | 8          |
| <i>Snap Inc. v. You Map, Inc.</i> ,<br>No. 24-1120, 2025 WL 2793538 (Fed. Cir. Oct. 1, 2025) .....                         | 2, 3, 4, 6 |

## LISTING OF EXHIBITS

| Exhibit | Description                                                                                                                                                                                            |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1001    | U.S. Patent No. 10,868,031 to Liu et al.                                                                                                                                                               |
| 1002    | File History of U.S. Patent No. 10,868,031 to Liu et al.                                                                                                                                               |
| 1003    | Declaration of Dr. Sanjay Banerjee (“Banerjee”)                                                                                                                                                        |
| 1004    | <i>Curriculum Vitae</i> of Dr. Sanjay Banerjee                                                                                                                                                         |
| 1005    | U.S. Patent No. 10,381,369 to Kim et al. (“Kim”)                                                                                                                                                       |
| 1006    | U.S. Patent Publ. No. 2019/0081061 A1 to Tessariol et al. (“Tessariol”)                                                                                                                                |
| 1007    | Aritome, “NAND Flash Memory Technologies” (2016)                                                                                                                                                       |
| 1008    | Silvagni, “3D NAND Flash Based on Planar Cells,” Computers 2017                                                                                                                                        |
| 1009    | Micheloni et al., “Inside Solid State Drives (SSDs)” (2 <sup>nd</sup> Ed. 2018)                                                                                                                        |
| 1010    | U.S. Patent No. 10,475,737 to Tang et al.                                                                                                                                                              |
| 1011    | U.S. Patent No. 10,559,583 to Park et al.                                                                                                                                                              |
| 1012    | U.S. Patent No. 9,768,186 to Shimabukuro et al.                                                                                                                                                        |
| 1013    | U.S. Patent No. 9,728,499 to Shimabukuro et al.                                                                                                                                                        |
| 1014    | U.S. Patent No. 9,299,641 to Sekar et al.                                                                                                                                                              |
| 1015    | U.S. Patent No. 11,244,725 to Goda et al.                                                                                                                                                              |
| 1016    | U.S. Patent No. 9,142,302 to Dong et al.                                                                                                                                                               |
| 1017    | Minute Order, Dkt. No. 42, dated February 22, 2024 in <i>Yangtze Memory Technologies Company, Ltd. v. Micron Technology, Inc. and Micron Consumer Products Group, LLC</i> , Case No. 3:23-cv-05792-RFL |

| Exhibit | Description                                                                                                                                                                                                                                                                                               |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1018    | Combined Civil and Criminal Federal Court Management Statistics (December 31, 2023), available at <a href="https://www.uscourts.gov/sites/default/files/data_tables/fcms_na_distcomparison1231.2023.pdf">https://www.uscourts.gov/sites/default/files/data_tables/fcms_na_distcomparison1231.2023.pdf</a> |
| 1019    | Docket from <i>Yangtze Memory Technologies Company, Ltd. v. Micron Technology, Inc. and Micron Consumer Products Group, LLC</i> , Case No. 3:23-cv-05792-RFL                                                                                                                                              |
| 1020    | Micheloni, “3D Flash Memories” (2016)                                                                                                                                                                                                                                                                     |
| 1021    | Top Seiko Co., Ltd., Guide to Materials                                                                                                                                                                                                                                                                   |
| 1022    | Sharpe, W.N., et al., “Mechanical Properties of MEMS Materials,” DARPA, AFRL-IF-RS-TR-2004-76 (March 2004)                                                                                                                                                                                                |
| 1023    | Wolf. S., et al., “Silicon Processing for the VLSI Era, Volume 1 – Process Technology, Chapter 15, Multilevel Interconnects for ULSI,” (2 <sup>nd</sup> Ed. 2000)                                                                                                                                         |
| 1024    | Declaration of Jared Bobrow in Support of Petitioner’s Motion for Admission <i>Pro Hac Vice</i>                                                                                                                                                                                                           |
| 1025    | Reply Declaration of Dr. Sanjay Banerjee (“Banerjee Reply Decl.”)                                                                                                                                                                                                                                         |
| 1026    | Transcript of the deposition of Dr. Kelin Kuhn, dated March 31, 2025, in IPR2024-00790, concerning U.S. Patent No. 10,868,031                                                                                                                                                                             |
| 1027    | Wolf. S., et al., “Silicon Processing for the VLSI Era, Volume 1 – Process Technology,” (1 <sup>st</sup> Ed. 1986)                                                                                                                                                                                        |
| 1028    | Transcript of the deposition of Dr. Kelin Kuhn, dated March 28, 2025, in IPR2024-00789, concerning U.S. Patent No. 10,861,872                                                                                                                                                                             |
| 1029    | U.S. Patent Publ. No. 2017/0148805 to Nishikawa et al. (“Nishikawa”)                                                                                                                                                                                                                                      |
| 1030    | U.S. Patent Publ. No. 2017/0236746 to Yu et al. (“Yu”)                                                                                                                                                                                                                                                    |
| 1031    | Petitioner’s Hearing Demonstratives                                                                                                                                                                                                                                                                       |

