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**(54) Organic light emitting display device and method of driving the same**

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Dispositif à affichage électroluminescent organique et son procédé de commande

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CA-A1- 2 557 713 US-A1- 2004 026 723  
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**Description**

[0001] The present invention relates to an organic light emitting display device and a method of driving the same.

5 [0002] Recently, various types of flat panel display devices having reduced weight and volume in comparison to cathode ray tubes have been developed. Flat panel display devices include liquid crystal display devices, field emission display devices, plasma display panels, and organic light emitting display devices, among others.

[0003] Among these flat panel display devices, the organic light emitting display device displays images using organic light emitting diodes that emit light through the recombination of electrons and holes. The organic light emitting display device has a fast response time and is driven with low power consumption.

10 [0004] FIG. 1 is a circuit diagram of a conventional pixel of an organic light emitting display device. In FIG. 1, transistors included in the pixel are NMOS transistors.

[0005] Referring to FIG. 1, the conventional pixel 4 of the organic light emitting display device includes an organic light emitting diode OLED and a pixel circuit 2 connected to a data line Dm and a scan line Sn to control the organic light emitting diode OLED.

15 [0006] An anode electrode of the organic light emitting diode OLED is coupled to the pixel circuit 2, and a cathode electrode thereof is coupled to a second power source ELVSS. The organic light emitting diode OLED emits light having luminance corresponding to current supplied from the pixel circuit 2.

20 [0007] The pixel circuit 2 controls an amount of current supplied to the organic light emitting diode OLED corresponding to a data signal supplied to a data line Dm when a scan signal is supplied to a scan line Sn. To this end, the pixel circuit 2 includes a second transistor M2 (i.e., a driving transistor) coupled between a first power source ELVDD and the organic light emitting diode OLED; a first transistor M1 coupled between the second transistor M2 and the data line Dm, with a gate electrode coupled to the scan line Sn; and a storage capacitor Cst coupled between a gate electrode and a second electrode of the second transistor M2.

25 [0008] A gate electrode of the first transistor M1 is coupled to the scan line Sn, and a first electrode thereof is coupled to the data line Dm. A second electrode of the first transistor M1 is coupled to one terminal of the storage capacitor Cst. Here, the first electrode is either a source or a drain electrode, and the second electrode is the other electrode different from the first electrode. For example, if the first electrode is a drain electrode, the second electrode is a source electrode. When a scan signal is supplied to the first transistor M1 from the scan line Sn, the first transistor M1 is turned on, and a data signal supplied from the data line Dm is supplied to the storage capacitor Cst. At this time, a voltage corresponding to the data signal is charged into the storage capacitor Cst.

30 [0009] The gate electrode of the second transistor M2 is coupled to the one terminal of the storage capacitor Cst, and a first electrode thereof is coupled to the first power source ELVDD. The second electrode of the second transistor M2 is coupled to the other terminal of the storage capacitor Cst and the anode electrode of the organic light emitting diode OLED. The second transistor M2 controls an amount of current flowing from the first power source ELVDD through the organic light emitting diode OLED to the second power source ELVSS, the amount of current corresponding to the voltage stored in the storage capacitor Cst.

35 [0010] One terminal of the storage capacitor Cst is coupled to the gate electrode of the second transistor M2, and the other terminal thereof is coupled to the anode electrode of the organic light emitting diode OLED. A voltage corresponding to a data signal is charged into the storage capacitor Cst.

40 [0011] The conventional pixel 4 displays an image having a predetermined luminance by supplying current to the organic light emitting diode OLED corresponding to the voltage charged in the storage capacitor Cst. However, in such a conventional organic light emitting display device, images having uniform luminance are very difficult to display due to the threshold voltage variation of the second transistor M2.

45 [0012] Threshold voltages of second transistors M2 in respective pixels 4 are different from each other, and the respective pixels 4 generate light having different luminance in response to a same data signal. Therefore, images having uniform luminance cannot be displayed.

[0013] WO 2008/075697 A1 discloses a light emitting display device which suppresses the effects of characteristic variations of a driving transistor and a characteristic shift caused by electrical stress.

50 [0014] US 2007/126665 A1 discloses a display device which includes a pixel formed using a current-drive display element whose luminance changes in accordance with signals and a semiconductor having a function to control current supplied to a load with a transistor.

[0015] CA 2 557 713 A1 discloses a method and system for compensating luminance degradation in electro-luminance devices.

55 [0016] US 2004/026723 A1 discloses an electronic circuit and method capable of reducing dispersion in the threshold voltages of driving transistors for obtaining a desired image display quality.

[0017] WO 2005/036515 A1 discloses an active matrix electroluminescent display with means for interrupting the drive of current through a pixel, thereby enabling a scrolling row-by-row addressing scheme for the pixels to be implemented.

[0018] Accordingly, exemplary embodiments of the present invention provide an organic light emitting display device

which may compensate for a threshold voltage of a driving transistor and a method of driving the same. The invention is set forth in claims 1 and 4. According to the present invention, there is provided an organic light emitting display device according to claim 1.

**[0019]** An aspect of an exemplary embodiment of the present invention provides an organic light emitting display device including: a scan driver for sequentially supplying a scan signal through scan lines; a data driver for supplying an initial voltage through data lines during a first period of a time period when the scan signal is supplied through a corresponding scan line of the scan lines, and for supplying data signals to the data lines during a second period of the time period when the scan signal is supplied through the corresponding scan line, the second period following the first period; and pixels at crossing regions of the scan lines and the data lines, wherein a pixel coupled to an i-th ("i" is a natural number) scan line of the scan lines and a j-th ("j" is a natural number) data line of the data lines from among the pixels includes: an organic light emitting diode having a cathode electrode coupled to a second power source; a first transistor for controlling current flowing through the organic light emitting diode; a second transistor coupled to the j-th data line and a second node, the second transistor being on when the scan signal is supplied through the i-th scan line; a third transistor coupled between a first node coupled to a gate electrode of the first transistor and the second node, the third transistor being off when the second transistor is on; a fourth transistor coupled between the first node and a reference voltage source, the fourth transistor being on when the scan signal is supplied through the i-th scan line; and a first capacitor coupled between the second node and an anode electrode of the organic light emitting diode.

**[0020]** A voltage of the data signals may be equal to or higher than a voltage of the reference voltage source. The initial voltage may be higher than a voltage of the data signal. The organic light emitting display device may further include a second capacitor coupled in parallel with the third transistor between the first node and the second node.

**[0021]** An aspect of another exemplary embodiment of the present invention provides a method of driving an organic light emitting display device, including: supplying a reference power to a gate electrode of the driving transistor when a scan signal is supplied; supplying an initial power to a second terminal of the first capacitor through a data line during a first period of a time period when the scan signal is supplied; supplying a data signal to the second terminal of the first capacitor through the data line during a second period of the time period when the scan signal is supplied, the second period following the first period, wherein a voltage at the anode electrode of the organic light emitting diode is obtained by subtracting a threshold voltage of the driving transistor from the reference power; and supplying current to the organic light emitting diode by coupling the gate electrode of the driving transistor to the second terminal of the first capacitor.

