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(54) **Organic light emitting device pixel circuit with self-compensation of threshold voltage and driving method therefor**

Pixelschaltung für eine organische lichtemittierende Vorrichtung mit Selbstkompensation der Schwellenspannung und Ansteuerungsverfahren dafür

Circuit de pixel pour un dispositif organique luminescent avec autocompensation de la tension de seuil et procédé de commande correspondant

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Description**CROSS-REFERENCE TO RELATED APPLICATION**

[0001] This application claims the benefit of Korean Patent Application No. 2003-45610, filed Jul 7, 2003.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates to a flat panel display and, more specifically, to a pixel circuit in an organic light emitting device capable of realizing high gradation by self-compensating a threshold voltage of a transistor that drives an electroluminescent (EL) element, and a method for driving the same.

2. Description of the Related Art

[0003] Normally, an organic light emitting device may be classified into a passive matrix organic light emitting diode (OLED) and an active matrix OLED (AMOLED), and can be classified into a current driving OLED and a voltage driving OLED depending on the manner in which the EL element is driven.

[0004] A typical AMOLED is generally composed of a plurality of gate lines, a plurality of data lines, a plurality of power lines, and a plurality of pixels connected to the lines and arranged in a matrix form. Each pixel is normally composed of: an EL element; two transistors, in which one is a switching transistor for transferring a data signal while the other is a driving transistor for driving the EL element depending on the data signal; and one capacitor for maintaining the data voltage.

[0005] Although this AMOLED has an advantage in that power consumption is low, current intensity flowing through the EL element changing over time, causing display nonuniformity, can be a problem. This results from a change in voltage between the gate and the source of the driving transistor for driving the EL element, namely, the threshold voltage of the driving transistor, which leads to a change in the current flowing through the EL element. Since the threshold voltage of a thin film transistor for the driving transistor changes depending on manufacturing process parameters, it becomes difficult to manufacture transistors in the AMOLED so that all of the transistors have the same threshold voltage. Thus, there are threshold voltage deviations between pixels.

[0006] In order to solve this voltage deviation problem, a method has been developed for compensating the threshold voltage depending on manufacturing process parameters by adding a transistor for threshold voltage compensation. U.S. Patent No. 6,229,506 ('506 patent) discloses an organic light emitting device for compensating the threshold voltage deviation. The '506 patent discloses a pixel structure in which a current source adjusts a voltage between the source and the gate of a driving transistor with respect to an overdrive voltage thereof and compensates the threshold voltage deviation of the driving transistor. The organic light emitting device in the '506 patent performs a two-step operation involving a data load (data write) step and a continuous light-emitting step, in which a current source adjusts a voltage between the source and the gate of the driving transistor with respect to the overdrive voltage and compensates the threshold voltage deviation of the driving transistor.

[0007] However, the organic light emitting device as described above employs a current driving approach for driving the EL element which depends on a data signal current level applied from the current source and has difficulty in charging a data line. Because a parasitic capacitance of the data line is relatively large while the current level of the data signal provided from the current source is relatively small, the data becomes unstable as well as considerably long time t_x is required to charge the data line.

[0008] In order to solve the data line charging problem in the current driving approach, an organic light emitting device having a mirror type pixel structure has been proposed. Fig. 1 shows a pixel circuit of a voltage driving manner having a mirror type in a conventional voltage driving organic light emitting device.

[0009] Referring to Fig. 1, the pixel circuit comprises first P-type transistor T11 in which the gate of the first transistor is connected to current scan signal SCAN[n] applied to an associated scan line of a plurality of gate lines. Data signal VDATAm applied to an associated data line of a plurality of data lines is applied to its source. Second P-type transistor T12 in which a previous scan signal SCAN[n-1] is applied to a scan line just before the current scan line is applied to its gate. Initialization voltage Vinti is applied to its drain. Third and fourth P-type transistors T13 and T14 have a mirror type configuration. Fifth N-type transistor T15 in which previous scan signal SCAN[n-1] is applied to its gate has its drain coupled to the drain of fourth transistor T14. EL element EL11 is connected between fifth transistor T15 and ground voltage VSS. First capacitor C11 is connected between the gate and the source of fourth transistor T14.

[0010] Operation of the pixel in the organic light emitting device having the above-described structure will be described with reference to an operation waveform diagram of Fig. 2. Here, it is assumed that a scan line to be currently driven is

the n-th scan line. A scan signal applied to the n-th scan line is SCAN[n]. A scan line driven before the current scan line is the (n-1)th scan line. A scan signal applied to the (n-1)th scan line is SCAN[n-1].

[0011] First of all, in initializing the operation, if predetermined levels of previous scan signal SCAN[n-1] and current scan signal SCAN[n] are applied thereto, that is, if a low level of previous scan signal SCAN[n-1] and a high level of current scan signal SCAN[n] are applied thereto, transistor T12 is turned on and transistors T11 and T15 are turned off, such that mirror-type transistors T13 and T14 are also turned off. Accordingly, the data stored in capacitor C11 is initialized through transistor T12 to initialization voltage V_{int}.

[0012] Meanwhile, in programming data, if predetermined levels of previous scan signal SCAN[n-1] and current scan signal are applied thereto, that is, if a high level of previous scan signal SCAN[n-1] and a low level of current scan signal SCAN[n] are applied thereto, transistor T12 is turned off and transistor T11 is turned on, such that mirror-type transistors T13 and T14 are turned on.

[0013] Thus, a data signal voltage level V_{DATA} applied to the data line is transferred through transistor T13 to the gate of driving transistor T14. At this time, since transistor T15 is turned on by previous scan signal SCAN[n-1], a driving current corresponding to the data signal voltage V_{DATA} applied to the gate of driving transistor T14 flows into EL element EL 11 for its light-emitting.

[0014] The voltage applied to the gate of transistor T14 becomes V_{DATA}-V_{TH(T13)}, and the current flowing through EL element EL11 is represented by the following Expression 1.

$$I_{EL11} = \frac{\beta}{2} (V_{GS(T14)} - V_{TH(T14)})^2$$

$$= \frac{\beta}{2} (V_{DD} - V_{DATA} + V_{TH(T13)} - V_{TH(T14)})^2 \quad \dots\dots(1)$$

[0015] Where, I_{EL 11} represents the current flowing through organic EL element EL 11, V_{GS(T14)} represents a voltage between the source and the gate of transistor T14, V_{TH(T13)} represents a threshold voltage of transistor T13, V_{DATA} represents a data voltage, and β represents a constant value, respectively.

[0016] At this time, if threshold voltages of transistors T13 and T14 for the current mirror are identical with each other, i.e., if V_{TH(T13)}=V_{TH(T14)}, the threshold voltage of the transistor can be compensated, thereby maintaining the driving current of EL element EL 11 to be uniform.

