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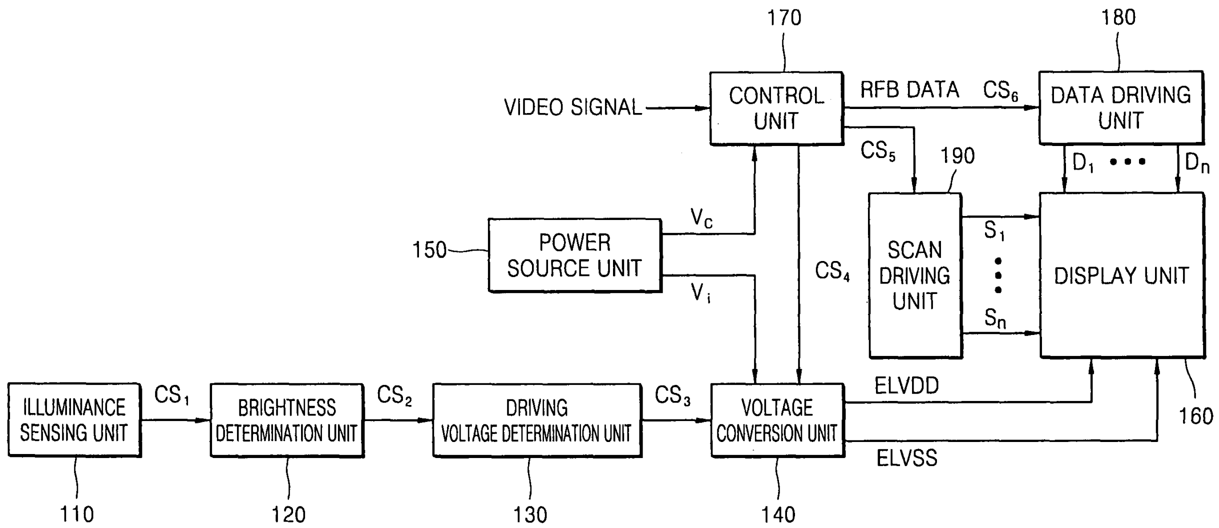
(54) **Organic light emitting diode (OLED) display and a method of driving the same**

(57) An organic light emitting diode (OLED) display includes an illuminance sensing unit configured to sense an external illuminance, a brightness determination unit configured to determine a brightness of the OLED display according to an illuminance sensed by the illuminance sensing unit, a driving voltage determination unit configured to determine a driving voltage corresponding with a current saturation point of the OLED display, the driving voltage being determined based at least in part on a driving current and the brightness determined by the brightness determination unit, a voltage conversion unit configured to receive an input voltage, generate a first voltage higher than the input voltage, and generate a second voltage lower than the input voltage, and a display unit configured to receive the first and second voltages from the voltage conversion unit and display an image.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The invention relates to a display apparatus capable of being driven with reduced power consumption, and a method of driving the same.

2. Description of the Related Art

[0002] Recently, as digital technology continues to grow, various display apparatuses have been developed. In particular, flat panel displays in which a plurality of pixels constitute images, e.g., liquid crystal displays (LCDs), plasma display panels (PDPs), and organic light emitting diode (OLED) displays have been developed.

[0003] Among these flat panel displays, particular attention has been paid to OLED displays having advantages such as high brightness, self-emission, a wide viewing angle, and a rapid response speed.

[0004] In general, OLED displays emit light in proportion to a driving current supplied to OLEDs of the OLED display from driving transistors. Thus, a desired grayscale may be displayed on the OLED display by adjusting the driving current amount or the duty of the emission duration of the OLEDs.

[0005] Meanwhile, various attempts have been made to create high-quality images by driving an OLED display with low power. For example, OLED displays have been developed that may be capable of performing an auto brightness control (ABC) function such that brightness may be automatically adjusted according to an external illuminance. In OLED displays such as these, as the illuminance of external light decreases, brightness is reduced. That is, the reduction of brightness is accomplished by reducing a driving current to thereby prevent a waste of power. The brightness may be adjusted according to an external illuminance by using a driving current reducer.

[0006] Generally, as brightness decreases, a driving voltage to reach a current saturation point decreases. Thus, when the illuminance of external light is sensed as being at a low level, and thus brightness of an OLED display may be reduced, a driving current corresponding to the brightness may reach a saturation region at a relatively low driving voltage. However, in conventional OLED displays, a driving voltage may still be provided at a level that may lead to a waste of power.

[0007] Accordingly, there remains a need for an OLED display and a method of driving the same that may address one or more of these limitations of the conventional art.

SUMMARY OF THE INVENTION

[0008] It is an object of the present invention to provide an OLED display that may be operated with reduced power consumption as compared to the conventional art.

[0009] It is another object of the present invention to provide a method of driving an OLED display at a reduced power as compared to the conventional art.