**[0022]** An aspect of yet another exemplary embodiment of the present invention provides a pixel of an organic light emitting display device coupled to a scan line for supplying a scan signal and a data line for supplying a data signal, including: an organic light emitting diode coupled to a second power source; a first transistor coupled between the organic light emitting diode and a first power source, the first transistor for controlling current flowing through the organic light emitting diode in accordance with the data signal; a second transistor coupled to the data line for supplying the data signal when the scan signal is supplied; a third transistor coupled between the second transistor and a gate electrode of the first transistor; a fourth transistor coupled between the gate electrode of the first transistor and a reference voltage source; and a first capacitor coupled between the second transistor and the organic light emitting diode; wherein the second transistor and the fourth transistor concurrently turn on and off, and wherein the third transistor is turned off when the second transistor and the fourth transistor are turned on.

**[0023]** In an organic light emitting display device and a method of driving the same, a desired current may be supplied to an organic light emitting diode regardless of a threshold voltage of a driving transistor. Accordingly, an image having uniform luminance may be displayed.

**[0024]** The accompanying drawings illustrate exemplary embodiments of the present invention, and, together with the description, serve to explain the principles of the present invention.

**45** FIG. 1 is a circuit diagram of a pixel of a conventional organic light emitting display device.

FIG. 2 is a schematic block diagram of an organic light emitting display device according to an embodiment of the present invention.

FIG. 3 is a circuit diagram of a pixel according to a first embodiment of the present invention.

FIG. 4 is a waveform diagram illustrating a method of driving the pixel shown in FIG. 3.

**50** FIG. 5 is a graph showing current of an organic light emitting diode, corresponding to a change in voltage of a data signal in the pixel shown in FIG. 3.

FIG. 6 is a circuit diagram of a pixel according to an example not forming part of the present invention.

FIG. 7 is a waveform diagram illustrating a method of driving the pixel shown in FIG. 6.

**55** FIG. 8 is a circuit diagram showing a structure in which transistors are converted into PMOS transistors in the pixel shown in FIG. 3.

**[0025]** Hereinafter, certain exemplary embodiments according to the present invention will be described with reference to the accompanying drawings. Here, when a first element is described as being coupled to a second element, the first

element may be directly coupled to the second element, or may be indirectly coupled to the second element via one or more additional elements. Further, some of the elements that are not essential to the complete understanding of the invention are omitted for clarity. Also, like reference numerals refer to like elements throughout.

**[0026]** FIG. 2 is a schematic block diagram of an organic light emitting display device according to an embodiment of the present invention.

**[0027]** Referring to FIG. 2, the organic light emitting display device according to the embodiment of the present invention includes pixels 140 coupled to scan lines S1 to Sn+1 and data lines D1 to Dm; a scan driver 110 driving the scan lines S1 to Sn+1; a data driver 120 driving the data lines D1 to Dm; and a timing controller 150 controlling the scan and data drivers 110 and 120.

**[0028]** The scan driver 110 receives a scan driving control signal SCS from the timing controller 150. The scan driver 110 generates a scan signal and sequentially supplies the generated scan signal to the scan lines S1 to Sn+1.

**[0029]** The data driver 120 receives a data driving control signal DCS supplied from the timing controller 150. The data driver 120 supplies an initial voltage to the data lines D1 to Dm during a first period of a time period when a scan signal (e.g., a high scan signal) is supplied, and supplies a data signal to the data lines D1 to Dm during a second period after the first period. Here, the initial voltage is set higher than that of the data signal.

**[0030]** The timing controller 150 generates a data driving control signal DCS and a scan driving control signal SCS in response to synchronization signals supplied from the outside. The data driving control signal DCS generated from the timing controller 150 is supplied to the data driver 120, and the scan driving control signal SCS generated from the timing controller 150 is supplied to the scan driver 110. The timing controller 150 also supplies data Data supplied from the outside to the data driver 120.

**[0031]** A display unit 130 receives a first power source ELVDD, a second power source ELVSS and a reference voltage source Vref supplied from the outside, and supplies them to each of the pixels 140. Each of the pixels 140 receiving the first power source ELVDD, the second power source ELVSS and the reference voltage source Vref generates light in response to the data signals.

**[0032]** Here, the voltage of the first power source ELVDD is set higher than that of the second power source ELVSS so that a current (e.g., a predetermined current) is supplied to the organic light emitting diodes. A voltage of the reference voltage source Vref is set equal to or lower than that of the data signal.

**[0033]** Meanwhile, a pixel 140 positioned in an i-th ("i" is a natural number) horizontal line is coupled to an i-th scan line and an (i+1)-th scan line, as well as a j-th ("j" is a natural number) data line. The pixel 140 includes a plurality of transistors, which may be NMOS transistors, and supplies a current which is compensated for the threshold voltage of a driving transistor to a corresponding organic light emitting diode. In other embodiments, some or all of the plurality of transistors may be PMOS transistors.

**[0034]** FIG. 3 is a circuit diagram of a pixel according to a first embodiment of the present invention. For convenience of illustration, FIG. 3 shows a pixel positioned on an n-th horizontal line and coupled to an m-th data line Dm.

**[0035]** Referring to FIG. 3, the pixel 140 according to the first embodiment of the present invention includes an organic light emitting diode OLED and a pixel circuit 142 coupled to the data line Dm and the scan lines Sn and Sn+1 to control the organic light emitting diode OLED.

**[0036]** An anode electrode of the organic light emitting diode OLED is coupled to the pixel circuit 142, and a cathode electrode thereof is coupled to a second power source ELVSS. The organic light emitting diode OLED generates light having a luminance (e.g., a predetermined luminance) corresponding to current supplied from the pixel circuit 142.

**[0037]** When a scan signal is supplied through the n-th scan line Sn, the pixel circuit 142 supplies a voltage corresponding to a data signal supplied through the data line Dm and a threshold voltage of a first transistor M1 to be charged in a first capacitor C1. When a scan signal is supplied through the (n+1)-th scan line Sn+1, the pixel circuit 142 supplies current corresponding to the charged voltage to the organic light emitting diode OLED. To this end, the pixel circuit 142 includes first to fourth transistors M1 to M4, and first and second capacitors C1 and C2.

**[0038]** A gate electrode of the first transistor M1 is coupled to a first node N1, and a first electrode thereof is coupled to a first power source ELVDD. A second electrode of the first transistor M1 is coupled to an anode electrode of the organic light emitting diode OLED at a third node N3.

**[0039]** A gate electrode of the second transistor M2 is coupled to the n-th scan line Sn, and a first electrode thereof is coupled to the data line Dm. A second electrode of the second transistor M2 is coupled to a second node N2. When a scan signal is supplied through the n-th scan line Sn, the second transistor M2 is turned on to allow the data line Dm to be electrically coupled to the second node N2.

**[0040]** A gate electrode of the third transistor M3 is coupled to the (n+1)-th scan line Sn+1, and a first electrode thereof is coupled to the second node N2. A second electrode of the third transistor M3 is coupled to the first node N1 (i.e., the gate electrode of the first transistor M1). When a scan signal is supplied through the (n+1)-th scan line Sn+1, the third transistor M3 is turned on to allow the first node N1 to be electrically coupled to the second node N2. The third transistor M3 is in a turned-off state while the second transistor M2 is turned on.

**[0041]** A gate electrode of the fourth transistor M4 is coupled to the n-th scan line Sn, and a first electrode thereof is

coupled to a reference voltage source  $V_{ref}$ . A second electrode of the fourth transistor  $M_4$  is coupled to the first node  $N_1$ . When a scan signal is supplied through the  $n$ -th scan line  $S_n$ , the fourth transistor  $M_4$  is turned on to supply the voltage of the reference voltage source  $V_{ref}$  to the first node  $N_1$ .