## I. INTRODUCTION

Petitioner Micron Technology, Inc. requests Director Review of the Board’s Final Written Decision (“FWD,” Paper 29) that claim 4 of the ’031 patent is not unpatentable for obviousness. In reaching this conclusion, the Board erroneously applied a pre-*KSR* standard for obviousness, ruling that a skilled artisan would not have replaced an element in a prior art reference with a different, known substitute unless the known substitute resulted in a superior device. This analysis ignores clear policy prescriptions and implications of *KSR* and subsequent precedent.

The ’031 Patent relates to 3D memory that uses pillars to support the memory stack. Petitioner asserted that all challenged claims were obvious over the teachings of Kim (Ground 1) or Kim in view of Tessariol (Ground 3). Both Kim and Tessariol, like the ’031 Patent, disclose 3D memory devices in which pillars support the memory stack. The dispute between the parties was whether it would have been obvious to replace Kim’s supporting pillar—a “dummy structure” with a non-conductive core—with a supporting pillar that includes a conductive core, such as the one that Tessariol discloses. Petitioner contended that modifying Kim in this fashion would have been obvious because it involves replacing one well-known technique for providing stack support with a known substitute. Petitioner also contended that it would have been obvious because using supporting pillars with a conductive core in Kim would have resulted in an improved memory device.

The Board accepted the fact that a supporting pillar with a conductive core was a well-known substitute for a non-conductive dummy structure. And the Board recognized that Tessariol itself discloses a supporting pillar with a conductive core to provide memory stack support. Nevertheless, the Board rejected Petitioner's Grounds for obviousness, reasoning that Petitioner had failed to establish that Kim's dummy structures were "inferior" to supporting pillars with a conductive core. FWD, 33-34; *see id.*, 23-24. This is clear legal error. Under *KSR* and ample Federal Circuit precedent, Petitioner had no obligation to show superiority. Petitioner "need[ed] only show that one element was a known substitute for the other." *Snap Inc. v. You Map, Inc.*, No. 24-1120, 2025 WL 2793538, at \*4 (Fed. Cir. Oct. 1, 2025) (quoting *Intel Corp. v. PACT XPP Schweiz AG*, 61 F.4th 1373, 1381 (Fed. Cir. 2023)).

Moreover, even under the Board's erroneous standard, Petitioner established obviousness. Petitioner provided two distinct reasons a skilled artisan would have been motivated to replace Kim's dummy structures with supporting pillars with a conductive core—over and above the fact that the one constitutes a known substitute for the other. The Board erred in disregarding this clear record evidence providing an added motivation to modify Kim as Petitioner proposed.

First, Petitioner demonstrated that Kim itself suggests use of alternative materials in its supporting pillars, and as such, a skilled artisan would have been

encouraged to use the known alternative of a supporting pillar with a conductive core. In rejecting this motivation on the theory that Kim does not expressly disclose use of a conductive core in particular, the Board erred as the law imposes no such express disclosure requirement.

Second, Petitioner established that its proposed modification of Kim would result in a *superior* memory device because supporting pillars with a conductive core provide a beneficial interconnect functionality. The Board mistakenly found that Kim does not need interconnect functionality, relying on the fact that Kim lacks circuitry under its memory array or staircase. But as Petitioner showed (and Patent Owner never disputed), Kim discloses circuitry in a different place: the peripheral region. And Kim undisputedly needs interconnect functionality in this peripheral region. The Board's rejection of this motivation to modify, therefore, rests on a clear misapprehension of the factual record.

