

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG DISPLAY CO., LTD; SAMSUNG ELECTRONICS CO., LTD.; and
SAMSUNG ELECTRONICS AMERICA, INC.

Petitioners

v.

POLARIS POWERLED TECHNOLOGIES, LLC

Patent Owner

IPR2023-00771

U.S. Patent No. 7,259,521

PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE

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EXHIBIT LIST

Exhibit No. ¹	Description
1001	U.S. Patent No. 7,259,521 (“the ’521 Patent”)
1002	Expert Declaration of Dr. Alex Kattamis
1003	CV of Dr. Alex Kattamis
1004	Prosecution File History of the ’521 Patent
1005	Complaint in <i>Polaris PowerLED Technologies, LLC v. Samsung Electronics America, Inc.</i> , Case No. 2:22-cv-00469 (E.D. Tex.)
1006	U.S. Patent Publication No. 2005/0190128 (“Hayafuji”)
1007	U.S. Patent Publication No. 2005/0140600 (“Kim”)
1008	International Publication No. WO2004034365A1 (“Steer”)
1009 / 1013	James W. Nilsson, et al., <i>Electric Circuits</i> (5th ed. 1996)
1010	Paul Horowitz, et al., <i>The Art of Electronics</i> (2nd ed. 1989)
1011 / 1014	Willem Den Boer, <i>Active Matrix Liquid Crystal Displays – Fundamentals and Applications</i> (1st ed. 2005)
1012	Min-Koo Han, <i>AM backplane for AMOLED</i> , PROC. OF ASID (2006)
1015	Supplemental Expert Declaration of Dr. Alex Kattamis
1016	Transcript of April 18, 2024 Deposition of Thomas L. Credelle
1017	Transcript of April 11, 2024 Markman Hearing <i>Polaris PowerLED Technologies, LLC v. Samsung Electronics America, Inc. et al</i> , EDTX-2-22-cv-00469
1018	Claim Construction Declaration of Thomas L. Credelle (February 23, 2024) <i>Polaris PowerLED Technologies, LLC v. Samsung Electronics America, Inc. et al</i> , EDTX-2-22-cv-00469

¹ Citations to patents are made by column and line cite; citations to U.S. patent publications are made by paragraph number; citations to International patent applications are made by page number; citations to other exhibits are made with reference to the Bates-stamped pagination.

I. INTRODUCTION

Patent Owner (PO) rehashes arguments the Board already properly rejected and offers nothing to compel a different result. Applying the correct legal analysis and record evidence, as explained herein, the Petition demonstrates that each of the prior art references, *Kim*, *Hayafuji*, and *Steer*, render the challenged claims unpatentable.²

II. CLAIM CONSTRUCTION

Petitioner addresses Patent Owner's apparent constructions of various terms below, where relevant to the Grounds.

III. GROUNDS 1 AND 2 - CLAIMS 1, 2, AND 7 ARE ANTICIPATED OR OBVIOUS IN VIEW OF *KIM*

PO's arguments against *Kim* fall into two categories: (1) a temporal-based argument that "due to variations in VDD over time," the VDD driving the pixel does not perfectly cancel out with the VDD used to which the video drive signal is referenced, and (2) an argument that the circuitry from *Kim* that was mapped to the claimed video driver is not a "video driver", based on various unclaimed but supposedly necessary functions. POR, 8-35. As explained below, neither of these arguments have merit and both should be rejected. EX1015, ¶¶161-205.

² Emphasis supplied throughout, unless noted.

A. PO's temporal argument would apply equally to all embodiments of the '521 Patent, and would exclude all Active-Matrix Displays from the claims

PO's temporal argument against *Kim* is that “due to variations in VDD over time,” the PPS voltage VDD that drives the pixel does not fully “cancel out” with the PPS voltage VDD used to generate the video drive signal and therefore does not satisfy the *independent of* limitation. POR, 27-35. This argument proves too much because, as explained below, this purported deficiency would be true of any active-matrix display, including all of the embodiments of the '521 Patent. EX1015, ¶¶166-184.

Both experts agree that active-matrix displays operate in two phases: (1) a programming phase where the pixel is programmed (similar to a DRAM cell) with a brightness to be displayed for the current image frame held in a storage capacitor, and (2) an emission phase, where the pixel emits that programmed brightness until the next programming cycle. EX2011, ¶¶32-78; EX1015, ¶167. PO attempts to seize upon this fact to argue that because the signal programmed during the programming phase is referenced to the VDD existing at the time of programming, it is not referenced to the VDD existing during the emitting phase. POR, 27-31; EX2011, ¶¶103-110. This, PO argues, leads to the drive current not being “independent of” the power supply. POR, 31-35; EX2011, ¶¶111-120. The problem is that if this temporal interpretation of the *independent of* limitation were correct, it would both

exclude all embodiments of the '521 Patent, and would render the claims nonsensical, as they would be limited to “active matrix” display panels,³ while simultaneously excluding all “active matrix” display panels, which inherently include this temporal effect. EX1015, ¶170.

