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(54) **Pixel and organic light emitting display device using the same with compensation of the degradation of the organic light emitting element**

Pixel und organische Licht-emittierende Anzeigevorrichtung mit Kompensierung für Alterung des organischen Licht-emittierenden Elementes

Pixel et dispositif d'affichage électroluminescent organique utilisant ce pixel avec compensation de la dégradation de l'élément électroluminescent organique

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## Description

### BACKGROUND

#### 1. Field of the Invention

**[0001]** The present invention relates to a pixel and an organic light emitting display device using the same.

#### 2. Discussion of Related Art

**[0002]** In recent years, there have been many attempts to develop various flat panel display devices with reduced weight and volume, as compared to cathode ray tubes. Flat panel display devices include liquid crystal display devices, field emission display devices, plasma display devices, and organic light emitting display devices, among others.

**[0003]** Among flat panel display devices, the organic light emitting display device displays an image by using organic light emitting diodes, which generate light by recombining electrons and holes. The organic light emitting display device has an advantage in that it has a relatively rapid response time and may also be driven with relatively low power consumption.

**[0004]** FIG. 1 is a circuit diagram showing a pixel of a conventional organic light emitting display device.

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

**[0006]** An anode electrode of the organic light emitting diode (OLED) is coupled to the pixel circuit 2, and a cathode electrode of the organic light emitting diode (OLED) is coupled to a second power source (ELVSS). The organic light emitting diode (OLED) generates light with a luminance corresponding to an electric current supplied from the pixel circuit 2.

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

**[0008]** The gate electrode of the first transistor (M1') is coupled to the scan line (Sn), and a first electrode of the first transistor (M1') 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 of the first transistor (M1') is either a source

electrode or a drain electrode, and the second electrode of the first transistor (M1') is the other of the source electrode and the drain electrode. For example, when the first electrode is a source electrode, the second electrode is a drain electrode. The first transistor (M1') is turned on when a low scan signal is supplied from the scan line (Sn), and supplies a data signal from the data line (Dm) to the storage capacitor (Cst). In this case, the storage capacitor (Cst) is charged with a voltage corresponding to the data signal.

**[0009]** The gate electrode of the second transistor (M2') is coupled to one terminal of the storage capacitor (Cst), and the first electrode of the second transistor (M2') is coupled to the other terminal of the storage capacitor (Cst) and the first power source (ELVDD). A second electrode of the second transistor (M2') is coupled to the anode electrode of the organic light emitting diode (OLED). The second transistor (M2') controls the amount of current in accordance with a voltage value stored in the storage capacitor (Cst), the current flowing from the first power source (ELVDD) to the second power source (ELVSS) via the organic light emitting diode (OLED). In this case, the organic light emitting diode (OLED) generates light corresponding to the amount of current supplied from the second transistor (M2').

**[0010]** However, the pixel of the conventional organic light emitting display device has problems with displaying an image with uniform luminance. More particularly, a threshold voltage of the second transistor (M2') (e.g., driving transistor) in each of the pixels is different due to manufacturing process variances. When the threshold voltages of drive transistors are set to different threshold voltage levels as described above, inaccurate luminance is generated in pixels of the organic light emitting diode (OLED) due to the different threshold voltages of the drive transistors, even though data signals corresponding to a same gray level are supplied to the pixels.

**[0011]** Also, the conventional organic light emitting display device has problems in that the voltage from the first power source (ELVDD) may vary from pixel to pixel due to a voltage drop of the voltage from the first power source (ELVDD), depending on the position of each pixel in the display unit. When the voltage from the first power source (ELVDD) varies according to the position of the pixels as described above, it is very difficult to display an image with uniform luminance.

**[0012]** Furthermore, the conventional organic light emitting display device has problems displaying images with desired luminance due to the changes in efficiency from degradation of the organic light emitting diode (OLED). That is to say, organic light emitting diodes (OLED) degrade with time, which makes it more difficult to display an image with desired luminance. In fact, the organic light emitting diode (OLED) device generates images with progressively lower luminance as the organic light emitting diodes (OLED) degrade.

**[0013]** Document US-A-2006097965 describes a pixel circuit for an OLED display device that, differently from

the circuit in Fig. 1, uses two storage capacitors for threshold compensation and a third transistor coupled to a power source terminal for an additional light emission control; the first transistor, with gate coupled to a scan line, is coupled to the gate of the driving transistor via one of the storage capacitors. Documents EP-A-1923857 and US-A-2004252089 describe different types of pixel circuits for OLED displays, which, in addition to a threshold compensation arrangement, include a special compensation circuit to compensate for degradation of the OLED element, without using a third transistor for additional light emission control; the latter document has again a coupling via one of the storage capacitors between the first transistor and the driving transistor.

### SUMMARY OF THE INVENTION

**[0014]** Accordingly, an aspect of exemplary embodiments according to the present invention is to provide a pixel capable of compensating for the threshold voltage of the drive transistor, the voltage drop of the first power source and the degradation of the organic light emitting diode, and an organic light emitting display device using the same.

**[0015]** One aspect of an embodiment of the present invention provides a pixel as recited in claim 1; other aspects correspond to the subject-matter of the dependent claims.

**[0016]** A pixel according to embodiments of the present invention, and an organic light emitting display device using the same, may be useful to display an image with uniform luminance by compensating for the threshold voltage of the drive transistor, the voltage drop of the first power source, and degradation of the organic light emitting diode included in each of the pixels.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0017]** The accompanying drawings, together with the specification, illustrate exemplary embodiments of the present invention, and, together with the description, serve to explain the principles of the present invention.

FIG. 1 is a circuit diagram illustrating a conventional pixel.

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

FIG. 3 is a waveform diagram illustrating a driving waveform supplied from a scan driver and a data driver as shown in FIG. 2.

FIG. 4 is a circuit diagram illustrating a pixel according to one exemplary embodiment of the present invention as shown in FIG. 2.

FIG. 5 is a waveform diagram illustrating a driving waveform of the pixel as shown in FIG. 4.

### DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

**[0018]** 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.

**[0019]** FIG. 2 is a schematic block diagram illustrating an organic light emitting display device according to one exemplary embodiment of the present invention.

**[0020]** Referring to FIG. 2, the organic light emitting display device according to one exemplary embodiment of the present invention includes a display unit 130 including pixels 140 arranged at crossing regions of scan lines (S1 to Sn) and data lines (D1 to Dm); a scan driver 110 for driving the scan lines (S1 to Sn) and light emission control lines (E1 to En); a data driver 120 for driving the data lines (D1 to Dm); and a timing controller 150 for controlling the scan driver 110 and the data driver 120.