## **II. THE BOARD ERRONEOUSLY REJECTED CLAIM 4'S OBVIOUSNESS BASED ON AN INCORRECT LEGAL STANDARD FOR OBVIOUSNESS**

An overarching legal error infected the Board's evaluation of both Grounds 1 and 3, leading the Board to incorrectly reject the obviousness of claim 4. In the Board's view, replacing Kim's dummy structures with supporting pillars that have a conductive core would do nothing more than "provide the same stack support function" that Kim already possessed. FWD, 32; *see id.*, 22-23. According to the

Board, because there was no “need[]” for or evidence of a “benefit from” substituting one support material for the other, Petitioner had not established a motivation to modify or combine. *Id.*, 22-23. That reflects an overly demanding standard for obviousness. Petitioner “never had to show that [its proposed modification] was an ‘improvement’ in a categorical sense.” *Intel*, 61 F.4th at 1381. Petitioner needed to show only that a skilled artisan would have understood that “replac[ing]” one known mechanism for another would have resulted in a “suitable option.” *Id.* The law well establishes that “when a patent ‘simply arranges old elements with each performing the same function it had been known to perform’ and yields no more than one would expect from such an arrangement, the combination is obvious.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007). As such, when a ground for obviousness depends on replacing a prior art element with a known alternative, “[the] challenger need not show that the substitution would be an improvement over the original invention. Instead, the challenger need only show that one element was a known substitute for the other.” *Snap*, 2025 WL 2793538, at \*4.

Consider *Intel Corp. v. PACT XPP Schweiz AG*, which squarely addressed and rejected the same flawed reasoning that the Board provided here. In *Intel*, the petitioner suggested that a skilled artisan would have replaced an element of a prior art reference with another element drawn from a secondary reference that “address[ed] the same [] issue”—“just through a different mechanism.” 61 F.4th at

1380. The Board there—much as it has here—reasoned that because this straightforward substitution would provide no “obvious improvement” to the primary reference, there would be no motivation to combine. *Id.* The Federal Circuit reversed, explaining that the fact that the secondary reference provided a “known way to address [the same problem] is precisely the reason that there’s a motivation to combine under *KSR* and our precedent.” *Id.* The petitioner “never had to show that replacing” one known mechanism for addressing the same problem with another known mechanism “was an ‘improvement’ in a categorical sense”; petitioner needed only to show that it was a “suitable option.” *Id.* at 1381.

Under the correct legal standard, Petitioner plainly established obviousness. Indeed, this is a “textbook case” of using one type of known technique for addressing a problem to replace another. *Agrizap, Inc. v. Woodstream Corp.*, 520 F.3d 1337, 1344 (Fed. Cir. 2008) (reversing Board’s rejection of obviousness contention where proposed combination merely “substitute[d]” one “type of switch” for another).

In each of Grounds 1 and 3, Petitioner contended that a skilled artisan would have substituted supporting pillars with a conductive core (as, for example, Tessariol discloses) for the dummy channel structures in Kim. *See Pet.*, 55-56, 86-89. And Petitioner provided ample evidence that a supporting pillar with a conductive core was a known substitute for Kim’s dummy structures—each addressing the known need for stack support in a memory device. *Id.*, 55-56 (citing Kim at 13:28-36;

Tessariol, [0037], [0038], [0041]; Banerjee, ¶ 156 and Ex. 1012); *Id.*, 87 (citing Banerjee, ¶¶ 214-215); *compare* Kim 9:30-31, *with* Tessariol, [0041]. Even Patent Owner’s expert admitted that support pillars were routine and well-known for use in a memory device like Kim to support the stack. Ex. 1026, 79:2-12, 85:1-9, 91:10-23; *see* Reply, 30. And the Board accepted as a factual matter that “pillar support structures comprising electrically conductive material were known in the art.” FWD, 23. Given this record evidence and the governing legal standard, a finding of obviousness necessarily should have followed.

In sum, it is enough that Petitioner demonstrated a need for stack support in a memory device, that use of a supporting pillar with a conductive core was a known technique for addressing that need, and that modifying Kim to use such pillars was within the skill of an ordinary artisan. When obviousness grounds depend on replacing a prior art element with a known alternative, “[the] challenger need not show that the substitution would be an improvement over the original invention. Instead, the challenger need only show that one element was a known substitute for the other.” *Snap*, 2025 WL 2793538, at \*4. Because the Board found that a supporting pillar with a conductive core was a “known substitute” for Kim’s support pillar in providing stack support, the Board should have held claim 4 unpatentable for obviousness.