1. PO’s Attempt to Add a Temporal Distinction to the Voltage Source is Flawed

PO argues that in *Kim*, “the positive power supply voltage VDD is not constant with time,” and therefore “[t]he value of VDD that is used to determine VA4 in Equation 11 is not necessarily the same value of VDD that is applied to the source of drive transistor M31.” POR, 27-28. Based on this premise, PO rewrites the equations in *Kim* “[u]sing t1 to indicate the short period of time during which VDD is applied to electrode A4 of capacitor Cst4 [*i.e.* the pixel programming time] and t to indicate the longer time period during which VDD is applied to the source

³ The '521 Patent states that “[t]he present invention relates to a video driver for AMOLED displays,” *i.e.*, an “Active Matrix” OLED display. EX1001, 1:6-17, 3:8-10. *See, e.g.*, EX1001, Claims 1-8. (“...referenced to a positive power supply voltage of **the AMOLED** display panel”; “An **active matrix** organic light emitting diode (AMOLED) display system ...”).

terminal of drive transistor M31 and current is flowing to the OLED [*i.e.* the emission time].” POR, 29.

In the rewritten equations, PO attempts to differentiate between the PPS voltage VDD that is received by the video driver during programming, which PO calls “VDD(t1),” and the PPS voltage VDD that is continuously received by the current driver, which PO calls “VDD(t).” *See, e.g.,* POR, 29, 34, 35. PO’s “VDD(t1)” is referred to herein as “VDD_{VID}” to indicate that it is the VDD voltage received by the video driver, and PO’s “VDD(t)” herein as “VDD_{CUR}” to indicate that it is the VDD voltage received by the current driver. An example of PO’s rewritten equations is shown below, in which *Kim*’s VA4 corresponds to the claimed video drive signal, and VC2 corresponds to the claimed current drive voltage.

$$\begin{aligned} \text{VA4} &= \text{VDD}(t1) + \Delta\text{VB4} = \text{VDD}(t1) + \text{V}_{\text{DATA}} - \text{V}_{\text{sus}} \\ \text{VC2} &= \text{VDD}(t) - (\text{VDD}(t1) + \text{V}_{\text{DATA}} - \text{V}_{\text{sus}}) \end{aligned}$$

POR, 29.

Having rewritten *Kim*’s equations, PO argues that “[t]he modified equations above illustrate that [VDD_{VID}] is a constant representing the value of VDD stored on the A4 electrode” and that “[t]his is different than [VDD_{CUR}], which is the value of VDD over time and that is connected to the source terminal of drive transistor M31.” POR, 30. PO concludes that as to Element [1-A] “[t]he value of VA4 is therefore

not referenced to the relevant power supply voltage” and that as to Element [1-C], “the VDC components in $[VDD_{VID}]$ and $[VDD_{CUR}]$ cancel out, but the differences in undesirable voltage variations between $[VDD_{VID}]$ and $[VDD_{CUR}]$ do not.” POR, 30, 35.

Put simply, PO’s strategy is to effectively construe the claim term “independent of” to require that “variations over time” in the continuously fluctuating VDD_{CUR} must be reflected in the video drive signal throughout the entire emission time, which therefore means that the video drive signal must also be continuously fluctuating throughout the entire frame to incorporate the ever changing “variations over time.”

The underlying premise of PO’s position for this temporal argument, which PO attempts to obfuscate and avoid saying clearly, is that because *Kim* includes a storage mechanism (capacitor C2) to store the voltage each pixel is individually programmed with, the stored voltage “is a constant” based on the static value of VDD_{VID} , whereas VDD_{CUR} is continuously changing, and therefore, based on PO’s apparent construction, *Kim* doesn’t satisfy the “independent of” limitation.

This cannot be correct, because it would also exclude all embodiments of the ’521 Patent, which even PO’s expert admit would also include storage capacitors, and would therefore experience the same issue as *Kim*. EX1016, 54:4-8; EX1015,

¶¶171-179.⁴ PO does not dispute that active-matrix displays use sequential programming of many different pixels in a column or row with a stored voltage for each pixel for a full frame: “With respect to the concept of the pixel circuits having a storage mechanism, we don’t dispute that that’s the case for active matrix displays.” EX1017, 19:10-12; *see also, e.g.*, EX2011, ¶¶35, 60 (“These pixel drivers are programmed by a single current driver...”; “...the current is controlled with an analog signal stored within the pixel circuit”). Thus, there is always a potential discrepancy between the instantaneous power supply voltage and the power supply voltage associated with the programmed voltage in the pixel.

The only way to avoid this problem, as PO’s expert seems to agree, is if the claims were limited to pixels that were “directly driven” (*i.e.*, continuously driven) by the driver, without using a programming phase. EX1016, 33:17-34:15; EX1015, ¶178. However, such a system would no longer be an “active matrix” display panel, as explained above. EX1001, 1:13-28; EX1016, 34:2-40:10; EX1015, ¶178;

⁴ Although storage capacitors (*i.e.*, capacitor storing the voltage between the gate and terminal of the transistor driving the pixel) are not shown in Figs. 1-4 of the ’521 Patent, both experts agree that a POSA would understand that all ’521 Patent embodiments would use such storage capacitors. EX1016, 54:4-8; EX1015, ¶177.