[0010] Accordingly, the invention provides an OLED display including an illuminance sensing unit configured to sense an external illuminance, a brightness determination unit configured to determine a brightness of the OLED display according to an illuminance sensed by the illuminance sensing unit, a driving voltage determination unit configured to determine a driving voltage corresponding with a current saturation point of the OLED display, the driving voltage being determined based at least in part on a driving current and the brightness determined by the brightness determination unit, a voltage conversion unit configured to receive an input voltage, generate a first voltage higher than the input voltage, and generate a second voltage lower than the input voltage, and a display unit configured to receive the first and second voltages from the voltage conversion unit and display an image.

[0011] The illuminance sensing unit may include a photosensor. The brightness determination unit may be configured to access a first lookup table of brightness values of the OLED display corresponding with an illuminance. Furthermore, the driving voltage determination unit may be configured to access a second lookup table of a driving voltage at a current saturation point of the OLED display corresponding with a brightness of the OLED display.

[0012] The display unit may include a plurality of pixels, each pixel including a driving transistor having a gate electrode and a first electrode, the gate electrode configured to receive a data voltage and the first electrode configured to receive the first voltage, and an OLED having an anode connected to a second electrode of the driving transistor and a cathode configured to receive the second voltage.

[0013] The voltage conversion unit may include a variable resistance for adjusting the driving voltage and generating the second voltage. The voltage conversion unit may further include a booster converter configured to generate the first voltage, and a buck converter configured to generate the second voltage. The buck converter may include a variable resistance, and the buck converter may be configured to adjust the variable resistance based at least in part on the driving voltage determined by the driving voltage determination unit.

[0014] The invention also provides a method of driving an organic light emitting diode (OLED) display, the method including sensing an external illuminance, determining a brightness of the OLED display according to the sensed illuminance, determining a driving voltage at a current saturation point for the OLED display based at least in part on a driving current corresponding to the determined brightness, receiving an input voltage from an input voltage source, generating a first voltage higher than the input voltage and a second voltage lower than the input voltage, and providing the first voltage and the second voltage to a display unit to display an image on the display unit.

[0015] Determining a brightness of the OLED display may further include accessing a first lookup table of brightness values of the OLED display corresponding with an illuminance. Determining a brightness may further include accessing a first graph of brightness values of the OLED display corresponding with an illuminance.

[0016] Determining a driving voltage may further include accessing a lookup table of a driving voltage at a current saturation point of the OLED display corresponding with a brightness of the OLED display. Determining a driving voltage may further include accessing a graph of driving voltages of the OLED display corresponding with brightness of the OLED display.

[0017] Generating the second voltage may further include adjusting a resistance of a variable resistor in accordance with a control signal corresponding to the determined driving voltage.

[0018] The display unit may include a plurality of pixels, each pixel having a driving transistor having a gate electrode receiving a data voltage, and an OLED having an anode and a cathode, wherein providing the first voltage and the second voltage to the OLED display unit further includes supplying the first voltage to the first electrode of the driving transistor, and supplying the second voltage to a cathode of the OLED.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The above and other features and advantages of the present invention will become more apparent to those of ordinary skill in the art upon making reference to the following description of embodiments of the invention, which is given with reference to the attached drawings, in which:

[0020] FIG. 1 is a block diagram of organic light emitting diode (OLED) display circuitry according to an embodiment of the present invention;

[0021] FIG. 2 is a graph of a relationship between a driving current and a driving voltage supplied to the OLED display circuitry illustrated in FIG. 1;

[0022] FIG. 3 is a graph of a relationship between brightness and a driving voltage of the OLED display circuitry illustrated in FIG. 1;

[0023] FIG. 4 is a circuit diagram of a voltage conversion unit that may supply a first voltage to a display unit of the OLED display circuitry illustrated in FIG. 1;

[0024] FIG. 5 is a circuit diagram of a voltage conversion unit that may supply a second voltage to the display unit of the OLED display circuitry illustrated in FIG. 1; and

[0025] FIG. 6 is a circuit diagram of a unit pixel of an OLED display according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0026] The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which embodiments of the invention are illustrated. The invention may, however, be embodied in different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

[0027] In the accompanying drawings, dimensions may be exaggerated for clarity of illustration. Furthermore, although the terms first, second, etc. may be used herein to describe various elements, these elements should not be limited by these terms. These terms are used to distinguish one element from another. For example, a first element could be termed a second element, and similarly, a second element could be termed a first element, without departing from the scope of the present invention. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

[0028] Additionally, it will be understood that when an element is referred to as being "connected" or "coupled" to another element, it can be directly connected or coupled to the other element or intervening elements may be present. In contrast, when an element is referred to as being "directly connected" or "directly coupled" to another element, there are no intervening elements present. Other words used to describe the relationship between elements should be interpreted in a like fashion (e.g., "between" versus "directly between," "adjacent" versus "directly adjacent", etc.).