**[0021]** The scan driver 110 receives a scan drive control signal (SCS) from the timing controller 150, and sequentially applies scan signals to the scan lines (S1 to Sn), as shown in FIG. 3. Also, the scan driver 110 sequentially applies a light emission control signal to the light emission control lines (E1 to En). Here, a light emission control signal is applied to an  $i^{\text{th}}$  light emission control line (Ei) after a scan signal is applied to a corresponding  $i^{\text{th}}$  scan line (Si), and suspended after application of the scan signal to the  $i^{\text{th}}$  scan line (Si) is suspended. In this embodiment, the scan signal has a LOW level voltage when it is applied, and the light emission control signal has a HIGH level voltage when it is applied. In other embodiments, the scan signal and the emission control signal may be at either high or low levels when they are applied, depending on the particular embodiment, without being limited to any particular embodiment.

**[0022]** The data driver 120 receives a data drive control signal (DCS) and data (Data) from the timing controller 150, generates a data signal (DS), and applies the generated data signal (DS) to the data lines (D1 to Dm). Here, the data driver 120 applies a reset power source (Vint) (e.g., the reset power source (Vint) described with respect to FIG. 3) to the data lines (D1 to Dm) during a portion of a period when a low scan signal is overlapped with a high light emission control signal from the time when the application of the high scan signal is started. Further, the data driver 120 applies a data signal (DS) to the data lines (D1 to Dm) during a remaining portion of the period when the low scan signal is overlapped with the high light emission control signal. A voltage of the reset power source (Vint) is set to a higher voltage level

than that of the data signal (DS), and set to a lower voltage level than that of the first power source (ELVDD).

**[0023]** The timing controller 150 generates a data drive control signal (DCS) and a scan drive control signal (SCS) in accordance with externally supplied synchronization signals. The data drive control signal (DCS) generated in the timing controller 150 is supplied to the data driver 120, and the scan drive control signal (SCS) is supplied to the scan driver 110. The timing controller 150 may also supply externally supplied data (Data) to the data driver 120.

**[0024]** The display unit 130 receives a first power source (ELVDD) and a second power source (ELVSS) from the outside, supplying the received first power source (ELVDD) and second power source (ELVSS) to each of the pixels 140. Each of the pixels 140 receiving the first power source (ELVDD) and the second power source (ELVSS) generates light corresponding to the data signal (DS).

**[0025]** FIG. 4 is a diagram showing a pixel according to one exemplary embodiment of the present invention as shown in FIG. 2. For convenience, FIG. 4 shows a pixel coupled to an  $n^{\text{th}}$  scan line ( $S_n$ ) and an  $m^{\text{th}}$  data line ( $D_m$ ).

**[0026]** Referring to FIG. 4, the pixel 140 according to one exemplary embodiment of the present invention includes an organic light emitting diode (OLED); a pixel circuit 142 coupled to the data line ( $D_m$ ) and the scan line ( $S_n$ ) to control the amount of current supplied to the organic light emitting diode (OLED); and a compensation circuit 144 that compensates for the degradation of the organic light emitting diode (OLED).

**[0027]** An anode electrode of the organic light emitting diode (OLED) is coupled to the pixel circuit 142, and a cathode electrode of the organic light emitting diode (OLED) is coupled to a second power source (ELVSS). The organic light emitting diode (OLED) generates light with a luminance corresponding to the amount of current supplied from the pixel circuit 142. Here, the voltage of the second power source (ELVSS) is set to a lower voltage level than that of the first power source (ELVDD).

**[0028]** The pixel circuit 142 controls the amount of current supplied to the organic light emitting diode (OLED) in accordance with the data signal applied to the data line ( $D_m$ ) when a scan signal is applied to the scan line ( $S_n$ ). For this purpose, the pixel circuit 142 includes first to third transistors (M1 to M3), a first capacitor (C1) and a second capacitor (C2).

**[0029]** A first electrode of a first transistor (M1) is coupled to the data line ( $D_m$ ), and a second electrode of the first transistor (M1) is coupled to a first node (N1) (namely, a gate electrode of a second transistor (M2)). A gate electrode of the first transistor (M1) is coupled to the scan line ( $S_n$ ). The first transistor (M1) is turned on when a low scan signal is applied to the scan line ( $S_n$ ), and applies a reset power source or a data signal from the data line ( $D_m$ ) to the first node (N1).

**[0030]** A first electrode of the second transistor (M2)

is coupled to a second node (N2) (namely, a second electrode of a third transistor (M3)), and a second electrode of the second transistor (M2) is coupled to an anode electrode of the organic light emitting diode (OLED). A gate electrode of the second transistor (M2) is coupled to the first node (N1). The second transistor (M2) applies an electric current to the organic light emitting diode (OLED), the electric current corresponding to the voltage applied to the first node (N1).

**[0031]** A first electrode of the third transistor (M3) is coupled to the first power source (ELVDD), and a second electrode of the third transistor (M3) is coupled to the second node (N2). A gate electrode of the third transistor (M3) is coupled to the light emission control line (En). The third transistor (M3) is turned off when a high emission light control signal is applied to the light emission control line (En), and turned on when a low light emission control signal is applied to the light emission control line (En).

**[0032]** The first capacitor (C1) is coupled between the first node (N1) and the second node (N2). The first capacitor (C1) stores a voltage corresponding to the data signal and the threshold voltage of the second transistor (M2).

**[0033]** The second capacitor (C2) is arranged between the first power source (ELVDD) and the second node (N2). The second capacitor (C2) stably maintains a voltage of the second node (N2). For this purpose, the second capacitor (C2) has a greater capacitance than the first capacitor (C1). For example, the second capacitor (C2) may have a capacitance 2 to 10 times the capacitance of the first capacitor (C1), or more.

**[0034]** The compensation circuit 144 controls a voltage of the first node (N1) to compensate for degradation of the organic light emitting diode (OLED). For this purpose, the compensation circuit 144 includes a fourth transistor (M4), a fifth transistor (M5), and a third capacitor (C3).

**[0035]** A second electrode of the fourth transistor (M4) is coupled to an anode electrode of the organic light emitting diode (OLED), and a first electrode of the fourth transistor (M4) is coupled to the third node (N3). A gate electrode of the fourth transistor (M4) is coupled to the scan line ( $S_n$ ). The fourth transistor (M4) is turned on when a low scan signal is applied to the scan line ( $S_n$ ), and applies a voltage, applied to the organic light emitting diode (OLED), to the third node (N3).

**[0036]** A first electrode of the fifth transistor (M5) is coupled to a reference power source ( $V_{\text{sus}}$ ), and a second electrode of the fifth transistor (M5) is coupled to the third node (N3). A gate electrode of the fifth transistor (M5) is coupled to the light emission control line (En). The fifth transistor (M5) is turned off when a high light emission control signal is applied to the light emission control line (En), and turned on when a low light emission control signal is applied to the light emission control line (En).

**[0037]** A first terminal of the third capacitor (C3) is coupled to the first node (N1), and a second terminal of the

third capacitor (C3) is coupled to the third node (N3). The third capacitor (C3) adjusts the voltage of the first node (N1) in accordance with voltage changes at the third node (N3).