EX1006, ¶¶4-5; EX1007, ¶¶6-13; EX1008, 1:10-2:2. Moreover, PO's expert admits such a system would be impractical as there would need to be "millions of wires" in the system, with at least one wire going between every pixel and the pixel driver circuitry. EX1016, 34:8-13, 36:1-4.

Because PO's argument is premised on an interpretation of the claims that cannot be correct, its argument should be rejected. Instead, as explained in the Petition, summarized below, *Kim* works in the same manner as the embodiments of the '521 Patent. As *Kim* explicitly states, its approach results in "the current flowing to the OLED" being "substantially not influenced by the power supply voltage." EX1007, ¶0114, EX1015, ¶179; Pet., 16-17, 38-39. Thus, whatever impact the effect of power supply voltages changes between the programming and emission phases are, those effects are present and subsumed in both *Kim* and the '521 Patent embodiments. Accordingly, if the claims cover any of the embodiments of the '521 Patent, they must also cover *Kim*. EX1015, ¶¶171-179.

2. *Kim* Meets the Claims

The '521 Patent provides equations showing how the video drive signal and current drive voltage are calculated in an embodiment that does expressly use a storage capacitor. As shown below, " $v(t)$ " is the claimed video drive signal and "Video.OLED" is the claimed current drive voltage.

every horizontal line. The video drive signal $v(t)$ is given as:

$$\begin{aligned} v(t) &= V_{clamp} + Video.DAC; \\ &= VDC + Vdrift + Video.DAC. \end{aligned}$$

The current drive voltage signal Video.OLED is given as:

$$\begin{aligned} Video.OLED &= VDD - v(t); & \text{Eq. (9)} \\ &= VDC + Vdrift + Vnoise - \\ &\quad VDC - Vdrift - Video.DAC; \\ &= Vnoise - Video.DAC. \end{aligned}$$

EX1001, 7:28-42.

Kim provides substantially similar equations, shown below, in which Kim's VA4 corresponds to the claimed video drive signal, and VC2 corresponds to the claimed current drive voltage.

[0109] Equation 11

$$V_{A4} = V_{DD} + \Delta V_{B4} = V_{DD} + V_{DATA} - V_{sus}$$

[0112] Equation 12

$$V_{C2} = V_{DD} - (V_{DD} + V_{DATA} - V_{sus}) = V_{DATA} - V_{sus}$$

EX1007, ¶¶ 0109, 0112.

Thus, in the equations for current drive voltage in both the '521 Patent and *Kim*, the variable “VDD” drops out of the final resulting equation at least to the same extent, if not more so (because *Kim* additionally removes noise as well as drift), in *Kim* relative to the '521 Patent. EX1015, ¶182. Both the '521 Patent and *Kim* treat the variable “VDD” as having the same variable subparts (to the extent that they are specified) in being applied or substituted into both the video drive signal equation and the current drive voltage equation. EX1015, ¶182.

Also, the '521 Patent specification does not articulate which particular temporal portions of VDD the current drive voltage must be “independent of.” EX1015, ¶182. Instead, it discusses how “independent of” is satisfied if the circuit eliminates any part of the power supply variation, whether it includes “noise or glitches,” which a POSA would understand are short term issues (*i.e.*, changes occur in a relatively short amount of time), or voltage drifts, which a POSA would understand are long term trends (*i.e.* changes occur over a relatively long amount of time). EX1015, ¶182; EX1016, 109:22-112:13; EX1001, 1:32-39 (discussing “noise” and “drift,” noting “[b]oth...are undesirable”), 2:38-3:4 (“noise and drifts result in variations of the brightness...”), 4:1-3 (“the display panel is no longer affected by power supply voltage fluctuations, noise **or** glitches”); 5:18-30 (describing “independent of” as meaning “any noise **or** DC drifts” are eliminated), 6:33-37 (same). Indeed, as the equations above verify, the specification includes an

example where power supply noise is expressly present in the current drive voltage equation due to this temporal variation between pixel programming and emission. EX1015, ¶182; EX1001, 7:9-51.

Therefore, in the '521 Patent, just like *Kim*, the claimed video driver would receive the PPS voltage VDD_{VID} and output a video drive signal $v(t)$ based on VDD_{VID} , such that the stored voltage would also be based on the specific fluctuations present in VDD_{VID} *at the specific time that particular pixel is written*. Thus, in an actual AMOLED display in the context of the '521 Patent, as the video driver is programming any other pixel during a given frame, the voltage stored for the particular pixel would continue to be based on the VDD_{VID} at the time of programming, whereas the PPS voltage VDD_{CUR} driving the pixel would continue to fluctuate over time.