### **III. EVEN UNDER THE BOARD’S ERRONEOUS, HEIGHTENED LEGAL STANDARD FOR OBVIOUSNESS, THE BOARD COMMITTED ERROR IN FINDING CLAIM 4 NOT UNPATENTABLE (GROUNDS 1 AND 3)**

Additionally, even under the Board’s incorrectly heightened standard for obviousness, Petitioner provided ample evidence of a suggestion or motivation to replace Kim’s dummy structures with supporting pillars that have a conductive core. Petitioner established not only that such a modification would use known elements to secure predictable results, as discussed above (*supra* Arg. I), but also that (1) Kim itself suggests such a modification, Pet., 55 (citing Kim, 13:28-33); and (2) this modification would *improve* Kim’s memory device, because the supporting pillar would provide two functions (support and interconnect) instead of just one (support). *Id.*, 55 (citing Banerjee, ¶ 157); *Id.*, 87-88 (citing Banerjee, ¶ 217).<sup>1</sup> The Board’s contrary findings rest on clear factual errors which, if corrected, would require a

---

<sup>1</sup> Petitioner also argued that a metal core may provide a superior support function compared to Kim’s non-conductive support pillar, Pet., 87 (citing Ex. 1012, 4:60-5:12 and expert testimony). In rejecting this argument, the Board stated that Petitioner’s evidence did not establish that Kim’s support structure was “inferior” to a supporting pillar with a metal core. FWD, 33-34. As demonstrated in § II, the Board legally erred by requiring Petitioner to show the superiority of a conductive pillar.

finding of unpatentability even under the Board’s erroneous legal standard for obviousness.

**A. A Skilled Artisan Would Have Read Kim Itself To Suggest The Proposed Modification**

Petitioner established in Ground 1 that a skilled artisan would have modified Kim to use supporting pillars with a conductive core because Kim itself suggests just such a modification. Specifically, Kim discloses that the relevant dummy structures (the supporting pillars) in its device may include a “layer or component” that is different from those in its vertical structures. Pet., 55 (citing Kim, 13:28-33). Moreover, as discussed above (*supra* §II), the Board acknowledged that a supporting pillar with a conductive core was a well-known substitute for a support pillar in a 3D memory device. FWD, 23. Where, as here, a prior art reference suggests that “a wide variety” of substitutes “could be used” to perform the same function, this provides a motivation to use a substitute “well known” in the art even if the reference does not expressly describe that substitute. *See, e.g., Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1372 (Fed. Cir. 2019); *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2007) (affirming finding of motivation to combine where prior art reference suggests use of differently shaped studs “other than those expressly described”). Thus, Kim clearly provided motivation to use the well-known substitute of a pillar with a conductive core.

In rejecting Petitioner’s showing, the Board reasoned that Kim identifies various particular “materials from which dummy structures can be formed” and does not expressly disclose the use of a conductive core. Pet., 23-24. But the Board never addressed Kim’s disclosure that a different “layer or component” could be used; and the Board provided no evidence that Kim *limited* its dummy structures to the particular materials that it teaches “may” be used. See FWD, 23-24. As such, the Board erred in ignoring Kim’s explicit suggestion that other substitutes for the dummy structure channel material may be used, which would have motivated a skilled artisan to look for other “known techniques” for providing stack support—like a supporting pillar with a conductive core. Reply, 20-21. Kim itself did not need to “express[ly] suggest[.]” use of a conductive core, because “the suggestion to combine may come from the prior art, as filtered through the knowledge of one skilled in the art.” *DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1361 (Fed. Cir. 2006). And here, one skilled in the art reading Kim would have immediately considered this option because, as the Board accepted in view of the record, “pillar support structures comprising electrically conductive material were known in the art.” FWD, 23.

**B. A Skilled Artisan Would Have Understood That Supporting Pillars With A Conductive Core Would Improve Kim**

Petitioner also demonstrated in both Grounds 1 and 3 that supporting pillars with a conductive core provide an additional benefit over Kim’s dummy structures:

namely, an interconnect function (i.e., they extend vertically through the stack and can connect two circuit elements together). Pet., 88.

In rejecting this argument, the Board’s reasoning reveals a clear factual error. Specifically, the Board credited the testimony of Patent Owner’s expert, Dr. Kuhn, who stated that “Kim does not disclose any circuitry (either transistors or interconnects) *under the memory array or the staircase*.” FWD, 34 (quoting Ex. 2013, ¶ 169) (emphasis added).<sup>2</sup> The Board then adopted Dr. Kuhn’s reasoning that without such “circuitry under the array or the staircase,” there would be no need in “Kim to create connections to *that* circuitry.” *Id.* (quoting Ex. 2013, ¶ 169) (emphasis added).

