

**Samsung Display Co., LTD; Samsung Electronics Co., LTD; and
Samsung Electronics America, Inc.**

v.

Polaris PowerLED Technologies, LLC

IPR2023-00771

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

Patent Owner's Demonstratives

Instituted Grounds

IPR2023-00771		
Claims Challenged	Basis	Applied References
1, 2, 7	35 U.S.C. § 102	Kim
1, 2, 7	35 U.S.C. § 103	Kim
1, 2	35 U.S.C. § 102	Hayafuji
1, 2, 3, 5	35 U.S.C. § 103	Hayafuji
1, 2, 3, 4	35 U.S.C. § 103	Steer

Agenda

- ▶ **The '521 Patent**
- ▶ Kim does not disclose or render obvious generating a video drive signal
- ▶ Kim's pixel circuit is not a "video driver"
- ▶ Hayafuji addresses *only* voltage ripple
- ▶ Steer's alleged video drive signal is a function of the feedback current
- ▶ Steer's alleged video drive signal is amplified with non-unity gain

The '521 Patent

(12) **United States Patent**
Ritter

(10) **Patent No.:** **US 7,259,521 B1**
(45) **Date of Patent:** **Aug. 21, 2007**

(54) **VIDEO DRIVER ARCHITECTURE FOR AMOLED DISPLAYS** 2005/0285822 A1* 12/2005 Reddy et al. 345/76
OTHER PUBLICATIONS

(75) Inventor: **David W. Ritter**, San Jose, CA (US) "Design of current programmed amorphous silicon AMOLED pixel circuit," B. Mazhari and Yogesh S. Chauhan, 8th Asian Symposium on information display, Nanjing, China, 2004, pp. 327-330.
(73) Assignee: **Micrel, Inc.**, San Jose, CA (US) Yenchung Lin et al., "A Novel Current Memory Circuit for Active Matrix Organic Light Emitting Display," SID 03 Digest, 2003, 4 pages.
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.
* cited by examiner

(21) Appl. No.: **11/467,738** *Primary Examiner*—Haissa Philogene
(22) Filed: **Aug. 28, 2006** (74) *Attorney, Agent, or Firm*—Patent Law Group LLP; Carmen C. Cook

(51) **Int. Cl.** (2006.01) **ABSTRACT**
G09G 3/10 An AMOLED display system, including an AMOLED display panel receiving a video signal, includes a video driver receiving the video signal and generating a video drive signal indicative of the video signal and referenced to a positive power supply voltage of the display panel, and a current driver coupled to an OLED pixel element receiving the video drive signal and the positive power supply voltage and providing a drive current to the OLED pixel element. The drive current is proportional to a current drive voltage which is indicative of the video signal and independent of the positive power supply voltage. In one embodiment, the video drive signal is indicative of the sum of or the difference between the positive power supply voltage and the video signal and the current drive voltage is indicative of the difference between the positive power supply voltage and the video drive signal.

(52) **U.S. Cl.** 315/169.1; 315/169.3; 345/82; 345/84; 345/214; 327/108; 327/246; 327/355

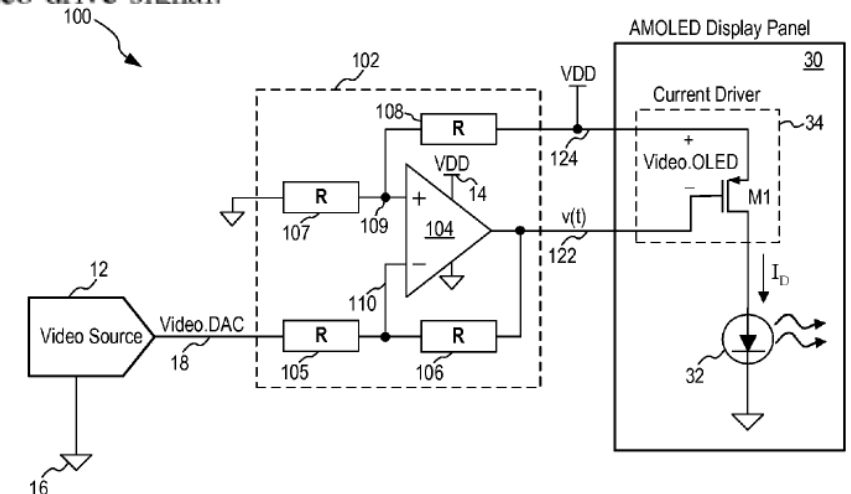
(58) **Field of Classification Search** 315/169.1, 315/169.2, 169.3; 345/82, 84, 98, 211, 212, 345/214; 327/100, 108, 127, 137, 245-248, 327/355, 359, 358, 361; 326/82, 83, 86; 341/144
See application file for complete search history.

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7,167,169 B2* 1/2007 Libsch et al. 345/211

8 Claims, 3 Drawing Sheets

An AMOLED display system, including an AMOLED display panel receiving a video signal, includes a video driver receiving the video signal and generating a video drive signal indicative of the video signal and referenced to a positive power supply voltage of the display panel, and a current driver coupled to an OLED pixel element receiving the video drive signal and the positive power supply voltage and providing a drive current to the OLED pixel element.

The drive current is proportional to a current drive voltage which is indicative of the video signal and independent of the positive power supply voltage. In one embodiment, the video drive signal is indicative of the sum of or the difference between the positive power supply voltage and the video signal and the current drive voltage is indicative of the difference between the positive power supply voltage and the video drive signal.



The '521 Patent Addresses the Problem of Undesirable Variations in the Positive Power Supply Voltage

FIELD OF THE INVENTION

The invention relates to video driver for AMOLED displays and, in particular, to a video driver for AMOLED displays that is capable of isolating the pixel circuit from power supply voltage variations.

IPR2023-00771, EX1001, 1:7-9.

The current provided by the current driver is proportional to the difference between the voltage level of the video drive signal and the positive power supply voltage of the display panel. Therefore, any variations in the power supply voltage will modulate the brightness of the AMOLED display.

IPR2023-00771, EX1001, 1:24-26.

objectionable to the viewer. The direct relationship between the drive current and the power supply voltage renders AMOLED displays extremely sensitive to power supply voltage noise. It also makes the AMOLED display's overall

IPR2023-00771, EX1001, 1:32-35.

There are many sources of power supply voltage variations that can cause flickering in AMOLED displays. In particular, when the AMOLED display is incorporated in a battery powered application, the power supply voltage will inevitably fluctuate whenever circuitry in the application device is powered up from being in a standby mode. For

IPR2023-00771, EX1001, 1:41-45.

AMOLED display system. The power supply voltage will fluctuate when the transmitter or receiver circuit is powered up. Furthermore, battery voltage tends to drift over time.

IPR2023-00771, EX1001, 1:49-51.

'521 Patent Exemplary Claim

1. An active matrix organic light emitting diode (AMOLED) display system comprising an AMOLED display panel receiving a video signal to be displayed on the AMOLED display panel, the AMOLED display panel comprising a plurality of organic light emitting diode (OLED) pixel elements, the AMOLED display system comprising:

- a video driver receiving the video signal and generating a video drive signal indicative of the video signal and referenced to a positive power supply voltage of the AMOLED display panel; and
- a current driver coupled to at least one OLED pixel element, the current driver receiving the video drive signal and the positive power supply voltage and providing a drive current to the at least one OLED pixel element, the drive current being proportional to a current drive voltage being indicative of the video signal and independent of the positive power supply voltage.

IPR2023-00771, EX1001, Claim 1.

Agenda

- ▶ The '521 Patent
- ▶ **Kim does not disclose or render obvious generating a video drive signal**
- ▶ Kim's pixel circuit is not a "video driver"
- ▶ Hayafuji addresses *only* voltage ripple
- ▶ Steer's alleged video drive signal is a function of the feedback current
- ▶ Steer's alleged video drive signal is amplified with non-unity gain

Claim 1 Requires a Video Driver to Generate a Video Drive Signal

1. An active matrix organic light emitting diode (AMOLED) display system comprising an AMOLED display panel receiving a video signal to be displayed on the AMOLED display panel, the AMOLED display panel comprising a plurality of organic light emitting diode (OLED) pixel elements, the AMOLED display system comprising:
 - a video driver receiving the video signal and generating a video drive signal indicative of the video signal and referenced to a positive power supply voltage of the AMOLED display panel; and
 - a current driver coupled to at least one OLED pixel element, the current driver receiving the video drive signal and the positive power supply voltage and providing a drive current to the at least one OLED pixel element, the drive current being proportional to a current drive voltage being indicative of the video signal and independent of the positive power supply voltage.

IPR2023-00771, EX1001, Claim 1.

Petitioner's Position

Petitioner incorrectly argues that Kim's fourth embodiment discloses the claimed video driver including a clamp circuit as in the '521 patent's third embodiment.

Petition

Kim's fourth embodiment similarly discloses the claimed video driver, including a video clamp circuit as in the '521 Patent's third embodiment.

Specifically, *Kim's fourth embodiment's video driver includes "capacitor C_{st4} [which] has electrodes A4 and B4 similar to the electrodes A and B of the capacitor C_{st1} [of Figure 6A], and a "transistor M33." Ex.[1007], ¶0105. Consistent with Kim's Figure 10 (annotated) and as discussed further below, a POSA would understand that Kim's capacitor C_{st4} corresponds to the '521 Patent's capacitor C1, that Kim's transistor M33 corresponds to transistor M3 in the '521 Patent, and, based on the disclosed configuration and functionality of Kim's fourth embodiment, Kim therefore discloses the claimed video driver (circuitry in green Video Driver annotation including Capacitor C_{st4} and clamp transistor M33) in the same manner as in the '521 Patent's third embodiment. Ex.[1002], ¶¶107-109; Ex.[1007], Fig. 10.*

Petitioner's Dr. Kattamis

109. A POSA would have recognized that Kim's fourth embodiment similarly discloses the claimed "video driver," including a video clamp circuit as in the '521 Patent's third embodiment. Specifically, Kim's fourth embodiment's video driver includes "capacitor C_{st4} [which] has electrodes A4 and B4 similar to the electrodes A and B of the capacitor C_{st1} [of FIG.6A], and a "transistor M33." Consistent with Kim's FIG. 10 (annotated) and as discussed further below, a POSA would have understood that Kim's capacitor C_{st4} corresponds to the '521 Patent's capacitor C1, that Kim's transistor M33 corresponds to transistor M3 in the '521 Patent, and, based on the disclosed configuration and functionality of Kim's fourth embodiment, Kim therefore discloses the claimed video driver (circuitry in green Video Driver annotation including Capacitor C_{st4} and clamp transistor M33) in the same manner as in the '521 Patent's third embodiment. Ex. [1007], Kim at FIG. 10 (annotated).

Petitioner's Position

Petitioner incorrectly argues that node A4 of Kim's fourth embodiment discloses the claimed video drive signal.

Petition

Regarding *generating a video drive signal indicative of the video signal*, as shown above, **Kim's Figure 10 shows video drive signal (node A4) generated by the video driver (green box).** "The voltage of the first electrode **A4** of the capacitor C_{st4} is given as Equation 11." Ex.[1007], ¶¶0108-0109 ("Equation 11").

IPR2023-00771, Pet., 29.

Petitioner's Dr. Kattamis

112. A POSA would have recognized that, as in the '521 Patent's third embodiment in which the claimed video drive signal is voltage $v(t)$ 322 supplied to the gate of transistor M1 driving the OLED 32 by the video driver 302, Kim's fourth embodiment similarly discloses voltage at node A4 being supplied to the gate of transistor **M31** driving the organic light emitting diode OLED by the video driver circuitry including Capacitor C_{st4} and clamp transistor **M33**. **A POSA would thus recognize that Kim's "voltage of the first electrode A4" corresponds to the claimed generated video drive signal.**

IPR2023-00771, EX1002, ¶112.

The Institution Decision Acknowledged That Patent Owner's Arguments Have Merit

Institution Decision

Second, Patent Owner argues that Kim's alleged video driver does not generate a video drive signal. Prelim. Resp. 27–31. Specifically, Patent Owner contends that “the pixel circuit of Figure 10 lacks the necessary components of a video driver that are responsible for generating a video drive signal.” *Id.* at 27 (citing Ex. 2001 ¶ 73). According to Patent Owner, Kim's alleged video driver includes only switching transistors M33 and M34 and capacitor C_{st4}, which are not capable of generating a video signal. *Id.* (citing Ex. 2001 ¶ 73). Rather, Patent Owner contends, with supporting testimony from Mr. Credelle, that an amplifier, among other components, is used to generate a video drive signal. *Id.* Patent Owner further argues that Kim's fourth embodiment merely modifies an existing video signal, but does not generate a video signal. *Id.* (citing Ex. 2001 ¶ 74). According to Patent Owner, one of ordinary skill in the art would understand that switching transistors M33 and M34 and capacitor C_{st4}, as described in Kim, adjust, but do not generate, the video drive signal. *Id.* at 27–28 (citing Ex. 1007 ¶¶ 107, 108; Fig. 4; Ex. 2001 ¶ 74). Patent Owner asserts that “the only component in Kim that generates a drive signal with video data is data driver 300, as illustrated in Kim's Figure 3.” *Id.* at 29 (citing Ex. 2001 ¶ 75).

IPR2023-00771, ID, 28.

In Sur-reply, Patent Owner argues that dependent claims 3, 4, and 6 “specify exactly *how* an amplifier is configured in the circuit that references the video drive signal to the positive power supply voltage.” Prelim. Sur-reply 2. Patent Owner further argues that a person of ordinary skill in the art would understand that a video driver must include an amplifier, and that every embodiment in the '521 patent includes an amplifier. *Id.* at 3 (citing Ex. 2001 ¶¶ 28–30, 73; Ex. 1001, Figs. 2–4).

Patent Owner's arguments may have merit, but are better evaluated on a full record at trial. The claim language recites “a video driver receiving

IPR2023-00771, ID, 29.

Background: Generating a Video Drive Signal

Patent Owner's Mr. Credelle

86. One of ordinary skill in the art would understand that generating a video drive signal requires taking a usually digital video signal and shifting, converting to analog, and amplifying the voltage so that it can properly drive the transistors in the display panel's pixel circuits. For example, as explained in the den Boer textbook, a video driver (also referred to as source driver, column driver, and data driver) in an Active Matrix display, illustrated in Figure 4.11, uses a level shifter to shift the voltage of the video signal from the “logical levels” to a level that can drive the pixel circuit's transistors, a digital to analog converter, which also adjusts the gamma of the output voltage, and amplifiers (buffers) to provide sufficient current to the low impedance column electrodes. EX1011, 97.¹

IPR2023-00771, EX2011, ¶86.