[0042] The first and second capacitors  $C_1$  and  $C_2$  are coupled in series between the first and third nodes  $N_1$  and  $N_3$ . A common node of the first and second capacitors  $C_1$  and  $C_2$  is coupled to a common node (i.e., the second node  $N_2$ ) of the second and third transistors  $M_2$  and  $M_3$ . Here, the second capacitor  $C_2$  and the third transistor  $M_3$  are coupled in parallel between the first and second node  $N_1$  and  $N_2$ .

[0043] FIG. 4 is a waveform diagram illustrating a method of driving the pixel shown in FIG. 3.

[0044] Operations of the pixel will be described in detail in conjunction with FIGS. 3 and 4. First, a scan signal (e.g., a high scan signal) is supplied through the  $n$ -th scan line  $S_n$ , and an initial voltage  $V_{init}$  is supplied through the data line  $D_m$  during a first period of a time period when the scan signal is supplied through the  $n$ -th scan line  $S_n$ .

[0045] When the scan signal is supplied through the  $n$ -th scan line  $S_n$ , the second and fourth transistors  $M_2$  and  $M_4$  are turned on. When the second transistor  $M_2$  is turned on, the initial voltage  $V_{init}$  is supplied to the second node  $N_2$ . When the fourth transistor  $M_4$  is turned on, the voltage of the reference voltage source  $V_{ref}$  is supplied to the first node  $N_1$ . Here, the voltage of the reference voltage source  $V_{ref}$  is set as a low voltage at which the first transistor  $M_1$  is turned off.

[0046] Thereafter, a data signal is supplied through the data line  $D_m$  during a second period after the first period, and accordingly the voltage at the second node  $N_2$  is dropped to the voltage of the data signal. When the voltage at the second node  $N_2$  is dropped, the voltage at the third node  $N_3$  is also dropped due to coupling of the first capacitor  $C_1$ . At this time, the first transistor  $M_1$  is turned on, and the voltage at the third node  $N_3$  is raised to a voltage obtained by subtracting the threshold voltage of the first transistor  $M_1$  from the voltage of the reference voltage source  $V_{ref}$ . To this end, when the data signal is supplied through the data line  $D_m$ , the initial voltage  $V_{init}$  is set to allow the voltage at the third node  $N_3$  to be dropped to a lower voltage than that of the reference voltage source  $V_{ref}$ .

[0047] At this time, a voltage of  $V_{data}-V_{ref}$  is charged in the second capacitor  $C_2$ , and a voltage of  $V_{data}-V_{ref}+V_{th}$  is charged in the first capacitor  $C_1$ . Here,  $V_{data}$  refers to a voltage of the data signal.

[0048] Thereafter, the supply of the scan signal through the  $n$ -th scan line  $S_n$  is stopped (e.g., the scan signal turns low), and the second and fourth transistors  $M_2$  and  $M_4$  are turned off. A scan signal (e.g., the high scan signal) is supplied through the  $(n+1)$ -th scan line  $S_{n+1}$ , and the first node  $N_1$  is electrically coupled to the second node  $N_2$ . In this case, the voltage applied between the terminals of the second capacitor  $C_2$  is set as 0V, and the voltage between the gate and source electrodes of the first transistor  $M_1$  is set as a voltage charged into the first capacitor  $C_1$ . That is, the voltage of the first transistor  $M_1$  is set based on Equation 1:

Equation 1

$$V_{gs}(M_1) = V_{data} - V_{ref} + V_{th}(M_1) \quad \dots \dots (1)$$

[0049] An amount of current flowing through the organic light emitting diode OLED is set using the voltage  $V_{gs}$  of the first transistor  $M_1$  based on Equation 2:

Equation 2

$$\begin{aligned} I_{oled} &= \beta(V_{gs}(M_1) - V_{th}(M_1))^2 = \beta \{(V_{data} - V_{ref} + V_{th}(M_1)) - V_{th}(M_1)\}^2 \\ &= \beta(V_{data} - V_{ref})^2 \quad \dots \dots (2) \end{aligned}$$

[0050] Referring to Equation 2, the current flowing through the organic light emitting diode OLED is determined by a voltage difference between the voltage  $V_{data}$  of the data signal and the reference voltage source  $V_{ref}$ . Here, since the reference voltage source  $V_{ref}$  is a fixed voltage, the current flowing through the organic light emitting diode OLED is determined by the data signal.

[0051] Meanwhile, a voltage range of the first power source  $ELVDD$ , the reference voltage source  $V_{ref}$  and the voltage  $V_{data}$  of the data signal is set based on Equation 3:

Equation 3

$$ELVDD > V_{data} \geq V_{ref} \quad \dots \dots (3)$$

[0052] The voltage of the reference voltage  $V_{ref}$  is a fixed voltage having a low voltage at which current does not flow through the organic light emitting diode OLED, and  $V_{data}$  is changed corresponding to a gray level expressed as the

voltage of the data signal. Here, a gray level is realized by the voltage  $V_{data}$  of the data signal and the voltage of the reference voltage source. Therefore, the voltage  $V_{data}$  of the data signal is set equal to or higher than that of the reference voltage source  $V_{ref}$ .

**[0053]** FIG. 5 is a graph showing current flowing through an organic light emitting diode, corresponding to a voltage of a data signal.

**[0054]** Referring to FIG. 5, the current flowing through the organic light emitting diode OLED is changed depending on a change in voltage  $V_{data}$  of the data signal. That is, in the present invention, an amount of current flowing through the organic light emitting diode OLED is changed corresponding to a change in voltage of the data signal. Accordingly, a desired gray level can be expressed.

**[0055]** FIG. 6 is a circuit diagram of a pixel according to an example not forming part of the present invention. In FIG. 6, elements identical to those of FIG. 3 are provided with the same reference numerals, and their detailed descriptions will be omitted.

**[0056]** Referring to FIG. 6, the pixel 140' according to the second embodiment of the present invention is coupled to a light emission control line  $E_n$ . Here, light emission control lines  $E_1$  to  $E_n$  are positioned parallel with scan lines  $S_1$  to  $S_n$  and formed in respective horizontal lines. That is, the light emission control lines  $E_1$  to  $E_n$  are arranged parallel with the scan lines  $S_1$  to  $S_n$ . A light emission control signal supplied through an  $i$ -th (" $i$ " is a natural number) light emission control line  $E_i$  is supplied to overlap with a scan signal supplied through an  $i$ -th scan line  $S_i$ .

**[0057]** Meanwhile, the scan signal sequentially supplied through the scan lines  $S_1$  to  $S_n$  may be set as a voltage (e.g., a high level voltage) at which transistors may be turned on, and the light emission control signal sequentially supplied through the light emission control lines  $E_1$  to  $E_n$  may be set as a voltage (e.g., a low level voltage) at which the transistors may be turned off.

**[0058]** A gate electrode of a third transistor  $M_3'$  included in the pixel circuit 142' is coupled to the light emission control line  $E_n$ , and a first electrode of the third transistor  $M_3'$  is coupled to a second node  $N_2$ . A second electrode of the third transistor  $M_3'$  is coupled to a first node  $N_1$ .

**[0059]** A first capacitor  $C_1'$  is coupled between the first electrode of the third transistor  $M_3'$  (i.e., the second node  $N_2$ ) and a third node  $N_3$ .

