

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APTIV SERVICES US, LLC,
Petitioner,

v.

MICROCHIP TECHNOLOGY INC.,
Patent Owner.

Patent No. 9,471,074

Inter Partes Review No. IPR2024-00646

PETITIONER REPLY TO PATENT OWNER RESPONSE

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Petitioner’s Updated Exhibit List

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U.S. Patent No. 9,471,074	1001
Declaration of Dr. Michael S. Chen	1002
Prosecution History of U.S. Patent No. 9,471,074	1003
Mohammad Al-Shyoukh, et al., “A Transient-Enhanced Low-Quiescent Current Low-Dropout Regulator with Buffer Impedance Attenuation,” <i>IEEE Journal of Solid-State Circuits</i> , Vol. 42, No. 8 (Aug. 2007) (“Al-Shyoukh”)	1004
U.S. Patent No. 6,400,207 (“Ivanov”)	1005
U.S. Patent No. 6,710,583 (“Stanescu”)	1006
Miranda J. Ha, “A Low-Power, High-Bandwidth LDO Voltage Regulator with No External Capacitor” (May 23, 2008) (“Ha”)	1007
Le Ye, et al., “Highly Power-Efficient Active-RC Filters with Wide Bandwidth-Range Using Low-Gain Push-Pull Opamps,” <i>IEEE Transactions on Circuits and Systems—I: Regular Papers</i> , Vol. 60, No. 1 (Jan. 2013) (“Ye”)	1008
Mikhail Popovich, “High Performance Power Distribution Networks with On-Chip Decoupling Capacitors for Nanoscale Integrated Circuits” (2007) (“Popovich”)	1009
U.S. Patent No. 7,345,547 (“Wang”)	1010
Micrel Inc., MIC59300 Datasheet (Jan. 2009) (“MIC59300”)	1011
U.S. Patent No. 7,644,217 (“Butler”)	1012
U.S. Patent No. 6,046,577 (“Rincon-Mora”)	1013
Gabriel A. Rincon-Mora, “A Low-Voltage, Low Quiescent Current, Low Drop-Out Regulator,” <i>IEEE Journal of Solid-State Circuits</i> , Vol. 33, No. 1 (Jan. 1998) (“Rincon-Mora Paper”)	1014

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Gabriel A. Rincon-Mora, "Current Efficient, Low Voltage, Low Dropout Regulators" (Nov. 1996) ("Rincon-Mora Dissertation")	1015
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Michael Day, "Understanding Low Drop Out (LDO) Regulators," 2006 Texas Instruments Portable Power Design Seminar (2006) ("Day")	1017
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Micrel Inc., MIC3385 Datasheet (May 2010) ("MIC3385")	1030 [NEW]
Declaration of Dr. Greg Taylor in Support of Microchip's Opening Claim Construction Brief, dated Mar. 1, 2024 in <i>Microchip Technology Inc. v. Aptiv Services, LLC</i> , Case No. 1:23-cv-00778-JDW (D. Del.)	1031 [NEW]

I. INTRODUCTION

The Patent Owner's Response ("POR") confirms that claims 1-18 of the '074 patent are unpatentable.

The Petition showed that each limitation was disclosed in or obvious over the prior art. Instead of disputing the technical merits of Aptiv's proof, Patent Owner conjures false claim constructions that it does not even attempt to support with the patent's disclosures.

The Petition also showed why it was obvious to apply enable/disable—a well-known technique that Patent Owner's expert admits was used routinely in all types of applications to improve power efficiency—for its exact intended purpose in Al-Shyoukh's and Rincon-Mora's regulators. Unable to contest this, Patent Owner tries to argue that the prior art taught away by misreading and misapplying its disclosures.

In doing so, Patent Owner disputes only the Petition's showings with respect to limitations 1[b], 1[c], and 1[d]. Because those challenges are meritless, the Board should find all claims of the '074 patent unpatentable.

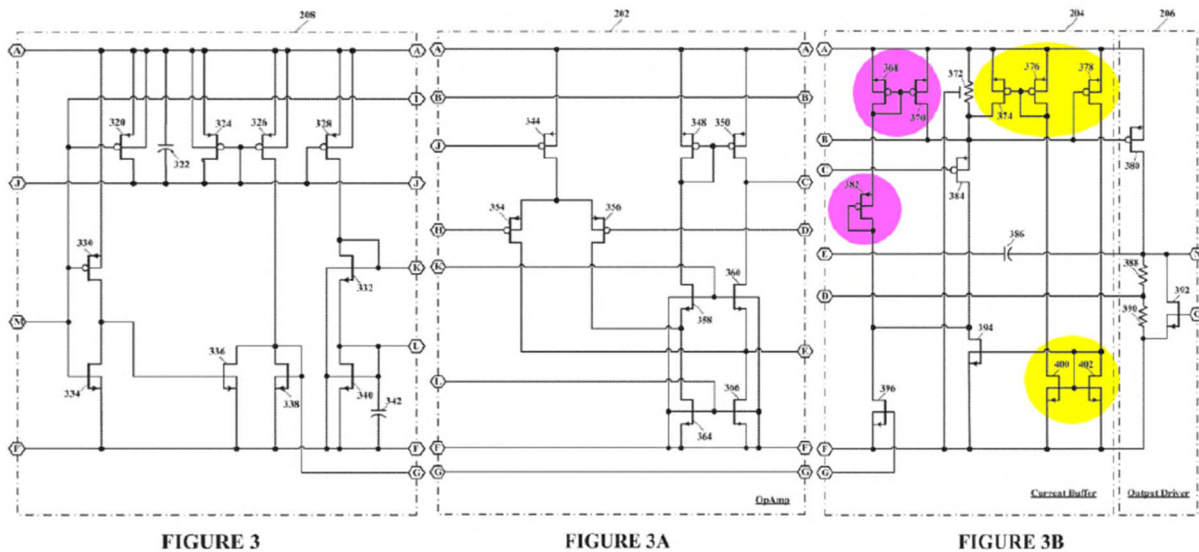
II. GROUNDS 1 AND 2 DISCLOSE "A GM ENHANCED CURRENT BUFFER DRIVER"

Patent Owner seeks to sidestep the Petition's arguments by inventing a claim requirement: a "gm enhancement" mechanism that "changes the *allocation* of where [standing] current is deployed," whereas "gm-boost changes the overall *magnitude* of the standing current." (POR, 23.) But Patent Owner does not articulate how this

mechanism resembles anything in the patent’s description of its purported invention. Instead, it relies on its expert’s interpretation—untethered to the specification and technically flawed—of a single patent figure. Meanwhile, the patent itself confirms the Petition’s interpretation—a gm boost results in a gm enhanced buffer. As Patent Owner relies solely on its wrong construction, the Board should find unpatentability.