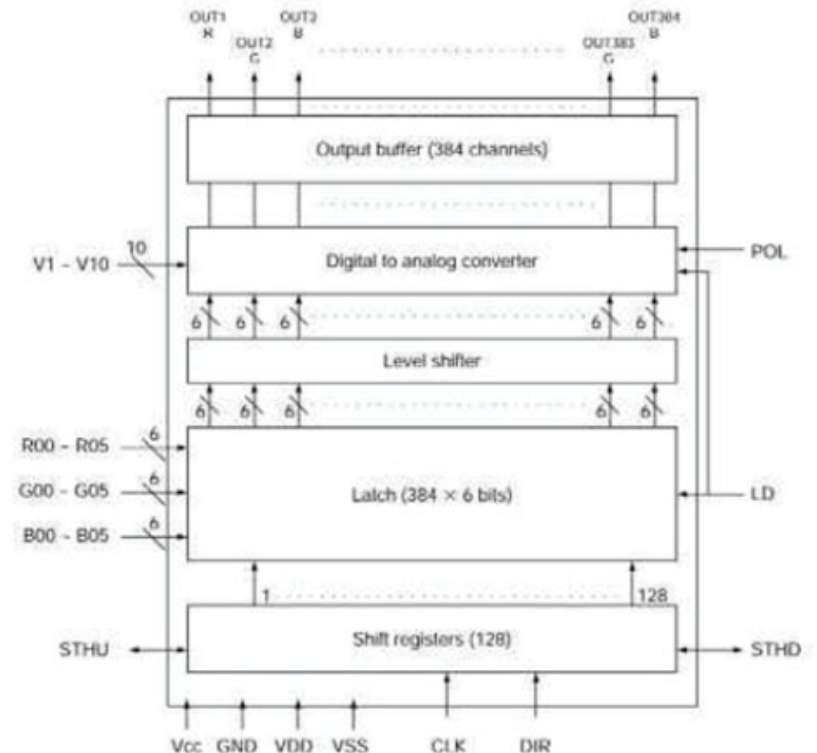


Figure 4.11: Basic architecture of a source driver IC with 384 channel outputs for use in XGA and SXGA panels (eight or ten chips per panel, respectively).

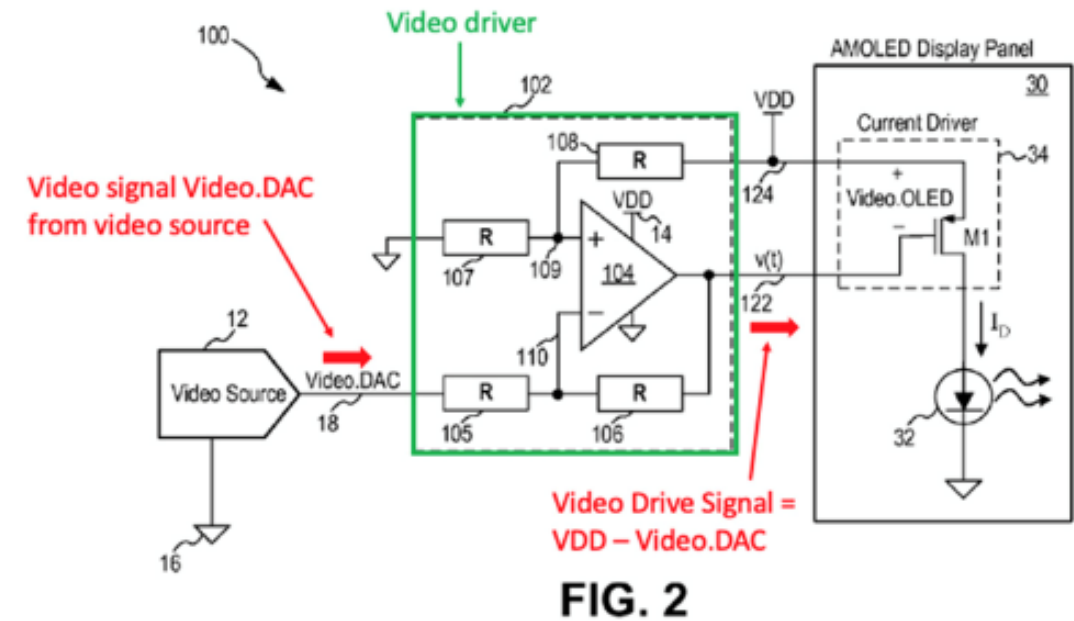
IPR2023-00771, EX2011, ¶86; EX1011, 97, FIG. 4.11.

Background: Generating a Video Drive Signal

Patent Owner's Mr. Credelle

87. Consistent with the understanding of a POSITA, 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." EX1001, 1:56-2:12. The '521 patent's embodiments disclose a video driver that receives a video signal as input and uses the power supply voltage VDD as an offset to the video signal to generate a video drive signal that is within the range of the AMOLED display panel and referenced to power supply voltage VDD as illustrated in Figure 2 below. 4:34-37; 6:1-6; 7:4-8.

IPR2023-00771, EX2011, ¶87.



IPR2023-00771, EX2011, ¶87; EX1001, FIG. 2.

Background: Generating a Video Drive Signal

Patent Owner's Mr. Credelle

88. One of ordinary skill in the art would also understand that a video driver would use amplifiers, among other components, to generate a drive signal. For example, the video driver disclosed in den Boer uses output buffers to reduce the output impedance of the output channels in order to drive the data lines that connect to the pixel circuits. EX1011, 97-98. Output buffers typically include amplifiers to drive current onto the data lines, as illustrated in the Figure below from the Cristaldi textbook on LCD video drivers.

IPR2023-00771, EX2011, ¶¶88.

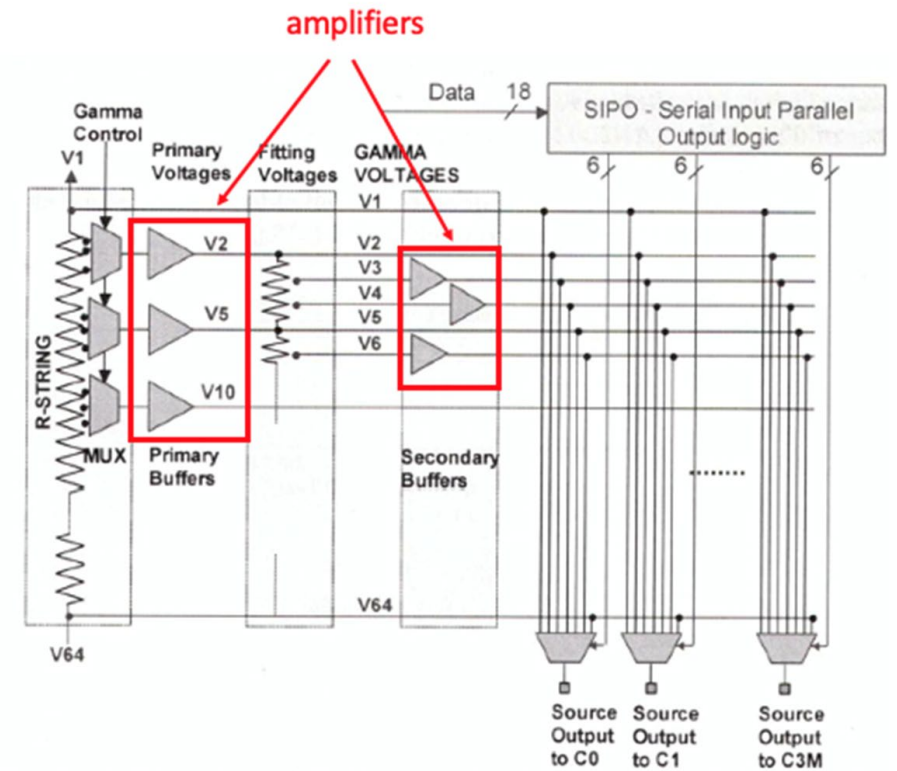


Fig. 6.16 Resistor string and MUX adopted implementing the R-DAC for positive voltages

IPR2023-00771, EX2011, ¶¶88; EX2006, FIG. 6.16.

Background: Generating a Video Drive Signal

All '521 patent embodiments include at least one amplifier.

Patent Owner's Mr. Credelle

88. One of ordinary skill in the art would also understand that a video driver would use amplifiers, among other components, to generate a drive signal.

For example, the video driver disclosed in den Boer uses output buffers to reduce the output impedance of the output channels in order to drive the data lines that connect to the pixel circuits. EX1011, 97-98. Output buffers typically include amplifiers to drive current onto the data lines, as illustrated in the Figure below from the Cristaldi textbook on LCD video drivers.

Consistent with this understanding, the video driver in each embodiment of the '521 patent includes at least one amplifier. EX1001, FIGs. 2-4.

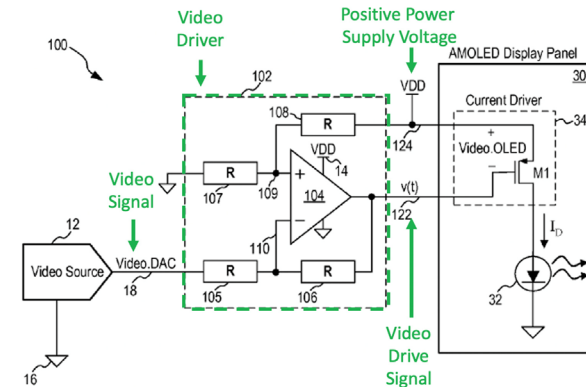


FIG. 2

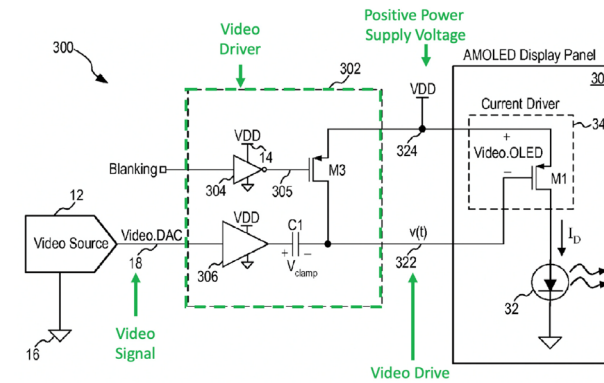


FIG. 4

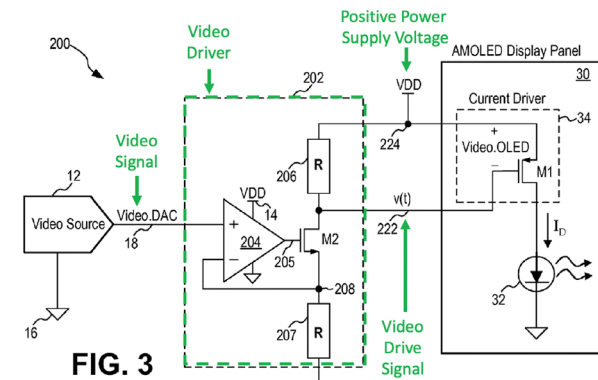


FIG. 3

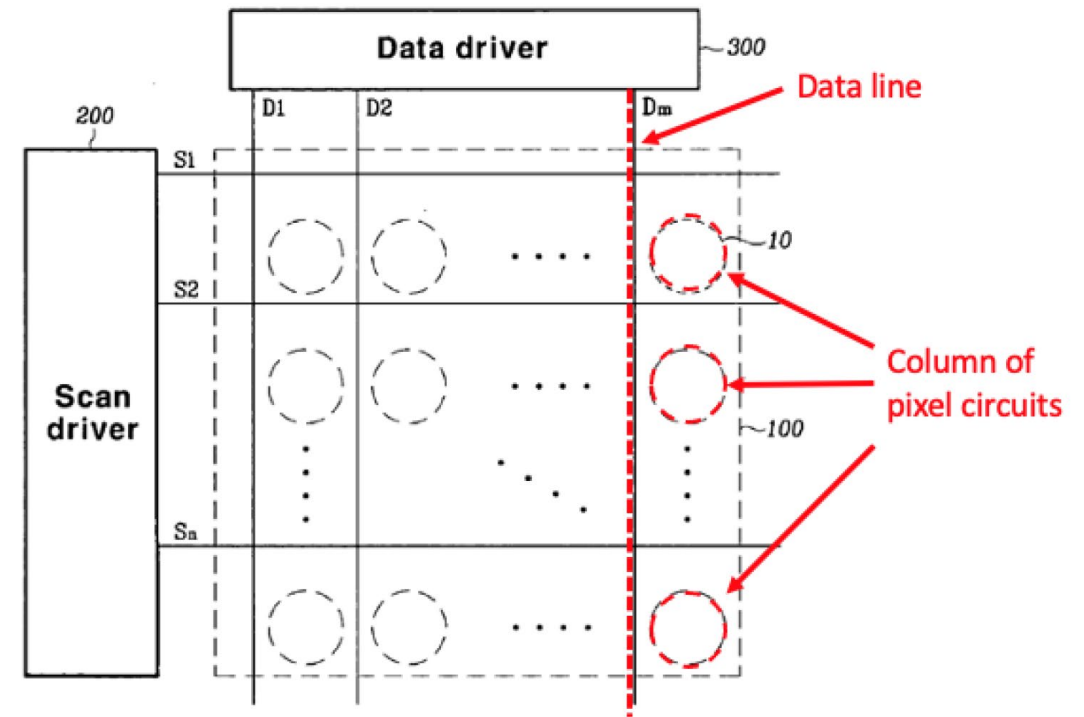
IPR2023-00771, EX2011, ¶¶88.

The Pixel Circuit of Kim's Fourth Embodiment Does Not Generate the Claimed Video Drive Signal

Kim's pixel circuit does not increase the voltage of the video signal to the level of the display.

Patent Owner's Mr. Credelle

89. In contrast, the alleged video driver of Kim does not perform these functions in creating the alleged video drive signal. The signal of the alleged video driver of Kim does not increase the voltage from the logical level of the video source to the level of the display. The signal received by Kim's pixel circuit must have necessarily already undergone this voltage level shifting, otherwise the signal would not properly interact with the pixel circuit's transistors and capacitors. Additionally, the alleged video driver does not have the components needed to drive current onto the column data lines. EX1007, FIG. 10. The alleged video drive signal of Kim that actually resides within the pixel array includes only switching transistors M33 and M34 and capacitor Cst4, which one of ordinary skill in the art



IPR2023-00771, EX2011, ¶¶90; EX1007, FIG. 3 (annotated).