[0017] However, although transistors T13 and T14 configuring the current mirror are arranged adjacent to each other on a substrate in the voltage driving manner of the current mirror type as described above, it is very difficult to obtain the same threshold voltage due to the manufacturing process parameters of TFT. Therefore, there is a problem that it is difficult to obtain a uniform driving current due to deviation of the threshold voltage of TFT, resulting in degraded Image quality. US publication 2003/0667424 describes an image Display including light emitting drive means driving light emitting means and a control switch for controlling light ON or light OFF. A technique for solving the Image quality degradation due to the threshold voltage deviation between TFTs for the current mirror in the voltage driving manner of the current mirror type as described above is disclosed in U.S. Patent No. 6,362,798 ('798 patent). In the '798 patent, a compensating thin film transistor having a diode form is connected to a gate of the driving transistor in order to compensate the threshold voltage of the driving transistor. However, there is a problem with the '798 patent that when threshold voltages of the thin film transistor for compensation and the thin film transistor for driving EL element drive are different from each other, threshold voltage deviation of the driving transistor is not compensated, as well.

SUMMARY OF THE INVENTION

[0018] The present invention, therefore, addresses the aforementioned problem of the prior art, and provides a pixel circuit in an organic light emitting device capable of detecting and self-compensating threshold voltage deviations, and a method for driving the same, as recited in the appended claims.

[0019] Further in accordance with the present invention a pixel circuit in an organic light emitting device is provided capable of compensating threshold voltage deviations regardless of manufacturing process parameters, and a method for driving the same.

[0020] Still further in accordance with the present invention a pixel circuit in an organic light emitting device is provided which is capable of allowing a driving current flowing through an EL element to be uniform regardless of threshold voltage deviation between respective pixels, and a method for driving the same.

[0021] Yet still further in accordance with the present invention a pixel circuit in an organic light emitting device is provided capable of realizing high gradation representation regardless of threshold voltage deviation between respective

pixels, and a method for driving the same.

[0022] According to one aspect of the invention, there is provided a pixel circuit in an organic light emitting device. A first transistor delivers a data signal voltage in response to a current scan line signal. A second transistor generates a driving current depending on the data signal voltage delivered through the first transistor. A third transistor detects and self-compensates threshold voltage deviations in the second transistor. A capacitor for stores the data signal voltage delivered to the second transistor. An electroluminescent element emits light corresponding to the driving current generated through the second transistor.

[0023] A fourth transistor delivers a power supply voltage to the second transistor when the light is emitted. A fifth transistor delivers the driving

current, provided from the second transistor, depending on the data signal voltage when the light is emitted. An electroluminescent element emits light corresponding to the driving current delivered through the fifth transistor. The third transistor connects the second transistor in the form of a diode in response to the current scan signal, so that the second transistor detects and compensates its threshold voltage deviation in itself. An initialization transistor composed of a PMOS transistor includes a gate to which a previous scan line signal is applied, a source coupled to a gate of the first transistor and one terminal of the capacitor and a drain coupled to an initialization voltage supply for discharging the capacitor in response to the previous scan signal. It is the fourth transistor which characterizes the invention.

[0024] In an embodiment the first transistor is composed of a PMOS transistor including a gate to which the current scan line signal is applied, a source to which the data signal voltage is applied, and a drain coupled to the second transistor. The second transistor is composed of a PMOS transistor including a gate coupled to one terminal of the capacitor, a source coupled to the first transistor, and a drain coupled to the electroluminescent element. The third transistor is composed of a PMOS transistor including a gate to which the current scan signal is applied, and a drain and a source which are coupled to the gate and the drain of the second transistor, respectively, so that the second transistor is connected in the form of a diode in response to the current scan signal to self-compensate a threshold voltage of the second transistor. The fourth transistor is composed of a PMOS transistor including a gate to which the current light-emitting signal is applied, a source to which a power supply voltage is applied, and a drain coupled to the second transistor. The fifth transistor is composed of a PMOS transistor including a gate to which the current light-emitting signal is applied, a source coupled to the second transistor, and a drain coupled to the electroluminescent element.

[0025] According to yet another aspect of the invention, there is provided pixel circuit in an organic light emitting device. An electroluminescent element emits light depending on an applied driving current. A first transistor delivers a data signal voltage in response to a current scan line signal. A second transistor for generates a driving current to drive the electroluminescent element in response to the data signal voltage. A third transistor connects the second transistor in the form of a diode in response to a current scan signal to self-compensate a threshold voltage of the second transistor. A capacitor stores the data signal voltage delivered to the second transistor. A fourth transistor delivers a power supply voltage to the second transistor in response to a current light-emitting signal. A fifth transistor provides the driving current, provided from the second transistor, for the electroluminescent element in response to the current light-emitting signal.

[0026] According to yet still another aspect of the invention, there is provided a pixel circuit in an organic light emitting device. A first transistor includes a gate to which a current scan signal is applied, and a source to which a data signal voltage is applied. A second transistor has its source coupled to a drain of the first transistor. A third transistor has its drain and source connected between a gate and a drain of the second transistor. A fourth transistor includes a gate to which a current light-emitting signal is applied, a source to which a power supply voltage is applied, and a drain coupled to the source of the second transistor. A fifth transistor includes a gate to which the current light-emitting signal is applied, a source coupled to the drain of the second transistor, and a drain coupled to one terminal of an electroluminescent element. The electroluminescent element has one terminal coupled to the drain of the fifth transistor and the other terminal grounded. A capacitor has one terminal coupled to the gate of the second transistor. A power supply voltage is applied to the other terminal of the capacitor.

[0027] According to yet still another aspect of the invention, there is provided a pixel circuit in an organic light emitting device having a plurality of data lines, a plurality of scan lines, a plurality of power lines, and a plurality of pixels each connected to one associated data line, scan line and power line of the plurality of data lines, scan lines and power lines. Each pixel comprises: a first transistor including a gate to which a current scan signal to be applied to the associated scan line is applied, and a source to which a data signal voltage from the data line is applied; a second transistor whose source is coupled to a drain of the first transistor; a third transistor whose drain and source are connected between a gate and a drain of the second transistor, respectively; a fourth emitting transistor including a gate to which a current light-emitting signal is applied, a source to which a power supply voltage from the power line is applied, and a drain coupled to the source of the second transistor; a fifth transistor including a gate to which the current light-emitting signal is applied, and a source coupled to the drain of the second transistor; an electroluminescent element including one terminal coupled to the drain of the fifth transistor and the other terminal grounded; and a capacitor including one terminal coupled to the gate of the second transistor, and the other terminal to which the power supply voltage from the power

line is applied.

[0028] According to yet still another aspect of the invention, there is provided a method of driving a pixel in an organic light emitting device having a plurality of data lines, a plurality of scan lines, a plurality of power lines, and a plurality of pixels each connected to an associated one data line, scan line and power line of the plurality of data lines, scan lines and power lines. The method comprises: performing initialization in response to a scan signal applied to a scan line just before the associated scan line; compensating threshold voltage deviation in response to a scan signal applied to the associated scan line, and programming a data voltage applied from the associated data line, regardless of the threshold voltage deviation; and generating a driving current corresponding to the data voltage to emit an electroluminescent (EL) element in response to a current light-emitting signal.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029]

Fig. 1 illustrates a circuit construction of a pixel in a conventional organic light emitting device.

Fig. 2 is a waveform diagram for explaining operation of the pixel in the conventional organic light emitting device.