A. Patent Owner and Its Expert Identify Zero Evidence in Support of Their Construction of “Gm Enhanced”

As an initial matter, Patent Owner provides no support for its construction. It argues that “gm enhancement” is provided by the pink circuitry below, as opposed to the yellow “gm-boost circuitry”:



(*Id.*, 17-18.) Per Patent Owner, “gm enhancement” shifts current between transistors 368 and 384, such that transistor 370 increases overall gm by helping 384 charge or discharge node B. (*Id.*, 22-23.)

But Patent Owner never explains where the patent describes this mechanism.

Across 12 pages of discussion (*see id.*, 16-18, 21-23, 39-44), Patent Owner cites the patent just twice for its view of “gm enhanced” (*see id.*, 16). First, it cites a snippet that just parrots claim language without shedding any light on what “gm enhanced” means. (*Id.* (citing EX1001, 1:60-62).) Second, Patent Owner baldly states that “col. 5:8-49” discusses “a different and independent approach from gm-boost.” (*Id.*) It does not elaborate because it cannot: The cited passage explicitly defines the **gm-boost** circuit to include the very transistors—368, 370, and 382—that Patent Owner contends provide the alleged “gm enhancement.” (EX1001, 5:8-10.) Nor does the passage say anything about “steering current around transistor 384” or changing the “allocation of where the current is deployed,” which is how Patent Owner contends “gm enhancement” works. (*See* POR, 17, 23.)

Dr. Taylor, too, offers zero patent support. (*See* EX2021 ¶¶ 66-71, 75-81, 83-97, 105-111 (citing patent for “gm boost” only); POR, 16-18, 21-23, 39-44.) Instead, he speculates about a single figure, ignoring the patent’s corresponding descriptions.

Patent Owner’s silence alone confirms the lack of evidence for its alleged “gm enhancement” technique. If evidence existed, Patent Owner would have cited it.¹

¹ Having forfeited its opportunity to identify intrinsic evidence support for its claim construction in the POR, Patent Owner should not be permitted to do so on sur-reply.

B. The '074 Patent Contradicts Patent Owner

The '074 patent never discusses Patent Owner's "gm enhancement." Instead, in the three places it mentions the key transistors for that alleged technique—368 and 370—the patent consistently describes them as part of "gm boost":

First, as previewed above, it states unequivocally that 368 and 370 are part of the "gm-boost stage." (EX1001, 5:8-10.)

Second, the patent states that 368 and 370 "provide a sufficient *amount of current* for the driver transistor 384 but not enough to increase more current based upon a limited current mirror by transistor 396." (*Id.*, 5:15-24 (emphasis added).) But according to Patent Owner, it is "gm boost" that deals with the "*magnitude*"—or amount—of current, whereas "gm enhancement" is about its "*allocation*." (POR, 23.) Thus, under Patent Owner's dichotomy, 368 and 370 relate to "gm boost," not the alleged "gm enhancement."

Furthermore, the same passage of the patent describes two currents, "one from the bias network and the other as current feedback," being "ratio'ed in" 368 and 370. Per Patent Owner, "gm enhancement" does "*not* rely on output current feedback," which relates strictly to "gm boost." (POR, 16.) As for the bias current, Dr. Taylor admits that a source follower like transistor 384 must be "biased by a current source" to provide sufficient current (EX2021 ¶ 48), just as the patent says 368 and 370 do for 384. (EX1001, 5:15-24.) This biasing is not the shifting or allocation of current

central to Patent Owner’s alleged “gm enhancement.”²

Third, the patent lists 368 and 370 alongside other transistors as part of the “simple current buffer.” (EX1001, 5:40-45.) This neither describes the alleged “gm enhancement” nor treats transistors 368 and 370 separately from what Patent Owner distinguishes as “gm boost” circuitry—374, 376, 378, 400, 402. (*Id.*)

It is also notable where the patent does **not** mention 368 and 370: The patent states that “[t]he gm of the PMOS current buffer driver 204 may comprise transistor 384.” (*Id.*, 5:15-16.) But Patent Owner defines the gm of the buffer driver to include more than that of transistor 384 in order to make its “gm enhanced” argument. (POR, 22-23 (arguing buffer driver has “a gm greater than that provided by source follower 384”; EX2021 ¶ 79 (similar).) Whatever gm is added by transistors 368 and 370, the patent evidently does not consider it to be part of the buffer driver’s gm, as far as its invention is concerned. Thus, “gm enhanced” cannot refer to that addition.

Simply put, the patent does not mention Patent Owner’s “gm enhancement” technique. Nor does it mention **any** “gm enhancement” technique distinct from “gm boost.” Whenever the patent mentions gm, it does so to describe “gm boost.” (*See*

² The Petition analyzed this specification passage in the same way Aptiv does here. (Petition, 6-7, 17-19, 59-60; *see also* EX1002 ¶¶ 36-37, 57, 147.) The POR, which does not discuss this passage at all, concedes that analysis.