[0029] FIG. 1 is a block diagram of circuitry of an organic light emitting diode (OLED) display that may be capable of being operated at a reduced power consumption according to an embodiment of the present invention. A method of driving the OLED display circuitry illustrated in FIG. 1 will also be described in detail later with reference to FIG. 1, Table 1 and FIGS. 2 and 3.

[0030] Referring to FIG. 1, the OLED display circuitry includes an illuminance sensing unit 110, a brightness determination unit 120, a driving voltage determination unit 130, a voltage conversion unit 140, and a display unit 160. The illuminance sensing unit 110 includes a photosensor, and may be capable of sensing an external illuminance by converting an external light signal into an electrical signal and measuring the electrical signal.

[0031] The brightness determination unit 120 is capable of determining the appropriate brightness of the OLED display that may correspond to the sensed illuminance. The appropriate brightness is indicated by a first control signal CS_1. The brightness determination unit 120 is further capable of storing a first lookup table showing brightness with respect to an external illuminance and/or a first graph illustrating a relationship between brightness with respect to an external illuminance. An external illuminance and brightness that have been previously stored are embodied in a database, and the database is embodied in the first lookup table or the first graph. The first lookup table and/or the first graph are embodied on a storage medium such as a computer-readable storage medium, for example.

[0032] Table 1 below illustrates a first lookup table in accordance with the embodiment. In Table 1, if an external illuminance is approximately 500 lux, or approximately an indoor lighting level, the corresponding brightness of a display apparatus according to Table 1 may be approximately 90 cd/m2. Furthermore, if the external illuminance is approximately 60 lux, the brightness of the display apparatus according to Table 1 may be approximately 45 cd/m2. However, it is worthwhile to note that this is just one embodiment, and the present invention is not so limited.

[0033]

Table 1

Illuminance (lux)	Brightness (cd/m^2)
500	90
60	45

[0034] Thus, in this embodiment, if the OLED display is placed under indoor lighting conditions, the illuminance sensing unit 110 may sense an external illuminance of approximately 500 lux, and transmit the first control signal CS_1 corresponding to approximately 500 lux to the brightness determination unit 120. The brightness determination unit 120 then selects approximately 90 cd/m2 as an appropriate brightness of the display apparatus according to the first control signal CS_1 corresponding to approximately 500 lux.

[0035] The brightness determination unit 120 transmits a second control signal CS_2 corresponding to the determined brightness to the driving voltage determination unit 130. The driving voltage determination unit 130 receives the second control signal CS_2 and determines a driving voltage at a current saturation point according to the second control signal CS_2.

[0036] As brightness decreases, a driving voltage at a current saturation point decreases. Referring to FIG. 2; there is illustrated a relationship between a driving current and a driving voltage with respect to a current saturation point. The driving current and the driving voltage are supplied to an OLED of the OLED display and, as a driving current I_{ds} of a saturation region decreases, a driving voltage V_{ds} at a current saturation point decreases. Thus, as brightness decreases, the driving voltage V_{ds} at a current saturation point decreases.

[0037] For example, in an OLED display using V_3 as a maximum driving voltage at maximum brightness, it can be seen from Table 1 above that if an external illuminance is sensed as approximately 500 lux and approximately 60 lux, then brightness values are determined as approximately 90 cd/m^2 and approximately 45 cd/m^2, respectively. Accordingly, driving voltages can be determined as V_2 and V_1 according to driving currents corresponding to the brightness values. Thus, in an environment in which an external illuminance is low, it may be desirable to reduce brightness. Accordingly, a driving current is reduced and a driving voltage at a current saturation point is reduced. A driving voltage reduced in such a manner is supplied to the display unit 170, thereby resulting in a reduction in power consumption.

[0038] Additionally, based on the abovedescribed relationship between driving current and driving voltage, the driving voltage determination unit 130 stores a second lookup table showing a driving voltage with respect to brightness (not shown) and/or a graph illustrating a relationship between the brightness and the driving voltage, such as illustrated in FIG. 3, and may employ one or more of these in the operation of an OLED display, for example. The second lookup table and/or the second graph may be embodied on a storage medium such as a computer-readable storage medium, for example.

[0039] Referring to FIG. 3, a graph of a brightness ΔB with respect to a driving voltage ΔV_{ds} is illustrated. The graph includes a regression line that may be obtained by employing existing data or experimental values, for example. The graph illustrated in FIG. 3 has a slope wherein there is an increase of approximately 0.3V in a driving voltage for approximately every 50 cd/m2 increase in brightness, as just an example.