IPR2023-00771, EX2011, ¶¶89.

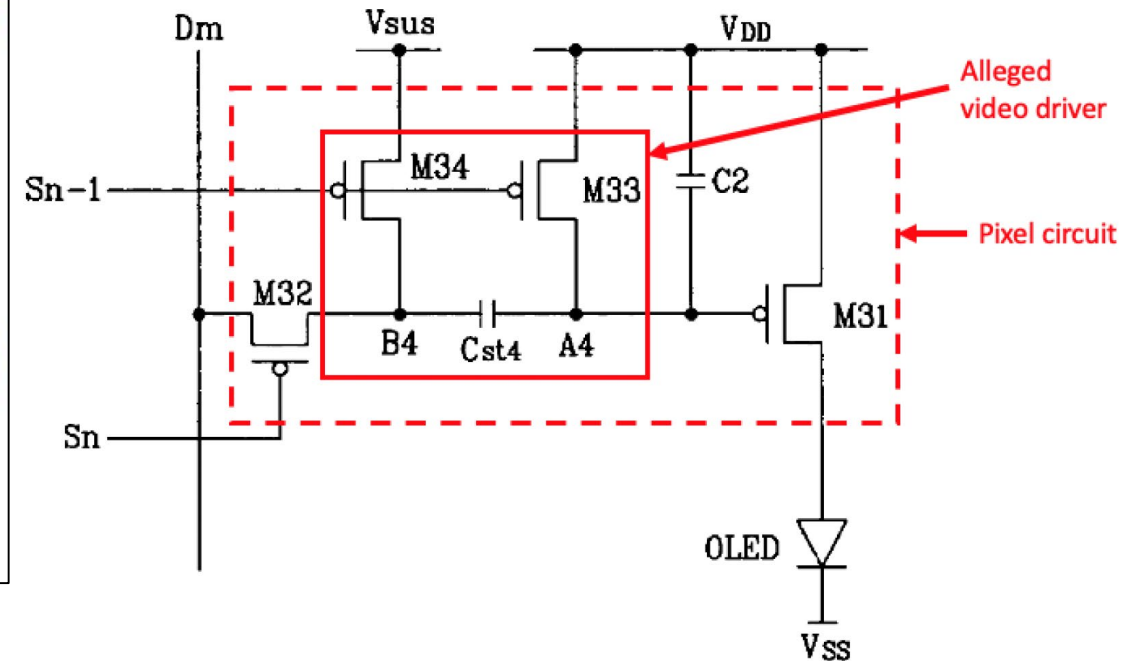
The Pixel Circuit of Kim's Fourth Embodiment Does Not Generate the Claimed Video Drive Signal

Kim's pixel circuit does not have the components needed to generate a video drive signal.

Patent Owner's Mr. Credelle

drive current onto the column data lines. EX1007, FIG. 10. The alleged video drive signal of Kim that actually resides within the pixel array includes only switching transistors M33 and M34 and capacitor Cst4, which one of ordinary skill in the art would expect in a pixel circuit that corrects for local non-uniformities such as threshold voltage or IR drop. EX1007, FIG. 10. Without an amplifier the alleged video driver within the pixel array is unable to generate the claimed video drive signal. EX1007, FIG. 10; see ¶¶46-51, *supra*.

IPR2023-00771, EX2011, ¶89.



IPR2023-00771, EX2011, ¶89; EX1007, FIG. 10 (annotated).

Agenda

- ▶ The '521 Patent
- ▶ Kim does not disclose or render obvious generating a video drive signal
- ▶ **Kim's pixel circuit is not a "video driver"**
 - ▶ The claimed "video driver" maps to a data driver in an AMOLED display, not a pixel circuit
 - ▶ Even if the claimed "video driver" is integrated with the AMOLED display, it is not a pixel circuit
- ▶ Hayafuji addresses *only* voltage ripple
- ▶ Steer's alleged video drive signal is a function of the feedback current
- ▶ Steer's alleged video drive signal is amplified with non-unity gain

Claim 1 Requires a Video Driver to Generate a Video Drive Signal

1. An active matrix organic light emitting diode (AMOLED) display system comprising an AMOLED display panel receiving a video signal to be displayed on the AMOLED display panel, the AMOLED display panel comprising a plurality of organic light emitting diode (OLED) pixel elements, the AMOLED display system comprising:
 - a video driver receiving the video signal and generating a video drive signal indicative of the video signal and referenced to a positive power supply voltage of the AMOLED display panel; and
 - a current driver coupled to at least one OLED pixel element, the current driver receiving the video drive signal and the positive power supply voltage and providing a drive current to the at least one OLED pixel element, the drive current being proportional to a current drive voltage being indicative of the video signal and independent of the positive power supply voltage.

IPR2023-00771, EX1001, Claim 1.

The Pixel Circuit of Kim's Fourth Embodiment Is Not a Video Driver

An AMOLED display includes drivers that send video drive signals to pixel circuits.

Patent Owner's Mr. Credelle

40. An exemplary active-matrix architecture for OLEDs from the Tsujimura article is shown below. EX2007, 99. As with AMLCDs, there are data drivers, which supply analog video signals (usually voltages) to columns of the display, and scan drivers, also referred to as gate drivers, which switch transistors within the pixel array. EX2007, 99. One new feature of AMOLED active matrix is the requirement for a power lead to each pixel that supplies current to the light emitting diode. As with AMLCDs, a pixel circuit is located at the intersection of rows and columns; the pixel circuit in its simplest format receives and stores data from the video driver onto a capacitor. The stored analog video voltage is applied to the gate of a driving transistor to modulate the current flowing to the OLED.

IPR2023-00771, EX2011, ¶¶40, 93.

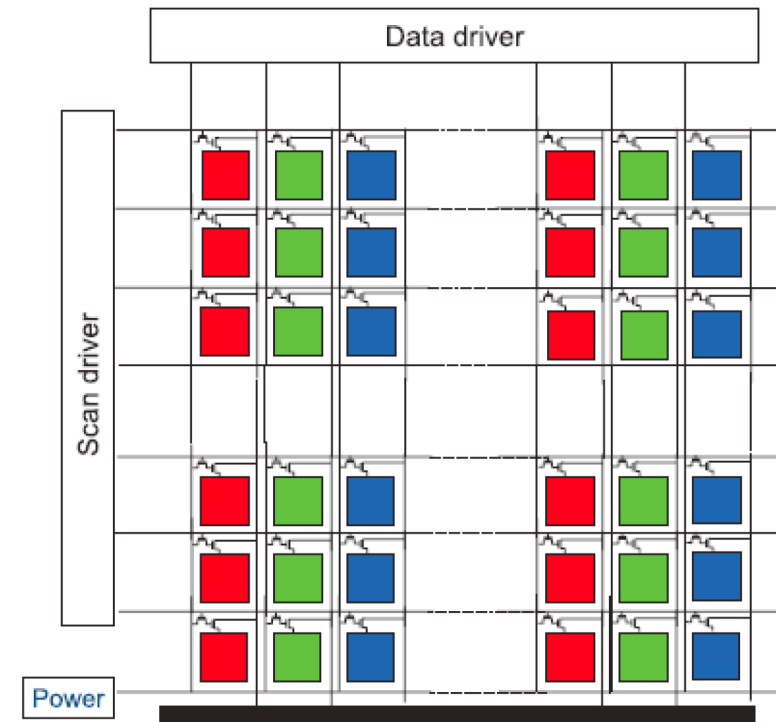


Figure 4.31 An active-matrix OLED display.

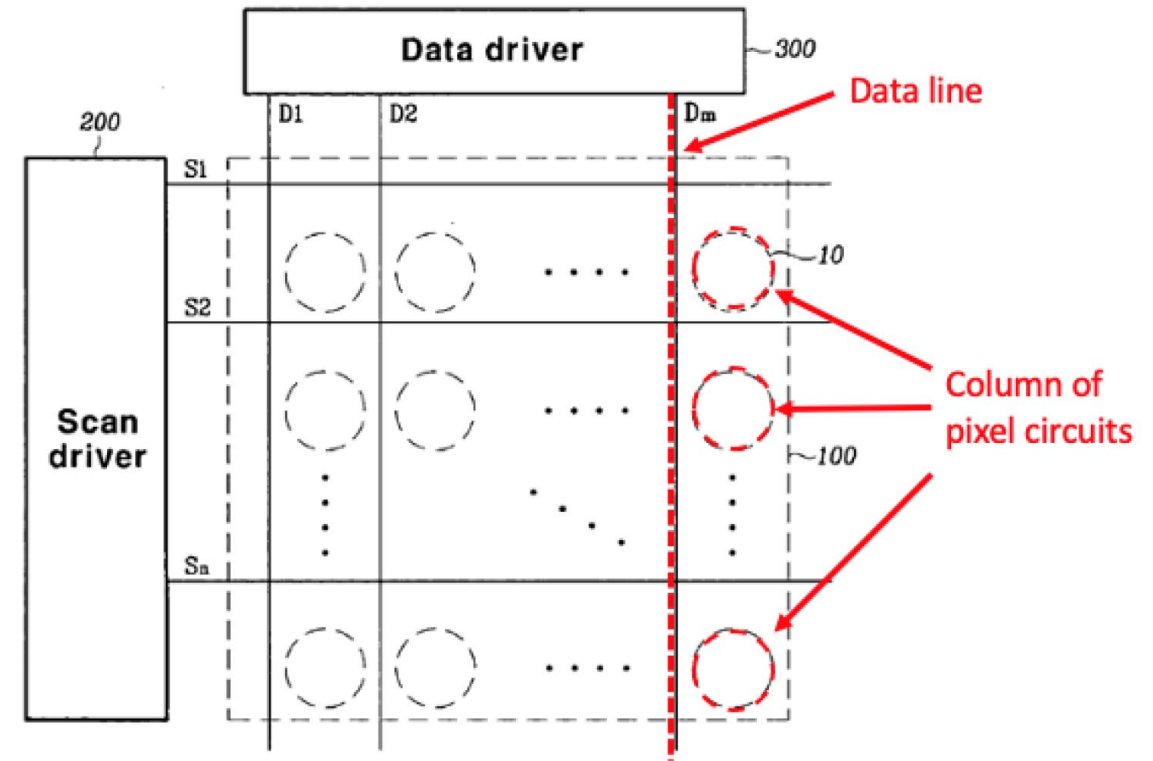
IPR2023-00771, EX2011, ¶¶40; EX2007, 8, FIG. 4.31.

The Pixel Circuit of Kim's Fourth Embodiment Is Not a Video Driver

Kim discloses a data driver that generates a video drive signal and transmits it to the pixel circuits.

[0046] The organic EL display panel **100** includes a plurality of data lines D_1 through D_m , each extending in a column direction, a plurality of scan lines S_1 through S_n , each extending in a row direction, and a plurality of pixel circuits **10**. The data lines D_1 through D_m transmit data voltages that correspond to video signals to the pixel circuits **10**, and the scan lines S_1 through S_n transmit select signals for selecting the pixel circuits **10**. Each pixel circuit **10** is formed at a pixel region defined by two adjacent data lines D_1 through D_m , and two adjacent scan lines S_1 through S_n .

[0047] The scan driver **200** sequentially applies select signals to the scan lines S_1 through S_n , and the data driver **300** applies the data voltage that corresponds to video signals to the data lines D_1 through D_m .



IPR2023-00771, EX2011, ¶¶90; EX1007, ¶¶46-47.

IPR2023-00771, EX2011, ¶¶90; EX1007, FIG. 3 (annotated).

The Pixel Circuit of Kim's Fourth Embodiment Is Not a Video Driver

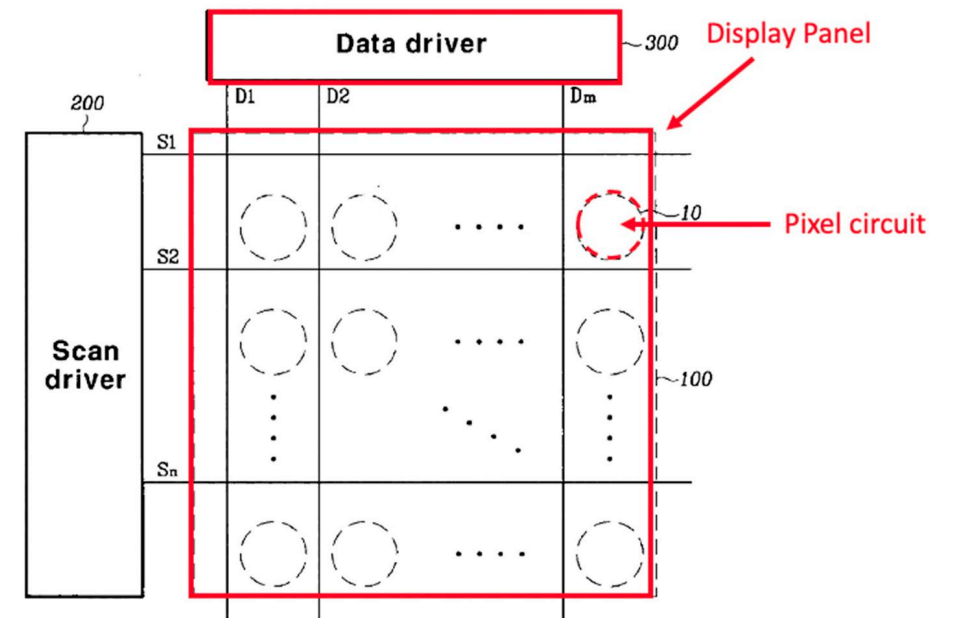
An AMOLED display includes drivers that send video drive signals to pixel circuits.

Patent Owner's Mr. Credelle

92. Kim discloses an AMOLED display system, with data (video) driver, scan driver, and an array of pixel circuits. EX1007, ¶¶[0007]-[0009], [0044]-[0047], FIG. 3. Kim's disclosure is consistent with a POSITA's understanding of a conventional AMOLED display, where a video driver (also referred to as source drivers, column drivers, display drivers, or data drivers, *see* ¶¶32-40, *supra*) provides video data to columns of pixels and a scan driver sequentially selects rows of pixels for programming. For example, the figure below from the Tsujimura textbook shows the same relationship between the video (data) driver and pixel

IPR2023-00771, EX2011, ¶92.