**[0038]** FIG. 5 is a waveform diagram illustrating a driving waveform of the pixel shown in FIG. 4.

**[0039]** An operation of the pixel 140 will be described in detail in connection with FIGS. 4 and 5. First, when a low scan signal is applied to the scan line (Sn), the first transistor (M1) and the fourth transistor (M4) are turned on. A reset power source (Vint) is supplied to the data line (Dm) during a first portion (T1) of the period when the scan signal is supplied to the scan line (Sn).

**[0040]** When the first transistor (M1) is turned on, the reset power source (Vint) supplied to the data line (Dm) is supplied to the first node (N1) via the first transistor (M1). The second node (N2) maintains a voltage of the first power source (ELVDD) since the third transistor (M3) is turned on during the first portion (T1). Here, the second transistor (M2) is turned on since a voltage of the reset power source (Vint) has a lower voltage than the first power source (ELVDD).

**[0041]** When the fourth transistor (M4) is turned on, the voltage applied to the organic light emitting diode (OLED) is applied to the third node (N3).

**[0042]** A high light emission control signal is applied to the light emission control line (En) during a second portion (T2) of the period when the low scan signal is applied to the scan line (Sn). When the high light emission control signal is applied to the light emission control line (En), the third transistor (M3) and the fifth transistor (M5) are turned off.

**[0043]** When the third transistor (M3) is turned off, the second transistor (M2) is consequently turned off. When the second transistor (M2) is turned off, a voltage corresponding to the threshold voltage of the second transistor (M2) (e.g., a voltage difference between the second node (N2) and the first node (N1)) is charged in the first capacitor (C1) during the second portion (T2).

**[0044]** When the fifth transistor (M5) is turned off, the third node (N3) and the reference power source (Vsus) are electrically isolated from each other. In this case, the third node (N3) stably receives a voltage applied to the organic light emitting diode (OLED).

**[0045]** A data signal (DS) is applied to the data line (Dm) during a third portion (T3) of the period in which the scan signal is supplied to the scan line (Sn). During the third portion (T3), the data signal (DS) applied to the data line (Dm) is applied to the first node (N1) via the first transistor (M1). When the data signal (DS) is applied to the first node (N1), a voltage of the first node (N1) drops from the reset power source (Vint) to a voltage of the data signal (DS). In this case, the second node (N2) maintains its voltage from the second portion (T2). More particularly, the capacitance of the second capacitor (C2) is greater than the capacitance of the first capacitor (C1). Therefore, the second node (N2) maintains its voltage from the second portion (T2) even if the voltage of the

first node (N1) is changed. Thus, a voltage corresponding to the threshold voltage of the second transistor (M2) and the data signal (DS) is charged in the first capacitor (C1).

**[0046]** Meanwhile, the threshold voltage of the organic light emitting diode (OLED) is applied to the third node (N3) during the third portion (T3). The threshold voltage of the organic light emitting diode (OLED) increases as the organic light emitting diode (OLED) degrades.

**[0047]** Then, the first transistor (M1) and the fourth transistor (M4) are turned off when the application of the low scan signal is stopped. When the first transistor (M1) is turned off, the first node (N1) is floated. When the fourth transistor (M4) is turned off, the organic light emitting diode (OLED) and the third node (N3) are electrically isolated from each other.

**[0048]** After the application of the low scan signal is stopped, the application of the high light emission control signal is also stopped. When the application of the high light emission control signal is stopped, the third transistor (M3) and the fifth transistor (M5) are turned on. When the third transistor (M3) is turned on, a voltage of the first power source (ELVDD) is supplied to the second node (N2). In this case, the voltage of the floated first node (N1) is also increased to correspond to the increase in voltage of the second node (N2). That is to say, the voltage charged in the first capacitor (C1) is maintained at the voltage of the previous portion even when the third transistor (M3) is turned on.

**[0049]** Also, since the first node (N1) is floated when the voltage of the first power source (ELVDD) is supplied to the second node (N2), the pixel circuit 142 compensates for the voltage drop of the voltage from the first power source (ELVDD) corresponding to the position of the pixel 140. That is to say, the voltage of the first node (N1) is increased in accordance with the increase in voltage of the second node (N2), to display an image with desired luminance regardless of the voltage drop of the voltage from the first power source (ELVDD).

**[0050]** When the fifth transistor (M5) is turned on, a voltage of the third node (N3) increases from the threshold voltage of the organic light emitting diode (OLED) to the reference power source (Vsus). For this purpose, a voltage of the reference power source (Vsus) is set to a higher voltage level than the threshold voltage of the organic light emitting diode (OLED). The voltage of the floated first node (N1) is also increased in accordance with increases of the voltage at the third node (N3). Then, the second transistor (M2) generates light with a luminance by supplying an electric current to the organic light emitting diode (OLED), the electric current corresponding to the voltage applied to the first node (N1).

**[0051]** Meanwhile, the organic light emitting diode (OLED) degrades with time. Here, the threshold voltage of the organic light emitting diode (OLED) increases as the organic light emitting diode (OLED) degrades. That is to say, when an electric current is supplied from the second transistor (M2), the voltage applied to the organic light emitting diode (OLED) increases as the organic light

emitting diode (OLED) degrades.

**[0052]** The voltage of the organic light emitting diode (OLED) applied to the third node (N3) thus increases as the organic light emitting diode (OLED) degrades. Therefore, a voltage charged in the third capacitor (C3) becomes lower as the organic light emitting diode (OLED) degrades.

**[0053]** When the voltage charged in the third capacitor (C3) becomes lower, the increase in voltage of the first node (N1) also decreases. In this case, an amount of current supplied from the second transistor (M2) to the organic light emitting diode (OLED) is increased for a same data signal. That is to say, the amount of current supplied from the second transistor (M2) to the organic light emitting diode (OLED) increases as the organic light emitting diode (OLED) degrades according to an embodiment of the present invention. Therefore, the compensation circuit 144 compensates for a luminance drop caused by degradation of the organic light emitting diode (OLED).

## Claims

1. A pixel (140), comprising:

an organic light emitting diode (OLED);

a second transistor (M2) being coupled between a first power source (ELVDD) and the organic light emitting diode (OLED) so as to control an amount of current supplied from the first power source (ELVDD) to the organic light emitting diode (OLED);

a third transistor (M3) being coupled between a first electrode of the second transistor (M2) and the first power source (ELVDD), the third transistor (M3) being configured to turn off when a light emission control signal is applied to a light emission control line (E1, ..., En) which is coupled to a gate electrode of the third transistor (M3);

a first transistor (M1) being coupled between a gate electrode of the second transistor (M2) and a data line (D1, ..., Dm), the first transistor (M1) being coupled directly to the gate electrode of the second transistor (M2), the first transistor (M1) being configured to turn on when a scan signal is applied to a scan line (S1, ..., Sn) which is coupled to a gate electrode of the first transistor (M1);

a first capacitor (C1) being coupled between the gate electrode and the first electrode of the second transistor (M2);

a second capacitor (C2) being coupled between the first electrode of the second transistor (M2) and the first power source (ELVDD); and

a compensation circuit (144) being coupled between the organic light emitting diode (OLED)

and the gate electrode of the second transistor (M2), the compensation circuit (144) being coupled to a second electrode of the second transistor (M2), the compensation circuit (144) being configured for adjusting a voltage at the gate electrode of the second transistor (M2) in accordance with degradation of the organic light emitting diode (OLED).