In sum, comparing these dissonant positions taken by PO: (1) for the current drive voltage Video.OLED to be “independent of” VDD , VDD_{CUR} and VDD_{VID} continuously **MUST BE EQUAL** and fully cancel out, and (2) PO, PO's expert, and the '521 Patent's claims and specification all require that the claimed video driver is implemented in an active-matrix display, in which a pixel stores a voltage based on the VDD_{VID} at the time it is written, and therefore VDD_{VID} and the continuously changing VDD_{CUR} **WOULD NOT BE EQUAL** and would not fully cancel out. In other words, a requirement that the claimed video driver be implemented in an

active-matrix display is inexorably at odds with a requirement that VDD must fully drop out of the current driver output in the manner PO argues against *Kim*.

Thus, it is unclear what PO believes “independent of” means. However, in view of the ’521 Patent’s claims, specification, figures, and particularly in view of PO’s statements, either this claim is incoherent as requiring an impossibility (*e.g.*, an active matrix panel that is not active matrix) or *Kim* satisfies the claim language for the same reasons that the embodiments of the ’521 Patent do (*i.e.*, at least some portion of the undesirable power supply variation is eliminated). EX1015, ¶¶166-184.

B. *Kim* teaches the claimed “video driver”

PO maintains its argument that *Kim* isn’t sufficiently “separate and distinct from the pixel circuit.” POR, 13-27. PO’s argument fails for the same reasons acknowledged by the Board in the Institution Decision. EX1015, ¶¶185-205. Additionally, PO’s arguments are not commensurate with the scope of the claims. EX1015, ¶¶185-205.

The crux of PO’s argument is to construe the claim to require that the video driver be “separate and distinct” from the pixel circuit. POR, 13-27; EX1015, ¶185. To reach this construction, PO relies on the opening sentence of the ’521 Patent describing the field of the invention as “a video driver for AMOLED displays that is capable of isolating the pixel circuit from power supply voltage variations,” and

in particular, points to the word “isolating” to give rise to the alleged “separate and distinct” requirement. EX1015, ¶¶186-187. PO then argues that the circuitry identified in *Kim* by the Petition as the claimed video driver isn’t “separate” enough from the rest of the pixel and display circuitry. EX1015, ¶¶186-187.

First, even if “isolating” were to be interpreted as meaning “separate and distinct” (which it does not), “isolating” is not part of the claim language, and it is improper to import such a requirement into the claims. EX1015, ¶188.

Second, such a requirement is expressly contradicted by the specification of the ’521 Patent:

In FIGS. 2-4, the video drivers are shown as being formed outside of the AMOLED display panel 30. The embodiments in FIGS. 2-4 are illustrative only and are ***not intended to require the video driver to be formed outside of the AMOLED display panel.***

EX1001, 7:62-66; *see also id.*, 3:67-4:1 (“the ***video driver... incorporated in an AMOLED display panel ...***”); 7:59-62 (“[T]he ***video driver... can be integrated on the same integrated circuit with the current driver and the OLED pixel elements of the AMOLED display panel.***”); 7:52-59. EX1015, ¶189. Further, the Petition does not identify the video driver and the display panel as the same components. EX1015, ¶191. Instead, the Petition identifies *Kim*’s EL display panel 100, which includes a plurality of pixel circuits 10, as the claimed “display panel,” and identifies particular

circuitry in *Kim*'s Figure 10 as corresponding to the claimed "video driver" and "current driver." Petition, 19-45; EX1015, ¶191.

Third, assuming for the sake of argument that "isolating" could properly be read into the claims, PO's explanation of how "isolation" translates into "separate and distinct" is still conclusory and unexplained. EX1015, ¶192. Nor does PO explain why "it would be impossible" to achieve electrical isolation "if the video driver was part of the pixel circuit," especially where the references expressly state that they solve the problem of pixel current being dependent on power supply variations. EX1015, ¶192; *cf* POR, 21-22 with EX1007 at ¶¶0114, 0123; EX1006, ¶¶0025-0028, 0075, 0082; EX1008, 3:17-21, 4:14-27.

The POR also introduces narrower requirements for how the video driver should be construed. EX1015, ¶¶193-205. PO's argument is based on an excerpt from the Den Boer textbook which purportedly supports PO's position that "generating a video drive signal requires taking a usually digital video signal and (1) shifting, (2) converting to analog, and (3) amplifying the voltage." POR, 14 (numbering added for discussion); EX1015, ¶195. From there, PO asserts that these features from Den Boer must somehow be incorporated into the claims of the '521 Patent. EX1015, ¶¶193-205.

PO uses this premise to remap the circuitry in *Kim* such that the "video drive signal" is actually produced by *Kim*'s "data driver 300" and therefore the circuitry

identified by the Petition as the claimed video driver merely “receives a video drive signal” and “does not generate a video drive signal, as required.” POR, 18; EX1015, ¶¶196-198. This strawman argument fails for many reasons.