[0040] For example, in an OLED display utilizing a maximum brightness of approximately 150 cd/m^2 and a maximum driving voltage of approximately 9.5V, if the illuminance sensing unit 110 senses an external illuminance of approximately 500 lux, the brightness determination unit 120 determines brightness as approximately 90 cd/m^2 according to the sensed external illuminance, and transmits the second control signal CS_2 corresponding to the determined brightness to the driving voltage determination unit 130. The driving voltage determination unit 130 then determines a driving voltage as a voltage which is approximately 0.36V lower than the maximum driving voltage according to the second control signal CS_2. As one example, based on the maximum brightness, an increment ΔB (i.e., approximately -40%) of a brightness determined according to the external illuminance can be determined according to second control signal CS_2. The calculated brightness increment is applied to the graph illustrated in FIG. 3 in order to obtain a driving voltage increment ΔV_{ds}, i.e., approximately -0.36V. That is, the driving voltage is determined as approximately 9.14V which is approximately 0.36V lower than the maximum driving voltage, i.e., approximately 9.5V.

[0041] If the illuminance sensing unit 110 senses an external illuminance of approximately 60 lux, the brightness determination unit 120 determines brightness corresponding to the external illuminance to be approximately 45 cd/m^2. The driving voltage determination unit

130 calculates a brightness increment ΔB based on the determined brightness, and calculates a driving voltage increment ΔV_{ds} according to the brightness increment ΔB. For example, a brightness increment ΔB is calculated as a reduction of approximately 70% based on the maximum brightness. By applying the brightness increment ΔB to the graph illustrated in FIG. 3, a driving voltage increment ΔV_{ds} is determined as approximately -0.63V. Thus, the driving voltage is determined as approximately 8.87V which is 0.63V lower than 9.5V.

[0042] Therefore, in the above-described two examples, a reduction in power consumption of about 4% and 7%, respectively, can be accomplished. However, it is worthwhile to note that the scope of the present invention is not limited in this respect.

[0043] Furthermore, referring again to FIG. 1, a third control signal CS_3 can be supplied to the voltage conversion unit 140 to control a driving voltage determined by the driving voltage determination unit 130. The driving voltage can be supplied by the driving voltage determination unit 130 to the display unit 160. The voltage conversion unit 140 receives an input voltage V_i from a power source unit 150, e.g., a lithium ion battery, and converts the input voltage V_i into a first voltage ELVDD that is higher than the input voltage V_i and a second voltage ELVSS that is lower than the input voltage V_i. Accordingly, a voltage margin or voltage difference exists between the first voltage ELVDD and the second voltage ELVSS. The first voltage ELVDD and the second voltage ELVSS are supplied to the display unit 160.

[0044] The voltage conversion unit 140 receives the third control signal CS_3 that controls the driving voltage supplied to the display unit 160, and adjusts the second voltage ELVSS according to the third control signal CS_3. In the voltage conversion unit 140, a variable resistance varying in response to the third control signal CS_3 is connected to an output terminal of a circuit determining the second voltage ELVSS. Thus, the second voltage ELVSS is adjusted using the variable resistance. The voltage conversion unit 140 will be described in greater detail with reference to FIGS. 4 and 5, later.

[0045] The current embodiment of the present invention illustrates that the voltage conversion unit 140 is capable of adjusting the second voltage ELVSS such that an adjusted driving voltage can be supplied to the display unit 160, but the scope of the present invention is not limited thereto. The second voltage ELVSS can also be adjusted using a lookup table and/or a graph illustrating a relationship between a driving voltage increment, brightness, a brightness increment, and/or a driving voltage with respect to a sensed illuminance, and the second voltage ELVSS.

[0046] Furthermore, continuing with FIG. 1, the first voltage ELVDD and the second voltage ELVSS generated in the voltage conversion unit 140 can be supplied to the display unit 160. The display unit 160 includes a plurality of pixels defined by a plurality of data lines D_1 through D_n and a plurality of scan lines S_1 through S_n. Each pixel includes a driving transistor and an OLED.

[0047] The OLED display further includes a data driving unit 180 and a scan driving unit 190. The data driving unit 180 is capable of supplying data voltages corresponding to image data to the pixels. The scan driving unit 190 is capable of selectively supplying selection signals to the pixels to select pixels to be displayed. The data driving unit 180 is further capable of supplying data voltages to the pixels via the data lines D_1 through D_n, and the scan driving unit 190 is further capable of selectively supplying selection signals to the pixels via the scan lines S_1 through S_n.

[0048] The data driving unit 180 receives a sixth control signal CS_6 and image data RGB data from a control unit 170, and the scan driving unit 190 receives a fifth control signal CS_5 from the control unit 170. The control unit 170 generates image data RGB data corresponding to an input image signal video signal, and control signals CS_4, CS_5, and CS_6, e.g., a vertical synchronization signal, a horizontal synchronization signal, and a clock signal. The control unit 170 generates the fourth control signal CS_4 controlling the first voltage ELVDD and the second voltage ELVSS, such that the first voltage ELVDD and the second voltage ELVSS can be stably supplied to the display unit 160 from the voltage conversion unit 140, and can additionally supply the fourth control signal CS_4 to the voltage conversion unit 140. The control unit 170 can receive a predetermined voltage V_C from the power source unit 150 and perform the above-described signal processing.