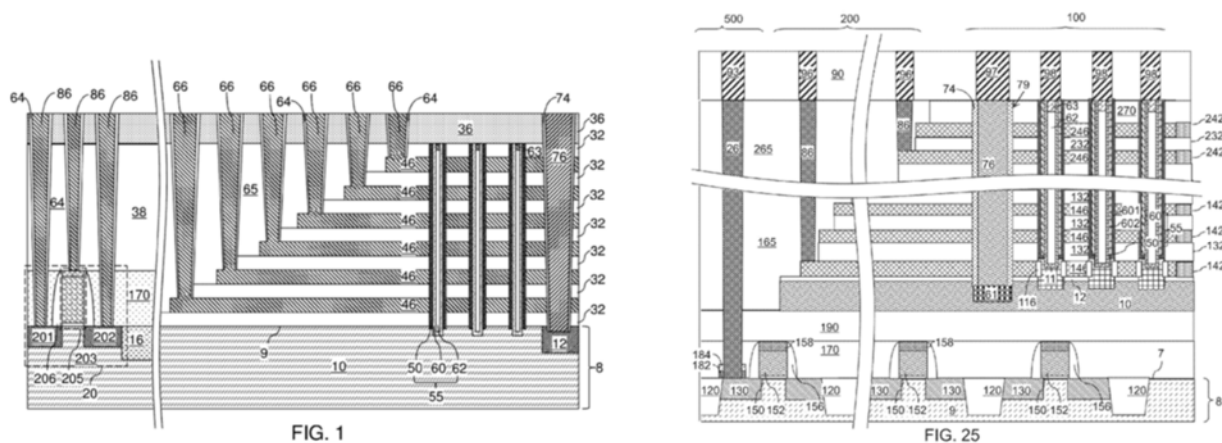
Dr. Kuhn’s statement, however, carefully avoids addressing the fact that—as Patent Owner never disputed—Kim discloses that its memory device may include a “peripheral circuit region” (effectively, to left or right of the array) and that supporting pillars with a conductive core could beneficially provide interconnect functionality to *that* circuitry. Reply, 23 (citing Kim, 4:59-65).

Moreover, Patent Owner never disputed that Kim suggests the need for, or the desirability of, an interconnect function. The record clearly demonstrates, as shown

---

<sup>2</sup> PO misled the Board by always carefully framing its argument that Kim does not need interconnects under the array. *E.g.*, Sur-reply (Paper 17), 25.

below, that peripheral circuitry (on the left in each figure) requires a vertical, conductive structure (86 on the left figure and 20 on the right figure) to function as interconnects:



Reply, 23 (citing Exs. 1029-1030), Banerjee Reply Decl. ¶¶ 66-67. Tessariol's support pillars with a conductive core can therefore function both as support members and peripheral interconnects—as Tessariol discloses, and Patent Owner never disputed. Pet., 55-56 (citing Tessariol, [0037], [0038], [0041]). Simply put, Dr. Kuhn's careful wording led the Board to conclude that Kim had no circuits to connect with conductive pillars when, based on the undisputed record, there are such circuits in the periphery and those circuits need structures that perform an interconnect function.

Accordingly, although Petitioner had no obligation to prove that its proposed combination improves on Kim, Petitioner met that burden. This, too, compels a finding of obviousness.

#### IV. CONCLUSION

For the reasons stated above, the Board's final written decision finding claim 4 of the '031 patent not unpatentable must be reversed or vacated.

Respectfully submitted,

ORRICK, HERRINGTON & SUTCLIFFE LLP

Dated: November 14, 2025

/Jeremy Jason Lang/

Jeremy Jason Lang  
Lead Counsel for Petitioner  
Reg. No. 73,064  
Jared Bobrow (admitted *Pro Hac Vice*)  
1000 Marsh Road  
Menlo Park, CA 94025-1015  
T: (650) 614-7400  
F: (650) 614-7401  
Email: PTABDocketJJL2@orrick.com  
Email: PTABDocketJ3B3@orrick.com

K. Patrick Herman  
Reg. No. 75,018  
51 West 52nd Street  
New York, NY 10019  
T: (212) 506-5000  
F: (212) 506-5151  
Email: P52PTABDocket@orrick.com

*Attorneys for Petitioner Micron Technology,  
Inc.*

## **CERTIFICATE OF SERVICE**

The undersigned hereby confirms that the foregoing Petitioner's Request for Director Review were caused to be served on November 14, 2025 via electronic mail, upon the following attorneys of record for the Patent Owner:

Christopher M. Bonny (Christopher.Bonny@ropesgray.com)  
Andrew T. Radsch (andrew.radsch@ropesgray.com)  
Allen S. Cross (allen.cross@ropesgray.com)  
YMTC-Micron-IPRs-Ropes-Service@ropesgray.com

/Karen Johnson/

Karen Johnson