EX1001, 2:4-6, 4:11-20; 5:3-7.) In other words, there is only one way that the patent describes enhancing gm—gm boost.³

The patent’s contradiction of Patent Owner’s position and its use of “enhance” and “boost” interchangeably are more than sufficient to overcome any presumption that different terms have different meanings. *See Uniloc 2017 LLC v. Netflix, Inc.*, No. 2021-2085, 2022 WL 17688150, at *6 (Fed. Cir. Dec. 15, 2022) (presumption overcome where there was “no reference in the specification to suggest” that a term entailed additional requirement); *Baran v. Med. Device Techs., Inc.*, 616 F.3d 1309, 1316 (Fed. Cir. 2010) (presumption overcome where terms used “interchangeably”).

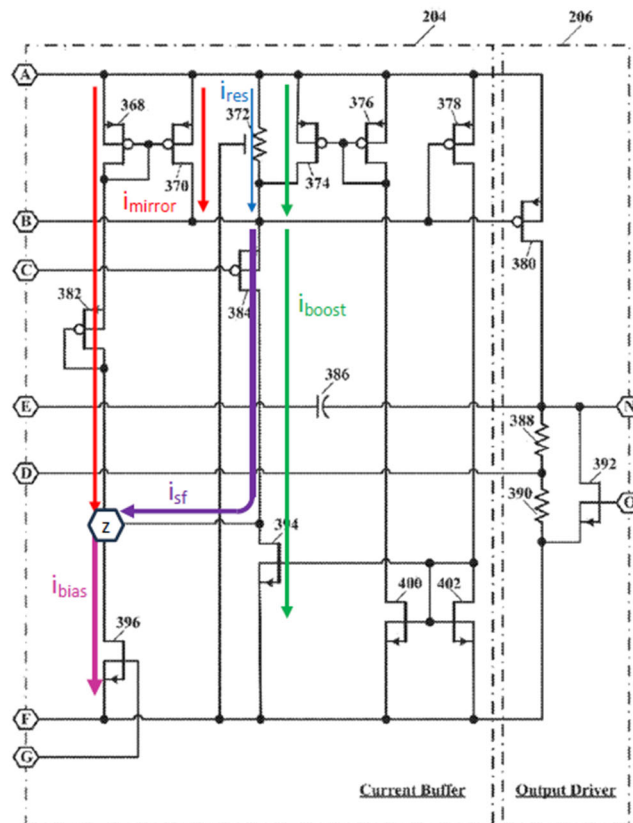
C. Patent Owner’s “Gm Enhancement” Has No Technical Basis

Patent Owner fails to prove that the alleged “gm enhancement” even exists, let alone that the patent supports its construction. Dr. Taylor, on whom Patent Owner exclusively relies, rests his argument on incorrect assumptions.

Referring to his markup of Figure 3B below, Dr. Taylor argues that (1) when

³ To the extent Patent Owner’s arguments raise issues under 35 U.S.C. § 112, Aptiv does not concede that the challenged claims satisfy that statute. But for purposes of this IPR proceeding, it is sufficient for the Board to reject Patent Owner’s proposed construction and apply a meaning of “gm enhanced” that does not require a separate technique for increasing gm from “gm-boost.”

the load current increases, it pulls the voltage at output node N down, (2) the error amplifier responds by dropping node C (*i.e.*, gate voltage of transistor 384), (3) the gate-to-source voltage V_{gs} of 384 increases, pulling B and Z together, and (4) when node Z rises, it “shifts current from i_{mirror} to i_{sf} ” such that i_{mirror} in 370 “pull[s] up less strongly on node B, helping source follower 384 pull node B down.” (*Id.* ¶¶ 76-79.)



First, Dr. Taylor incorrectly assumes that node B responds slowly. (EX2021 ¶ 79.) To justify step (3) above, he claims that V_{gs} increases because node B “has a lot of capacitance due to the large size of driver 380” and “moves more slowly.” (*Id.* ¶ 79.) The logic, apparently, is that because node B is slow, a drop in voltage at node C will cause an appreciable increase in V_{gs} (the voltage difference between B

and C). But node B is fast. As Dr. Taylor admitted, a source follower like transistor 384 counteracts the slow response of the large capacitance to help “deliver the signal more quickly.” (EX1029, 45:7-19.) Moreover, the goal of the '074 patent's circuit is to push the pole at the gate of the output driver transistor 380 “to a high frequency domain, effectively leav[ing] the only dominant pole at the output (node C) of the OpAmp 202 during full-load conditions.” (EX1001, 5:3-6; Petition, 4-5; EX1002 ¶¶ 33-34; *see also* EX2007, 56 (Dr. Taylor admitting that pole-splitting is “*why* the circuitry of the '074 patent includes a gm-boost circuit”).) But pole-splitting allows node B to respond quickly to changes in the much slower node C. (EX1028 ¶¶ 3-7.) Thus, any rise in V_{gs} caused by a drop at node C would be fleeting and small, as B reacts quickly. (*Id.*) Dr. Taylor's failure to account for this is fatal to his analysis.

Second, Dr. Taylor incorrectly assumes that the same i_{boost} current provided by transistor 374 carries through to 394, as shown in green in his annotations above. He never explains this assumption, which is wrong: The patent says that transistors 368 and 370 receive feedback current (EX1001, 5:15-24), which they get from 394 (EX1002 ¶¶ 37, 57). Dr. Taylor assumes no current between 368/370 and 394. (*See* EX2021 ¶¶ 76-79.)

Thus, Patent Owner has not shown that its alleged “gm enhancement” exists, let alone matches the patent.