2. The pixel (140) according to claim 1, wherein the capacitance of the second capacitor (C2) is greater than the capacitance of the first capacitor (C1).

3. The pixel (140) according to claim 2, wherein the capacitance of the second capacitor (C2) is 2 to 10 times the capacitance of the first capacitor (C1).

4. The pixel (140) according to claim 1, wherein the compensation circuit (144) comprises:

a third capacitor (C3) having a first terminal coupled to the gate electrode of the second transistor (M2);

a fourth transistor (M4) being coupled between a second terminal of the third capacitor (C3) and an anode electrode of the organic light emitting diode (OLED), the fourth transistor (M4) being configured to turn on when the scan signal is applied to the scan line (S1, ..., Sn), the scanline being coupled also to a gate electrode of the fourth transistor (M4); and

a fifth transistor (M5) being coupled between the second terminal of the third capacitor (C3) and a reference power source (Vsus), the fifth transistor (M5) being configured to turn off when the light emission control signal is applied to the light emission control line (E1, ..., En), the light emission control line being coupled also to a gate electrode of the fifth transistor (M5).

5. The pixel (140) according to claim 4, wherein a voltage of the reference power source (Vsus) is higher than a threshold voltage of the organic light emitting diode (OLED).

6. An organic light emitting display device, comprising:

a scan driver (110) for applying scan signals to a plurality of scan lines (S1, ..., Sn) and applying light emission control signals to a plurality of light emission control lines (E1, ..., En);

a data driver (120) for supplying a reset power voltage (Vint) and applying data signals (DS) to a plurality of data lines (D1, ..., Dm); and

a plurality of pixels (140) according to any one of claims 1 to 5 arranged at crossing regions of the plurality of data lines (D1, ..., Dm) and the plurality of scan lines (S1, ..., Sn).

7. The organic light emitting display device according to claim 6, wherein the scan driver (110) is configured to apply a light emission control signal to an  $i^{\text{th}}$  light emission control line ( $E_i$ ) during a second portion (T2) and a third portion (T3) of a period in which a scan signal is being applied to a corresponding  $i^{\text{th}}$  scan line ( $S_i$ ). 5
8. The organic light emitting display device according to claim 7, wherein the scan driver (110) is configured to stop the application of the light emission control signal to the  $i^{\text{th}}$  light emission control line ( $E_i$ ) after the application of the scan signal to the corresponding  $i^{\text{th}}$  scan line ( $S_i$ ) is stopped. 10
9. The organic light emitting display device according to claim 7, wherein the data driver (120) is configured to supply the reset power voltage ( $V_{\text{int}}$ ) to the plurality of data lines ( $D_1, \dots, D_m$ ) during a first portion (T1) and the second portion (T2) of the period, and configured to apply data signals (DS) to the plurality of data lines ( $D_1, \dots, D_m$ ) during the third portion (T3) of the period. 15 20
10. The organic light emitting display device according to claim 6, wherein the reset power voltage ( $V_{\text{int}}$ ) is higher than the data signals (DS). 25
11. The organic light emitting display device according to claim 10, wherein the reset power voltage ( $V_{\text{int}}$ ) is lower than a voltage of the first power source (ELVDD). 30
12. A method of driving an organic light emitting display device according to any one of claims 6 to 11, the method comprising the steps of: 35
- applying a light emission control signal to an  $i^{\text{th}}$  light emission control line ( $E_i$ ) during a second portion (T2) and a third portion (T3) of a period in which a scan signal is being applied to a corresponding  $i^{\text{th}}$  scan line ( $S_i$ ); 40
- stopping the application of the light emission control signal to the  $i^{\text{th}}$  light emission control line ( $E_i$ ) after the application of the scan signal to the corresponding  $i^{\text{th}}$  scan line ( $S_i$ ) is stopped; 45
- supplying the reset power voltage to the plurality of data lines ( $D_1, \dots, D_m$ ) during a first portion (T1) and the second portion (T2) of the period; and 50
- applying data signals (DS) to the plurality of data lines ( $D_1, \dots, D_m$ ) during the third portion (T3) of the period. 55

## Patentansprüche

1. Pixel (140), aufweisend:

eine organische lichtemittierende Diode (OLED);  
 einen zweiten Transistor (M2), der zwischen eine erste Energiequelle (ELVDD) und die organische lichtemittierende Diode (OLED) geschaltet ist, so dass er eine Strommenge steuert, mit der die organische lichtemittierende Diode (OLED) von der ersten Energiequelle (ELVDD) versorgt wird;  
 einen dritten Transistor (M3), der zwischen eine erste Elektrode des zweiten Transistors (M2) und die erste Energiequelle (ELVDD) geschaltet ist, wobei der dritte Transistor (M3) konfiguriert ist, ausgeschaltet zu werden, wenn ein Lichtemissionskontrollsignal an einer Lichtemissionskontrollleitung ( $E_1, \dots, E_n$ ) anliegt, die mit einer Gate-Elektrode des dritten Transistors (M3) gekoppelt ist;  
 einen ersten Transistor (M1), der zwischen eine Gate-Elektrode des zweiten Transistors (M2) und eine Datenleitung ( $D_1, \dots, D_m$ ) geschaltet ist, wobei der erste Transistor (M1) direkt mit der Gate-Elektrode des zweiten Transistors (M2) gekoppelt ist, wobei der erste Transistor (M1) konfiguriert ist, eingeschaltet zu werden, wenn ein Ansteuersignal an einer Ansteuerleitung ( $S_1, \dots, S_n$ ) anliegt, die mit einer Gate-Elektrode des ersten Transistors (M1) gekoppelt ist;  
 einen ersten Kondensator (C1), der zwischen die Gate-Elektrode und die erste Elektrode des zweiten Transistors (M2) geschaltet ist;  
 einen zweiten Kondensator (C2), der zwischen die erste Elektrode des zweiten Transistors (M2) und die erste Energiequelle (ELVDD) geschaltet ist; und  
 eine Kompensationsschaltung (144), die zwischen die organische lichtemittierende Diode (OLED) und die Gate-Elektrode des zweiten Transistors (M2) geschaltet ist, wobei die Kompensationsschaltung (144) mit einer zweiten Elektrode des zweiten Transistors (M2) gekoppelt ist, wobei die Kompensationsschaltung (144) konfiguriert ist, eine Spannung an der Gate-Elektrode des zweiten Transistors (M2) gemäß der Alterung der organischen lichtemittierenden Diode (OLED) einzustellen.