**[0060]** When comparing the pixel 140' with the pixel 140 shown in FIG. 3, the electric connection of the third transistor  $M_3'$  and the first capacitor  $C_1'$  is set different from that in the pixel 140. When comparing the pixel 140' with the pixel 140 shown in FIG. 3, the second capacitor  $C_2$  has been removed in the pixel 140'.

**[0061]** FIG. 7 is a waveform diagram illustrating a method of driving the pixel shown in FIG. 6, which does not form part of the present invention.

**[0062]** Operations of the pixel will be described in detail in conjunction with FIGS. 6 and 7. First, a scan signal (e.g., a high scan signal) is supplied through the  $n$ -th scan line  $S_n$ , and an initial voltage  $V_{init}$  is supplied through a data line  $D_m$  during a first period of a time period when the scan signal is supplied through the  $n$ -th scan line  $S_n$ . A light emission control signal (e.g., a low light emission control signal) is supplied through the  $n$ -th light emission control line  $E_n$  during the period when the scan signal is supplied through the  $n$ -th scan line  $S_n$ .

**[0063]** When the light emission control signal is supplied through the  $n$ -th light emission control line  $E_n$ , the third transistor  $M_3'$  is turned off. When the scan signal is supplied through the  $n$ -th scan line  $S_n$ , second and fourth transistors  $M_2$  and  $M_4$  are turned on. When the second transistor  $M_2$  is turned on, the initial voltage  $V_{init}$  supplied from the data line  $D_m$  is supplied to the second node  $N_2$ . When the fourth transistor  $M_4$  is turned on, the voltage of a reference voltage  $V_{ref}$  is supplied to the first node  $N_1$ .

**[0064]** Thereafter, a data signal is supplied through the data line  $D_m$  during a second period after the first period, and accordingly, the voltage at the second node  $N_2$  is dropped to the voltage  $V_{data}$  of the data signal. When the voltage at the second node  $N_2$  is dropped, the voltage at the third node  $N_3$  is also dropped due to coupling of the first capacitor  $C_1'$ . At this time, the first transistor  $M_1$  is turned on, and the voltage at the third node  $N_3$  is raised to a voltage obtained by subtracting the threshold voltage of the first transistor  $M_1$  from the voltage of the reference voltage source  $V_{ref}$ . Here, a voltage set based on Equation 1 is charged into the first capacitor  $C_1'$ .

**[0065]** Thereafter, the supply of the scan signal through the  $n$ -th scan line  $S_n$  is stopped (e.g., the scan signal is turned low), and the second and fourth transistors  $M_2$  and  $M_4$  are turned off. The supply of the light emission control signal through the  $n$ -th light emission control line  $E_n$  is also stopped (e.g., the light emission control signal is turned high), and the third transistor  $M_3'$  is turned on. When the third transistor  $M_3'$  is turned on, the second node  $N_2$  is electrically coupled to the first node  $N_1$ . Accordingly, the first transistor  $M_1$  supplies current corresponding to the voltage charged into the first capacitor  $C_1'$  to an organic light emitting diode OLED. A current set based on Equation 2 is therefore supplied to the organic light emitting diode OLED. That is, in the pixel 140' according to the second embodiment of the present invention, a desired current may be supplied to the organic light emitting diode OLED regardless of the threshold voltage of the first transistor  $M_1$ .

**[0066]** Meanwhile, it has been described in FIGS. 3 and 6 that the transistors are NMOS transistors. However, the present invention is not limited thereto. For example, the transistors of the pixel shown in FIG. 3 may instead be PMOS

transistors, as shown in, for example, FIG. 8. In this case, operations are substantially similar, except that the polarities of the waveforms shown in FIG. 4 are reversed.

**[0067]** While the present invention has been described in connection with certain exemplary embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but is instead intended to cover various modifications and equivalent arrangements included within the scope of the appended claims.

## Claims

10 1. An organic light emitting display device comprising:

15 a scan driver (110) for sequentially supplying a scan signal through scan lines;  
a data driver (120) for supplying an initial voltage ( $V_{init}$ ) through data lines during a first period when the scan signal is supplied through a corresponding one of the scan lines, and for supplying data signals to the data lines during a second period when the scan signal is supplied through the corresponding scan line, the second period following the first period; and  
pixels (140, 140') at crossing regions of the scan lines and the data lines,  
wherein a pixel coupled to an i-th ("i" is a natural number) scan line and a j-th ("j" is a natural number) data line comprises:

20 an organic light emitting diode having a first electrode coupled to a power source;  
a first transistor (M1) for controlling current flowing through the organic light emitting diode;  
a second transistor (M2) coupled to the j-th data line and a second node (N2), wherein a gate electrode of the second transistor (M2) is coupled to the i-th scan line, a first electrode of the second transistor (M2) is coupled to the j-th data line and a second electrode of the second transistor (M2) is coupled to the second node (N2);  
a third transistor (M3) coupled between a first node (N1) that is coupled to a gate electrode of the first transistor (M1) and the second node (N2), wherein a gate electrode of the third transistor (M3) is coupled to an (i+1)-th scan line, a first electrode of the third transistor (M3) is coupled to the second node (N2) and a second electrode of the third transistor (M3) is coupled to the first node (N1);  
a fourth transistor (M4) coupled between the first node (N1) and a reference voltage source ( $V_{ref}$ ), wherein a gate electrode of the fourth transistor (M4) is coupled to the i-th scan line;  
a first capacitor (C1, C2) coupled between the second node (N2) and a second electrode (N3) of the organic light emitting diode; and  
35 a second capacitor (C2, C1) coupled in parallel with the third transistor (M3) between the first node and the second node.

2. The organic light emitting display device of claim 1, wherein a voltage of the data signals is equal to or higher than a voltage of the reference voltage source.

3. The organic light emitting display device of claim 1 or 2, wherein the initial voltage ( $V_{init}$ ) is higher than a voltage of the data signals.

4. A method of driving an organic light emitting display device according to any one of the preceding claims, the method comprising:

45 supplying a reference voltage to the gate electrode of the first transistor when a scan signal is supplied;  
supplying an initial voltage to the second terminal of the first capacitor through a data line during a first period when the scan signal is supplied;  
50 supplying a data signal to the second terminal of the first capacitor through the data line during a second period when the scan signal is supplied, the second period following the first period, wherein a voltage at the electrode of the organic light emitting diode is obtained by subtracting a threshold voltage of the first transistor from the reference voltage; and  
55 supplying current to the organic light emitting diode by coupling the gate electrode of the first transistor to the second terminal of the first capacitor.

5. The method of claim 4, wherein a voltage of the data signal is equal to or higher than the reference voltage of the reference power.