Kim



IPR2023-00771, EX2011, ¶80; EX1007, FIG. 3 (annotated).

The Pixel Circuit of Kim's Fourth Embodiment Is Not a Video Driver

The claimed “video driver” maps to the Kim’s data driver, not a pixel circuit.

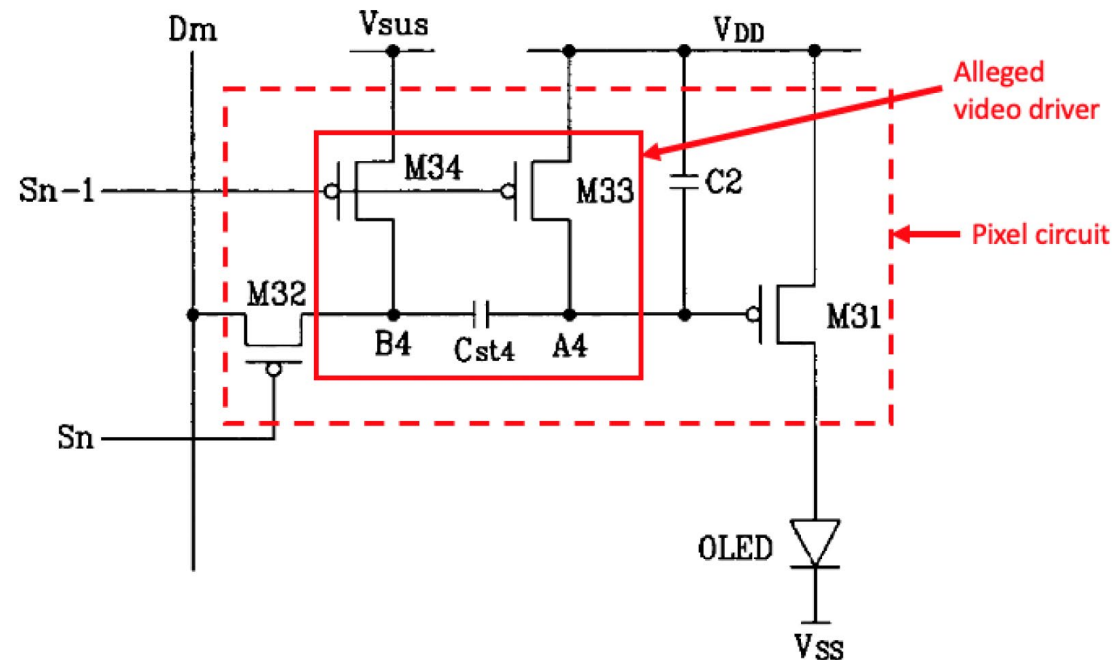
Patent Owner’s Mr. Credelle

circuits as Kim’s Figure 3. Thus, a POSITA would understand that the *video driver* of the ’521 patent, which generates an analog video drive signal with voltages and impedance levels that match the voltage and current requirements of the pixel array, is the same as the data driver in Kim’s Figure 3 or Tsujimura’s Figure 4.31 below. This is further supported by the fact that Kim does not refer to the voltage compensator within the pixel circuit as a “video driver.” EX2012, 87:20-88:7.

IPR2023-00771, EX2011, ¶¶92.

The Pixel Circuit of Kim's Fourth Embodiment Is Not a Video Driver

Kim's fourth embodiment discloses a pixel circuit, not a video driver.



IPR2023-00771, EX2011, ¶89; EX1007, FIG. 10 (annotated)

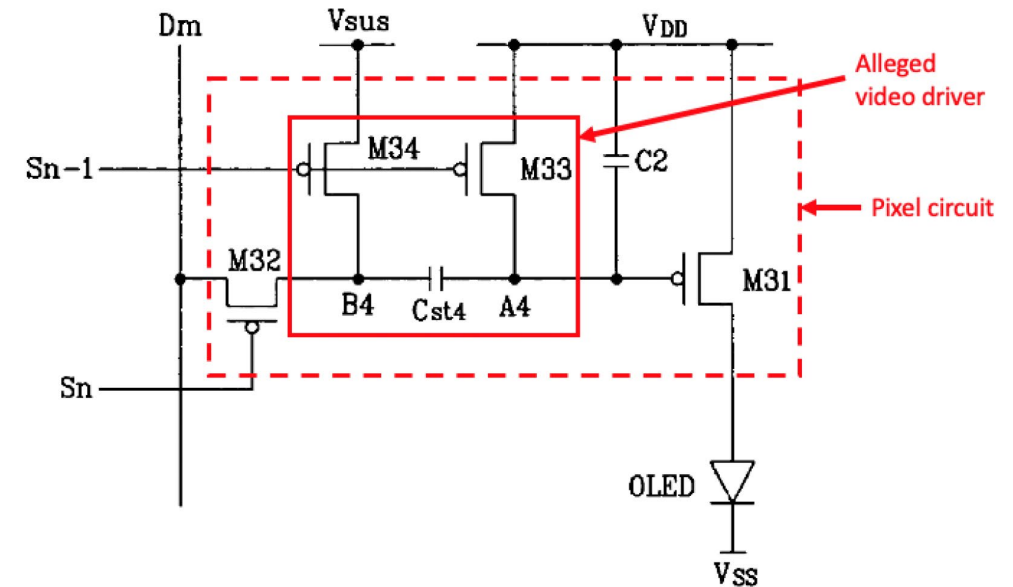
The Pixel Circuit of Kim's Fourth Embodiment Is Not a Video Driver

In AMOLED displays, there is a one-to-many relationship between drivers and pixel circuits. In contrast, the alleged video driver of Kim does not drive multiple pixel circuits.

Patent Owner's Mr. Credelle

93. One of ordinary skill would also understand that in AMOLED displays there is a one-to-many relationship between drivers and pixel circuits. See ¶¶32-40, *supra*. The data (video) driver circuitry comprises an array of drivers where each driver in the array “drives” an entire column of pixel circuits. See ¶¶32-40, *supra*. The scan driver similarly is comprised of an array of drivers wherein each driver in the array “drives” a row of pixel circuits, allowing one row at a time to be programmed with the video signal in repeating cycles. See ¶¶32-40, *supra*. In contrast, the alleged video driver of Kim does not drive a number of pixel circuits and is therefore not a video driver. EX1007, FIGs. 4, 10.

Kim



IPR2023-00771, EX2011, ¶89; EX1007, FIG. 10 (annotated).

The Pixel Circuit of Kim's Fourth Embodiment Is Not a Video Driver

The '521 patent expressly states that the claimed “video driver” isolates the pixel circuit from power supply voltage variations. Thus, the video driver is separate from the pixel circuit.

Patent Owner's Mr. Credelle

95. One of ordinary skill in the art would thus understand that the invention relates to the functionality of an upstream video driver that isolates the downstream pixel circuit from the power supply voltage variations. Petitioner has admitted that the specification refers to “*electrical* isolation” of the pixel circuit. POPR Reply, 1. Therefore, in the understanding of one of ordinary skill in the art, the claimed video driver of the '521 patent is necessarily separate and distinct from the pixel circuit, which is consistent with the general usage of these terms in the field. POPR Reply, 1. Otherwise, if the video driver were part of the pixel circuit,

IPR2023-00771, EX2011, ¶¶94-95.

Kim

FIELD OF THE INVENTION

The invention relates to video driver for AMOLED displays and, in particular, to a video driver for AMOLED displays that is capable of isolating the pixel circuit from power supply voltage variations.

IPR2023-00771, EX1001, 1:6-9.

The Pixel Circuit of Kim's Fourth Embodiment Is Not a Video Driver

Kim addresses non-uniformities in power supply voltage *between pixels* in the display.

Patent Owner's Mr. Credelle

96. The differences in the problems addressed by the '521 patent and Kim help explain why they propose different solutions. The problems Kim seeks to address – driving transistor threshold voltage variations and voltage drop – vary among the pixel circuits in a display. EX1007, ¶¶[0014], [0015]; EX2012, 55:17-56:11, 59:1-18. As explained in the following excerpt from a 2006 article by Han,

97. Similarly, Kim explains that due to “voltage drop”, “the power supply voltage V_{DD} applied to a plurality of pixel circuits is not uniform” and “a desired amount of current may not flow to the OLED, thereby degrading image quality.” EX1007, Kim, ¶[0013] (emphasis added). Because these voltage disturbances are not uniform across pixel circuits, the solution must provide a form of voltage compensation to each pixel circuit separately. The Han article, similar to Kim, proposed providing a compensation voltage, V_{SUS} to the pixel circuits to address similar challenges:

Kim

[0013] However, when a voltage drop (IR-drop) is generated on a line for supplying the power supply voltage V_{DD} , and the power supply voltage V_{DD} applied to a plurality of pixel circuits is not uniform, a desired amount of current may not flow to the OLED, thereby degrading image qualities, since the current flowing to the OLED is influenced by the power supply voltage V_{DD} in the conventional pixel circuit based on the voltage programming method. As the area of the organic EL display becomes larger, and the brightness increases, the voltage drop on the line for supplying the power supply voltage V_{DD} increases to generate further problems.

IPR2023-00771, EX2007, ¶13.

The Pixel Circuit of Kim's Fourth Embodiment Is Not a Video Driver

In contrast, the '521 patent teaches a solution that addresses power supply voltage variations for the entire display.

Patent Owner's Mr. Credelle

98. In contrast, the '521 patent provides examples of voltage variations that do not vary from pixel circuit to pixel circuit. The '521 patent provides the example of a component in a battery powered device turning on, causing the power supply voltage delivered to the display to fluctuate:

[W]hen the AMOLED display is incorporated in a battery powered application, the power supply voltage will inevitably fluctuate whenever circuitry in the application device is powered up from being in a standby mode.

IPR2023-00771, EX2011, ¶98.

EX1001, 1:40-56. In this example, the circuitry of a battery-powered device turning on would impact the power supply voltage for the entire display. Thus, the '521 claims a solution that is implemented in the video driver that is outside of the pixel circuits. That is, the '521 patent teaches a “global” correction to the generated video signal by referencing the video signal to V_{DD} before the data is supplied to the pixel circuits.

IPR2023-00771, EX2011, ¶98.

Agenda

- ▶ The '521 Patent
- ▶ Kim does not disclose or render obvious generating a video drive signal
- ▶ **Kim's pixel circuit is not a "video driver"**
 - ▶ The claimed "video driver" maps to a data driver in an AMOLED display, not a pixel circuit
 - ▶ **Even if the claimed "video driver" is integrated with the AMOLED display, it is not a pixel circuit**
- ▶ Hayafuji addresses *only* voltage ripple
- ▶ Steer's alleged video drive signal is a function of the feedback current
- ▶ Steer's alleged video drive signal is amplified with non-unity gain

The Pixel Circuit of Kim's Fourth Embodiment Is Not a Video Driver

The specification states that the claimed “video driver” can be integrated with the AMOLED display.

The video driver circuit of the present invention described above with reference to FIGS. 2-4 can be implemented using discrete components. Alternately, the video driver circuit of the present invention can be implemented as an integrated circuit to be incorporated in the AMOLED display system. Furthermore, the video driver circuit of the present invention can be integrated with other circuitry of the AMOLED display panel into a single integrate circuit. For instance, the video driver of the present invention can be integrated on the same integrated circuit with the current driver and the OLED pixel elements of the AMOLED display panel. 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. The video driver of the present invention can be integrated

IPR2023-00771, EX1001, 7:52-67.

The Pixel Circuit of Kim's Fourth Embodiment Is Not a Video Driver

Even if the video driver and display panel are integrated, the video driver is distinct from the pixel circuits.

Patent Owner's Mr. Credelle

100. These embodiments do not eliminate the requirement that the claimed video driver be distinct from the pixel circuits. The defining features of an *Active Matrix* OLED display are distinct pixel circuits for each OLED pixel, a video driver that sends a video drive signal to columns of pixel circuits, and a scan driver that selects which row of pixel circuits is active. See ¶¶32-40, *supra*. Petitioner does not dispute this. EX1002, ¶¶67-70; EX2012, 79:11-16. Thus, even if the video driver and display panels are integrated, a POSITA would understand that the display would still comprise distinct pixel circuits and video drivers.

Illustrating this, Figure 4.16 in the den Boer textbook shows an AMOLED display with the video driver (referred to as data driver) and the viewing area (the matrix of OLED pixels and pixel circuits) integrated on a single piece of glass. EX1011, 102-104; EX2012, 48:2-50:11.

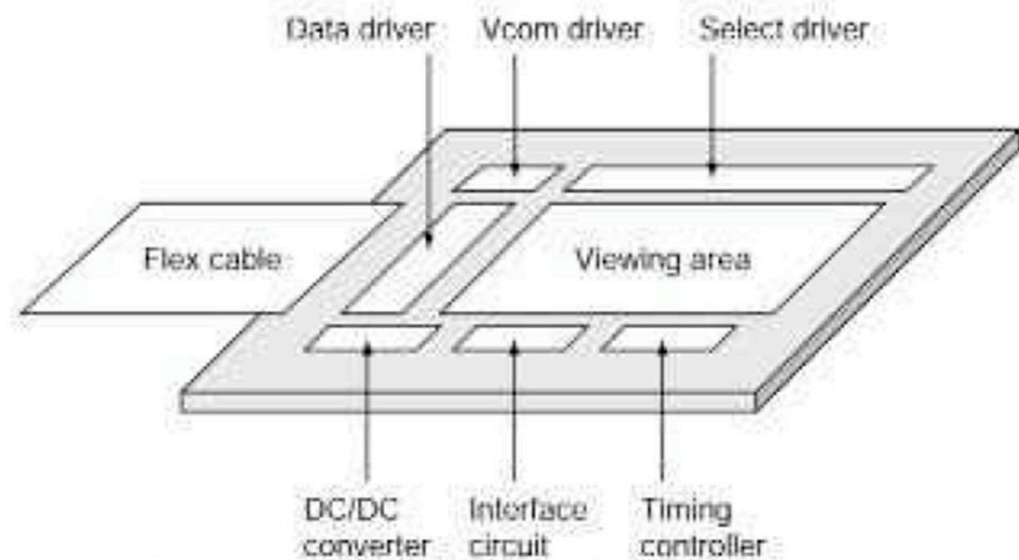


Figure 4.16: Example of configuration for a “system-on-panel.”