First, the intrinsic evidence does not support PO. The claim language refutes aspect (3) of PO’s construction (amplification). EX1015, ¶¶198, 203-205. Claim 1 does not recite “an amplifier,” while dependent Claims 3, 4, 6 and 8 do. Construing the term “video driver” to require an “amplifier” would improperly render the “amplifier” recited in claims 3, 4, 6, and 8 superfluous. *AMP Plus, Inc. v. DMF, Inc.*, 2022 WL 16844516, *6 (Fed. Cir. Nov. 10, 2022).

As to the specification, the only connection PO makes between the ’521 Patent and its three requirements is: “the ’521 patent describes generating a video drive signal as, among other things, receiving a video signal from a video source, such as an image processor, and shifting it *‘to bring the DC range of the analog video signal to within the range of the AMOLED display panel.’*” POR, 15 (citing EX1001, 1:56-2:12) (emphasis supplied); EX1015, ¶199. However, this cherry-picked, half-sentence is a discussion of the prior art system in Figure 1—which does not include the purportedly inventive **claimed video driver**. EX1015, ¶199. Figure 1 would also not satisfy PO’s framework—the “required” steps occur in the wrong order (DAC conversion comes before the “shifting”), and there is also no OpAmp. EX1015, ¶199.

Similarly, the purported inventive embodiments of the '521 Patent fail to meet PO's definition. EX1015, ¶¶202-203. For example, the signal received by the claimed video driver is the already-analog video signal, as PO's expert admitted, so aspect (2) of PO's construction is not satisfied. EX1016, 133:10-134:4 (admitting Video.DAC is analog); EX1015, ¶¶202-203. Regarding aspect (3) (amplification), the specification expressly states that amplification is not required: "the differential instrumentation amplifier *has unity gain*. ¶¶203-205. *If some gain or attenuation is desired*, then different resistance values for resistors 105 to 108 can be used." EX1001, 5:30-36; see also id., 6:38-44 (same). EX1015, ¶¶203-205. To the extent PO argues that the amplifier must generate the video drive signal based on the PPS voltage VDD, the third embodiment does not do that. EX1015, ¶205. That "amplifier 306" uses VDD to power the OpAmp itself, rather than as an input used to generate the output signal. EX1015, ¶205.

Second, PO fails to link the Den Boer discussion to the claim term. Patent Owner relies on disclosure of Den Boer's "source driver IC," then asserts without explanation that the source driver is a "video driver." POR, 13-14; EX1011, 95-97; EX1015, ¶200. But Den Boer does not purport to define "video drivers" at all (nor does it use the word "video diver" anywhere in its text), much less define the claimed video drivers of the '521 Patent. EX1015, ¶200. The claimed "video driver" was applicant's purported invention, and PO makes no attempt to explain why a POSA

would turn to extrinsic evidence discussing another term (source driver IC) to understand its meaning. EX1015, ¶200.

Third, even if PO's construction were right, the prior art grounds perform those functions. EX1015, ¶201. For example, *Kim* would still read onto the claims by drawing the "video driver" box bigger to include Kim's data driver 300 together with the previously-identified circuitry. EX1015, ¶201; *see Axonics Inv. v. Medtronic, Inc.*, 75 F.4th 1374, 1379, 1384 (Fed. Cir. 2003) (Petitioner's reply may respond to PO's arguments by relying on additional disclosures in the embodiments of the prior art already relied upon in the Petition). Indeed, PO's expert admitted that *Kim* would include the claimed video drive signal. EX1016, 117:23-118:8; EX1015, ¶201.