Fig. 3 illustrates a circuit construction of a pixel in an organic light emitting device according to an embodiment of the present invention.

Fig. 4 is a waveform diagram for explaining operation of the pixel in the organic light emitting device according to the embodiment of the present invention, as shown in Fig. 3.

Figs. 5 to 7 are circuit construction diagrams for explaining initialization operation, program operation and light-emitting operation of a pixel in an organic light emitting device according to an embodiment of the present invention.

DETAILED DESCRIPTION

[0030] The organic light emitting device in accordance with the present invention includes a plurality of gate lines; a plurality of data lines; a plurality of power lines; and a plurality of pixels each arranged in an associated gate line, data line and power line of the plurality of gate lines, data lines and power lines. Fig. 3 shows only one pixel arranged in an associated gate line (the n-th gate line), data line (the m-th data line) and power line (the m-th power line).

[0031] Referring to Fig. 3, each pixel in the organic light emitting device according to the present invention is composed of six transistors T31-T36, one capacitor C31 and electroluminescent (EL) element EL31. That is, each pixel includes organic electroluminescent device EL31 for emitting light corresponding to an applied driving current; first switching transistor T32 for switching data signal voltage VDATAm, applied to the associated data line, in response to current scan line signal SCAN[n] applied to the associated scan line; driving transistor T31 for supplying a driving current of the organic electroluminescent device corresponding to the data signal voltage inputted to its gate through first switching transistor T32; threshold voltage compensation transistor T33 for compensating the threshold voltage of driving transistor T31; and capacitor C31 for storing the data signal that is applied to the gate of driving transistor T31.

[0032] First switching transistor T32 is composed of a P-type thin film transistor in which current scan signal SCAN[n], applied to the associated scan line, is applied to its gate, data signal voltage VDATAm, applied to the associated data line, is applied to its source, and its drain is connected to the source of driving transistor T31.

[0033] Driving transistor T31 is composed of a P-type thin film transistor in which its gate is connected to one terminal of capacitor C31 and its drain is connected to one terminal of EL element EL31. Threshold voltage compensation transistor T33 is composed of a P-type thin film transistor in which its drain and source are connected to the gate and drain of driving transistor T31, respectively, and a current scan signal scan [n] is applied to the gate of transistor T33. Power supply voltage VDD from the associated power line is provided for the other side of capacitor C31.

[0034] Further, each pixel comprises second switching transistor T35 for providing power supply voltage VDD for driving transistor T31 in response to current light-emitting signal EMI[n], and third switching transistor T36 for providing a driving current, generated through driving transistor T31, for EL element EL31 in response to current light-emitting signal EMI[n].

[0035] Second switching transistor T35 is composed of a P-type thin film transistor in which current light-emitting signal EMI[n] is applied to its gate, the power supply voltage from the associated power supply voltage line is applied to its source, and its drain is connected to the source of driving transistor T31. Third switching transistor T36 is composed of a P-type thin film transistor in which current light-emitting signal EMI[n] is applied to its gate, its source is coupled to the drain of driving transistor T31, and the drain of transistor T36 is coupled to one terminal of EL element EL31. The other terminal of EL element EL31 is grounded.

[0036] Moreover, each pixel includes initialization transistor T34 for initializing the data signal stored in capacitor C31 in response to a previous scan signal SCAN[n-1] applied to a scan line just before the associated scan line. Transistor T34 is composed of a P-type thin film transistor in which previous scan signal SCAN[n-1] is applied to its gate, its source

is coupled to the one terminal of capacitor C31, and initialization voltage Vinti is applied to its drain.

[0037] Operation of the pixel having the above-described configuration according to the present invention will be described with reference to Figs. 4 to 7.

[0038] First, in an initialization operation, during an initialization period in which previous scan signal SCAN[n-1] is of a low level, and current scan signal SCAN[n] and light-emitting signal EMI[n] are of high level as shown in Fig. 4, since transistor T34 is turned on by the low level of previous scan signal SCAN[n-1], and transistors T31-T33 and T35-T36 are turned off by the high level of current scan signal SCAN[n] and current light-emitting signal EMI[n], an initialization path (as indicated by a solid line shown in Fig. 5) is formed. Accordingly, the data signal that has been stored in capacitor C31, namely, a gate voltage of driving transistor T31, is initialized.

[0039] Next, in a data program operation, during a programming period in which previous scan signal scan [n-1] is at a high level, current scan signal SCAN[n] is at a low level and current light-emitting signal EMI[n] is at a high level as shown in Fig. 4, transistor T34 is turned off, and transistor T33 is turned on by the low level of current scan signal SCAN[n], such that driving transistor T31 is connected in the form of a diode.

[0040] Since switching transistor T32 is also turned on by current scan signal SCAN[n], and switching transistors T35 and T36 are turned off by current light-emitting signal EMI[n], such that a data program path (as indicated by a solid line shown in Fig. 6) is formed. Accordingly, data voltage VDATAm applied to the associated data line is provided for the gate of driving transistor T31 through threshold voltage compensation transistor T33.

[0041] Since driving transistor T31 is in the diode connection, VDATAm- $V_{TH(T31)}$ is applied to the gate of transistor T31 and the gate voltage is stored in capacitor C31, such that the program operation is completed.

[0042] Finally, in a light-emitting operation, during an light-emitting period in which previous scan signal SCAN[n-1] is of high level, current scan signal SCAN[n] becomes a high level, and then current light-emitting signal EMI[n] becomes a low level as shown in Fig. 4, an light-emitting path (as indicated by the solid line as shown in Fig. 7) is formed. That is, switching transistors T35 and T36 are turned on by the low level of current light-emitting signal EMI[n], initialization transistor T34 is turned off by the high level of previous scan signal SCAN[n-1], and threshold voltage compensation transistor T33 and switching transistor T32 are turned off by the high level of current scan signal SCAN[n]. Accordingly, a driving current generated in response to the data signal voltage applied to the gate of driving transistor T31 is provided through transistor T31 for organic EL element EL31, such that the light-emitting of organic EL element EL31 occurs.

[0043] At this time, the current into organic EL element EL31 is represented by the following Expression 2.

$$\begin{aligned}
 I_{EL31} &= \frac{\beta}{2} (V_{GS} - V_{TH(M31)})^2 \\
 &= \frac{\beta}{2} (V_{DD} - V_{DATA} + V_{TH(M31)} - V_{TH(M31)})^2 \dots (2)
 \end{aligned}$$

[0044] Where, I_{EL31} represents the current flowing into organic EL element EL31, V_{GS} represents a voltage between the source and the gate of transistor T31, $V_{TH(T31)}$ represents a threshold voltage of transistor T31, V_{DATA} represents a data voltage, and β represent a constant value, respectively.

[0045] As can be seen from the Expression 2, the driving current flows through EL element EL31, corresponding to the data signal voltage applied to the data line regardless of the threshold voltage of current driving transistor T31. That is, because the present invention detects and self-compensates the threshold voltage deviation in current driving transistor T31 through transistor T33, it is possible to finely control the current flowing into the organic EL element, thereby providing the high gradation of the organic EL element.