IPR2023-00771, EX2011, ¶100; EX1011, 104, FIG. 4.16.

The Pixel Circuit of Kim's Fourth Embodiment Is Not a Video Driver

Even if the video driver and display panel are incorporated into a single integrated circuit, the video driver is distinct from the pixel circuits.

101. Similarly, AMOLED display systems where the video driver, scan driver, and pixel circuits are incorporated into an integrated circuit have been implemented. For example, Oyonama describes an AMOLED display where the video driver, scan driver, and pixel circuits are built onto a single piece of silicon:

EX2010, 952. The figures below from Oyonama further illustrate that the video driver, scan driver, and pixel circuits are distinct components built on a single semiconductor substrate. EX2010, 950, 952.

102. Thus, even in a design where the video driver and pixel circuits are integrated with the display panel or incorporated into a single integrated circuit, the video drivers are still distinct from the pixel circuits. Thus, the compensation circuit (alleged video driver) located in the pixel circuit of Kim does not disclose the video driver of claim 1.

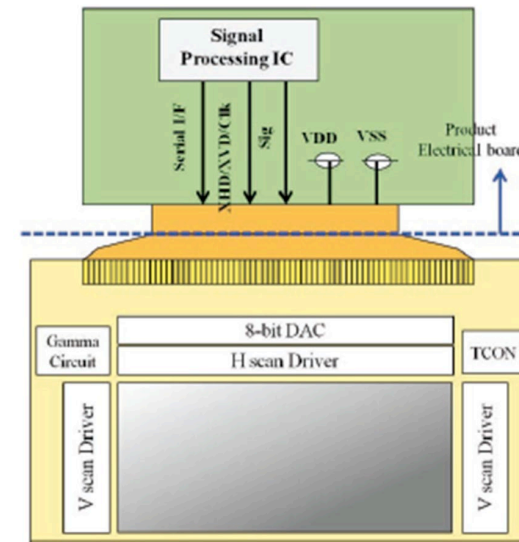


Figure 6. Block diagram of driving circuit

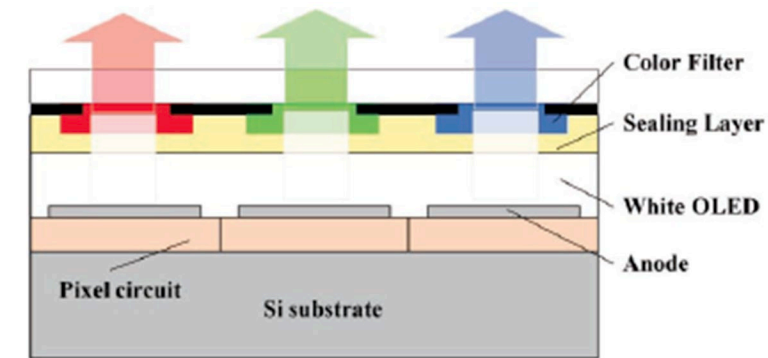


Figure 5. Cross-sectional composition

The Pixel Circuit of Kim's Fourth Embodiment Is Not a Video Driver

Even if the video driver and display panel are incorporated into a single integrated circuit, the video driver is distinct from the pixel circuits.

Kim

[0048] The scan driver 200 and/or the data driver 300 may be coupled to the display panel 100, or may be installed, in a chip format, in a TCP (tape carrier package) coupled to the display panel 100. The same can be attached to the display panel 100, and installed, in a chip format, on an FPC (flexible printed circuit) or a film coupled to the display panel 100, which is referred to as a CoF (chip on flexible board, or chip on film) method. In other embodiments, the scan driver 200 and/or the data driver 300 may be installed on a glass substrate of the display panel. Further, the same can be substituted for the driving circuit formed in the same layers as the scan lines, the data lines, and TFTs on the glass substrate, or directly installed on the glass substrate.

IPR2023-00771, EX1007, ¶¶48; EX2011, ¶¶101-102.

Agenda

- ▶ The '521 Patent
- ▶ Kim does not disclose or render obvious generating a video drive signal
- ▶ Kim's pixel circuit is not a "video driver"
- ▶ **Hayafuji addresses *only* voltage ripple**
 - ▶ Hayafuji does not disclose a video drive signal referenced to the PPS voltage
 - ▶ Hayafuji does not disclose the current drive voltage being independent of the PPS voltage
 - ▶ Hayafuji does not disclose claim 2
- ▶ Steer's alleged video drive signal is a function of the feedback current
- ▶ Steer's alleged video drive signal is amplified with non-unity gain

Hayafuji Does Not Disclose a Video Drive Signal Referenced to the PPS Voltage

Hayafuji teaches a system that addresses *only* undesirable voltage ripple, not other voltage noise or voltage drift

Patent Owner's Mr. Credelle

126. Hayafuji discloses a circuit that purports to compensate for undesirable ripple variations in the power supply voltage that are introduced by the use of a DC-DC converter in the system. EX1006, ¶¶[0017], [0018], [0022], [0028], [0030]. In Hayafuji, the power supply voltage V_a is delivered to a ripple component extraction circuit that extracts *only* the ripple component, V_{ri} , of power supply voltage V_a . EX1006, FIG. 6, ¶¶[0048]-[0049]. The ripple component V_{ri} is then supplied to an addition circuit where it is added to the video signal V_{data} to produce V_{gate} . EX1006, FIG. 6, ¶¶[0048]-[0049]. The Petition argues that adding

IPR2023-00771, EX2011, ¶126.

Hayafuji

[0022] Here, for the drive voltage V_a supplied to the source of the transistor Tr_2 , the boosted voltage by the DC-DC converter is employed as already described, and in this type of DC-DC converter, it is unavoidable that ripple noise (ripple component) is superimposed on the voltage V_a to some degree since switching operation is accompanied as a matter of its operating principle. In the DC-DC converter,

IPR2023-00771, EX2011, ¶126; EX1006, ¶22.

Agenda

- ▶ The '521 Patent
- ▶ Kim does not disclose or render obvious generating a video drive signal
- ▶ Kim's pixel circuit is not a "video driver"
- ▶ **Hayafuji addresses *only* voltage ripple**
 - ▶ **Hayafuji does not disclose a video drive signal referenced to the PPS voltage**
 - ▶ Hayafuji does not disclose the current drive voltage being independent of the PPS voltage
 - ▶ Hayafuji does not disclose claim 2
- ▶ Steer's alleged video drive signal is a function of the feedback current
- ▶ Steer's alleged video drive signal is amplified with non-unity gain

Claim 1 Requires a Video Drive Signal That Is Referenced to the Positive Power Supply Voltage of the AMOLED Display

1. An active matrix organic light emitting diode (AMOLED) display system comprising an AMOLED display panel receiving a video signal to be displayed on the AMOLED display panel, the AMOLED display panel comprising a plurality of organic light emitting diode (OLED) pixel elements, the AMOLED display system comprising:

a video driver receiving the video signal and generating a video drive signal indicative of the video signal and referenced to a positive power supply voltage of the AMOLED display panel; and

a current driver coupled to at least one OLED pixel element, the current driver receiving the video drive signal and the positive power supply voltage and providing a drive current to the at least one OLED pixel element, the drive current being proportional to a current drive voltage being indicative of the video signal and independent of the positive power supply voltage.

IPR2023-00771, EX1001, Claim 1.

Petitioner's Position

Petitioner argues that the alleged video drive signal, V_{gate} , is referenced to the PPS voltage because it is the sum of the ripple component V_{ri} and the video signal V_{data} .

Petition

Hayafuji explains “in the voltage addition circuit **15**, treating the data voltage V_{data} as a base, the ripple component V_{ri} extracted by the ripple component extraction circuit **14** is added to the base. The output thereof as V_{gate} ... is supplied to the gate of a light emission drive transistor **Tr2**.” Ex.[1006], ¶0049. Thus, because the output of circuit 15 (V_{gate}) is the sum of (1) the relevant portion of the video signal and (2) the ripple component of the supply voltage, V_{gate} is both indicative of the video signal and referenced to the supply voltage. Ex.[1002], ¶¶173-182.

IPR2023-00771, Pet., 54-55

Petitioner's Dr. Kattamis

179. Hayafuji explains that “in the voltage addition circuit **15**, treating the data voltage V_{data} as a base, the ripple component V_{ri} extracted by the ripple component extraction circuit **14** is added to the base. The output thereof as V_{gate} ... is supplied to the gate of a light emission drive transistor **Tr2**.” See Ex. [1006], Hayafuji at ¶ 0049.

182. Therefore, Hayafuji discloses a video driver receiving the video signal and generating a video drive signal indicative of the video signal and referenced to a positive power supply voltage of the AMOLED display panel.

IPR2023-00771, EX1002, ¶¶179, 182

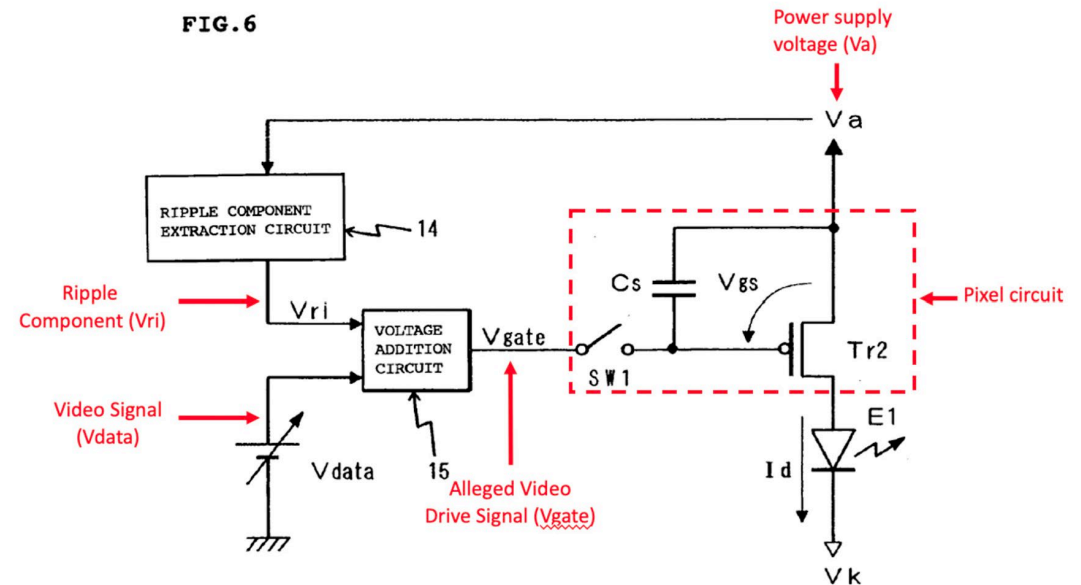
Hayafuji Does Not Disclose a Video Drive Signal Referenced To the PPS Voltage

The positive power supply voltage V_a is *not* used as a baseline in calculating the alleged video drive signal V_{gate} .

Patent Owner's Mr. Credelle

128. In contrast to the '521 patent, the alleged video drive signal V_{gate} of Hayafuji is not calculated using the positive power supply as a baseline and is thus not “referenced to a positive power supply voltage.” As illustrated in Hayafuji's Figure 6, only the ripple component V_{ri} , not power supply voltage V_a , is combined with the video signal V_{data} in the addition circuit. EX1006, FIG. 6, ¶[0049]. V_{gate} is therefore the sum of ripple component V_{ri} and video signal V_{data} : $V_{gate} = V_{ri} + V_{data}$. EX1006, FIG. 6, ¶[0049]. Because the positive power supply voltage V_a of

IPR2023-00771, EX2011, ¶128.



IPR2023-00771, EX2011, ¶125; EX1006, FIG. 6 (annotated).

[0049] Accordingly, in the voltage addition circuit 15, treating the data voltage V_{data} as a base, the ripple component V_{ri} extracted by the ripple component extraction circuit 14 is added to the base. The output thereof as V_{gate} is supplied to a scan selection transistor $Tr1$ represented by reference character SW1, and the V_{gate} is supplied to the gate of a light emission drive transistor $Tr2$ by the turning on of the transistor $Tr1$ during the addressing time and is written in a capacitor C_s .

Hayafuji Does Not Disclose a Video Drive Signal Referenced To the PPS Voltage

Petitioner admits that V_a can be broken down into V_{DC} and V_{ri} . V_{DC} is not used in generating the alleged video drive signal.

Patent Owner's Mr. Credelle

129. The Institution Decision states that “Patent Owner does not explain why combining the ripple component V_{ri} , which is included in power supply voltage V_a with the relevant portion of the video signal V_{data} , is not sufficient to show that the video drive signal V_{gate} is referenced to the power supply voltage V_a .” DI, 44. However, the non-ripple component of V_a , which includes noise and drift, is completely filtered out in Hayafuji’s ripple extraction circuit before it is added to the video signal. Petitioner admits that V_a can be expressed as $V_{DC} + V_{ri}$, where V_{DC} is the non-ripple power supply voltage. Pet., 59. V_{DC} is the main component of the power supply voltage and is not added to the video signal V_{data} . EX2012, 93:15-94:6. This is illustrated clearly in Hayafuji’s Figure 8, annotated below, where V_{ri} is added to V_{data} and V_{data} is referenced to ground and not V_a . EX1006, FIG. 8, ¶¶[0052]-[0053].

Petition

Thus, a POSA would understand V_a is composed of DC power $V_{dc} + V_{ri}$. Ex.[1002], ¶¶190-201. The impact of Hayafuji’s voltage addition circuit therefore is to generate output voltage $V_{gate} = V_{data} + V_{ri}$. The resulting current drive voltage is therefore: $V_{gs} = V_{dc} + V_{ri} - V_{data} - V_{ri}$, which simplifies to $V_{gs} = V_{dc} - V_{data}$, removing the variations (V_{ri}) in power supply voltage from the current drive voltage. Ex.[1002],

IPR2023-00771, Pet., 59.