2. Pixel (140) nach Anspruch 1, wobei die Kapazität des zweiten Kondensators (C2) größer ist als die Kapazität des ersten Kondensators (C1).
3. Pixel (140) nach Anspruch 2, wobei die Kapazität des zweiten Kondensators (C2) 2 bis 10 mal der Kapazität des ersten Kondensators (C1) entspricht.
4. Pixel (140) nach Anspruch 1, wobei die Kompensationsschaltung (144) aufweist:

- einen dritten Kondensator (C3), der einen ersten Anschluss aufweist, der mit der Gate-Elektrode des zweiten Transistors (M2) gekoppelt ist; einen vierten Transistor (M4), der zwischen einem zweiten Anschluss des dritten Kondensators (C3) und einer Anodenelektrode der organischen lichtemittierenden Diode (OLED) geschaltet ist, wobei der vierte Transistor (M4) konfiguriert ist, eingeschaltet zu werden, wenn das Ansteuersignal an der Ansteuerleitung (S1, ..., Sn) anliegt, wobei die Ansteuerleitung weiterhin mit einer Gate-Elektrode des vierten Transistors (M4) gekoppelt ist; und einen fünften Transistor (M5), der zwischen dem zweiten Anschluss des dritten Kondensators (C3) und einer Referenzenergiequelle (Vsus) geschaltet ist, wobei der fünfte Transistor (M5) konfiguriert ist, ausgeschaltet zu werden, wenn das Lichtemissionskontrollsignal an der Lichtemissionskontrollleitung (E1, ..., En) anliegt, wobei die Lichtemissionskontrollleitung weiterhin mit einer Gate-Elektrode des fünften Transistors (M5) gekoppelt ist.
5. Pixel (140) nach Anspruch 4, wobei eine Spannung der Referenzenergiequelle (Vsus) höher ist als eine Schwellenspannung der organischen lichtemittierenden Diode (OLED).
6. Organische lichtemittierende Anzeigevorrichtung, aufweisend:
- einen Ansteuertreiber (110) zum Anlegen von Ansteuersignalen an eine Vielzahl von Ansteuerleitungen (S1, ..., Sn) und Anlegen von Lichtemissionskontrollsignalen an eine Vielzahl von Lichtemissionskontrollleitungen (E1, ..., En); einen Datentreiber (120) zur Versorgung einer Vielzahl von Datenleitungen (D1, ..., Dm) mit einer Rücksetzspannung (Vint) und Anlegen von Datensignalen (DS) an die Vielzahl der Datenleitungen (D1, ..., Dm); und eine Vielzahl von Pixeln (140) nach einem der Ansprüche 1 bis 5, die in Kreuzungsbereichen der Vielzahl der Datenleitungen (D1, ..., Dm) und der Vielzahl der Ansteuerleitungen (S1, ..., Sn) angeordnet sind.
7. Organische lichtemittierende Anzeigevorrichtung nach Anspruch 6, wobei der Ansteuertreiber (110) konfiguriert ist, ein Lichtemissionskontrollsignal während eines zweiten Abschnitts (T2) und eines dritten Abschnitts (T3) einer Periode, in der ein Ansteuersignal an einer entsprechenden  $i^{\text{ten}}$  Ansteuerleitung (Si) anliegt, an eine  $i^{\text{te}}$  Lichtemissionskontrollleitung (Ei), anzulegen.
8. Organische lichtemittierende Anzeigevorrichtung nach Anspruch 7, wobei der Ansteuertreiber (110) konfiguriert ist, das Anlegen des Lichtemissionskontrollsignals an die  $i^{\text{te}}$  Lichtemissionskontrollleitung (Ei) zu stoppen, nachdem das Anlegen des Ansteuersignals an die entsprechende  $i^{\text{te}}$  Ansteuerleitung gestoppt wurde.
9. Organische lichtemittierende Anzeigevorrichtung nach Anspruch 7, wobei der Datentreiber (120) konfiguriert ist, während eines ersten Abschnitts (T1) und des zweiten Abschnitts (T2) der Periode die Vielzahl der Datenleitungen (D1, ..., Dm) mit der Rücksetzspannung (Vint) zu versorgen, und konfiguriert ist, während des dritten Abschnitts (T3) der Periode Datensignale (DS) an die Vielzahl der Datenleitungen (D1, ..., Dm) anzulegen.
10. Organische lichtemittierende Anzeigevorrichtung nach Anspruch 6, wobei die Rücksetzspannung (Vint) höher ist als die Datensignale (DS).
11. Organische lichtemittierende Anzeigevorrichtung nach Anspruch 10, wobei die Rücksetzspannung (Vint) niedriger ist als eine Spannung der ersten Energiequelle (ELVDD).
12. Verfahren zur Ansteuerung einer organischen lichtemittierenden Anzeigevorrichtung nach einem der Ansprüche 6 bis 11, wobei das Verfahren die folgenden Schritte aufweist:
- Anlegen eines Lichtemissionskontrollsignals an eine  $i^{\text{te}}$  Lichtemissionskontrollleitung (Ei) während eines zweiten Abschnitts (T2) und eines dritten Abschnitts (T3) einer Periode, in der ein Ansteuersignal an einer entsprechenden  $i^{\text{ten}}$  Ansteuerleitung (Si) anliegt; Stoppen des Anlegens des Lichtemissionskontrollsignals an die  $i^{\text{te}}$  Lichtemissionskontrollleitung (Ei), nachdem das Anlegen des Ansteuersignals an die entsprechende  $i^{\text{te}}$  Ansteuerleitung (Si) gestoppt wurde; Versorgen der Vielzahl der Datenleitungen (D1, ..., Dm) mit der Rücksetzspannung während eines ersten Abschnitts (T1) und des zweiten Abschnitts (T2) der Periode; und Anlegen von Datensignalen (DS) an die Vielzahl der Datenleitungen (D1, ..., Dm) während des dritten Abschnitts (T3) der Periode.

## Revendications

1. Pixel (140), comprenant :
- une diode électroluminescente organique (OLED) ;  
un deuxième transistor (M2) étant couplé entre

- une première source de puissance (ELVDD) et la diode électroluminescente organique (OLED) de manière à commander une quantité de courant délivrée par la première source de puissance (ELVDD) à la diode électroluminescente organique (OLED) ;
- un troisième transistor (M3) étant couplé entre une première électrode du deuxième transistor (M2) et la première source de puissance (ELVDD), le troisième transistor (M3) étant configuré pour se bloquer lorsqu'un signal de commande d'émission de lumière est appliqué à une ligne de commande d'émission de lumière (E1, ..., En) qui est couplée à une électrode de grille du troisième transistor (M3) ;
- un premier transistor (M1) étant couplé entre une électrode de grille du deuxième transistor (M2) et une ligne de données (D1, ..., Dm), le premier transistor (M1) étant couplé directement à l'électrode de grille du deuxième transistor (M2), le premier transistor (M1) étant configuré pour devenir passant lorsqu'un signal de balayage est appliqué à une ligne de balayage (S1, ..., Sn) qui est couplée à une électrode de grille du premier transistor (M1) ;
- un premier condensateur (C1) étant couplé entre l'électrode de grille et la première électrode du deuxième transistor (M2) ;
- un deuxième condensateur (C2) étant couplé entre la première électrode du deuxième transistor (M2) et la première source de puissance (ELVDD) ; et
- un circuit de compensation (144) étant couplé entre la diode électroluminescente organique (OLED) et l'électrode de grille du deuxième transistor (M2), le circuit de compensation (144) étant couplé à une deuxième électrode du deuxième transistor (M2), le circuit de compensation (144) étant configuré pour ajuster une tension au niveau de l'électrode de grille du deuxième transistor (M2) en fonction d'une dégradation de la diode électroluminescente organique (OLED).
2. Pixel (140) selon la revendication 1, dans lequel la capacitance du deuxième condensateur (C2) est supérieure à la capacitance du premier condensateur (C1).
  3. Pixel (140) selon la revendication 2, dans lequel la capacitance du deuxième condensateur (C2) est égale à 2 à 10 fois la capacitance du premier condensateur (C1).
  4. Pixel (140) selon la revendication 1, dans lequel le circuit de compensation (144) comprend :
    - un troisième condensateur (C3) ayant une pre-