[0049] Hereinafter, the voltage conversion unit 140 of the OLED display circuitry illustrated in FIG. 1 will be described in more detail with reference to FIGS. 4 and 5.

[0050] FIG. 4 illustrates a circuit diagram of a portion of the voltage conversion unit 140. The voltage conversion unit 140 is capable of supplying the first voltage ELVDD to the display unit 160 of the OLED display illustrated in FIG. 1. FIG. 5 illustrates a circuit diagram of a portion of the voltage conversion unit 140. The voltage conversion unit 140 is capable of supplying the second voltage ELVSS to the display unit 160 of the OLED display illustrated in FIG. 1.

[0051] FIG. 4 illustrates a booster converter 142. The booster converter 142 is capable of generating the first voltage ELVDD from the input voltage V_i. The booster converter 142 includes a first inductor L_1, a first switching device Q_1 which is turned on/off in response to the fourth control signal CS_4 supplied from the control unit 170, a first reflux diode D_1, a first capacitor C_1, and a resistance R_1.

[0052] If the first switching device Q_1 is turned on in response to the fourth control signal CS_4, energy is accumulated in the first inductor L_1, and charges accumulated in the first capacitor C_1 are discharged and provided as an output. If the first switching device Q_1 is turned off in response to the fourth control signal CS_4, the energy accumulated in the inductor L_1 and the input voltage V_1 are added to a voltage applied to both terminals of the first capacitor C_1, thereby outputting the first voltage ELVDD.

[0053] FIG. 5 illustrates a buck converter 141 generating the second voltage ELVSS from the input voltage V_i, but the present invention is not limited thereto. The buck converter 141 includes a second switching device Q_2 which can be turned on/off in response to the fourth control signal CS_4, a second reflux diode D_2, and a low pass filter including a second inductor L_2 and a second capacitor C_2. A variable resistance R_2 is connected to both terminals of the second capacitor C_2, and thus, the buck converter 141 is capable of adjusting the second voltage ELVSS according to the variable resistance R_2.

[0054] The third control signal CS_3 controls a driving voltage determined by the driving voltage determination unit 130. The driving voltage determined by the driving voltage determination unit 130 can then be supplied to the display unit 160. The variable resistance R_2 adjusts the second voltage ELVSS according to the driving voltage.

[0055] If the second switching device Q_2 is turned on in response to the fourth control signal CS_4, the input voltage V_i is output through the low pass filter. If the second switching device Q_2 is turned off in response to the fourth control signal CS_4, energy accumulated in the second inductor L_2 is discharged through the second reflux diode D_2 and output. At this time, the second voltage ELVSS is adjusted by the variable resistance R_2. Variable resistance R_2 varies in response to the third control signal CS_3. The third control signal CS_3 controls the driving voltage determined by the driving voltage determination unit 130.

[0056] The first voltage ELVDD and the second voltage ELVSS are applied to driving transistors and OLEDs of the display unit 160. A detailed description thereof will be provided hereinafter with reference to FIG. 6.

[0057] Illustrated in FIG. 6 is a unit pixel of an OLED display. The unit pixel is capable of receiving a first voltage and a second voltage, but the present invention is not limited thereto.

[0058] In FIG. 6, a unit pixel is defined by a scan line S[n] and a data line D[n]. The scan line S[n] is connected to a gate electrode of a switch transistor T_S, a first electrode of the switch transistor T_S is connected to the data line D[n], and a second electrode of the switch transistor T_S is connected to a first terminal of a capacitor C_{st} and a gate electrode of a driving transistor T_d.

[0059] A first voltage ELVDD is applied to a first terminal of the driving transistor T_d and a second terminal of the capacitor C_{st}. A second terminal of the driving transistor T_d is connected to an anode of an OLED, and a second voltage ELVSS is applied to a cathode of the OLED.

[0060] In the current embodiment of the present invention, the second voltage ELVSS is adjusted to supply a driving voltage V_{ds} determined by a driving voltage determination unit (element 130 of FIG. 1) to a display unit (element 160 of FIG. 1). The adjusted second voltage ELVSS is supplied to the cathode of the OLED.

[0061] The OLED receives a driving current I_{ds}. The driving current I_{ds} is determined by a data voltage supplied from the gate electrode of the driving transistor T_d. The OLED further receives the first voltage ELVDD applied to a first electrode of the driving transistor T_d, and emits light. In this example, the driving current I_{ds} determines brightness.