The '521 patent's third embodiment discloses referencing the video drive signal to VDD once every blanking period

FIG. 4 is a schematic diagram of a video driver for an AMOLED display system according to a third embodiment of the present invention. In the embodiment shown in FIG. 4, a video drive 302 is implemented using a video clamp circuit to reference the video drive signal to the power supply voltage VDD. In video driver 302, the video clamp circuit is implemented using an amplifier 306 coupled to

As thus configured, when the Blanking signal is asserted at the beginning of each video line to re-establish the black reference of the video display, transistor M3 is turned on and the right plate of capacitor C1 is charged up to the power supply voltage VDD. In this manner, the power supply

More specifically, video driver **302** is effective in removing voltage drifts in the power supply voltage but does not necessarily remove noise or glitches in the power supply voltage from impacting the video drive signal. This is because the clamping voltage V_{clamp} is recharged only once for each video line and thus **any noise or voltage glitches that may appear on the power supply voltage VDD will not get charged to capacitor C1 until the next Blanking period.**



IPR2023-00771, EX2011, ¶74; EX1001, FIG. 4 (annotated).

Hayafuji Does Not Disclose a Video Drive Signal Referenced To the PPS Voltage

Hayafuji is designed to compensate *only* for predictable voltage ripple. Hayafuji's system does not compensate for drift or random noise.

Patent Owner's Mr. Credelle

131. The differences in the designs of Hayafuji's circuit and the '521 patent's video driver impact the operation of the AMOLED display. Hayafuji's ripple component extraction circuit is designed to compensate for voltage ripple, which is a voltage disturbance that results in undesirable AC voltage signals being superimposed onto the DC power supply voltage signal. Ripple is consistently introduced by the normal operation of the DC-DC converter in the power supply system. Hayafuji uses a high-pass filter to extract only the ripple component that is on the power supply voltage. If the power supply voltage experiences fluctuations other than the ripple, the solution of Hayafuji will not work. For example, voltage change in pixel brightness over time. The high-pass filter of Hayafuji compensates *only* for the ripple that is consistently and predictably superimposed onto the power supply voltage by the DC-DC converter.

Petitioner's Dr. Kattamis

generation. Ripple, for instance, often appears in power supplies generated by switching power converters and is the result of imperfect filtering of the switching activity within those converters. Since ripple originates from a deterministic switching behavior, ripple components of power supplies are themselves deterministic and tend to exhibit periodic behavior at the same frequency as the oscillating signal controlling the DC-DC converter. Noise, on the other hand, is a random phenomenon and can originate from many different sources, including the random thermal motion of charge carriers within wires and components attached to these wires. Regardless of differences in their origination, ripple and noise are both

IPR2023-00771, EX1015, ¶1260.

Agenda

- ▶ The '521 Patent
- ▶ Kim does not disclose or render obvious generating a video drive signal
- ▶ Kim's pixel circuit is not a "video driver"
- ▶ **Hayafuji addresses *only* voltage ripple**
 - ▶ Hayafuji does not disclose a video drive signal referenced to the PPS voltage
 - ▶ **Hayafuji does not disclose the current drive voltage being independent of the PPS voltage**
 - ▶ Hayafuji does not disclose claim 2
- ▶ Steer's alleged video drive signal is a function of the feedback current
- ▶ Steer's alleged video drive signal is amplified with non-unity gain

Claim 1 Requires the Current Drive Voltage To Be Independent of the Positive Power Supply Voltage

1. An active matrix organic light emitting diode (AMOLED) display system comprising an AMOLED display panel receiving a video signal to be displayed on the AMOLED display panel, the AMOLED display panel comprising a plurality of organic light emitting diode (OLED) pixel elements, the AMOLED display system comprising:

- a video driver receiving the video signal and generating a video drive signal indicative of the video signal and referenced to a positive power supply voltage of the AMOLED display panel; and
- a current driver coupled to at least one OLED pixel element, the current driver receiving the video drive signal and the positive power supply voltage and providing a drive current to the at least one OLED pixel element, the drive current being proportional to a current drive voltage being indicative of the video signal and independent of the positive power supply voltage.

Petitioner's Position

Petitioner argues that Hayafuji satisfies this limitation because Voltage ripple V_{ri} is removed from the current drive voltage V_{GS} .

Petition

As explained above, this limitation means that the drive voltage is independent of variations in the power supply voltage, so that such noise or DC drifts do not propagate to the LED drive current. See §VI. *Hayafuji* achieves this. *Hayafuji*

Thus, a POSA would understand V_a is composed of DC power $V_{dc}+V_{ri}$. Ex.[1002], ¶¶190-201. The impact of *Hayafuji*'s voltage addition circuit therefore is to generate output voltage $V_{gate}=V_{data}+V_{ri}$. The resulting current drive voltage is therefore: $V_{gs}=V_{dc}+V_{ri}-V_{data}-V_{ri}$, which simplifies to $V_{gs}=V_{dc}-V_{data}$, removing the variations (V_{ri}) in power supply voltage from the current drive voltage. Ex.[1002], ¶¶190-201; Ex.[1006], ¶¶0053-0054. Thus, *Hayafuji*'s current drive voltage satisfies this limitation. Ex.[1002], ¶¶190-201.

IPR2023-00771, Pet., 58-60

Petitioner's Dr. Kattamis

200. A POSA would have quickly recognized that because Hayafuji's (1) drain current I_d is based on the gate-to-source voltage V_{gs} as discussed above, (2) gate-to-source voltage V_{gs} is the difference between gate voltage V_{gate} and drive voltage V_a , and (3) gate voltage V_{gate} and drive voltage V_a both include the ripple component V_{ri} which is thus cancelled out in gate-to-source voltage V_{gs} , that therefore, Hayafuji's drain current I_d is "independent of" drive voltage V_a (i.e., drain current I_d is "independent of" ripple component V_{ri}). Thus, a POSA would have recognized that Hayafuji discloses the drive current (drain current I_d) being... independent of (unaffected by ripple component V_{ri}) the positive power supply voltage (drive voltage V_a).

IPR2023-00771, EX1002, ¶200.

The Institution Decision Observed That Petitioner's Arguments Are Inconsistent

The Board observed that Petitioner's contention that V_{gate} is referenced to the positive power supply voltage is inconsistent with Petitioner's contention that V_{gs} is independent of the positive power supply voltage.

Institution Decision

that voltage drift and noise are not recited in claim 1. On this record, we also agree with Patent Owner that Petitioner appears to acknowledge that V_{DC} is part of the V_a ($V_a = V_{DC} + V_{ri}$). As a result, we observe that Petitioner's contentions that V_{gate} is referenced to the positive power supply ($V_{gate} = V_{data} + V_{ri}$) appears inconsistent with Petitioner's contentions that V_{gs} is independent of the positive power supply ($V_{gs} = V_{DC} - V_{data}$).

IPR2023-00771, ID, 48.

Hayafuji Does Not Disclose the Current Drive Voltage Being Independent of the PPS Voltage

Petitioner admits that the V_{DC} portion of the positive power supply voltage V_a is included in the current drive voltage.

Patent Owner's Mr. Credelle

139. *First*, Petitioner's own admission confirms that the drive current is not independent of the power supply voltage because the main component of the positive power supply voltage (i.e., V_{dc}) is part of Petitioner's admitted equation for the current drive voltage. Pet., 59.

IPR2023-00771, EX2011, ¶139.

Petition

Thus, a POSA would understand V_a is composed of DC power $V_{dc}+V_{ri}$. Ex.[1002], ¶¶190-201. The impact of *Hayafuji's* voltage addition circuit therefore is to generate output voltage $V_{gate}=V_{data}+V_{ri}$. The resulting current drive voltage is therefore: $V_{gs}=V_{dc}+V_{ri}-V_{data}-V_{ri}$, which simplifies to $V_{gs}=V_{dc}-V_{data}$, removing the variations (V_{ri}) in power supply voltage from the current drive voltage. Ex.[1002],

IPR2023-00771, Pet., 59.

Hayafuji Does Not Disclose the Current Drive Voltage Being Independent of the PPS Voltage

Petitioner admits that Hayafuji removes only predictable voltage ripple – *not noise or drift* – from the current drive voltage.

Patent Owner's Mr. Credelle

140. *Second*, this argument ignores the undesirable voltage drift that each embodiment of the '521 patent removes from the current drive voltage. Pet., 59; EX1001, 5:18-23, 6:33-37, 7:46-51. The limited teachings of Hayafuji relate to removing only the ripple component of the power supply voltage introduced by a DC-DC converter, which is distinct from voltage drift and noise addressed by the '521 patent's teachings. EX1006, ¶[0022]; EX1001, 1:40-55, 2:38-42, 2:67-3:4, 5:18-23, 6:33-37, 7:46-51. Thus, a more accurate formulation of Hayafuji's power supply voltage than provided in the Petition is: $V_a = V_{DC} + V_{ri} + V_{drift} + V_{noise}$. Using this formulation of V_a , we can see that the Hayafuji's current drive voltage includes both V_{drift} and V_{noise} , as well as the DC power component:

$$V_{gs} = V_{dc} + V_{ri} + V_{drift} + V_{noise} - V_{data} - V_{ri}$$

$$= V_{dc} + V_{drift} + V_{noise} - V_{data}$$

Petition

Thus, a POSA would understand V_a is composed of DC power $V_{dc} + V_{ri}$. Ex.[1002], ¶¶190-201. The impact of Hayafuji's voltage addition circuit therefore is to generate output voltage $V_{gate} = V_{data} + V_{ri}$. The resulting current drive voltage is therefore: $V_{gs} = V_{dc} + V_{ri} - V_{data} - V_{ri}$, which simplifies to $V_{gs} = V_{dc} - V_{data}$, removing the variations (V_{ri}) in power supply voltage from the current drive voltage. Ex.[1002],

IPR2023-00771, Pet., 59.

Agenda

- ▶ The '521 Patent
- ▶ Kim does not disclose or render obvious generating a video drive signal
- ▶ Kim's pixel circuit is not a "video driver"
- ▶ **Hayafuji addresses *only* voltage ripple**
 - ▶ Hayafuji does not disclose a video drive signal referenced to the PPS voltage
 - ▶ Hayafuji does not disclose the current drive voltage being independent of the PPS voltage
 - ▶ **Hayafuji does not disclose claim 2**
- ▶ Steer's alleged video drive signal is a function of the feedback current
- ▶ Steer's alleged video drive signal is amplified with non-unity gain

Claim 2 Requires the VDS To Be Indicative of the Sum of or Difference Between the PPS Voltage and the Video Signal

2. The AMOLED display system of claim 1, wherein the video drive signal is indicative of the sum of or the difference between the positive power supply voltage and the video signal and the current drive voltage is indicative of the difference between the positive power supply voltage and the video drive signal.

IPR2023-00771, EX1001, Claim 2.

Petitioner's Position

Petitioner argues that Hayafuji satisfies this limitation because the ripple component V_{ri} can allegedly be re-written as $V_a - V_{DC}$.

Petition

Thus, a POSA would recognize that *Hayafuji* teaches: (1) that the drive voltage V_a is the sum of a constant DC output voltage component (herein “ V_{dc} (constant)”) of the drive voltage V_a and the extracted ripple component V_{ri} ; (2) that the gate voltage V_{gate} is the sum of the data voltage V_{data} and the extracted ripple component V_{ri} ; and consequently, (3) that the gate voltage V_{gate} is indicative of the sum of or the difference between the drive voltage V_a and the data voltage V_{data} :

$$(1) V_a = V_{dc} + V_{ri}$$

$$(2) V_{gate} = V_{data} + V_{ri}$$

$$(3) V_{gate} = V_{data} + V_a - V_{dc} \text{ (constant)}$$

As equation (3) above shows, the drive voltage contains a DC voltage offset, but varies directly with the term $(V_{data} + V_a)$ and is therefore “indicative” of that term, as the claim recites. Ex.[1002], ¶¶202-209.

IPR2023-00771, Pet., 61-63.

Petitioner's Dr. Kattamis

205. Thus Hayafuji discloses that that (1) the drive voltage V_a is the sum of a constant DC output voltage component (herein “ V_{dc} (constant)”) of the drive voltage V_a and the extracted ripple component V_{ri} ; (2) that the gate voltage V_{gate} is the sum of the data voltage V_{data} and the extracted ripple component V_{ri} ; and consequently, (3) that the gate voltage V_{gate} is indicative of the sum of or the difference between the drive voltage V_a and the data voltage V_{data} :

$$V_a = V_{dc} + V_{ri} \quad (1)$$

$$V_{gate} = V_{data} + V_{ri} \quad (2)$$

$$V_{gate} = V_{data} + V_a - V_{dc} \text{ (constant)} \quad (3)$$

IPR2023-00771, EX1002, ¶205.

Hayafuji Does Not Disclose a VDS Indicative of the Sum of or Difference Between the PPS Voltage and the Video Signal

In Hayafuji, only the ripple component V_{ri} , *not* the positive power supply voltage V_a , is added to the video signal.

Patent Owner's Mr. Credelle

145. As set forth above, the Petition admits that the power supply voltage V_a can be expressed as a DC voltage component V_{DC} and a ripple component V_{ri} . Pet., 59. In Hayafuji, the alleged video drive signal V_{gate} is the output of the addition circuit, which calculates the sum of the video signal and the ripple component V_{ri} : $V_{gate} = V_{data} + V_{ri}$. EX1006, FIG. 6, ¶[0049]. The DC voltage component V_{DC} is filtered out of the signal that is provided to Hayafuji's addition circuit. EX1006, FIG. 6, ¶[0049]. Thus, the power supply voltage V_a is not summed with the video signal, and the video drive signal is *not* indicative of either the sum of or the difference between the positive power supply voltage (V_a) and the video signal.