[0046] Further, if the data for a previous frame time has a high level of voltage and the data for a next frame time has a low level of voltage, the data signal can be no longer applied to the gate node of transistor T31 owing to the diode connection property of transistor T31, and thus switching transistor T34 is placed to initialize the gate node of transistor T31 into a predetermined level Vinti per frame.

[0047] As described above, driving transistor T31 in the present invention can self-compensate the threshold voltage deviation by detecting its own threshold voltage.

[0048] Although the embodiment of the present invention illustrates the pixel circuit composed of six transistors and one capacitor, the present invention is applicable to all constructions for detecting and self-compensating a threshold voltage. Moreover, the pixel circuit can be configured of a NMOS transistor, a CMOS transistor or the like other than the PMOS transistor.

[0049] According to the embodiment of the present invention as described above, there are advantages that it is possible to realize high gradation by detecting and self-compensating the threshold voltage deviation in the driving transistor as well as to solve a charging problem in the data line by driving the driving transistor in the voltage driving

manner.

[0050] Although the present invention has been described with reference to the exemplary embodiments thereof, it will be appreciated by those skilled in the art that it is possible to modify and change the present invention variously without departing from the scope of the present invention as set forth in the following claims.

Claims

1. A pixel circuit for an organic light emitting device, comprising:

a first transistor (T 32) for delivering a voltage level of a data signal applied to its source in response to a current scan signal applied to its gate ;
 a second transistor (T 31) for generating a driving current depending on the voltage level of data signal delivered to its source through the first transistor;
 a third transistor (T 33) for connecting the second transistor in the form of a diode in response to the current scan signal applied to the gate of the third transistor (T 33);
 an electroluminescent element (EL 31) for emitting light corresponding to the driving current generated through the second transistor (T 31);
 a driving current providing transistor (T 36) for providing the driving current for the electroluminescent element (EL 31) from the drain of the second transistor (T 31) in response to a current light-emitting signal applied to the gate of the driving current providing transistor (T 36); and a capacitor (C 31) for storing the voltage level of the data signal delivered to the source of the second transistor (T 31), and
 an initialization transistor (T 34) for initializing the voltage level stored in the capacitor (C 31) in response to a previous scan signal,
 wherein the initialization transistor (T 34) is a PMOS transistor,
 wherein the initialization transistor (T 34) includes a gate to which the previous scan line signal is applied, a source coupled to a gate of the second transistor (T 31) and a first terminal of the capacitor (C 31), and a drain coupled to an initialization voltage supply, **characterized in that** the pixel circuit further comprises a transistor (T 35) providing a power supply voltage to the second transistor (T 31) in response to a current light emitting signal of the power supply providing transistor (T35) and **in that** the drain of the first transistor (T32) is connected to the source of the second transistor (T31).

2. The pixel circuit in the organic light emitting device of claim 1, wherein the first, second, and third transistors, the power supply providing transistor and the driving current providing transistor (T31, T 32, T 33, T 34, T35, T 36) are PMOS transistors.

3. The pixel circuit in the organic light emitting device of claim 2, wherein the second transistor includes a gate coupled to the first terminal of the capacitor, a source coupled to the drain of the first transistor, and a drain coupled to the electroluminescent element.

4. The pixel circuit in the organic light emitting device of claim 2, wherein the third transistor includes a gate to which the current scan signal is applied, and a drain and a source which are coupled to the gate and the drain of the second transistor, respectively.

5. The pixel circuit in the organic light emitting device of claim 2, wherein the power supply providing transistor includes a gate to which the current light-emitting signal is applied, a source to which a power supply voltage is applied and coupled to the second terminal of the capacitor, and a drain coupled to the source of the second transistor and the drain of the first transistor.

6. The pixel circuit in the organic light emitting device of claim 2, wherein the driving current providing transistor includes a gate to which the current light-emitting signal is applied, a source coupled to the drain of the second transistor, and a drain coupled to the electroluminescent element.

7. The pixel circuit in the organic light emitting device of claim 1, further comprising:

a voltage source for providing the voltage level of data signal through the first transistor for the second transistor.

8. An organic light emitting display device comprising:

a plurality of data lines extending in a first direction;
 a plurality of scan lines extending in a second direction crossing the first direction;
 a plurality of emission control lines; and
 a plurality of pixels each pixel comprising a pixel circuit according to one of the previous claims, each of the
 5 pixels being connected to a corresponding one of the plurality of data lines, a corresponding current scan line
 of the plurality of scan lines, a corresponding previous scan line of the plurality of scan lines and a corresponding
 one of the plurality of emission control lines.

9. The organic light emitting display device of claim 8, further comprising a controller adapted to provide a first scan
 10 signal to the previous scan line during an initialization period, to provide a second scan signal to the current scan
 line during a programming period following the initialization period, and to provide an emission control signal to the
 corresponding one of the plurality of emission control lines during an emitting period following the programming period.

10. A method of driving a pixel circuit according to one of claims 1-7, the pixel circuit being comprised in an organic light
 15 emitting device, the method comprising the steps of:

connecting a driving transistor in the form of a diode to provide a data voltage to the gate of the driving transistor,
 and storing the data voltage in the capacitor in response to current scan signal; and
 20 generating a driving current corresponding to the data voltage to emit an electroluminescent element in response
 to a current light-emitting signal,
 further comprising the step of initializing a capacitor in response to a previous scan signal.

Patentansprüche

1. Pixelschaltung für eine organische lichtemittierende Vorrichtung, aufweisend:

einen ersten Transistor (T 32) zum Liefern eines Spannungspegels eines Datensignals, der in Reaktion auf ein
 aktuelles Ansteuersignal, das an sein Gate angelegt wird, an seine Source angelegt wird;
 30 einen zweiten Transistor (T 31) zum Erzeugen eines Ansteuerstroms in Abhängigkeit vom Spannungspegel
 eines Datensignals, der durch den ersten Transistor an seine Source geliefert wird;
 einen dritten Transistor (T 33) zum Verbinden des zweiten Transistors in Form einer Diode in Reaktion auf das
 am Gate des dritten Transistor (T 33) anliegende aktuelle Ansteuersignal;
 ein elektrolumineszentes Element (EL 31) zum Emittieren von Licht entsprechend dem durch den zweiten
 35 Transistor (T 31) erzeugten Ansteuerstrom;
 einen Ansteuerstrom bereitstellenden Transistor (T 36) zum Liefern des Ansteuerstroms für das elektrolumi-
 neszente Element (EL 31) vom Drain des zweiten Transistors (T 31) in Reaktion auf ein aktuelles Lichtemissi-
 onssignal, das an das Gate des Ansteuerstrom bereitstellenden Transistors (T 36) angelegt wird; und einen
 Kondensator (C 31) zum Speichern des Spannungspegels des Datensignals, der zur Source des zweiten
 40 Transistors (T31) geliefert wird, und
 einen Initialisierungstransistor (T 34) zum Initialisieren des im Kondensator (C 31) gespeicherten Spannungs-
 pegels in Reaktion auf ein vorangehendes Ansteuersignal,
 wobei der Initialisierungstransistor (T 34) ein PMOS-Transistor ist,
 wobei der Initialisierungstransistor (T 34) ein Gate, an das das vorangehende Ansteuersignal angelegt wird,
 45 eine Source, die mit einem Gate des zweiten Transistors (T 31) und einem ersten Anschluss des Kondensators
 (C 31) gekoppelt ist, und ein Drain, das mit einer Initialisierungsspannungsversorgung gekoppelt ist, aufweist,
dadurch gekennzeichnet, dass die Pixelschaltung ferner einen Transistor (T 35), der in Reaktion auf ein
 aktuelles Lichtemissionssignal des eine Energieversorgung bereitstellenden Transistors (T35) eine Energie-
 versorgungsspannung an den zweiten Transistor (T31) liefert, und dadurch, dass das Drain des ersten Tran-
 50 sistors (T32) mit der Source des zweiten Transistors (T31) verbunden ist.