[0062] If the first voltage ELVDD is adjusted to supply a driving voltage determined according to a sensed illuminance to the display unit, the driving current I_{ds} and the brightness are changed. Thus, in order to correct the changed brightness to a desired brightness, a driving procedure, e.g., an adjustment of a data voltage, is performed. In one embodiment, the second voltage ELVSS is adjusted to correct the changed brightness rather than adjusting the first voltage ELVDD, so that the voltage adjustment does not affect the driving current I_{ds}.

[0063] As described above, in an OLED display and a method of driving the same in accordance with the present invention, based on the characteristics of a driving voltage at a current saturation point which varies according to brightness, a driving voltage may be determined so as to maintain a driving voltage margin, for example. That is, the brightness of an OLED display can be determined to vary according to an external illuminance, and a driving voltage at a current saturation point can be determined according to the variable brightness, and thereby constantly maintain a driving voltage margin. A reduction in power consumption of the OLED display can therefore be realized.

[0064] In addition, according the present invention, a voltage applied to a cathode of an OLED can be adjusted so as to supply a determined driving voltage to a display unit. The voltage supplied to the cathode of an OLED can be adjusted without affecting a driving current supplied to the OLED. Adjusting a determined driving voltage without affecting a driving current supplied to an OLED can make operation of an OLED display easier.

[0065] Embodiments of the present invention have been disclosed herein, and although specific terms are employed, they are used and are to be interpreted in a generic and descriptive sense only and not for purpose of limitation. Accordingly, it will be understood by those of ordinary skill in the art that various changes in form and details may be made without departing from the scope of the present invention as set forth in the following claims.

Claims

1. An organic light emitting diode (OLED) display, comprising:

an illuminance sensing unit configured to sense an external illuminance;
a brightness determination unit configured to de-

termine a brightness of the OLED display according to an illuminance sensed by the illuminance sensing unit;
a driving voltage determination unit configured to determine a driving voltage corresponding with a current saturation point of the OLED display, the driving voltage being determined based at least in part on a driving current and the brightness determined by the brightness determination unit;
a voltage conversion unit configured to receive an input voltage, generate a first voltage higher than the input voltage, and generate a second voltage lower than the input voltage; and
a display unit configured to receive the first and second voltages from the voltage conversion unit and display an image.

2. An OLED display as claimed in claim 1, wherein the illuminance sensing unit comprises a photosensor.

3. An OLED display as claimed in claim 1 or 2, wherein the brightness determination unit is configured to access a first lookup table of brightness values of the OLED display corresponding with an illuminance.

4. An OLED display as claimed in any preceding claim, wherein the driving voltage determination unit is configured to access a second lookup table of a driving voltage at a current saturation point of the OLED display corresponding with a brightness of the OLED display.

5. An OLED display as claimed in any preceding claim, wherein the display unit includes a plurality of pixels, each pixel having:

a driving transistor having a gate electrode and a first electrode, the gate electrode configured to receive a data voltage and the first electrode configured to receive the first voltage; and
an OLED having an anode connected to a second electrode of the driving transistor and a cathode configured to receive the second voltage.

6. An OLED display as claimed in claim 5, wherein the voltage conversion unit comprises:

a booster converter configured to generate the first voltage; and
a buck converter configured to generate the second voltage.

7. An OLED display as claimed in claim 6, wherein the buck converter includes a variable resistance and is configured to adjust the variable resistance based at least in part on the driving voltage determined by the driving voltage determination unit.

8. An OLED display as claimed in any preceding claim, wherein the voltage conversion unit includes a variable resistance for adjusting the driving voltage and generating the second voltage.

9. A method of driving an organic light emitting diode (OLED) display, the method comprising:

sensing an external illuminance;
determining a brightness of the OLED display according to the sensed illuminance;
determining a driving voltage at a current saturation point for the OLED display based at least in part on a driving current corresponding to the determined brightness;
receiving an input voltage from an input voltage source;
generating a first voltage higher than the input voltage and a second voltage lower than the input voltage; and
providing the first voltage and the second voltage to a display unit to display an image on the display unit.

10. A method as claimed in claim 9, wherein determining a brightness of the OLED display further includes accessing a first lookup table of brightness values of the OLED display corresponding with an illuminance.

11. A method as claimed in claim 10, wherein determining a brightness of the OLED display further includes accessing a first graph of brightness values of the OLED display corresponding with an illuminance.

12. A method as claimed in claim 9, 10 or 11, wherein determining a driving voltage includes accessing a lookup table of a driving voltage at a current saturation point of the OLED display corresponding with a brightness of the OLED display.

13. A method as claimed in claim 12, wherein determining a driving voltage further includes accessing a graph of driving voltages of the OLED display corresponding with brightness of the OLED display.