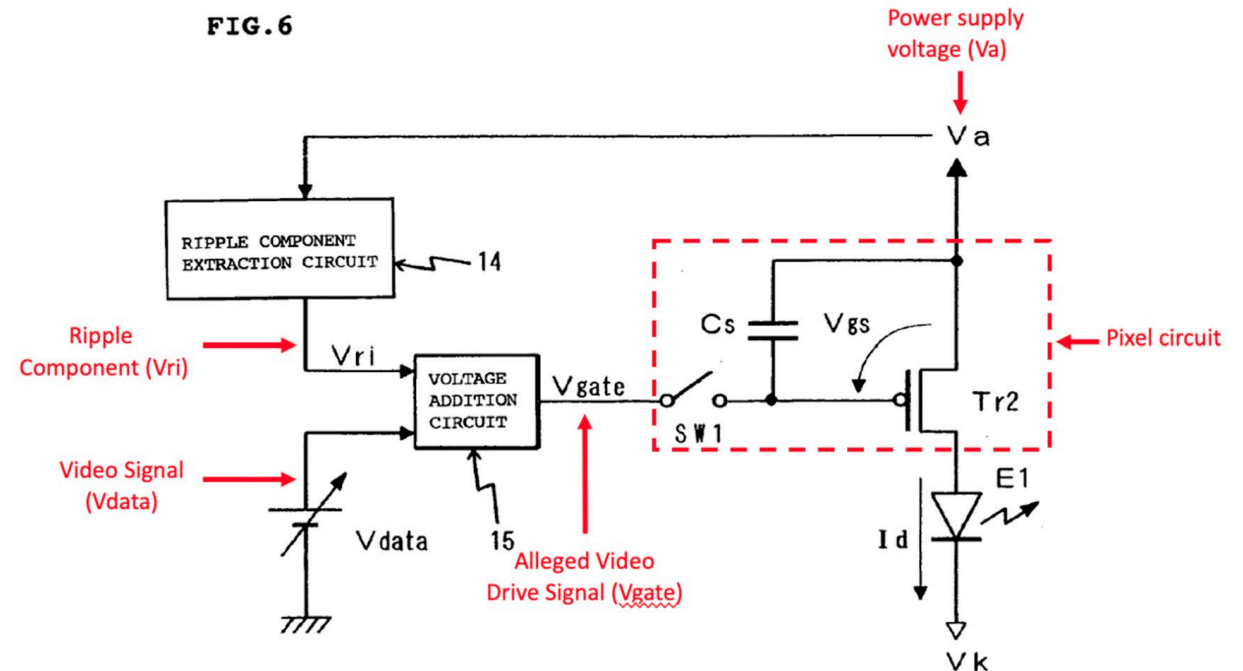
IPR2023-00771, EX2011, ¶145.

Hayafuji Does Not Disclose a VDS Indicative of the Sum of or Difference Between the PPS Voltage and the Video Signal

In Hayafuji, only the ripple component V_{ri} , *not* the positive power supply voltage V_a , is added to the video signal.

[0049] Accordingly, in the voltage addition circuit 15, treating the data voltage V_{data} as a base, the ripple component V_{ri} extracted by the ripple component extraction circuit 14 is added to the base. The output thereof as V_{gate} is supplied to a scan selection transistor $Tr1$ represented by reference character SW1, and the V_{gate} is supplied to the gate of a light emission drive transistor $Tr2$ by the turning on of the transistor $Tr1$ during the addressing time and is written in a capacitor C_s .

IPR2023-00771, EX1006, ¶49.



IPR2023-00771, EX1006, FIG. 6.

Agenda

- ▶ The '521 Patent
- ▶ Kim does not disclose or render obvious generating a video drive signal
- ▶ Kim's pixel circuit is not a "video driver"
- ▶ Hayafuji addresses *only* voltage ripple
- ▶ **Steer's alleged video drive signal is a function of the feedback current**
- ▶ Steer's alleged video drive signal is amplified with non-unity gain

Claim 1 Requires a Video Driver To Generate a Video Drive Signal Referenced To the Positive Power Supply Voltage

1. An active matrix organic light emitting diode (AMOLED) display system comprising an AMOLED display panel receiving a video signal to be displayed on the AMOLED display panel, the AMOLED display panel comprising a plurality of organic light emitting diode (OLED) pixel elements, the AMOLED display system comprising:

a video driver receiving the video signal and generating a video drive signal indicative of the video signal and referenced to a positive power supply voltage of the AMOLED display panel; and

a current driver coupled to at least one OLED pixel element, the current driver receiving the video drive signal and the positive power supply voltage and providing a drive current to the at least one OLED pixel element, the drive current being proportional to a current drive voltage being indicative of the video signal and independent of the positive power supply voltage.

IPR2023-00771, EX1001, Claim 1.

Petitioner's Position

Petitioner incorrectly argues that the output of comparator 50 (node 6) is the claimed video drive signal and is referenced to the positive power supply voltage.

Petition

Additionally, a POSA would recognize that the output of comparator section 50, which is a comparison between “the voltage at node 43 with an input voltage at input 52 representing the desired current” corresponds to the claimed *video drive signal indicative of the video signal and referenced to a positive power supply voltage of the AMOLED display panel*. In particular, voltage on node 43

power supply voltage of the AMOLED display panel). The output of the comparator 50 is column conductor 6 (or node 6) which has a transmission gate 40 connected in series with the conductor line 6. Ex.[1008], 9:1-2. The resulting output on node 6 (V_6) (the claimed *video drive signal*) in *Steer* is shown below in equation (2), which shows the output of the comparison between V_{43} and V_{52} that the video drive signal includes video signal ($input(t)$) subtracted from V_{SUPPLY} .

$$\text{Steer (2): } V_6 = V_{SUPPLY} + R \cdot I - input(t)$$

Petitioner's Dr. Kattamis

280. Additionally, a POSA would have recognized that the output of comparator section 50, which is a comparison between “the voltage at node 43 with an input voltage at input 52 representing the desired current” corresponds to the claimed video drive signal indicative of the video signal and referenced to a positive power supply voltage of the AMOLED display panel. In particular, voltage on node 43 corresponds to V_{SUPPLY} added to R multiplied by I , where R is the resistance of resistor 46 and I is the current flowing. *See* Ex. [1008], *Steer* at 9:10-14; *Steer's* Node 43 voltage is thus represented as:

$$\text{Steer (1): } V_{43} = V_{SUPPLY} + R \cdot I$$

281. Therefore, a POSA would have recognized that voltage at node 43 is V_{SUPPLY} with a offset, and therefore, a comparison between voltage at node 43 (V_{43}) and input voltage at input 52 via the operational amplifier would result in a signal indicative of voltage at input 52 (V_{52} or $input(t)$) (i.e., the claimed video signal) and referenced to V_{SUPPLY} (i.e., the claimed positive power supply voltage of the AMOLED display panel). The resulting output on node 6 (V_6) (the claimed video drive signal) in *Steer* is shown below in equation (2), which shows that the VGS includes video signal ($input(t)$) subtracted from V_{SUPPLY} .

$$\text{Steer (2): } V_6 = V_{SUPPLY} + R \cdot I - input(t)$$

Steer's Video Drive Signal Is a Function of the Feedback Current and Thus Not Referenced To the PPS Voltage

Steer's alleged video driver is a feedback system that uses the current supplied to the pixel during the programming phase.

Patent Owner's Mr. Credelle

161. Steer teaches a feedback circuit, illustrated by Figure 4, that is interposed between the current-measurement supply line 34 and data line 6.

IPR2023-00771, EX2011, ¶161.

Steer

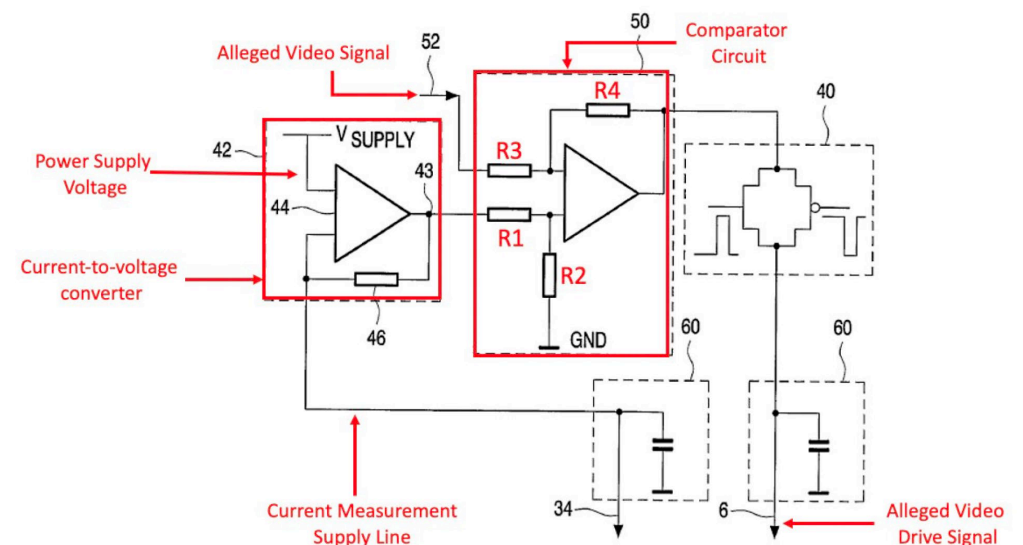


Fig.4

IPR2023-00771, EX1008, FIG. 4 (annotated).

Steer's Video Drive Signal Is a Function of the Feedback Current and Thus Not Referenced To the PPS Voltage

Steer's alleged video driver is a feedback system that uses the current supplied to the pixel during the programming phase.

Patent Owner's Mr. Credelle

162. Steer teaches that the circuit has two phases of operation, depending on whether there is a pulse on the scan line or not. The feedback system is used during the pixel circuit programming phase, when an ON pulse is provided on the scan line and the pixel does not emit light. EX1008, 8:29-32; 9:30-10:1. A current

IPR2023-00771, EX2011, ¶162

Steer

A feedback system is provided between the current-measurement supply line 34 and the control line 6. The voltage on the control line 6 is controlled in closed loop manner to achieve the desired current through the display element 2. The control voltage can then be used for subsequent driving of the display element of the pixel during the remainder of the frame period.

The feedback system is provided in a column driver of the display device, and Figure 4 shows one example of possible feedback system to be provided in the column driver.

The current-measurement supply line 34 supplies current to the pixel during the pixel programming stage, which is when the feedback system is used. During this stage, the current being drawn is effectively measured by

IPR2023-00771, EX1008, 8:21-32.

Steer's Video Drive Signal Is a Function of the Feedback Current and Thus Not Referenced To the PPS Voltage

Steer expressly states that the alleged video drive signal is a comparison of the video signal and feedback current. Therefore, it is not referenced to the positive power supply voltage.

Patent Owner's Mr. Credelle

and $R_{46} \cdot I$. Therefore, unlike in the '521 patent, where the video drive signal is calculated as an offset of the positive power supply voltage, in Steer the alleged video drive signal calculation includes the value of the reference current in the feedback system: $V_6 = V_{\text{SUPPLY}} + R_{46} \cdot I - \text{input}(t)$. Furthermore, Steer expressly describes comparator 50 as comparing the value of the alleged video signal V_{52} with the measured feedback current, not with V_{SUPPLY} :

A Comparator section 50 compares the voltage at node 43 with an input voltage at input 52 representing the desired current. These sections 42, 50 effectively *provide measurement of the current drawn and comparison with the desired current [52]*.

EX1008, 9:14-17 (emphasis added). Thus, "the output voltage is a function of the current drawn from the current-measurement supply line," EX1008, 9:12-13, and the alleged video drive signal is not referenced to the power supply voltage.

Steer

supply line 26. The voltage at node 43 differs from this supply voltage by a value $R \times I$, where R is the resistance of the feedback resistor 46 and I is the current flowing. Thus, the output voltage is a function of the current drawn from the current-measurement supply line.

A comparator section 50 compares the voltage at node 43 with an input voltage at input 52 representing the desired current. These sections 42, 50 effectively provide measurement of the current drawn and comparison with the desired current. The amplified output of the comparator section 50 is provided

IPR2023-00771, EX1008, 9:10-17.

IPR2023-00771, EX2011, ¶167.

Steer's Video Drive Signal Is a Function of the Feedback Current and Thus Not Referenced To the PPS Voltage

Contrary to Petitioner's arguments, the feedback current does flow when the alleged video drive signal is programming the pixel circuit.

Patent Owner's Mr. Credelle

168. The Petition argues that, during certain instances of the programming phase, no current flows to the feedback circuit and, therefore, the value of V_{43} is momentarily equal to V_{SUPPLY} . Pet., 100; EX1002, ¶¶315-317. This is irrelevant, however, because there can be no dispute that the current does flow to the feedback circuit when the alleged video drive signal is programming the pixel circuit. The entire purpose of Steer's teaching is to "use[] current feedback during pixel programming" in order to provide "per-pixel compensation of the drive transistor characteristics." EX1008, 7:6-9. If no current is flowing into the feedback circuit during the programming phase, then the feedback circuit provides no compensation to alleged video drive signal V_6 and serves no purpose.

IPR2023-00771, EX2011, ¶168.

IPR2023-00771, POR, 64-65.

Steer

This method uses current feedback during pixel programming but nevertheless implements voltage-programmed pixel driving. The method provides per-pixel compensation of the drive transistor characteristics, whilst enabling the feedback control circuitry to be outside the array of pixels.

IPR2023-00771, EX1008, 7:6-9.

Steer's Video Drive Signal Is a Function of the Feedback Current and Thus Not Referenced To the PPS Voltage

Steer attempts to solve a different problem. Steer's current feedback system is expressly intended to address per-pixel non-uniformities, not positive power supply voltage variations.

Patent Owner's Mr. Credelle

EX1008, 5:16-20. Thus, Steer does not seek to mitigate power supply voltage variations by referencing the alleged video drive signal to the positive power supply voltage. Instead, Steer's feedback system is designed to measure a feedback current to compensate for differences in transistor characteristics between the various pixel circuits. EX1008, 7:6-9, 7:29-32.

IPR2023-00771, EX2011, ¶170.

Steer

The invention provides an active matrix electroluminescent display device in which current feedback is used during pixel programming so that any effects of differences between characteristics of the drive transistor of different pixels are avoided.

IPR2023-00771, EX1008, 7:29-32.

Agenda

- ▶ The '521 Patent
- ▶ Kim does not disclose or render obvious generating a video drive signal
- ▶ Kim's pixel circuit is not a "video driver"
- ▶ Hayafuji addresses *only* voltage ripple
- ▶ Steer's alleged video drive signal is a function of the feedback current
- ▶ **Steer's alleged video drive signal is amplified with non-unity gain**

Claim 1 Requires a Video Driver To Generate a Video Drive Signal Referenced To the Positive Power Supply Voltage

1. An active matrix organic light emitting diode (AMOLED) display system comprising an AMOLED display panel receiving a video signal to be displayed on the AMOLED display panel, the AMOLED display panel comprising a plurality of organic light emitting diode (OLED) pixel elements, the AMOLED display system comprising:

a video driver receiving the video signal and generating a video drive signal indicative of the video signal and referenced to a positive power supply voltage of the AMOLED display panel; and

a current driver coupled to at least one OLED pixel element, the current driver receiving the video drive signal and the positive power supply voltage and providing a drive current to the at least one OLED pixel element, the drive current being proportional to a current drive voltage being indicative of the video signal and independent of the positive power supply voltage.