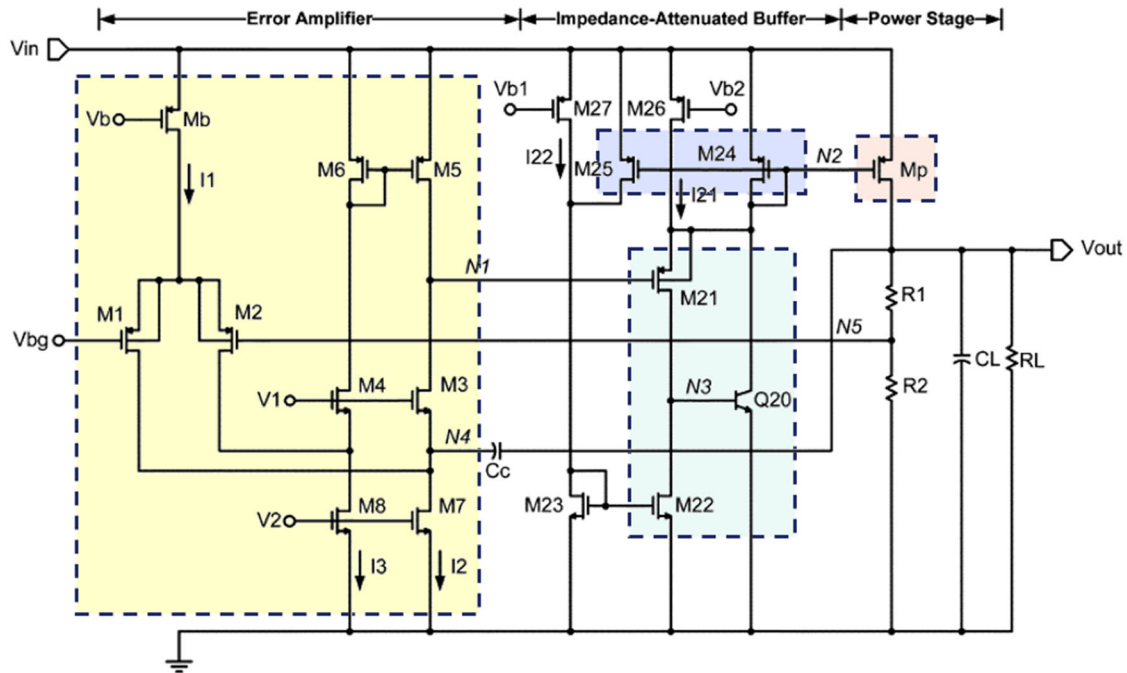
D. Patent Owner Concedes that Grounds 1 and 2 Disclose a “Gm Enhanced Current Buffer Driver,” as Properly Understood

Patent Owner’s rebuttal to Grounds 1 and 2 for limitation 1[b] is entirely based on its proposed construction. (POR, 39-44.) Patent Owner does not challenge the Petition’s showing that, if “gm enhanced” does not refer to a separate technique from “gm boost,” Al-Shyoukh and Rincon-Mora disclose a “gm enhanced current buffer driver.” (Petition, 16-17, 58-59; EX1002 ¶¶ 53-55, 142-144.) Since Patent Owner’s construction is wrong, it effectively concedes 1[b].

E. In the Alternative, Ground 1 Satisfies Patent Owner’s Incorrect Construction

Even under Patent Owner’s incorrect argument that “gm enhanced” entails a technique distinct from “gm boost,” Ground 1 still renders the claims obvious. *See Axonics, Inc. v. Medtronic, Inc.*, 75 F.4th 1374, 1384 (Fed. Cir. 2023) (where patent owner “first proposes a claim construction in a patent owner response, a petitioner must be given the opportunity in its reply to argue and present evidence” of invalidity under that construction).

The voltage regulator of Al-Shyoukh, the primary reference under Ground 1, is shown below, with its buffer driver in green:



(EX1004, Fig. 8 (annotated); EX1028 ¶¶ 12-15.) These annotations are identical to those in the Petition, except that transistor Q_{20} is now included in the buffer driver. (See Petition, 11-12; EX1002 ¶ 45.) Al-Shyoukh states:

During the transition from no load to full load, the decrease in the voltage at N_1 causes an increase in the transient current through M_{21} , which flows through the base of Q_{20} . The collector current of Q_{20} then increases to discharge the large gate capacitance of the pass device C_p and the voltage at N_2 decreases with a faster slewing.

(EX1004, 1734.) This is Patent Owner’s “gm enhancement”: Node N_1 is at the gate of driver transistor M_{21} (like the patent’s node C). (EX1028 ¶ 14.) Node N_2 is at the source of M_{21} and gate of output driver M_p (like node B). (*Id.*) To use Dr. Taylor’s words, when “the load current increases,” the error amplifier responds by “dropping

node [N₁],” which “increas[es] the current through [M₂₁],” causing Q₂₀ to “help[] source follower [M₂₁] pull node [N₂] down.” (EX2021 ¶ 79; *see also* EX1028 ¶ 14.) Thus, if “gm enhancement” entails a second transistor helping to charge or discharge the source node of the driver, Al-Shyoukh discloses it. (EX1028 ¶¶ 12-15.)

Adjusting Ground 1 to include Q₂₀ in the current buffer driver does not alter the Petition’s analysis as to any other limitation. (*Id.* ¶ 15.) Therefore, even under Patent Owner’s incorrect construction, the ’074 claims remain unpatentable.

III. GROUNDS 1 AND 2 DISCLOSE “A BIASING CIRCUIT COUPLED TO THE CURRENT BUFFER DRIVER TO SET A BIASING RATIO FOR GM-BOOST”

Patent Owner’s argument for limitation 1[c] likewise depends on an incorrect claim construction:

In the context of the claimed voltage regulator and the ’074 patent specification, a POSITA would understand that *[biasing ratio] refers to the ratio of current in the output transistor to the buffer driver.*