IV. GROUND 3 - ANTICIPATION BY *HAYAFUJI*

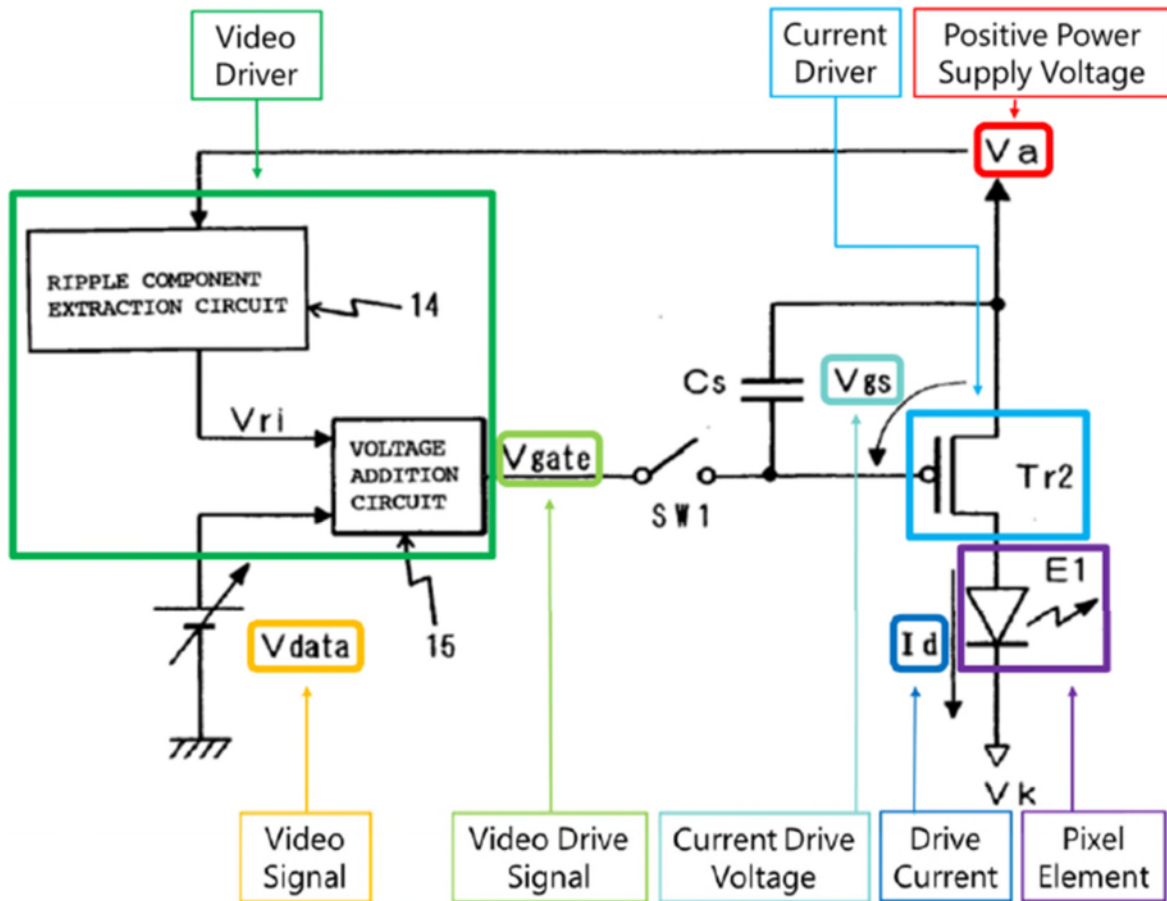
A. *Hayafuji*'s video drive signal Vgate is "referenced to" the power supply voltage Va

PO's arguments rely on its arbitrary selection of portions of the positive power supply voltage that the video drive signal needs to be "referenced to." EX1015, ¶¶255-264. PO argues that "the main component" of the power supply voltage needs to be referenced to the video drive signal. POR, 40; EX1015, ¶256. Yet, PO admits that the "Vnoise" component of the power supply voltage need not be referenced to that signal, as it is not the third embodiment of the '521 Patent. POR, 45, 68;

EX1015, ¶¶257-258. As there is no basis to draw this distinction in the claims or specification, PO's arguments should be rejected. EX1015, ¶¶255-264.

As to Element [1-A], PO says "the main component" of the PPS needs to be "referenced to" the video drive signal. POR, 38-44; EX1015, ¶¶256-257. But PO does not explain *why* the claim language requires that the "main component" of the PPS be what is "referenced to" the video drive signal. With respect to the third embodiment, PO admits that not all components of the PPS need be referenced to the driver signal to meet the claim limitation. POR, 40; EX1015, ¶¶257-258. Accordingly, PO's argument should be rejected as lacking basis in the claims or specification. EX1015, ¶¶255-264.

As discussed above, the specification suggests that the claims are satisfied if the circuit references to and eliminates any part of the power supply variation. *See supra* at III.A.2. Because "Vri" is a component of the PPS, referencing the video drive signal to it is sufficient to be "referenced to" the PPS. EX1015, ¶260. Moreover, as shown in Petitioner's annotated figure, the entire PPS voltage (including the "main component") is an input to the video driver, further confirming that the drive signal is "referenced to" the PPS. EX1015, ¶259; EX2011, ¶126; EX1018, ¶¶159:20-25.



Ex.[1006], Fig. 6 (annotated).

With respect to Element [1-C], PO argues that because the “undesirable variable voltage components V_{noise} and V_{drift} ” are present in the current drive signal that the “drive current of *Hayafuji* is not independent of” the PPS. POR, 48. Again, PO is unable to reconcile its conclusion with the specification, which says the current drive signal of the third embodiment also includes “ V_{noise} ” from the

power supply. POR, 45; EX1015, ¶263. Accordingly, PO's arguments fail because it does not (and cannot) explain why the presence of "Vnoise" in the current drive voltage is within the scope of the claim, but the presence of "Vdrift" is not. EX1015, ¶263. If anything, *Hayafuji*'s elimination of ripple (equivalent to noise) from the output would better remove the "objectionable" "flicker" from the display, than would the circuit of the '521 Patent's third embodiment, which would not eliminate that "flicker" at all. EX1015, ¶260-263; EX1001, 6:45-8:2, FIG. 4; EX1016, 161:3-4 ("They clearly are focused on ripple noise"). Thus, PO's position is not commensurate with the scope of the claims or the specification description and should be rejected.