6. The method of claim 4 or 5, wherein the initial voltage is higher than a voltage of the data signal.

## Patentansprüche

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1. Organische lichtemittierende Anzeigevorrichtung, umfassend:

10 einen Abtasttreiber (110) zum sequenziellen Bereitstellen eines Abtastsignals über Abtastleitungen; einen Datentreiber (120) zum Bereitstellen einer Anfangsspannung ( $V_{init}$ ) über Datenleitungen während eines ersten Zeitraums, in dem das Abtastsignal über eine entsprechende eine der Abtastleitungen bereitgestellt wird, und zum Bereitstellen von Datensignalen an die Datenleitungen während eines zweiten Zeitraums, in dem das Abtastsignal über die entsprechende Datenleitung bereitgestellt wird, wobei der zweite Zeitraum auf den ersten Zeitraum folgt; und

15 Pixel (140, 140') an sich kreuzenden Bereichen der Abtastleitungen und der Datenlinien, wobei ein Pixel, der mit einer i-ten ("i" ist eine natürliche Zahl) Abtastleitung und einer j-ten ("j" ist eine natürliche Zahl) Datenleitung gekoppelt ist, Folgendes umfasst:

20 eine organische lichtemittierende Diode, die eine erste Elektrode aufweist, die mit einer Stromquelle verbunden ist;

25 einen ersten Transistor (M1) zum Steuern eines Stroms, der durch die organische lichtemittierende Diode fließt;

30 einen zweiten Transistor (M2), der mit der j-ten Datenleitung und einem zweiten Knoten (N2) verbunden ist, wobei eine Gate-Elektrode des zweiten Transistors (M2) mit der i-ten Abtastleitung verbunden ist, eine erste Elektrode des zweiten Transistors (M2) mit der j-ten Datenleitung verbunden ist und eine zweite Elektrode des zweiten Transistors (M2) mit dem zweiten Knoten (N2) verbunden ist;

35 einen dritten Transistor (M3), der zwischen einem ersten Knoten (N1), der mit einer Gate-Elektrode des ersten Transistors (M1) verbunden ist, und dem zweiten Knoten (N2) verbunden ist, wobei eine Gate-Elektrode des dritten Transistors (M3) mit der (i+1)-ten Abtastleitung verbunden ist, eine erste Elektrode des dritten Transistors (M3) mit dem zweiten Knoten (N2) verbunden ist und eine zweite Elektrode des dritten Transistors (M3) mit dem ersten Knoten (N1) verbunden ist;

40 einen vierten Transistor (M4), der zwischen dem ersten Knoten (N1) und einer Referenzspannungsquelle ( $V_{ref}$ ) verbunden ist, wobei eine Gate-Elektrode des vierten Transistors (M4) mit der i-ten Abtastleitung verbunden ist;

45 einen ersten Kondensator (C1, C2), der zwischen dem zweiten Knoten (N2) und einer zweiten Elektrode (N3) der organischen lichtemittierenden Diode verbunden ist; und einen zweiten Kondensator (C2, C1), der parallel zu dem dritten Transistor (M3) zwischen dem ersten Knoten und dem zweiten Knoten verbunden ist.

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2. Organische lichtemittierende Anzeigevorrichtung nach Anspruch 1, wobei eine Spannung des Datensignals gleich oder höher als eine Spannung der Referenzspannungsquelle ist.

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3. Organische lichtemittierende Anzeigevorrichtung nach Anspruch 1 oder 2, wobei die Anfangsspannung ( $V_{init}$ ) höher als eine Spannung der Datensignale ist.

4. Verfahren zum Ansteuern einer organischen lichtemittierenden Anzeigevorrichtung nach einem der vorhergehenden Ansprüche, wobei das Verfahren Folgendes umfasst:

Bereitstellen einer Referenzspannung für die Gate-Elektrode des ersten Transistors, wenn ein Abtastsignal bereitgestellt wird;

50 Bereitstellen einer Anfangsspannung für den zweiten Anschluss des ersten Kondensators über eine Datenleitung während des ersten Zeitraums, wenn das Abtastsignal bereitgestellt wird;

Bereitstellen eines Datensignals für den zweiten Anschluss des ersten Kondensators über die Datenleitung während eines zweiten Zeitraums, wenn das Abtastsignal bereitgestellt wird, wobei der zweite Zeitraum auf den ersten Zeitraum folgt, wobei eine Spannung an der Elektrode der organischen lichtemittierenden Diode durch Subtrahieren einer Schwellenspannung des ersten Transistors von der Referenzspannung erhalten wird; und

55 Bereitstellen eines Stroms für die organische lichtemittierende Diode durch Verbinden der Gate-Elektrode des ersten Transistors mit dem zweiten Anschluss des ersten Kondensators.

5. Verfahren nach Anspruch 4, wobei eine Spannung des Datensignals gleich oder höher als die Referenzspannung des Referenzstroms ist.

6. Verfahren nach Anspruch 4 oder 5, wobei die Anfangsspannung höher als eine Spannung des Datensignals ist.

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## Revendications

1. Dispositif d'affichage électroluminescent organique comprenant :

10 un pilote de balayage (110) pour fournir séquentiellement un signal de balayage à travers des lignes de balayage ; un pilote de données (120) pour fournir une tension initiale ( $V_{init}$ ) à travers des lignes de données pendant une première période lorsque le signal de balayage est fourni à travers une ligne de balayage correspondante parmi les lignes de balayage, et pour fournir des signaux de données aux lignes de données pendant une deuxième période lorsque le signal de balayage est fourni à travers la ligne de balayage correspondante, la deuxième période suivant la première période ; et  
15 des pixels (140, 140') au niveau de régions de croisement des lignes de balayage et des lignes de données, où un pixel couplé à une  $i$ -ième (" $i$ " est un nombre naturel) ligne de balayage et à une  $j$ -ième (" $j$ " est un nombre naturel) ligne de données comprend :

20 une diode électroluminescente organique ayant une première électrode couplée à une source d'alimentation ;  
25 un premier transistor ( $M_1$ ) pour réguler le courant circulant à travers la diode électroluminescente organique ; un deuxième transistor ( $M_2$ ) couplé à la  $j$ -ième ligne de données et à un deuxième noeud ( $N_2$ ), où une électrode de grille du deuxième transistor ( $M_2$ ) est couplée à la  $i$ -ième ligne de balayage, une première électrode du deuxième transistor ( $M_2$ ) est couplée à la  $j$ -ième ligne de données et une deuxième électrode du deuxième transistor ( $M_2$ ) est couplée au deuxième noeud ( $N_2$ ) ;  
30 un troisième transistor ( $M_3$ ) couplé entre un premier noeud ( $N_1$ ) qui est couplé à une électrode de grille du premier transistor ( $M_1$ ) et le deuxième noeud ( $N_2$ ), où une électrode de grille du troisième transistor ( $M_3$ ) est couplée à une  $(i+1)$ -ième ligne de balayage, une première électrode du troisième transistor ( $M_3$ ) est couplée au premier noeud ( $N_1$ ) ;  
35 un quatrième transistor ( $M_4$ ) couplé entre le premier noeud ( $N_1$ ) et une source de tension de référence ( $V_{ref}$ ), où une électrode de grille du quatrième transistor ( $M_4$ ) est couplée à la  $i$ -ième ligne de balayage ; un premier condensateur ( $C_1, C_2$ ) couplé entre le deuxième noeud ( $N_2$ ) et une deuxième électrode ( $N_3$ ) de la diode électroluminescente organique ; et  
40 un deuxième condensateur ( $C_2, C_1$ ) couplé en parallèle avec le troisième transistor ( $M_3$ ) entre le premier noeud et le deuxième noeud.

40 2. Dispositif d'affichage électroluminescent organique de la revendication 1, dans lequel une tension des signaux de données est supérieure ou égale à une tension de la source de tension de référence.

45 3. Dispositif d'affichage électroluminescent organique de la revendication 1 ou 2, dans lequel la tension initiale ( $V_{init}$ ) est supérieure à une tension des signaux de données.