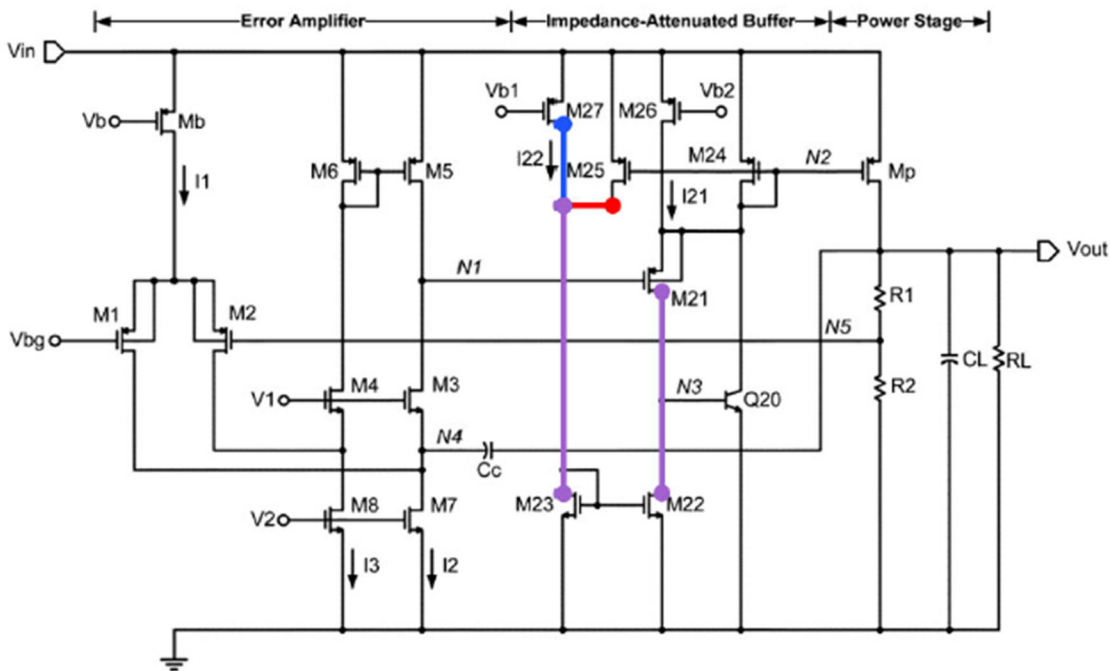
(POR, 46 (emphasis modified).) Without justifying this construction, Patent Owner argues that Aptiv fails to show such a ratio. (*See id.*, 46-55.) But the construction is wrong. And as Patent Owner does not otherwise challenge Grounds 1 and 2, the Board should find the claims unpatentable.

A. Patent Owner Offers Zero Evidence to Show that “Biasing Ratio” Means What It Claims

Instead of identifying support in the patent for its construction, Patent Owner

cites two inapposite paragraphs from Dr. Taylor’s declaration. (*Id.*) Paragraph 80 mentions neither the output transistor nor the buffer driver (EX2021 ¶ 80), while paragraph 118 does not even discuss the patent (*id.* ¶ 118). Nor does Dr. Taylor try to justify Patent Owner’s interpretation of “biasing ratio” anywhere else.

If anything, Dr. Taylor is inconsistent with the POR. He assumes that “biasing ratio” is “the fraction of the output driver current that biases the source follower.” (*Id.*) But this is not the “ratio of current in the output transistor to the buffer driver” because it excludes bias current. To illustrate, Dr. Taylor gives his biasing ratio for Al-Shyoukh’s circuit below as a transistor “size ratio,” $\frac{M25 \times M22}{M_p \times M23}$:



(*Id.* ¶¶ 117-118; EX1004, Fig. 8.) But at his deposition, Dr. Taylor confirmed that his fraction accounts only for the red current shown above, excluding the blue bias

current. (EX1029, 99:17-101:21.) He also agreed that the total current flowing into M_{23} and mirrored to M_{22} would include the blue current. (*Id.*; *see also* Petition, 19; EX1002 ¶ 56.) Dr. Taylor’s fraction thus omits some of the current M_{22} pulls from buffer driver M_{21} , contradicting the POR’s construction, which does not exclude any of the buffer driver’s current.

Worse, Patent Owner and Dr. Taylor never explain what their respective ratios have to do with “biasing.” As Dr. Taylor testified, biasing means “mak[ing] sure a transistor or the active network of a circuit is at a desired operating point,” where an operating point is a specific current or voltage. (EX1029, 38:14-40:8.) Neither the POR’s nor Dr. Taylor’s conflicting definitions of “biasing ratio” relate to a specific current or voltage.

Furthermore, Patent Owner’s criticisms of the prior art based on its “biasing ratio” construction also apply to the ’074 patent. For example, Patent Owner argues that Rincon-Mora’s biasing circuit “has nothing to do with set[ting] a biasing ratio” because it “merely performs the generic function of placing the circuit at a desired operating point or condition.” (POR, 49.) But that is also what the patent’s biasing circuit 208⁴ does—it places the gate of transistor 396 at a desired operating voltage.

⁴ In a footnote, Patent Owner contends that “block 208” is “only part of the claimed biasing circuit.” (POR, 18.) But Patent Owner never identifies the rest of the circuit.

(See EX2021 ¶¶ 46-47.) Likewise, applying Dr. Taylor’s “fraction” logic for Al-Shyouch to the ’074 patent, one would find that biasing circuit 208 does not set a size ratio involving either the buffer driver or output driver. (EX1028 ¶¶ 8-11.)

Patent Owner’s only other support for its construction is Dr. Chen’s alleged admission that Rincon-Mora’s biasing ratio is the “ratio between transistors 20 and 45.” (POR, 46, 49.) But Dr. Chen references a “mirror ratio” because the transistors are mirrored. (EX1002 ¶ 146.) He never calls this a “biasing ratio.”

Given the lack of evidence for Patent Owner’s construction of “biasing ratio,” its disagreement with its own expert, and the patent’s incompatibility with the POR’s stated construction, the Board should reject Patent Owner’s position.