Moreover, the fact that Vdc appears in the equation for *Hayafuji*'s current drive voltage does not remove it from the scope of the claims. Vdc corresponds to the non-varying portion of the power supply. EX1015, ¶260. A POSA would understand that a dependency on that portion of the voltage is necessary for device operation, and accordingly is not excluded from the scope of the claims, which instead relate to addressing dependency on "voltage **variations**." EX1015, ¶260; EX1001, 1:29-39. Indeed, even PO's expert admits that all of the '521 Patent embodiments include such dependency, such that if the power supply voltage went below the threshold voltage of the relevant transistors, the display would cease to function at all. EX1015, ¶260; EX1016, 177:20-178:8. Because such a dependency

would be understood to still be within the scope of the claims, so too is *Hayafuji*'s dependency on that steady-state DC voltage.⁵ EX1015, ¶260.

As to Claim [2], PO argues the claim allegedly requires the DC component of the PPS to be included in the sum or difference of the PPS and the video signal. Yet, the claim provides no such requirement. PO admits that the video drive signal is the sum of “the video signal and the ripple component V_{ri} .” POR, 49. Thus, *Hayafuji*'s video drive signal is “indicative of the sum of ... the positive power supply and the video signal. EX1015, ¶263.

V. GROUND 4 - OBVIOUSNESS OVER *HAYAFUJI*

A. A POSA would be motivated to modify *Hayafuji* with a “differential instrumentation amplifier circuit”

PO's arguments that a POSA would not be motivated to modify *Hayafuji* relies on the notion that the combination eliminates *Hayafuji*'s function of removing the “ripple component” of power supply variation. POR, 49-56; EX1015, ¶¶318-333. To the contrary, the modification was to **add** to that function, by using an obvious variation of the circuitry *Hayafuji* already discloses, which would eliminate **both** the ripple component **and** the non-ripple component from the pixel drive

⁵ For these reasons, Petitioner's contention that V_{gate} is referenced to the positive power supply while V_{gs} is independent of that supply are not inconsistent. EX1015, ¶260. *Cf.* Institution Decision, 48.

current. Pet., 70 (modification provides “improved immunity to power source noise” including “rejection of...drift”). EX1015, ¶¶321-333. Thus, contrary to PO’s argument, this is not a situation where the modification changes the principle of operation or renders inoperable Hayafuji’s technique. EX1015, ¶321-333. The ripple component is still removed from the output drive current; it would just be removed together with other undesirable variations from the power supply. EX1015, ¶¶324-333.

Hayafuji recognized that the ripple component of the PPS may be undesirable, but does not teach away from removing other aspects of PPS variations. EX1006, ¶28. This teaching (*i.e.*, that non-stable components of the PPS are desirable to remove) is express motivation to a POSA to modify the circuit in *Hayafuji* to remove other such variations in PPS voltage. EX1015, ¶¶323-333. Indeed, *Hayafuji* already shows effectively a differential amplifier implementing its techniques, and PO does not dispute that the modification described above was a known way to use such a circuit and was within the level of skill in the art. EX1015, ¶326-333. Thus, the claims are obvious. EX1015, ¶317-333; *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 401 (2007) (“combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results”); *Intel Corp. v. PACT XPP Schweiz AG*, 61 F.4d 1373, 1380 (Fed. Cir. 2023)(“if there’s a known

technique to address a known problem using ‘prior art elements according to their established functions’ then there is a motivation to combine.”).

B. A POSA would find it obvious to include a “current mode isolator circuit” in *Hayafuji*

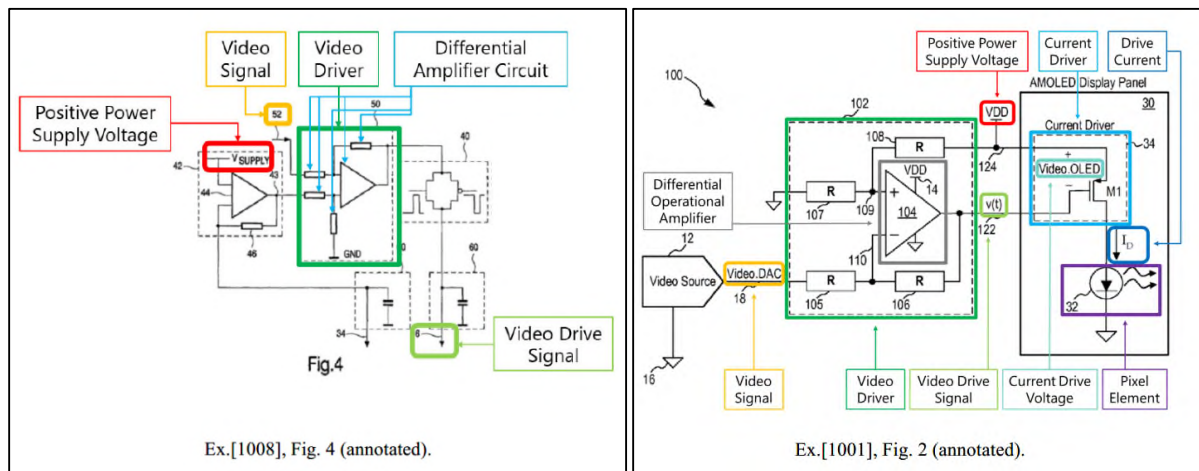
As to Claim 5, a POSA would have found it obvious to include “a current mode isolator circuit” because it allows improved compensation to transistor mobility and threshold variations. EX1015, ¶¶334-338. PO’s own expert explains it was known to use current drive. EX2011, ¶43. The reference PO’s expert relies on from 1998 explains the benefits: “[t]he advantage of programming the pixel with a current is that pixel to pixel variations in the drive TFT and the OLED threshold voltage can be calibrated out by letting the pixel settle to the conditions appropriate for the desired data current.” EX2003, 875-878. PO’s expert also admits it was known to “provide low impedance drive signals,” which a POSA would have recognized is a circuit that isolates its input from its output. EX2011, ¶38. Thus, the technique was known to be advantageous and predictable. EX1015, ¶¶334-338. It is therefore obvious. EX1015, ¶¶334-338. Additionally, as set forth in the Petition, whether or not *Hayafuji* is modified, a POSA would recognize that its circuitry, including transistor Q3 is a current mode isolator circuit. EX1002, ¶¶237-261; Pet. 73-77.