4. Procédé de pilotage d'un dispositif d'affichage électroluminescent organique selon l'une quelconque des revendications précédentes, le procédé comprenant le fait :

50 de fournir une tension de référence à l'électrode de grille du premier transistor lorsqu'un signal de balayage est fourni ;  
55 de fournir une tension initiale à la deuxième borne du premier condensateur à travers une ligne de données pendant une première période lorsque le signal de balayage est fourni ; de fournir un signal de données à la deuxième borne du premier condensateur à travers la ligne de données pendant une deuxième période lorsque le signal de balayage est fourni, la deuxième période suivant la première période, où une tension au niveau de l'électrode de la diode électroluminescente organique est obtenue en soustrayant une tension seuil du premier transistor de la tension de référence ; et de fournir du courant à la diode électroluminescente organique en couplant l'électrode de grille du premier transistor à la deuxième borne du premier condensateur.

5. Procédé de la revendication 4, dans lequel une tension du signal de données est supérieure ou égale à la tension de référence de la puissance de référence.
6. Procédé de la revendication 4 ou 5, dans lequel la tension initiale est supérieure à une tension du signal de données.

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FIG. 1  
(PRIOR ART)

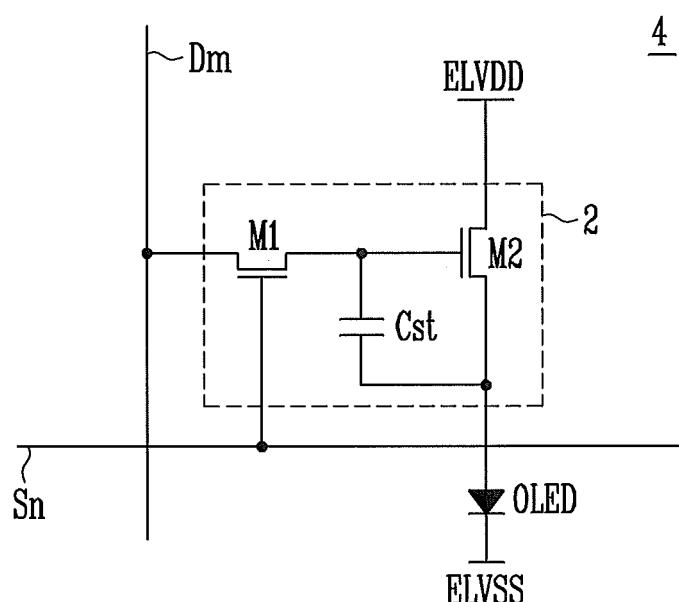


FIG. 2

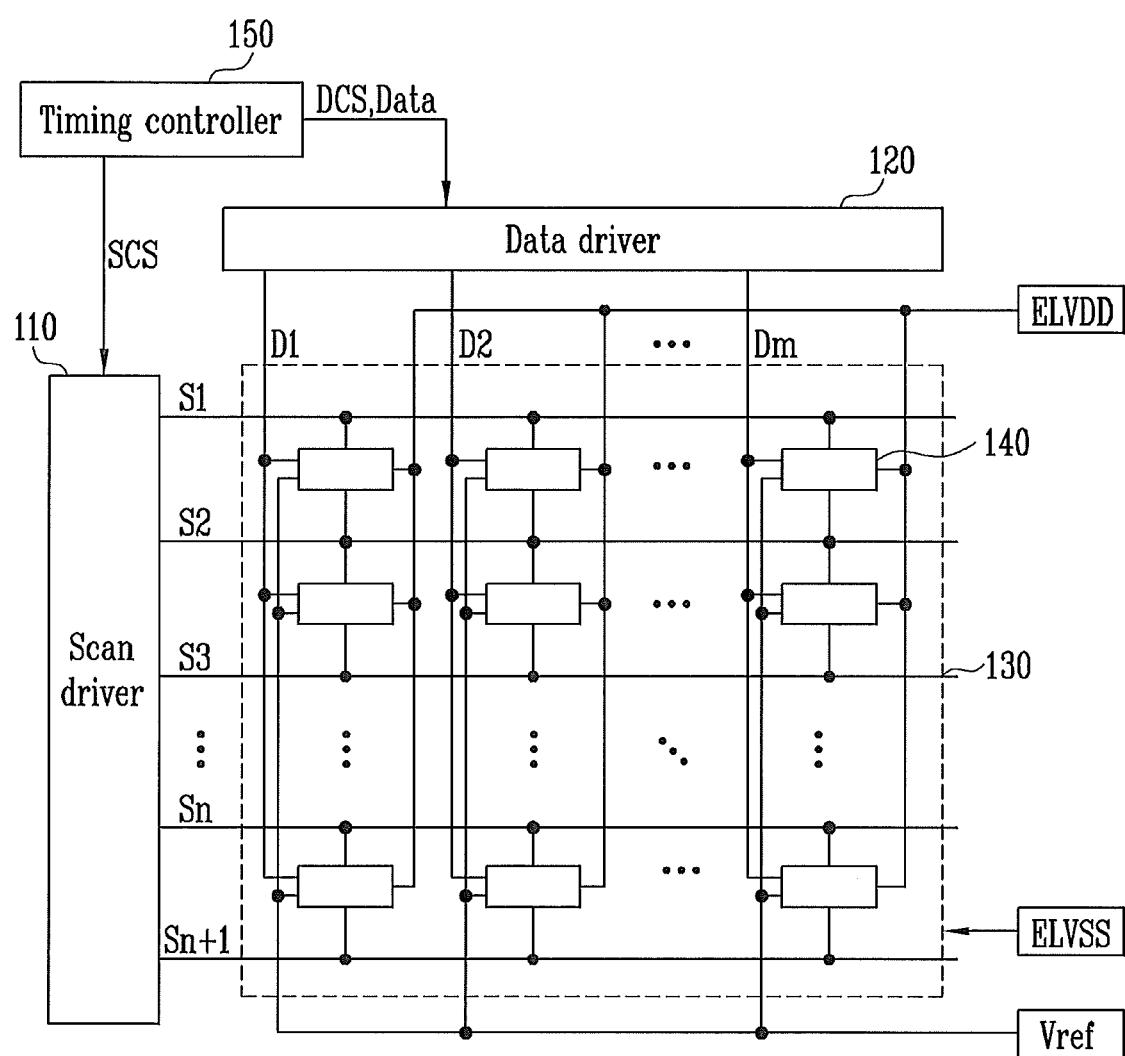


FIG. 3

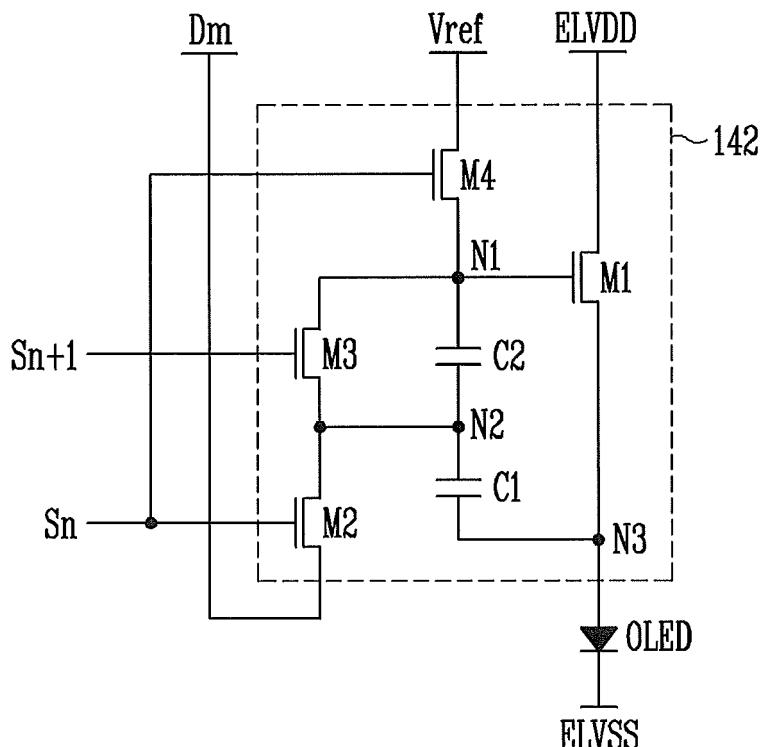
140

FIG. 4

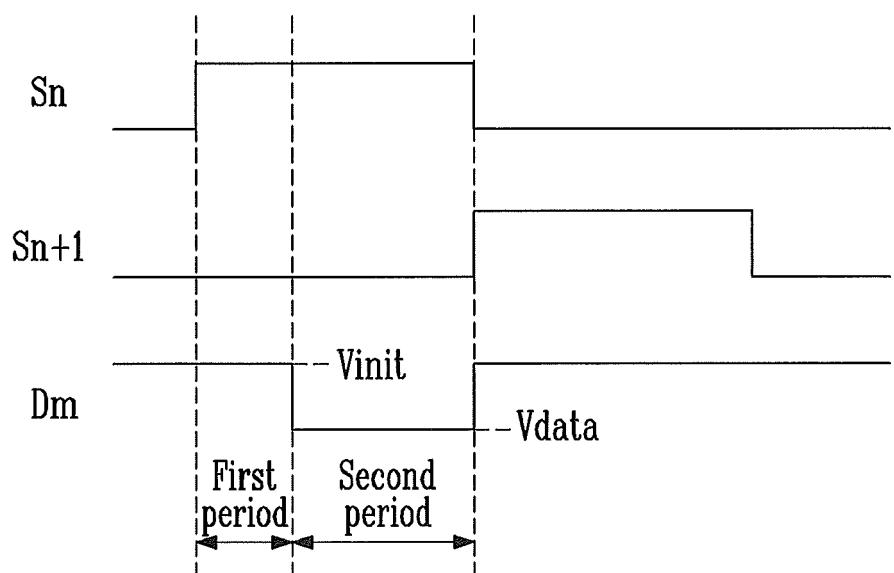


FIG. 5

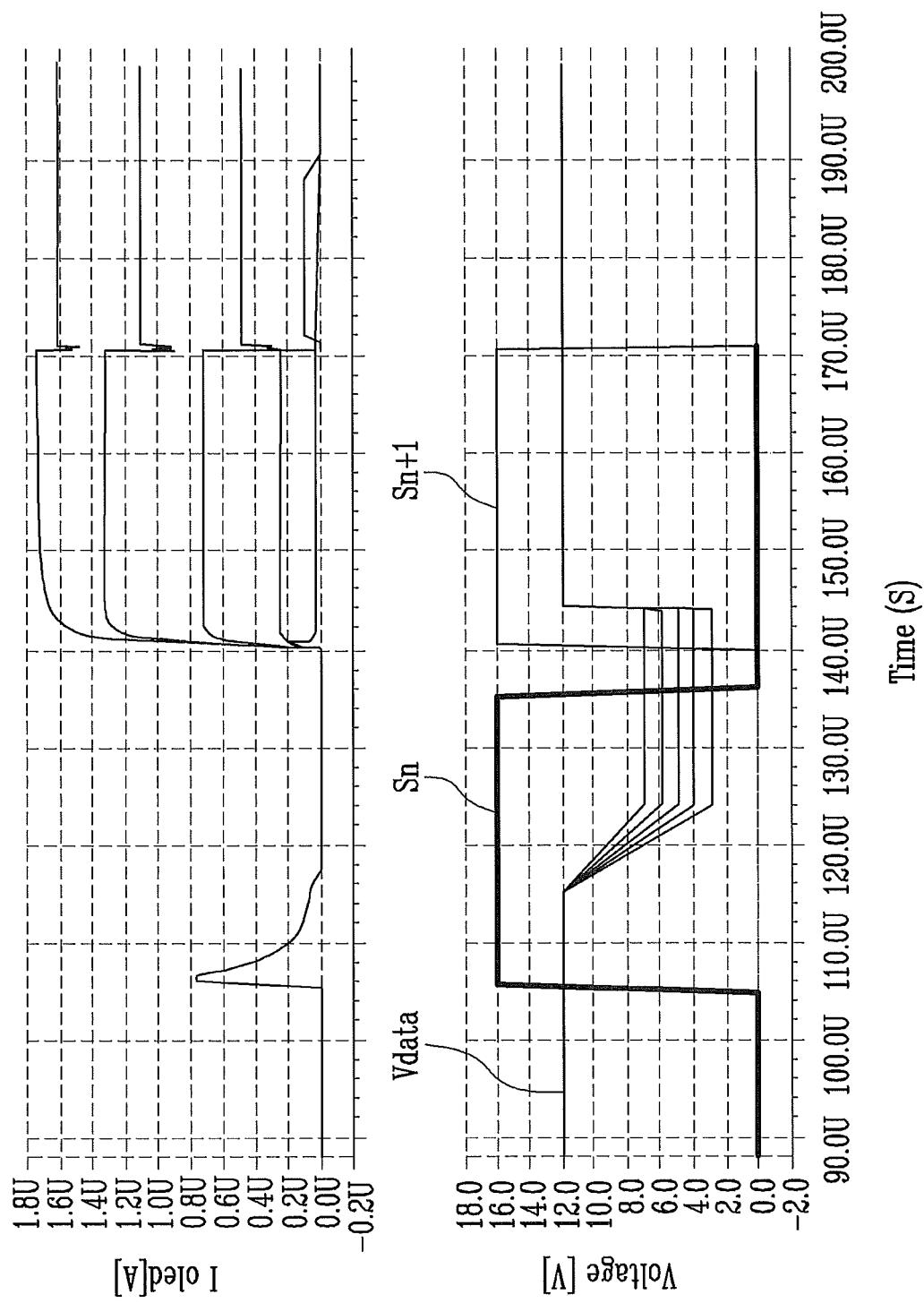


FIG. 6

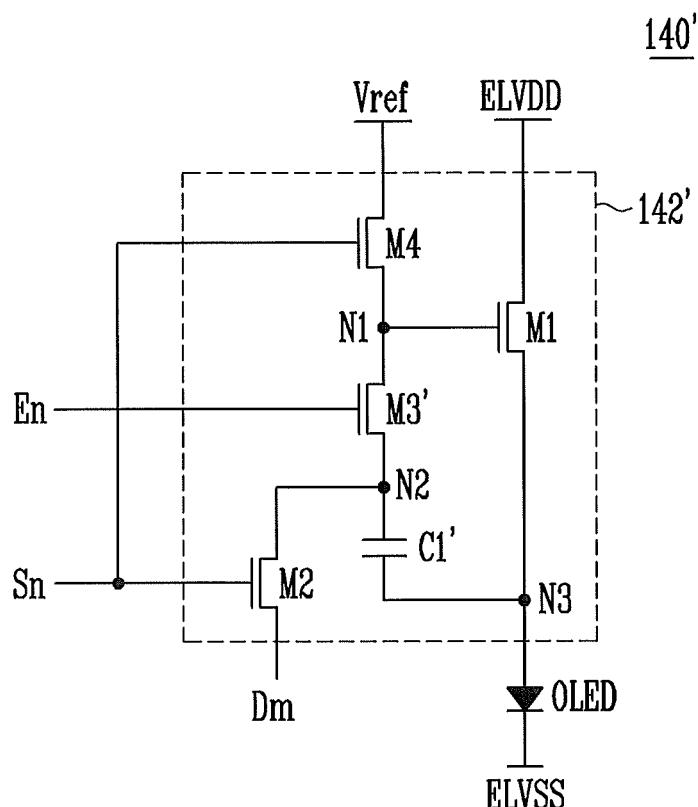


FIG. 7

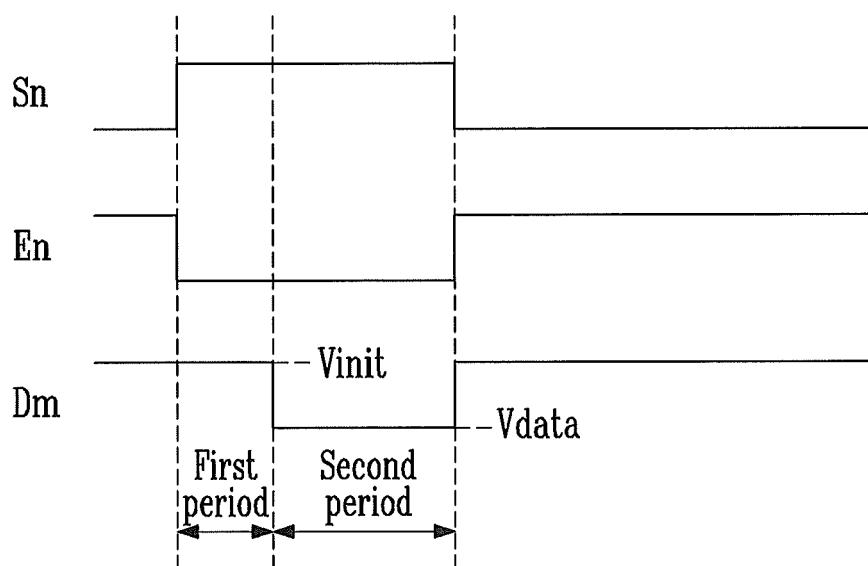
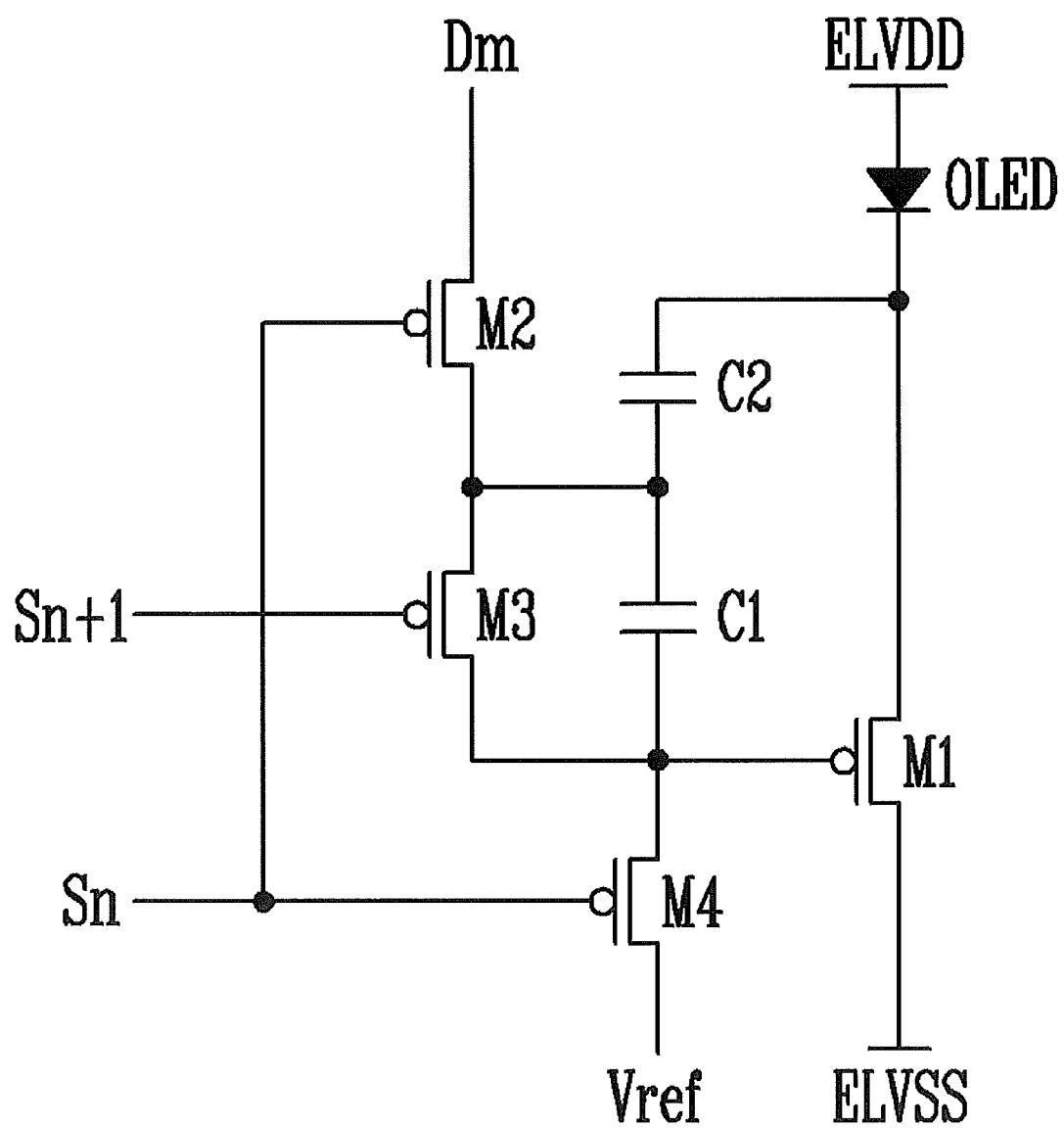


FIG. 8



**REFERENCES CITED IN THE DESCRIPTION**

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|                |  |         |            |
|----------------|--|---------|------------|
| 专利名称(译)        | 有机发光显示装置及其驱动方法   |         |            |
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| IPC分类号         | G09G3/32   |         |            |
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| 优先权            | 1020080118055 2008-11-26 KR  |         |            |
| 其他公开文献         | EP2192571A2<br>EP2192571A3   |         |            |
| 外部链接           | <a href="#">Espacenet</a>  |         |            |

### 摘要(译)

有机发光显示装置包括扫描驱动器，用于通过扫描线(  $S_n$  )顺序地提供扫描信号;数据驱动器，用于在通过扫描线的相应扫描线(  $S_n$  )提供扫描信号的时间段的第一时段期间通过数据线(  $D_m$  )提供初始电压(  $V_{init}$  )，并用于提供数据信号(  $V_{data}$  )在通过相应扫描线(  $S_n$  )提供扫描信号的时间段的第二时段期间到第一时段之后的第二时段;和扫描线(  $S_n$  )和数据线(  $D_m$  )的交叉区域处的像素( 140 )。