B. Patent Owner Concedes that the Prior Art Shows a Biasing Circuit in Exactly the Same Way as the ’074 Patent

Conspicuously, Patent Owner does not dispute the Petition’s analysis of how both Al-Shyouch and Rincon-Mora disclose a biasing circuit that sets a biasing ratio for gm-boost using the same topology as the patent. The Petition explains in detail how the patent’s bias circuit provides a bias current that, with a feedback current, is “ratio’ed” in transistors 368 and 370. (Petition, 17-19; EX1002 ¶¶ 57, 147.) It also

It also contradicts the patent’s consistent use of “biasing circuit,” “bias circuit,” and “biasing circuitry” to refer to 208 only. (EX1001, 3:63, 4:43, Fig. 1.)

explains how Al-Shyoukh's and Rincon-Mora's bias circuits do the same. (Petition, 19, 60-61; EX1002 ¶¶ 56-58, 145-148.) As Patent Owner concedes all of this, the Board should find Aptiv's "arguments sufficiently persuasive," as it did at institution where "Patent Owner d[id] not . . . contest these arguments." (D.I. (Paper 11), 23.)

C. Each Ground Articulates a Consistent "Biasing Circuit"

Patent Owner obtusely criticizes the Petition for pointing to "currents" instead of "any actual circuits." (POR, 45-46.) But the Petition explains clearly that "Al-Shyoukh's LDO uses a biasing circuit" to "set a voltage V_{b1} at the gate of transistor M_{27} , providing a bias current I_{22} " and "Rincon-Mora's LDO uses a biasing circuit" to "set a bias current I_{bias} ." (Petition, 17-21, 59-62; EX1002 ¶¶ 56-59, 145-149.) Patent Owner does not and cannot dispute that both Al-Shyoukh and Rincon-Mora use actual circuits to provide these voltages and currents.

Patent Owner also misconstrues the Petition when accusing it of playing "fast-and-loose with the biasing circuit requirements" by relying on Ivanov for limitation 1[d], but not for 1[c]. (POR, 47.) The Petition is consistent: 1[c] does not require that the biasing circuit take any specific form. It only requires that the circuit "couple to the current buffer driver to set a biasing ratio for gm-boost." The Petition shows that by providing bias voltages or currents, the prior art's biasing circuits each set a biasing ratio for gm-boost. (Petition, 17-21, 59-62.) None of this involves Ivanov because 1[c] relates to the function of the biasing circuit vis-à-vis the current buffer

driver. By contrast, 1[d] relates to a function within the biasing circuitry itself, and Ivanov discloses a way to implement that function. There is no inconsistency.

D. Patent Owner Fails to Rebut Aptiv's Alternative Argument

Instead of engaging with the alternative arguments presented in the Petition, Patent Owner complains that it does not understand them. (*See* POR, 50, 55.) But the Petition is clear: If “biasing ratio” means the “ratio of current that the current buffer draws from DC relative to the current feedback circuit,” as Patent Owner has represented to Aptiv in district court, then Al-Shyoukh’s and Rincon-Mora’s biasing circuits each set such a ratio. (Petition, 20-21, 61-62.) Al-Shyoukh’s current buffer driver M_{21} draws two currents from DC, I_{21} and I_{22} . (*Id.*, 20.) The ratio of that bias current relative to current from feedback thus depends on the voltages V_{b1} and V_{b2} provided by the biasing circuit to set I_{21} and I_{22} . (*Id.*) Likewise, Rincon-Mora’s current buffer driver, transistor 42, receives I_{bias} from its biasing circuit. (*Id.*, 61.) The ratio of that bias/DC current relative to feedback depends on the value of I_{bias} , as set by the biasing circuit. (*Id.*)

Patent Owner dismisses these arguments as “underdeveloped” or on the basis that they do not apply its incorrect construction of “biasing ratio.” (POR, 50, 55.) Neither response is valid. Furthermore, by feigning ignorance, Patent Owner avoids addressing how the meaning of “biasing ratio” under Aptiv’s alternative arguments (which Aptiv took directly from Patent Owner’s infringement positions in the district

court) is different from the construction Patent Owner proposes now.

IV. PATENT OWNER CONCEDES THAT ENABLE/DISABLE WAS A KNOWN TECHNIQUE USED FOR THE EXACT PURPOSE APTIV PROPOSES

Patent Owner concedes that “enable/disable signals for biasing circuits were known widely in the art” as “power efficiency was a common concern and disabling circuitry that was not in use was an obvious and conventional way of saving power.” (Petition, 65; EX1002 ¶¶ 70, 161.) As Dr. Taylor told the district court:

A POSITA would have recognized that there are only a limited number of ways for enabling/disabling the flow of current in a circuit and that by far the most common way is to turn on or off the transistor itself through which current is flowing. ***This is a fundamental technique that is used in all types of applications***, such as disabling current in a smartphone circuit or disabling the coils in a room heater when a given temperature is reached.

(EX2007, 50 (emphasis added) (adding that “engineers routinely use an input to a circuit to enable or disable it”).) The Petition uses this conventionality to show that a POSITA would have used enable/disable with Al-Shyoukh’s and Rincon-Mora’s circuit topologies to reduce standby current. (Petition, 21-26, 62-66; EX1002 ¶¶ 60-70, 150-161.)

Indeed, Aptiv’s proposed modification would have been the “mere application of a known technique to a piece of prior art ready for the improvement.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007). The Federal Circuit reaffirmed that

rationale in *Intel Corp. v. PACT XPP Schweiz AG*, explaining that a patent challenger need only show that the known technique was a “suitable option,” as opposed to “an ‘improvement’ in a categorical sense.” 61 F.4th 1373, 1381 (Fed. Cir. 2023). It thus reversed a finding of no motivation because the challenger showed that (1) there was a “known problem” in the art, (2) its secondary art “helped address that issue,” and (3) “combining the teachings of [the primary and secondary art] wasn’t beyond the skill of an ordinary artisan.” *Id.* And here, the Petition shows that power efficiency was a known problem, that either Ivanov or the conventional use of enable/disable helped improve power efficiency, and that a POSITA had the skill to integrate these solutions into the primary references. (Petition, 21-26, 62-66.)

Critically, the POR does not dispute any of this. Instead, it tries to cast doubt by misreading the prior art to teach away and invoking alleged tradeoffs that do not call motivation into question. Neither rebuts obviousness.