VI. GROUND 5 - OBVIOUSNESS OVER *STEER*

PO's arguments fall into two categories: that *Steer* allegedly requires the video drive signal to be (1) "amplified by the alleged video driver" and (2) "a function of the feedback current." POR, 60. With respect to Claim Element [1-A] and Claim 3, PO relies on both arguments. POR, 60, 70-72. With respect to Claim Element [1-C], PO relies on the second. POR, 67-70. Both arguments are flawed because (A) *Steer* teaches the same OpAmp configuration as the '521 Patent and a non-unity gain is not a requirement in either; and (B) the feedback current in some circumstances is zero and, even when it is not zero, the video drive signal is still "referenced to the positive power supply." EX1015, ¶¶414-432.

A. *Steer* teaches the same OpAmp configuration as the '521 Patent

PO's argument that *Steer* requires a non-unity gain is contradicted by PO's own expert, Petitioner's expert, and the '521 Patent itself. EX1015, ¶¶426-432. A side-by-side comparison of the Op Amp from Figure 4 of *Steer* (left) and the Op Amp from Figure 2 of the '521 Patent (right) is shown below for reference.



PO’s main argument is that *Steer* allegedly requires the output of “comparator 50” to have a non-unity gain. POR, 66, 67, 71. PO’s only support for this contention is that *Steer* describes an “amplified output.” POR, 66 (citing EX1008, 9:17-18). Yet, PO fails to explain why the term “amplified output” requires non-unity gain. Indeed, PO’s own expert, Dr. Credelle, used the same word “amplified” when describing a no-gain output buffer. EX2011, ¶38; EX1016, 101:12-14. Accordingly, *Steer*’s recitation of an “amplified output” does not preclude unity gain, nor does *Steer*’s reference to an optional “integrating amplifier.” EX1015, ¶¶426-430. A POSA would understand that *Steer* does not disclose that a non-unity gain is desired or necessary. EX1015, ¶430.

Moreover, it would be an obvious design choice to use the same value of resistors in the differential circuit—making the amplifier unity-gain—because it is conceptually simpler, and easier and cheaper to implement. EX1015, ¶431. The ’521 Patent itself admits that a POSA would be aware of this obvious design choice and

that an embodiment having different resistor values would be within the bounds of the invention. EX1001, 5:31-37; EX1015, ¶432.

B. *Steer*'s video drive signal V_6 is “referenced to” power supply voltage V_{SUPPLY} even when the feedback current is non-zero

PO argues that because the term “ $R_{46} \cdot I$ ” may appear in the equation for the voltage at node V_{43} , the “video drive signal” is not “referenced to the positive power supply voltage [V_{SUPPLY}].” POR, 63-64. PO does not explain why this is so. The claim does not recite “*exclusively*” “referenced to the positive power supply.” Accordingly, regardless of whether there is the presence of the term “ $R_{46} \cdot I$ ” in the video drive signal (V_6) of *Steer*, it is still “referenced to” the positive power supply as recited by Claim [1-A]. EX1015, ¶¶419-425.

Moreover, as Dr. Kattamis explains, there are times during the programming phase that the current “ I ” will be zero. EX1015, ¶¶423-425. Thus, the term “ $R_{46} \cdot I$ ” will fall out of the equation. EX1015, ¶¶423-425. For example, “ I ” will be zero initially when the programming phase begins and, in some circumstances, will remain zero until the voltage on capacitor 60 on line 36 discharges to a sufficiently low level. EX1015, ¶¶423-425. Thus, during at least these times the video drive signal of *Steer* is “the difference between the positive power supply voltage and the video signal” as required by Claim 3. EX1015, ¶¶423-425.

April 29, 2024

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CERTIFICATE OF COMPLIANCE

This Petitioner's Reply to Patent Owner's Response complies with the type-volume limitation of 5,600 words, excluding the parts exempted by 37 C.F.R. § 42.24. This Petitioner's Reply complies with the general format requirements of 37 C.F.R. § 42.6.

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