14. A method as claimed in one of claims 9 to 13, wherein the generation of the second voltage includes adjusting a resistance of a variable resistor in accordance with a control signal corresponding to the determined driving voltage.

15. A method as claimed in one of claims 9 to 14, wherein the display unit comprises a plurality of pixels, each pixel having:

a driving transistor having a gate electrode receiving a data voltage; and an OLED having an anode and a cathode,

wherein providing the first voltage and the second voltage to the OLED display unit further includes supplying the first voltage to the first electrode of the driving transistor, and supplying the second voltage to a cathode of the OLED.

FIG. 1

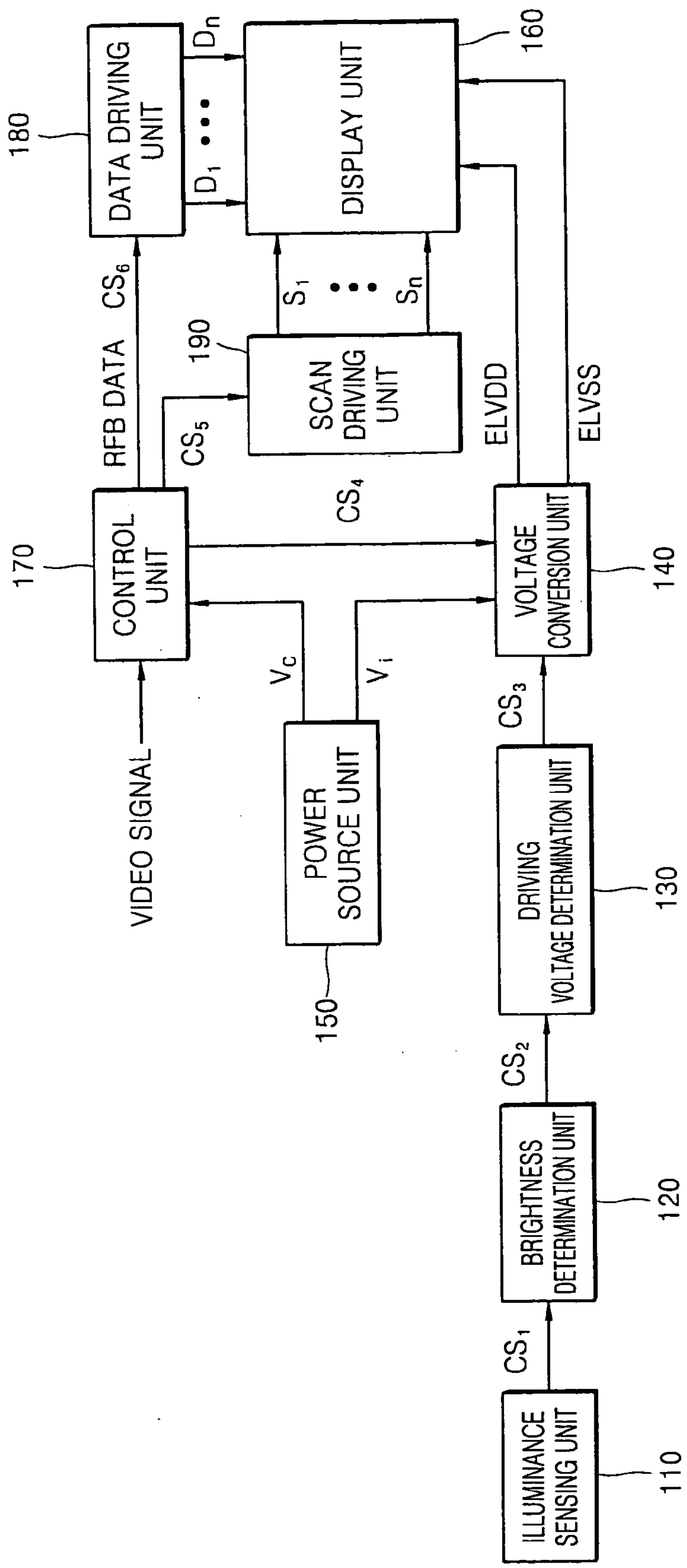

VIDEO SIGNAL
CONTROL UNIT
170
RFB DATA
CS_6
CS_5
DATA DRIVING UNIT
180
D_1
D_n
DISPLAY UNIT
160
SCAN DRIVING UNIT
190
S_1
S_n
CS_4
ELVDD
ELVSS
POWER SOURCE UNIT
150
V_C
V_i
VOLTAGE CONVERSION UNIT
140
CS_3
DRIVING VOLTAGE DETERMINATION UNIT
130
CS_2
BRIGHTNESS DETERMINATION UNIT
120
CS_1
ILLUMINANCE SENSING UNIT
110