A. The Prior Art Did Not Teach Away

The standard for teaching away is far higher than Patent Owner’s argument—devoid of authority or legal analysis—suggests. Patent Owner does not show, as it must, that Aptiv’s prior art references “criticize, discredit, or otherwise discourage investigation into the claimed invention.” *See Meiresonne v. Google, Inc.*, 849 F.3d 1379, 1382 (Fed. Cir. 2017). Indeed, Al-Shyoukh and Rincon-Mora never “criticize, discredit, or otherwise discourage” enable/disable. Lacking support, Patent Owner

instead misreads Rincon-Mora as calling its quiescent current “tantamount” to zero. (POR, 30, 60-61.) It then uses this misreading to set up a legally and factually flawed argument that because Rincon-Mora and Al-Shyoukh already had “sufficient” power efficiency, neither “rais[ed] a concern.” (POR, 63-64.) Patent Owner is wrong.

1. Rincon-Mora does not equate 23 μ A quiescent current to “no standby current.”

Patent Owner relies heavily on its misunderstanding that Rincon-Mora’s LDO regulator has “no standby current during zero output current load conditions.” (POR, 24, 27, 30-31, 57-60 (repeating the argument 14 times).) Based on that error, Patent Owner proposes that the Rincon-Mora Paper’s reported 23 μ A quiescent current is “tantamount” to zero. (*Id.*, 30, 60-61.)

What Rincon-Mora actually says is that a component of its LDO, and not the entire LDO, has “no standby current”:

More particularly, the present invention relates to a current efficient LDO voltage regulator *incorporating a transient response boost circuit which may be added to selectively apply current to a slew-rate limited node and yet* requires no standby current during zero output current load conditions of the LDO voltage regulator.

(EX1013, 1:12-17 (emphasis added).) The POR uses ellipses to hide the bolded part above. (POR, 27, 59; *see also id.* (presenting EX1013, 2:4-7, which mentions only the transient boost circuit, as describing the full LDO).)) Patent Owner repeats this mistake when criticizing the Petition’s discussion of transistor 45 and the “transient

Similarly, Patent Owner mischaracterizes Rincon-Mora when implying that it criticizes devices with “a separate enable terminal to switch the device into a standby mode.” (POR, 58.) Rincon-Mora simply notes enable/disable as a way of improving efficiency. (*See* EX1013, 1:25-30.) It neither criticizes the technique nor suggests

incompatibility with its own method. (*See id.*) That is not teaching away. *See Bayer Pharma AG v. Watson Lab'ys, Inc.*, 874 F.3d 1316, 1327 (Fed. Cir. 2017) (prior art did not teach away where POSITA “would have merely *avored* one disclosed option over another disclosed option”).

2. The prior art’s performance metrics would not have kept a POSITA from making further improvements.

Patent Owner also argues that a POSITA would have found Al-Shyoukh’s and Rincon-Mora’s solutions “sufficient” and not “raising a concern that lower quiescent current is needed” because they tout low quiescent currents. (POR, 63-64.) This is legally and factually incorrect.

First, prior art does not teach away just because it is already “sufficient.” *See Cole Kepro Int’l, LLC v. VSR Indus., Inc.*, 695 F. App’x 566, 570 (Fed. Cir. 2017) (although prior art disclosed a device that “already provides comfortable seating,” it did “not discourage the provision of additional legroom”). Nor must prior art “raise a concern” to motivate modification. *Janssen Pharms., Inc. v. Teva Pharms. USA, Inc.*, 97 F.4th 915, 929 (Fed. Cir. 2024) (patent challenger need not show that there was an “explicit problem” in the reference to be modified).

Second, Al-Shyoukh’s 20 μ A and Rincon-Mora’s 23 μ A quiescent currents have little bearing on motivation. As Dr. Taylor admitted, quiescent current varies with the physical parameters of a circuit’s elements. (EX1029, 91:25-93:16.) The reported quiescent currents were for actual chips with defined physical component

parameters. (EX1004, 1738-39; EX1014, 43.) Aptiv relies not on those chips, but on the prior art circuit topologies. Therefore, the issue here is motivation to improve on those topologies, not the test samples (whose parameters are not even disclosed). The Petition demonstrated such motivation: Disabling unused bias circuitry would have eliminated a source of power loss that neither Al-Shyoukh nor Rincon-Mora addressed. (Petition, 21-26, 62-66.) Thus, Patent Owner’s reliance on the reported quiescent currents is misplaced.⁵

Third, Patent Owner references Al-Shyoukh’s reported “current efficiency of 99.8%,” but that metric relates to full-load, not no-load. (POR, 62 (citing EX1004, 1741).) It is thus irrelevant to whether a POSITA would have disabled bias circuitry when *not in use*.

Insofar as Al-Shyoukh and Rincon-Mora generally tout their low quiescent currents, Patent Owner provides neither evidence nor legal authority as to why this would have discouraged a POSITA from making further improvements. If anything, a POSITA would have understood these disclosures to emphasize power efficiency

⁵ Dr. Taylor’s comparisons of Al-Shyoukh and Rincon-Mora to various datasheets are similarly of little use. (EX2021 ¶ 136.) As he admitted, the “quiescent currents” reported in the datasheets are not the same metric used by Al-Shyoukh and Rincon-Mora. (EX1029, 79:9-80:9, 86:13-87:9.)

as a goal, as the Petition explained. (Petition, 25, 64.)

B. Patent Owner Fails to Raise Any Material Tradeoff Concerns

Patent Owner also seeks to rebut motivation by accusing Aptiv of failing to analyze alleged tradeoffs involved in regulator design. (POR, 65-69.) But where the proposed modification was undisputedly a “known technique,” Aptiv need only show that it was “suitable,” not categorically better. *Intel*, 61 F.4th at 1380-81. The Petition did that by showing how enable/disable would improve power efficiency by shutting off unused circuitry. (Petition, 21-26, 62-66.) The POR neither disputes this improvement nor cites any authority imposing a stricter legal test.