IPR2023-00771, EX1001, Claim 1.

Petitioner's Position

Petitioner argues that the output of comparator 50 (node 6) is the claimed video drive signal and is referenced to the positive power supply voltage.

Petition

Additionally, a POSA would recognize that the output of comparator section 50, which is a comparison between “the voltage at node 43 with an input voltage at input 52 representing the desired current” corresponds to the claimed *video drive signal indicative of the video signal and referenced to a positive power supply voltage of the AMOLED display panel*. In particular, voltage on node 43

power supply voltage of the AMOLED display panel). The output of the comparator 50 is column conductor 6 (or node 6) which has a transmission gate 40 connected in series with the conductor line 6. Ex.[1008], 9:1-2. The resulting output on node 6 (V_6) (the claimed *video drive signal*) in Steer is shown below in equation (2), which shows the output of the comparison between V_{43} and V_{52} that the video drive signal includes video signal ($input(t)$) subtracted from V_{SUPPLY} .

$$\text{Steer (2): } V_6 = V_{SUPPLY} + R \cdot I - input(t)$$

Petitioner's Dr. Kattamis

280. Additionally, a POSA would have recognized that the output of comparator section 50, which is a comparison between “the voltage at node 43 with an input voltage at input 52 representing the desired current” corresponds to the claimed video drive signal indicative of the video signal and referenced to a positive power supply voltage of the AMOLED display panel. In particular, voltage on node 43 corresponds to V_{SUPPLY} added to R multiplied by I , where R is the resistance of resistor 46 and I is the current flowing. See Ex. [1008], Steer at 9:10-14; Steer's Node 43 voltage is thus represented as:

$$\text{Steer (1): } V_{43} = V_{SUPPLY} + R \cdot I$$

281. Therefore, a POSA would have recognized that voltage at node 43 is V_{SUPPLY} with a offset, and therefore, a comparison between voltage at node 43 (V_{43}) and input voltage at input 52 via the operational amplifier would result in a signal indicative of voltage at input 52 (V_{52} or $input(t)$) (i.e., the claimed video signal) and referenced to V_{SUPPLY} (i.e., the claimed positive power supply voltage of the AMOLED display panel). The resulting output on node 6 (V_6) (the claimed video drive signal) in Steer is shown below in equation (2), which shows that the VGS includes video signal ($input(t)$) subtracted from V_{SUPPLY} .

$$\text{Steer (2): } V_6 = V_{SUPPLY} + R \cdot I - input(t)$$

The Board Acknowledged That the Influence of Resistors in Steer's Comparator 50 Raises Factual Issues

The Institution Decision acknowledged that Patent Owner's contention that the value of resistors causes the alleged video drive signal to be multiplied by R4/R3 has merit.

Institution Decision

Patent Owner argues that “the value of V_6 also depends on the values of resistors R3 and R4 . . . which Petitioner ignored.” *Id.* at 61 (citing Ex. 2001 ¶ 133). Patent Owner, therefore, argues the equation for V_6 is as follows:

$$\begin{aligned} V_6 &= (V_{43} - V_{52}) * R4/R3 \\ &= [V_{SUPPLY} + R46 * I - V52] * R4/R3 \end{aligned}$$

Id. According to Patent Owner, V_6 is not “referenced to the positive power supply voltage” because “the entire equation is multiplied by R4/R3 . . . ,

Patent Owner's contentions may have merit, and we welcome further briefing regarding the influence (if any) of resistors R1–R4 in comparator section 50 and the parties' competing equations for calculation of the video drive signal, which raise factual issues that are best evaluated on a full record at trial.

Steer's Alleged Video Drive Signal Is Amplified, Thus Not Referenced To the Positive Power Supply Voltage

Petitioner's arguments improperly ignore that the video drive signal is multiplied by R_4/R_3 .

Patent Owner's Mr. Credelle

173. Petitioner's argument that V_6 is referenced to the power supply voltage V_{SUPPLY} is incorrect because the value of V_6 also depends on the values of resistors R_3 and R_4 , labeled in the figure above (as well as depending on R_{46} and the feedback current as discussed above), which Petitioner ignored. According to Steer, comparator 50 amplifies the signal, which requires resistors R_3 and R_4 to have different values. EX1008, 9:17-18 ("The amplified output of the comparator section 50 is provided to the column conductor through the gate 40."). Thus, V_6 is multiplied by R_4/R_3 where R_3 is not equal to R_4 :

$$V_6 = (V_{43} - V_{52}) * R_4 / R_3$$
$$= [V_{SUPPLY} + R_{46} * I - V_{52}] * R_4 / R_3$$

174. The alleged video drive signal V_6 of Steer is *not* "referenced to the positive power supply voltage" because the entire equation is multiplied by R_4/R_3 as shown above, resulting in a value for V_6 that is not an offset from V_{SUPPLY} .

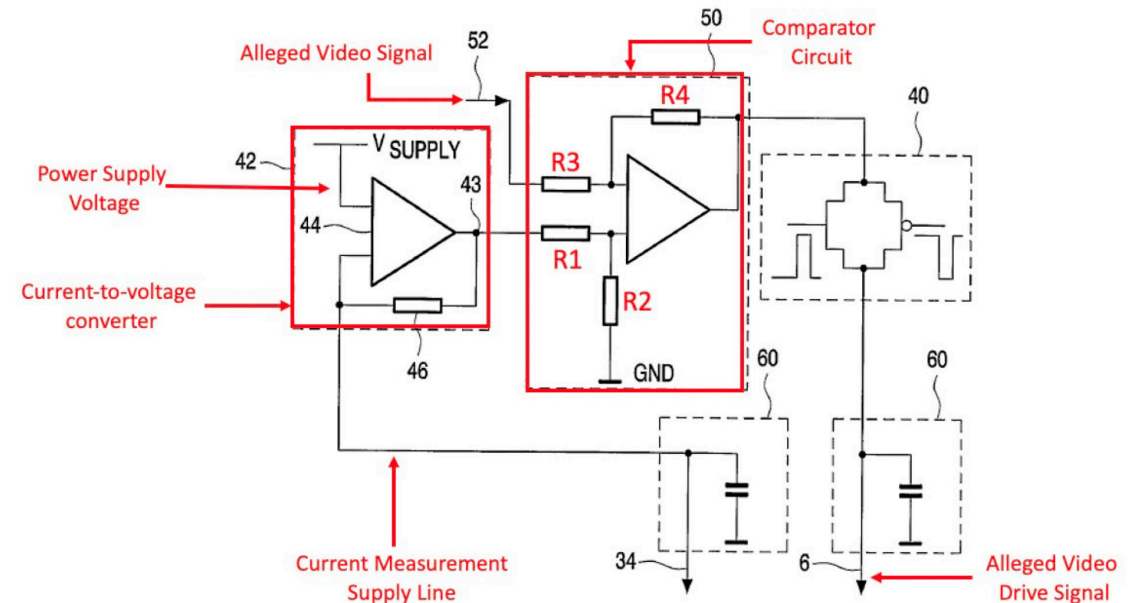


Fig.4

IPR2023-00771, EX1008, FIG. 4 (annotated).

Steer's Alleged Video Drive Signal Is Amplified, Thus Not Referenced To the Positive Power Supply Voltage

Contrary to Petitioner's arguments, Steer states that the feedback system provides amplification, thus R3 and R4 are not equal.

Patent Owner's Mr. Credelle

173. Petitioner's argument that V_6 is referenced to the power supply voltage V_{SUPPLY} is incorrect because the value of V_6 also depends on the values of resistors R_3 and R_4 , labeled in the figure above (as well as depending on R_{46} and the feedback current as discussed above), which Petitioner ignored. According to Steer, comparator 50 amplifies the signal, which requires resistors R_3 and R_4 to have different values. EX1008, 9:17-18 ("The amplified output of the comparator section 50 is provided to the column conductor through the gate 40."). Thus, V_6 is multiplied by R_4/R_3 where R_3 is not equal to R_4 :

IPR2023-00771, EX2011, ¶173.

Steer

Processing the current may comprise converting the current into a voltage, and comparing the voltage with an input voltage representing the desired current to produce an amplified differential output. Current is

IPR2023-00771, EX1008, 7:10-13.

A comparator section 50 compares the voltage at node 43 with an input voltage at input 52 representing the desired current. These sections 42, 50 effectively provide measurement of the current drawn and comparison with the desired current. The amplified output of the comparator section 50 is provided to the column conductor through the gate 40. The comparator section 50 thus also acts as the driver for providing the column conductor voltage.

IPR2023-00771, EX1008, 9:13-19.

The comparator section 50 may include an integrating amplifier at its output (not shown in Figure 4). This can further improve the stability of the feedback loop and permit a lower gain to be employed in the amplifier of the comparator, and provide better threshold compensation in practical implementations.

IPR2023-00771, EX1008, 9:20-24.

Claim 1 Requires the Current Drive Voltage To Be Independent of the Positive Power Supply Voltage

1. An active matrix organic light emitting diode (AMOLED) display system comprising an AMOLED display panel receiving a video signal to be displayed on the AMOLED display panel, the AMOLED display panel comprising a plurality of organic light emitting diode (OLED) pixel elements, the AMOLED display system comprising:

- a video driver receiving the video signal and generating a video drive signal indicative of the video signal and referenced to a positive power supply voltage of the AMOLED display panel; and
- a current driver coupled to at least one OLED pixel element, the current driver receiving the video drive signal and the positive power supply voltage and providing a drive current to the at least one OLED pixel element, the drive current being proportional to a current drive voltage being indicative of the video signal and independent of the positive power supply voltage.

IPR2023-00771, EX1001, Claim 1.

Petitioner's Position

Petitioner argues that because the positive power supply voltage V_{SUPPLY} drops out of the equation for the current drive voltage (V_{GS}), the current drive voltage is independent of the positive power supply voltage.

Petition

Moreover, as explained for Gr.5, Cl.[1-A], the video drive signal applied to the gate of drive transistor **22** is generated by “comparator section **50**” (i.e., the claimed *video driver*) via a comparison between the voltage on input **52** (i.e., the claimed *video signal*) and a voltage at node **43** that's dependent on V_{SUPPLY} (which is also the voltage on line **26**) (i.e., the claimed *positive power supply voltage*). Accordingly, a POSA would understand that generating the *video drive signal* using the *positive power supply voltage* and then applying the *video drive signal* as a gate voltage to drive transistor **22** relative to the *positive power supply voltage* to generate the drive current renders the current drive voltage *independent of the positive power supply voltage* as claimed. Ex.[1002], ¶¶293-297. That is, a change in voltage of V_{SUPPLY} will be recognized both at node **43** and at line **26**, and therefore, the current drive voltage will be independent of the PPS.

Petitioner's Dr. Kattamis

295. A mathematical representation of the voltages at each node shows that the V_{SUPPLY} does not appear in the gate to source voltage over the drive transistor **22** and therefore is independent of V_{SUPPLY} for at least the same reasons as described in the '521 Patent. As discussed with reference to Limitation [1-A], V_{SUPPLY} is the

296. Substituting equations (1)-(3) into equation (4) yields the updated equation (4A).

$$V_{\text{GS}} = V_{\text{SUPPLY}} + R * I - \text{video signal}(t) - V_{\text{SUPPLY}} \quad (4A)$$

297. Since the first V_{SUPPLY} will be eliminated in equation (4A) via subtraction of the second V_{SUPPLY} , the gate-to-source voltage V_{GS} on the drive transistor **22** (i.e., the claimed current drive voltage) is independent of the positive power supply voltage.

The Board Acknowledged That the Influence of Resistors in Steer's Comparator 50 Raises Factual Issues

The Institution Decision acknowledged that Patent Owner's contentions with respect to V_{supply} not dropping out of the current drive voltage equation have merit.

Institution Decision

Patent Owner argues that “the amplification introduced by the feedback system onto alleged video drive signal V_6 prevents V_{SUPPLY} from dropping out of the current drive voltage equation.” Prelim. Resp. 62.

Id. at 64 (citing Ex. 2001 ¶ 143). Patent Owner, therefore, contends that multiplier R_4/R_3 prevents V_{SUPPLY} from dropping out of the equation, and therefore, Steer does not disclose a drive current independent of the positive power supply voltage. *Id.*

Similar to limitation [1-A] above, Patent Owner's contentions regarding the influence (if any) of resistors R_1 – R_4 in comparator section 50 and the modification of the equation proposed by Petitioner raise factual issues that are best evaluated on a full record at trial.

IPR2023-00771, ID, 61-62.

Steer's Current Drive Voltage Is Not Independent of the Positive Power Supply Voltage

Because the video drive signal is amplified, the positive power supply voltage V_{SUPPLY} does not drop out of the equation for V_{GS} .

Patent Owner's Mr. Credelle

183. However, Petitioner's argument is incorrect because the amplification introduced onto alleged video drive signal V_6 prevents V_{SUPPLY} from cancelling out of the current drive voltage equation. As discussed in Section XI.B, *supra*, the equation describing the voltage of the signal generated by the video driver is multiplied by R_4/R_3 :

$$\begin{aligned} V_6 &= (V_{43} - V_{52}) * R_4/R_3 \\ &= [V_{\text{SUPPLY}} + R_{46} * I - V_{52}] * R_4/R_3 \end{aligned}$$

IPR2023-00771, EX2011, ¶183.

184. Using the correct equation for V_6 results in the following equation for the gate-source voltage V_{GS} on drive transistor 22:

$$\begin{aligned} V_{\text{GS}} &= V_6 - V_{26} \\ &= [V_{\text{SUPPLY}} + R_{46} * I - \text{input}(t)] * R_4/R_3 - V_{\text{SUPPLY}} \\ &= V_{\text{SUPPLY}} * R_4/R_3 + R_{46} * I * R_4/R_3 - \text{input}(t) * R_4/R_3 - V_{\text{SUPPLY}} \\ &= V_{\text{SUPPLY}}(R_4/R_3 - 1) + R_{46} * I * R_4/R_3 - \text{input}(t) * R_4/R_3 \end{aligned}$$

IPR2023-00771, EX2011, ¶184.

185. Using the correct equation for the current drive voltage rather than the Petitioner's equation (4B), it is apparent that the multiplier R_4/R_3 prevents V_{SUPPLY} from dropping out. Therefore, Steer does not disclose a drive current independent of the positive power supply voltage.

IPR2023-00771, EX2011, ¶185.

Thank You