2. Pixelschaltung in der organischen lichtemittierenden Vorrichtung nach Anspruch 1, wobei der erste, zweite und
 dritte Transistor, der eine Energieversorgung bereitstellende Transistor und der Ansteuerstrom bereitstellende Tran-
 sistor (T31, T 32, T 33, T 34, T 35, T 36) PMOS-Transistoren sind.

3. Pixelschaltung in der organischen lichtemittierenden Vorrichtung nach Anspruch 2, wobei der zweite Transistor ein
 Gate, das mit dem ersten Anschluss des Kondensators gekoppelt ist, eine Source, die mit dem Drain des ersten
 Transistors gekoppelt ist, und ein Drain, das mit dem elektrolumineszenten Element gekoppelt ist, aufweist.

4. Pixelschaltung in der organischen lichtemittierenden Vorrichtung nach Anspruch 2, wobei der dritte Transistor ein Gate, an das das aktuelle Ansteuersignal angelegt wird, und ein Drain und eine Source, die jeweils mit dem Gate und dem Drain des zweiten Transistors gekoppelt sind, aufweist.

5. Pixelschaltung in der organischen lichtemittierenden Vorrichtung nach Anspruch 2, wobei der eine Energieversorgung bereitstellende Transistor ein Gate, an das das aktuelle Lichtemissionssignal angelegt wird, eine Source, an die eine Energieversorgungsspannung angelegt wird und die mit dem zweiten Anschluss des Kondensators gekoppelt ist, und ein Drain, das mit der Source des zweiten Transistors und dem Drain des ersten Transistors gekoppelt ist, aufweist.

6. Pixelschaltung in der organischen lichtemittierenden Vorrichtung nach Anspruch 2, wobei der Ansteuerstrom bereitstellende Transistor ein Gate, an das das aktuelle Lichtemissionssignal angelegt wird, eine Source, die mit dem Drain des zweiten Transistors gekoppelt ist, und ein Drain, das mit dem elektrolumineszenten Element gekoppelt ist, aufweist.

7. Pixelschaltung in der organischen lichtemittierenden Vorrichtung nach Anspruch 1, ferner aufweisend:

eine Spannungsquelle zum Bereitstellen des Spannungspegels des Datensignals durch den ersten Transistor für den zweiten Transistor.

8. Organische lichtemittierende Anzeigevorrichtung, aufweisend:

eine Vielzahl von Datenleitungen, die in eine erste Richtung verlaufen;
eine Vielzahl von Ansteuerleitungen, die in eine zweite Richtung, die die erste Richtung kreuzt, verlaufen;
eine Vielzahl von Emissionssteuerleitungen; und
eine Vielzahl von Pixeln, wobei jeder Pixel eine Pixelschaltung nach einem der vorhergehenden Ansprüche aufweist, wobei jeder der Pixel mit einer entsprechenden der Vielzahl der Datenleitungen, einer entsprechenden aktuellen Ansteuerleitung der Vielzahl der Ansteuerleitungen, einer entsprechenden vorangehenden Ansteuerleitung der Vielzahl der Ansteuerleitungen und einer entsprechenden der Vielzahl der Emissionssteuerleitungen verbunden ist.

9. Organische lichtemittierende Anzeigevorrichtung nach Anspruch 8, ferner aufweisend eine Steuerung, die angepasst ist, um während einer Initialisierungsperiode ein erstes Ansteuersignal an die vorangehende Ansteuerleitung zu liefern, um während einer der Initialisierungsperiode folgenden Programmierungsperiode ein zweites Ansteuersignal an die aktuelle Ansteuerleitung zu liefern, und um während einer der Programmierungsperiode folgenden Emissionsperiode ein Emissionssteuersignal an die entsprechende der Vielzahl der Emissionssteuerleitungen zu liefern.

10. Verfahren zur Ansteuerung einer Pixelschaltung nach einem der Ansprüche 1-7, wobei die Pixelschaltung in einer organischen lichtemittierenden Vorrichtung enthalten ist, wobei das Verfahren die folgenden Schritte aufweist:

Verbinden des Ansteuertransistors in Form einer Diode, um eine Datenspannung an das Gate des Ansteuertransistors zu liefern, und Speichern der Datenspannung im Kondensator in Reaktion auf ein aktuelles Ansteuersignal; und
Erzeugen eines Ansteuerstroms entsprechend der Datenspannung, um in Reaktion auf ein aktuelles Lichtemissionssignal ein elektrolumineszentes Element zu emittieren,
ferner aufweisend den Schritt des Initialisierens eines Kondensators in Reaktion auf ein vorangehendes Ansteuersignal.

Revendications

1. Circuit de pixel pour un dispositif électroluminescent organique, comprenant :

un premier transistor (T32) pour délivrer en sortie un niveau de tension d'un signal de données appliqué à sa source en réponse à un signal de balayage actuel appliqué à sa grille ;
un deuxième transistor (T31) pour générer un courant d'attaque en fonction du niveau de tension du signal de données délivré en sortie à sa source par l'intermédiaire du premier transistor ;
un troisième transistor (T33) pour connecter le deuxième transistor sous la forme d'une diode en réponse au

signal de balayage actuel appliqué à la grille du troisième transistor (T33) ;
 un élément électroluminescent (EL31) pour émettre de la lumière correspondant au courant d'attaque généré par l'intermédiaire du deuxième transistor (T31) ;
 un transistor (T36) fournissant un courant d'attaque pour fournir le courant d'attaque pour l'élément électrolu-
 minescent (EL31) provenant du drain du deuxième transistor (T31) en réponse à un signal d'émission de lumière
 5 actuel appliqué à la grille du transistor (T36) fournissant un courant d'attaque ; et un condensateur (C31) pour
 stocker le niveau de tension du signal de données délivré en sortie à la source du deuxième transistor (T31), et
 un transistor d'initialisation (T34) pour initialiser le niveau de tension stocké dans le condensateur (C31) en
 10 réponse à un signal de balayage précédent,
 où le transistor d'initialisation (T34) est un transistor PMOS,
 où le transistor d'initialisation (T34) comporte une grille à laquelle est appliqué le signal de ligne de balayage
 précédent, une source couplée à une grille du deuxième transistor (T31) et à une première borne du conden-
 sateur (C31), et un drain couplé à une alimentation en tension d'initialisation, **caractérisé en ce que** le circuit
 15 de pixel comprend en outre un transistor (T35) fournissant une tension d'alimentation au deuxième transistor
 (T31) en réponse à un signal d'émission de lumière actuel du transistor (T35) fournissant une alimentation
 électrique et **en ce que** le drain du premier transistor (T32) est connecté à la source du deuxième transistor (T31).