While Patent Owner lists various design considerations, it only elaborates on two: “speed/timing” and that “[t]he enable/disable circuitry itself consumes power.” (See POR, 65-68.) The Board need not consider the remaining alleged tradeoffs, as “a generalized statement discussing tradeoffs in design does not rise to the level of discouraging [a] combination.” *Valencell, Inc. v. Fitbit, Inc.*, 786 F. App’x 247, 250 (Fed. Cir. 2019).

As to “speed/timing,” Patent Owner argues that enable/disable requires delay as the device “come[s] out of standby,” but does not demonstrate why delay would have been unacceptable to a POSITA. (POR, 67.) In fact, Dr. Taylor acknowledges that Ivanov reports a 100-150 ns start-up time (EX2021 ¶ 101), which is faster than the fastest application Dr. Taylor discusses: the 900 ns exit window for the USB U1

state (*id.* ¶ 64). Notably, the USB specification also discloses U2 and U3 states with exits 2,000x-10,000x slower than U1. (EX2022, 162.) Ivanov’s start-up would have been negligible in comparison. Meanwhile, Patent Owner does not show where Al-Shyoukh or Rincon-Mora identify a “goal of fast transient response.” (See POR, 67.) Nor does Patent Owner explain how these references impose any start-up time constraint that the proposed combinations would not meet. If anything, Dr. Taylor contradicts Patent Owner’s unjustified emphasis on response time when laying out Al-Shyoukh’s “key performance metrics”—none of which are response time. (See EX2021 ¶¶ 57-61.)

Patent Owner also does not show how the power consumed by enable/disable circuitry would deter using it with Al-Shyoukh and Rincon-Mora. In one sentence, Patent Owner blames Aptiv for not accounting for the “5 μ A ‘trickle charge’ current for [Ivanov’s] compensation capacitor C_0 .” (POR, 68.) But first, the exemplary trickle charge current is 1-2 μ A. (EX1005, 5:54-58.) Patent Owner confuses it with another current that has a range of 0.1-5 μ A. (*Id.*, 5:39-49.) Cherry-picking the high end, Patent Owner does not explain why 5 μ A would discourage a POSITA when it is multiples below Al-Shyoukh’s and Rincon-Mora’s 20/23 μ A. Indeed, commercial devices used enable/disable for similar reductions. (See EX1028 ¶¶ 16-18; EX1030, 3, 6 (MIC3385 datasheet reporting 29 μ A quiescent current, 5 μ A shutdown current, 70 μ s turn-on); EX1031, 151 (datasheet submitted by Dr. Taylor in the district court,

showing 75 μA quiescent current, 1 μA shutdown current, 80 μs start-up time).)

Patent Owner's argument also suffers from the same issue as its teaching away argument: Aptiv relies on Ivanov's general model for enabling and disabling a bias circuit, focusing on its V_{SHUTDOWN} signal and M_{11} and M_{22} transistors. (Petition, 23-25, 62-63; EX1002 ¶¶ 67, 157.) It does not rely on any specific embodiment with a 5 μA trickle circuit. As Dr. Chen noted, when applying Ivanov, a POSITA would have chosen "the different components in Ivanov's circuit" "to generate the desired bias voltages or currents." (EX1002 ¶¶ 68, 158.)

C. The Petition Sufficiently Articulates Motivation

Finally, Patent Owner focuses on form over substance to construct a vague argument against any instance of the word "could" used in the Petition. (POR, 69-72.) This misrepresents the Petition.

For example, Patent Owner attacks the Petition's point that a POSITA would have understood Rincon-Mora's error amplifier "could be an operational amplifier." (POR, 70.) But it ignores the Petition's explanation that "it was well known that an LDO's error amplifier should have sufficient loop gain, and op-amps were known to have high gain." (Petition, 57.) This demonstrated why a POSITA would have used an op-amp. (*Id.*) Similarly, the Petition followed its point that Rincon-Mora's buffer "could be implemented as an NMOS source follower" by explaining why a POSITA would have done so: An NMOS was "a readily available and well-known

option with recognizable benefits like cost savings.” (*Id.*, 58.)

For other instances of “could,” Patent Owner confuses discussion of whether a POSITA had the skill and knowledge to implement a modification (a question of “could”) with whether a POSITA was motivated to do so (a question of “would”). For example, by stating that a “biasing circuit could be implemented according to conventional, well-understood methods,” the Petition was describing a POSITA’s knowledge, not articulating a combination. (*Id.*, 22, 62.) Likewise, Patent Owner criticizes the “could”s in the Petition’s showing that a POSITA *could* have integrated Ivanov without undue experimentation. (*Id.*, 25, 64-65.) Why the POSITA *would* have done so was established separately. (*See id.*, 22-25, 62-64.)

Patent Owner’s final example has nothing to do with motivation. When Aptiv pointed out that “the biasing circuit could be adjusted to set V_{b1} and V_{b2} ,” that was a point about the literal possibility of setting V_{b1} and V_{b2} to desired values. (*Id.*, 21.)

V. CONCLUSION

None of Patent Owner’s three challenges to the Petition are viable. The Board should therefore find claims 1-18 of the ’074 unpatentable under Grounds 1 and 2.

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Certification of Word Count (37 C.F.R. § 42.24)

I hereby certify that this PETITIONER REPLY TO PATENT OWNER RESPONSE has 5,595 words (as counted by the “Word Count” feature of the Microsoft Word™ word-processing system), exclusive of “a table of contents, a table of authorities, a listing of facts which are admitted, denied, or cannot be admitted or denied, a certificate of service or word count, or appendix of exhibits.”

Dated: April 3, 2025

By /Stephen Liu/

Stephen Liu

Certificate of Service (37 C.F.R. § 42.6(e)(4))

I hereby certify that the attached PETITIONER REPLY TO PATENT OWNER RESPONSE was served as of the below date on the Patent Owner via e-mail (by agreement) to the following counsel of record:

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