mière borne couplée à l'électrode de grille du deuxième transistor (M2) ;

un quatrième transistor (M4) étant couplé entre une deuxième borne du troisième condensateur (C3) et une électrode d'anode de la diode électroluminescente organique (OLED), le quatrième transistor (M4) étant configuré pour devenir passant lorsque le signal de balayage est appliqué à la ligne de balayage (S1, ..., Sn), la ligne de balayage étant couplée également à une électrode de grille du quatrième transistor (M4) ; et

un cinquième transistor (M5) étant couplé entre la deuxième borne du troisième condensateur (C3) et une source de puissance de référence (V<sub>sus</sub>), le cinquième transistor (M5) étant configuré pour se bloquer lorsque le signal de commande d'émission de lumière est appliqué à la ligne de commande d'émission de lumière (E1, ..., En), la ligne de commande d'émission de lumière étant couplée également à une électrode de grille du cinquième transistor (M5).

5. Pixel (140) selon la revendication 4, dans lequel une tension de la source de puissance de référence (V<sub>sus</sub>) est supérieure à une tension de seuil de la diode électroluminescente organique (OLED).
6. Dispositif d'affichage à émission de lumière organique, comprenant :
  - un dispositif de commande de balayage (110) pour appliquer des signaux de balayage à une pluralité de lignes de balayage (S1, ..., Sn) et pour appliquer des signaux de commande d'émission de lumière à une pluralité de lignes de commande d'émission de lumière (E1, ..., En) ;
  - un dispositif de commande de données (120) pour fournir une tension de puissance de réinitialisation (V<sub>int</sub>) et pour appliquer des signaux de données (DS) à une pluralité de lignes de données (D1, ..., Dm) ; et
  - une pluralité de pixels (140) selon l'une quelconque des revendications 1 à 5 agencés au niveau des régions de croisement de la pluralité de lignes de données (D1, ..., Dm) et de la pluralité de lignes de balayage (S1, ..., Sn).
7. Dispositif d'affichage à émission de lumière organique selon la revendication 6, dans lequel le dispositif de commande de balayage (110) est configuré pour appliquer un signal de commande d'émission de lumière à une *i*<sup>ème</sup> ligne de commande d'émission de lumière (E<sub>i</sub>) pendant une deuxième partie (T2) et une troisième partie (T3) d'une période pendant laquelle un signal de balayage est appliqué à une *ji*<sup>ème</sup> ligne de balayage (S<sub>i</sub>) correspondante.

8. Dispositif d'affichage à émission de lumière organique selon la revendication 7, dans lequel le dispositif de commande de balayage (110) est configuré pour cesser l'application du signal de commande d'émission de lumière à la  $i^{\text{ème}}$  ligne de commande d'émission de lumière (Ei) après que l'application du signal de balayage à la  $j^{\text{ème}}$  ligne de balayage (Si) correspondante a cessé. 5
9. Dispositif d'affichage à émission de lumière organique selon la revendication 7, dans lequel le dispositif de commande de données (120) est configuré pour appliquer la tension de puissance de réinitialisation (Vint) à la pluralité de lignes de données (D1, ..., Dm) pendant une première partie (T1) et la deuxième partie (T2) de la période, et configuré pour appliquer des signaux de données (DS) à la pluralité de lignes de données (D1, ..., Dm) pendant la troisième partie (T3) de la période. 10  
15  
20
10. Dispositif d'affichage à émission de lumière organique selon la revendication 6, dans lequel la tension de puissance de réinitialisation (Vint) est supérieure aux signaux de données (DS). 25
11. Dispositif d'affichage à émission de lumière organique selon la revendication 10, dans lequel la tension de puissance de réinitialisation (Vint) est inférieure à une tension de la première source de puissance (ELVDD). 30
12. Procédé de commande d'un dispositif d'affichage à émission de lumière organique selon l'une quelconque des revendications 6 à 11, le procédé comprenant les étapes : 35
- d'application d'un signal de commande d'émission de lumière à une  $i^{\text{ème}}$  ligne de commande d'émission de lumière (Ei) pendant une deuxième partie (T2) et une troisième partie (T3) d'une période pendant laquelle un signal de balayage est appliqué à une  $j^{\text{ème}}$  ligne de balayage (Si) correspondante ; 40
- d'arrêt de l'application du signal de commande d'émission de lumière à la  $j^{\text{ème}}$  ligne de commande d'émission de lumière (Ei) après que l'application du signal de balayage à la  $i^{\text{ème}}$  ligne de balayage (Si) correspondante a cessé ; 45
- d'application de la tension de puissance de réinitialisation à la pluralité de lignes de données (D1, ..., Dm) pendant une première partie (T1) et la deuxième partie (T2) de la période ; et 50
- d'application de signaux de données (DS) à la pluralité de lignes de données (D1, ..., Dm) pendant la troisième partie (T3) de la période. 55

FIG. 1  
(PRIOR ART)