2. Circuit de pixel dans le dispositif électroluminescent organique de la revendication 1, dans lequel les premier,
 deuxième et troisième transistors, le transistor fournissant une alimentation électrique et le transistor fournissant
 20 un courant d'attaque (T31, T32, T33, T34, T35, T36) sont des transistors PMOS.

3. Circuit de pixel dans le dispositif électroluminescent organique de la revendication 2, dans lequel le deuxième
 transistor comporte une grille couplée à la première borne du condensateur, une source couplée au drain du premier
 transistor, et un drain couplé à l'élément électroluminescent.

4. Circuit de pixel dans le dispositif électroluminescent organique de la revendication 2, dans lequel le troisième
 transistor comporte une grille à laquelle est appliqué le signal de balayage actuel, et un drain et une source qui sont
 couplés à la grille et au drain du deuxième transistor, respectivement.

5. Circuit de pixel dans le dispositif électroluminescent organique de la revendication 2, dans lequel le transistor
 fournissant une alimentation électrique comporte une grille à laquelle est appliqué le signal d'émission de lumière
 30 actuel, une source à laquelle est appliquée une tension d'alimentation et couplée à la deuxième borne du conden-
 sateur, et un drain couplé à la source du deuxième transistor et au drain du premier transistor.

6. Circuit de pixel dans le dispositif électroluminescent organique de la revendication 2, dans lequel le transistor
 fournissant un courant d'attaque comporte une grille à laquelle est appliqué le signal d'émission de lumière actuel,
 35 une source couplée au drain du deuxième transistor, et un drain couplé à l'élément électroluminescent.

7. Circuit de pixel dans le dispositif électroluminescent organique de la revendication 1, comprenant en outre :

une source de tension pour fournir le niveau de tension du signal de données par l'intermédiaire du premier
 transistor pour le deuxième transistor.

8. Dispositif d'affichage électroluminescent organique comprenant :

une pluralité de lignes de données s'étendant dans une première direction ;
 une pluralité de lignes de balayage s'étendant dans une deuxième direction croisant la première direction ;
 une pluralité de lignes de commande d'émission ; et
 une pluralité de pixels, chaque pixel comprenant un circuit de pixel selon l'une des revendications précédentes,
 50 chacun des pixels étant connecté à une ligne de données correspondante de la pluralité de lignes de données,
 à une ligne de balayage actuelle correspondante de la pluralité de lignes de balayage, à une ligne de balayage
 précédente correspondante de la pluralité de lignes de balayage et à une ligne de commande d'émission
 correspondante de la pluralité de lignes de commande d'émission.

9. Dispositif d'affichage électroluminescent organique de la revendication 8, comprenant en outre un dispositif de
 commande adapté pour fournir un premier signal de balayage à la ligne de balayage précédente pendant une
 période d'initialisation, pour fournir un deuxième signal de balayage à la ligne de balayage actuelle pendant une
 période de programmation suivant la période d'initialisation, et pour fournir un signal de commande d'émission à la

ligne de commande d'émission correspondante de la pluralité de lignes de commande d'émission pendant une période d'émission suivant la période de programmation.

- 5 **10.** Procédé d'attaque d'un circuit de pixel selon l'une des revendications 1 à 7, le circuit de pixel étant compris dans un dispositif électroluminescent organique, le procédé comprenant les étapes consistant :

à connecter un transistor d'attaque sous la forme d'une diode pour fournir une tension de données à la grille du transistor d'attaque, et à stocker la tension de données dans le condensateur en réponse à un signal de balayage actuel ; et
10 à générer un courant d'attaque correspondant à la tension de données pour émettre un élément électroluminescent en réponse à un signal d'émission de lumière actuel, comprenant en outre l'étape d'initialisation d'un condensateur en réponse à un signal de balayage précédent.

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FIG. 1
(PRIOR ART)

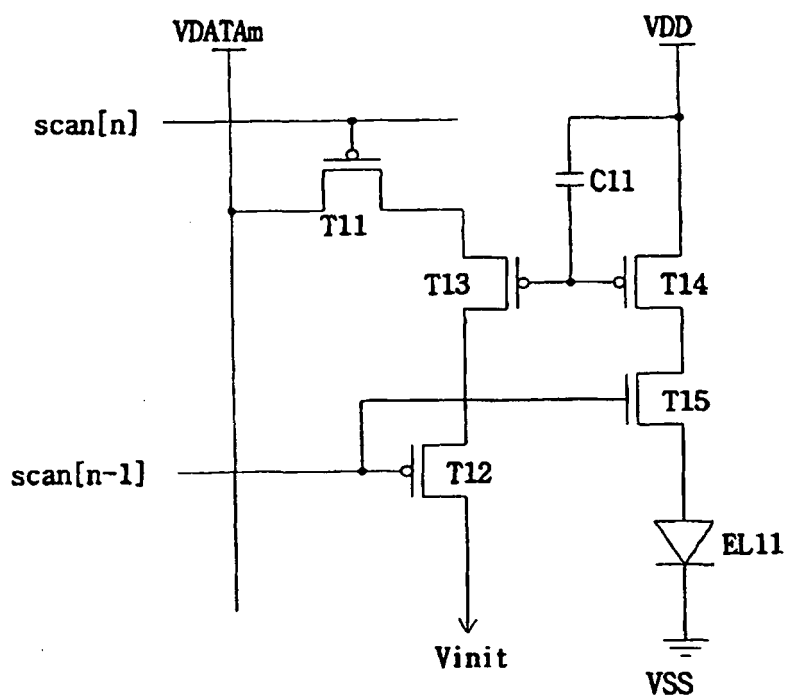


FIG. 2
(PRIOR ART)

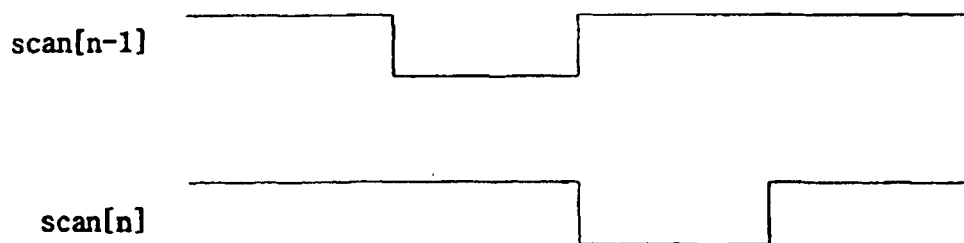


FIG. 3

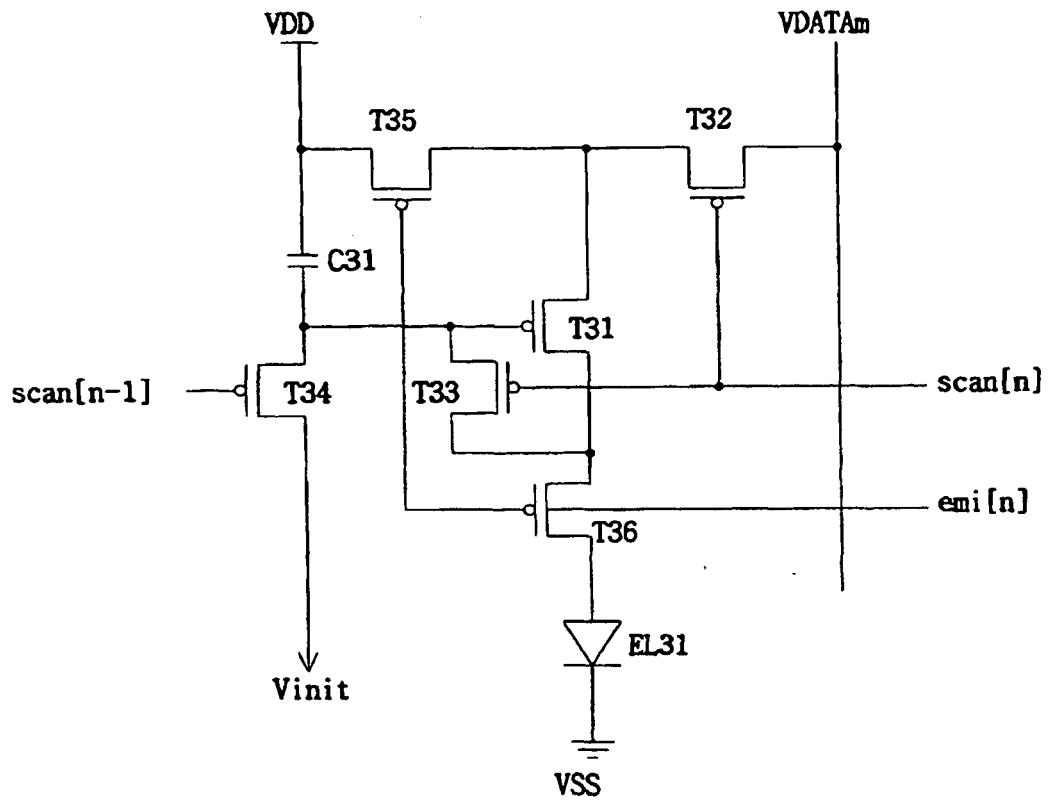


FIG. 4

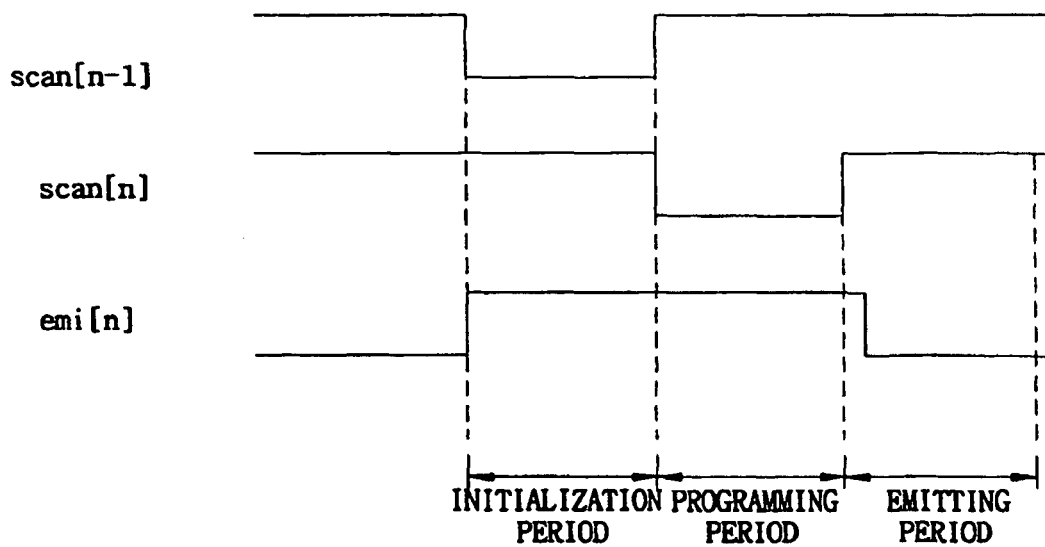


FIG. 5

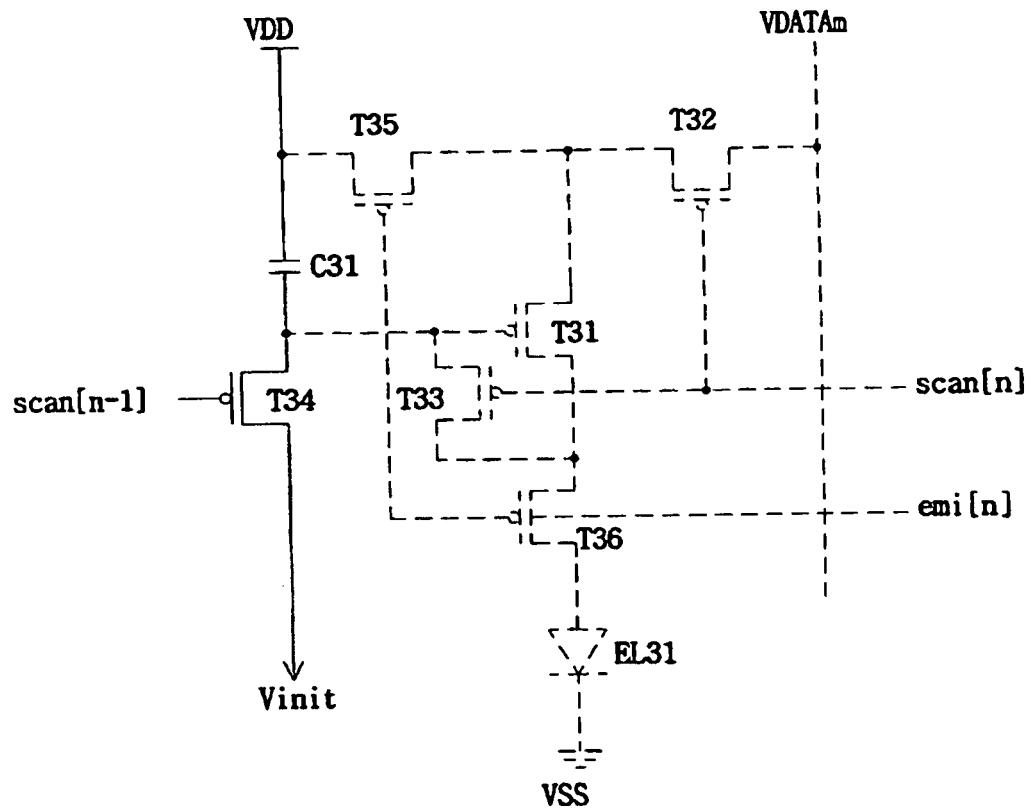


FIG. 6

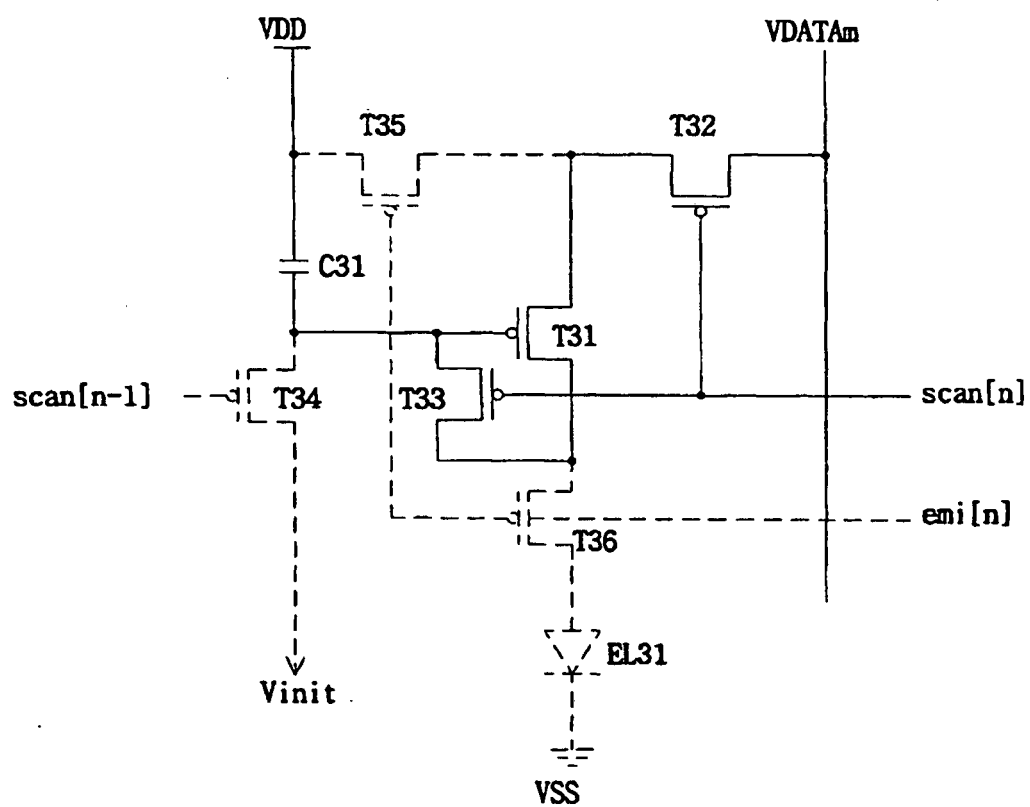
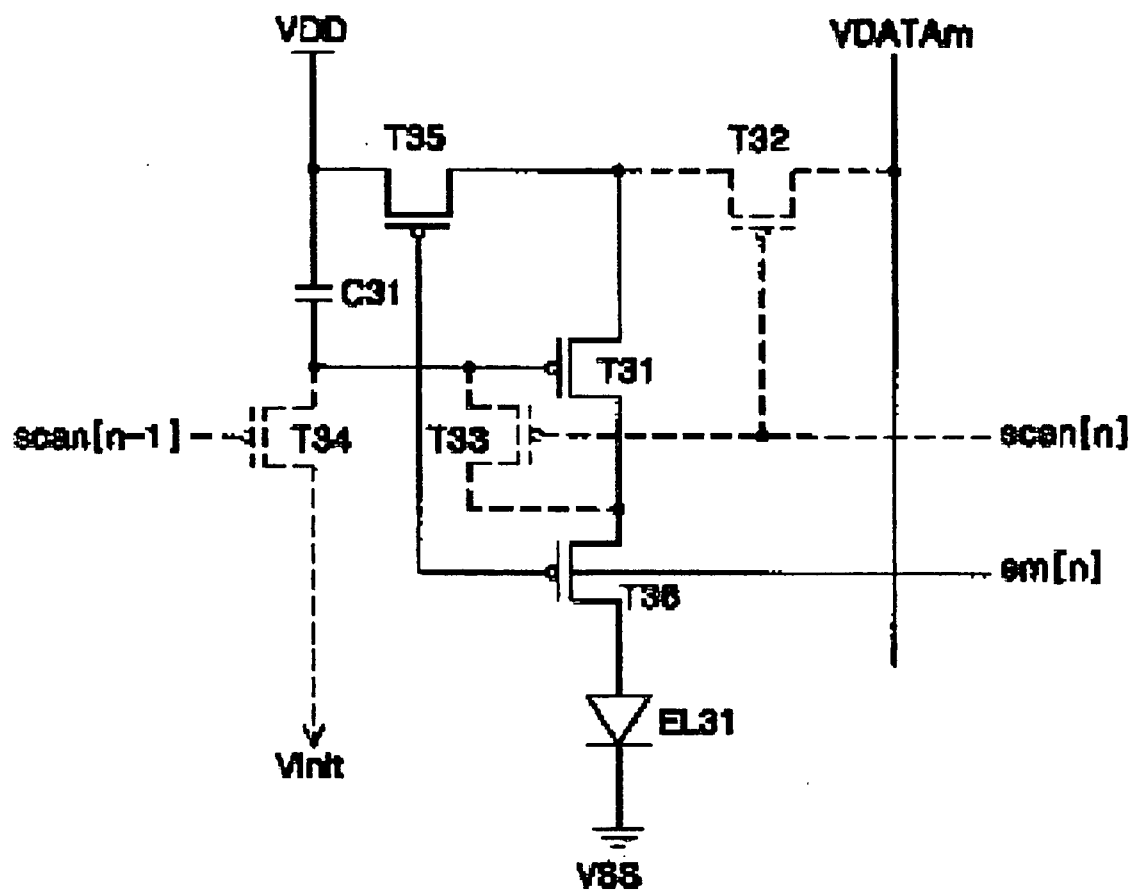


Fig. 7



REFERENCES CITED IN THE DESCRIPTION

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专利名称(译)	具有阈值电压自补偿的有机发光器件像素电路及其驱动方法		
公开(公告)号	EP1496495B1	公开(公告)日	2017-01-04
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[标]申请(专利权)人(译)	三星斯笛爱股份有限公司		
申请(专利权)人(译)	三星SDI CO. , LTD.		
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优先权	1020030045610 2003-07-07 KR		
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摘要(译)

能够通过自补偿阈值电压实现高灰度表示的有机发光装置中的像素电路及其驱动方法。像素电路包括用于响应于施加的驱动电流而发光的电致发光元件。第一晶体管响应于当前扫描线信号传递数据信号电压。第二晶体管响应于数据信号电压产生驱动电流以驱动电致发光元件。第三晶体管响应于电流扫描信号以二极管的形式连接第二晶体管，以自补偿第二晶体管的阈值电压。电容器存储传送到第二晶体管的数据信号电压。第四晶体管响应于当前的发光信号将电源电压传送到第二晶体管。第五晶体管响应于当前的发光信号提供从第二晶体管提供的用于电致发光元件的驱动电流。

scan[n-1]



scan[n]