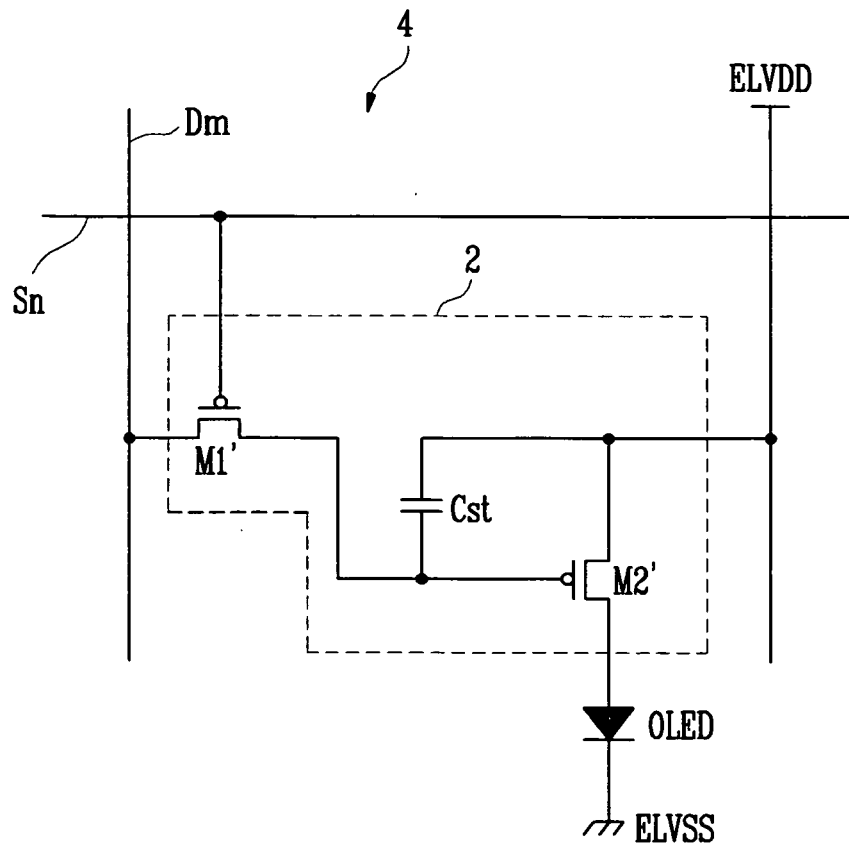


FIG. 2

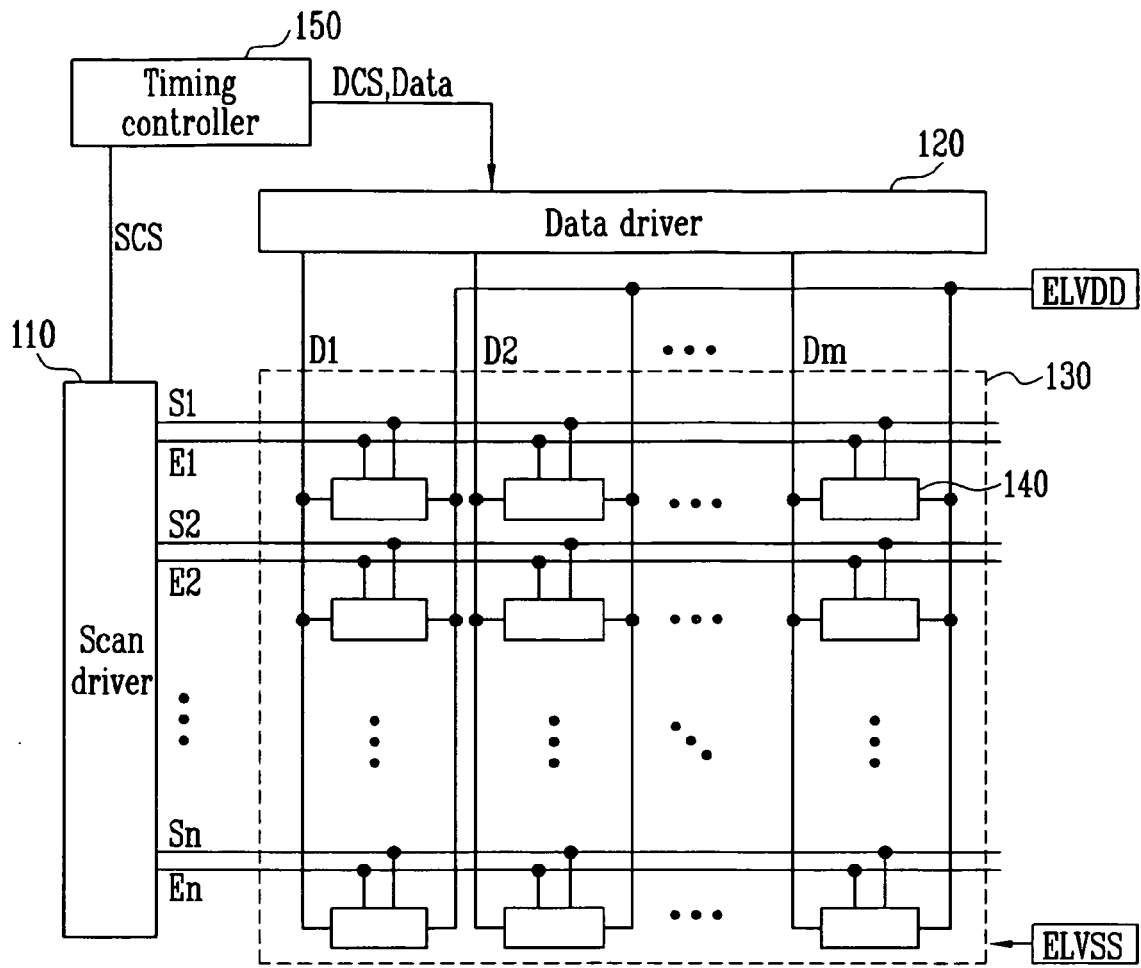


FIG. 3

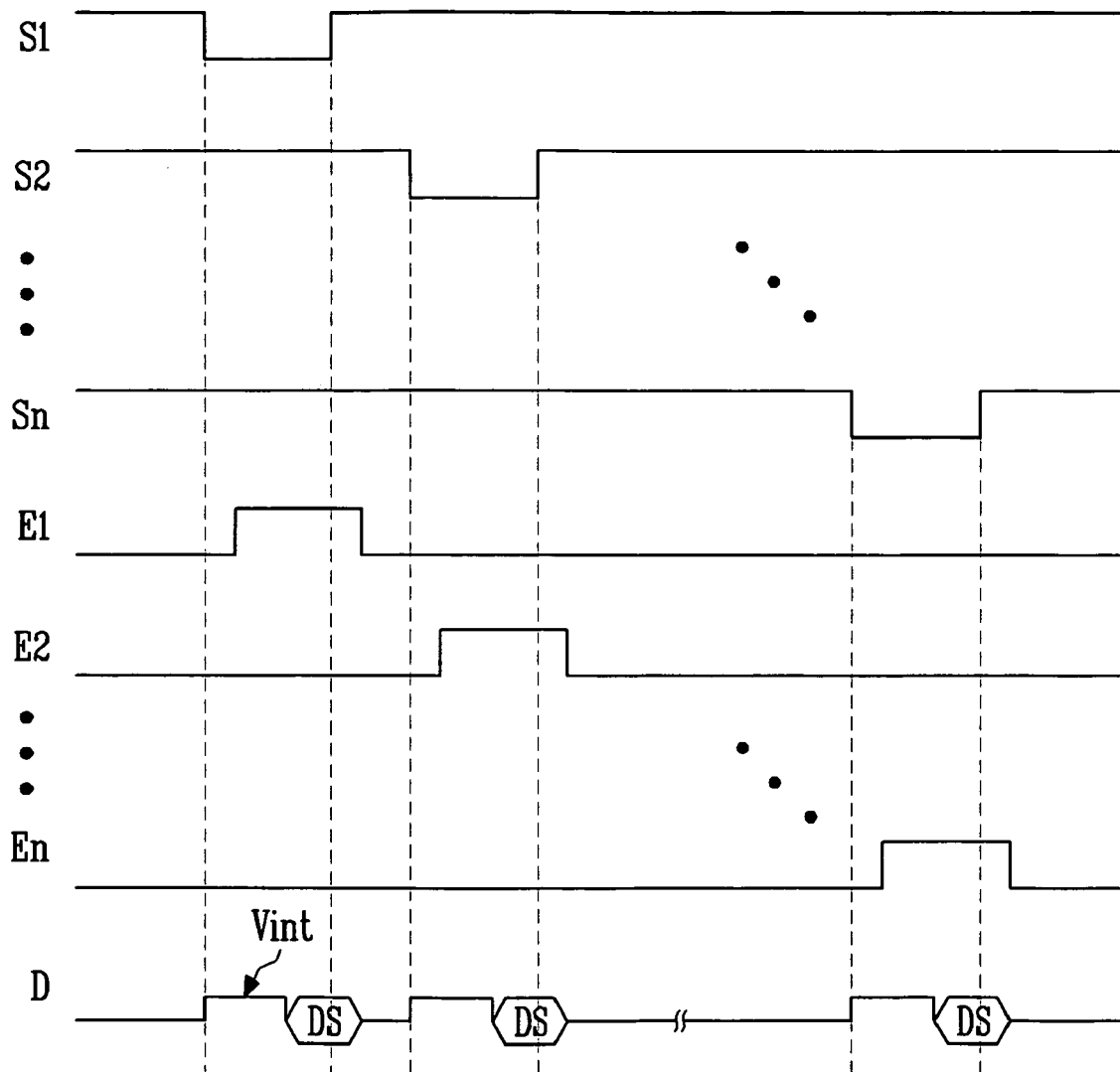


FIG. 4

140

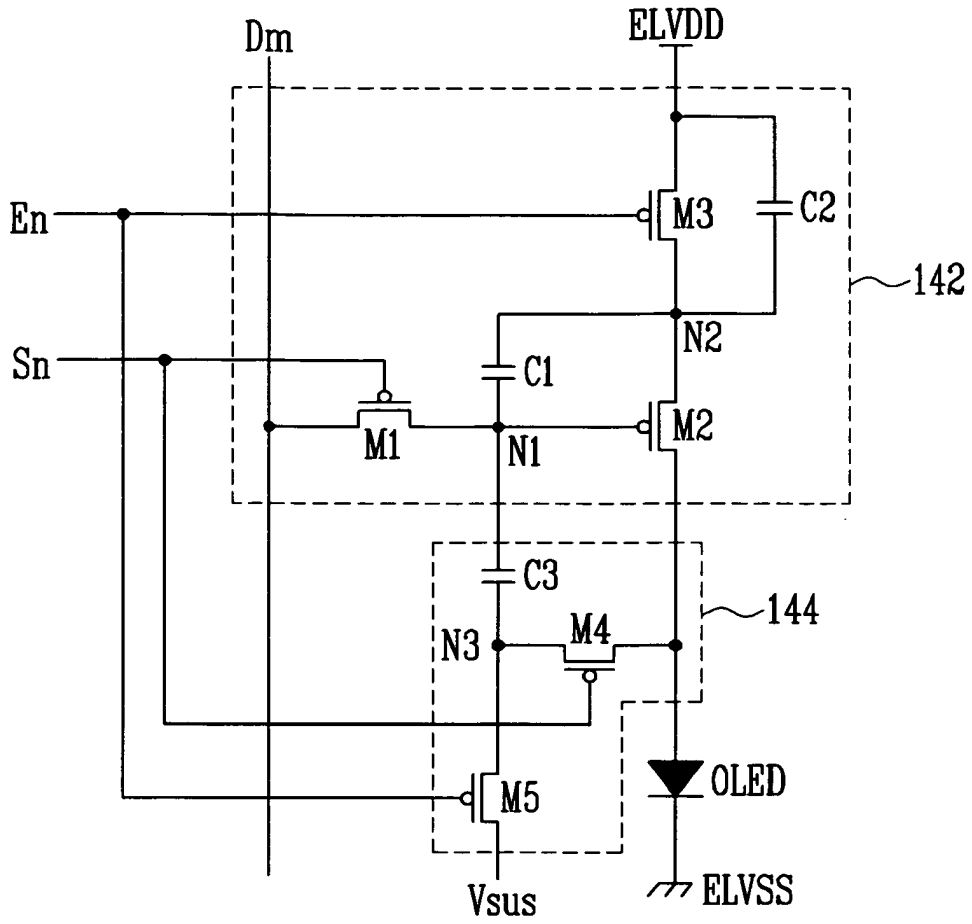
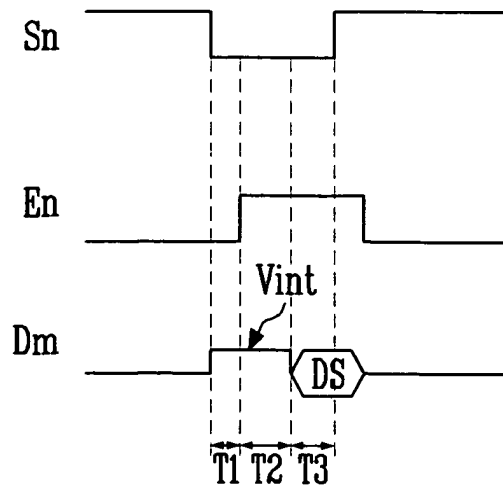


FIG. 5



**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

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- US 2004252089 A [0013]

专利名称(译)	使用其的像素和有机发光显示装置具有补偿有机发光元件的劣化的功能		
公开(公告)号	<a href="#">EP2136352B1</a>	公开(公告)日	2013-05-15
申请号	EP2009162890	申请日	2009-06-17
[标]申请(专利权)人(译)	三星显示有限公司		
申请(专利权)人(译)	三星移动显示器有限公司.		
当前申请(专利权)人(译)	三星DISPLAY CO., LTD.		
[标]发明人	KIM YANG WAN		
发明人	KIM, YANG-WAN		
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优先权	1020080056813 2008-06-17 KR		
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外部链接	<a href="#">Espacenet</a>		

摘要(译)

提供了一种能够补偿驱动晶体管的阈值电压，第一电源的电压降和有机发光二极管的劣化的像素。像素包括有机发光二极管;第二晶体管（例如，驱动晶体管），耦合在第一电源和有机发光二极管之间，以控制提供给有机发光二极管的电流;第三晶体管，耦合在第二晶体管的第一电极和第一电源之间;第一晶体管，耦合在第二晶体管的栅极和数据线之间;第一电容器，耦合在栅电极和第二晶体管的第一电极之间;第二电容器，耦合在第二晶体管的第一电极和第一电源之间;补偿电路连接在有机发光二极管和第二晶体管的栅极之间，用于根据有机发光二极管的劣化调节第二晶体管的栅极电压。

FIG. 1  
(PRIOR ART)