FIG. 2

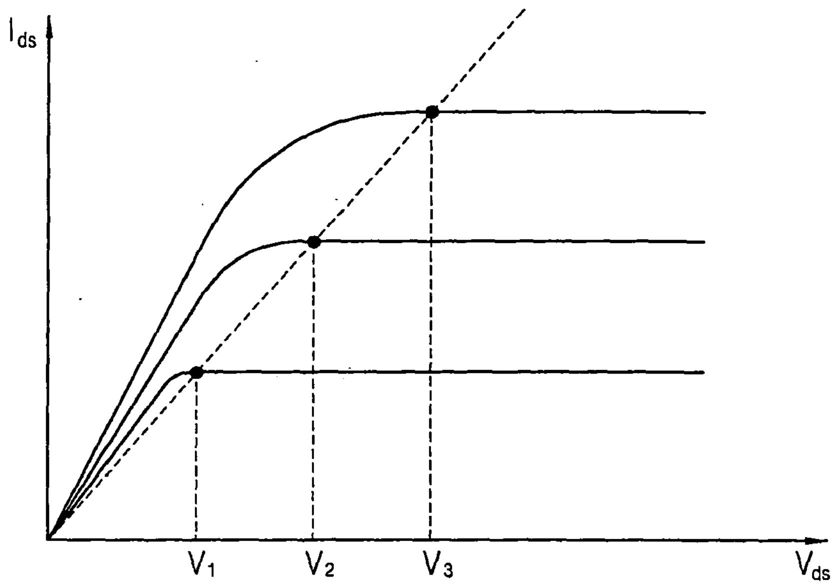


FIG. 3

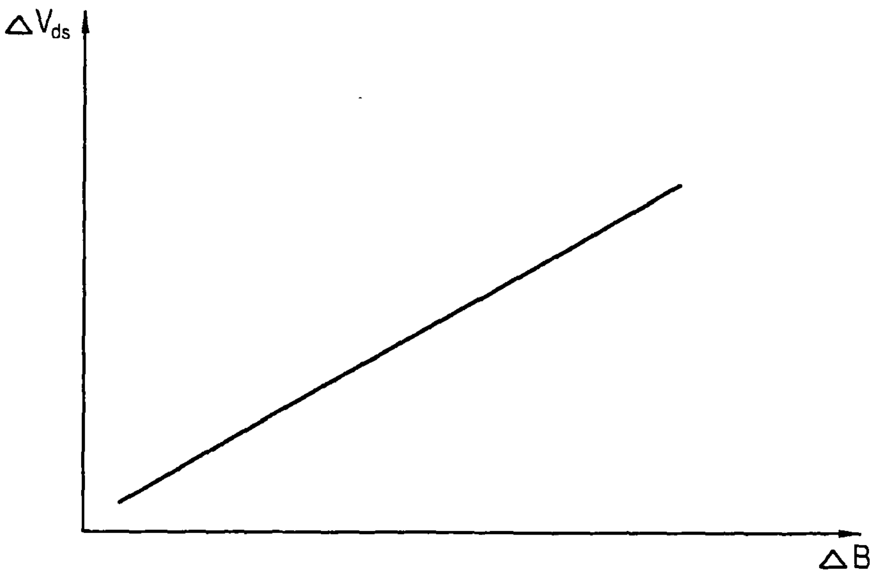


FIG. 4

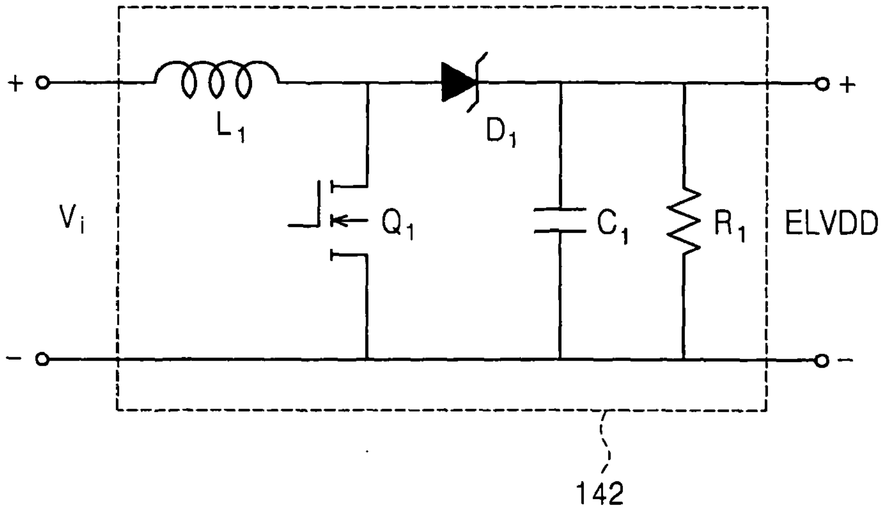


FIG. 5

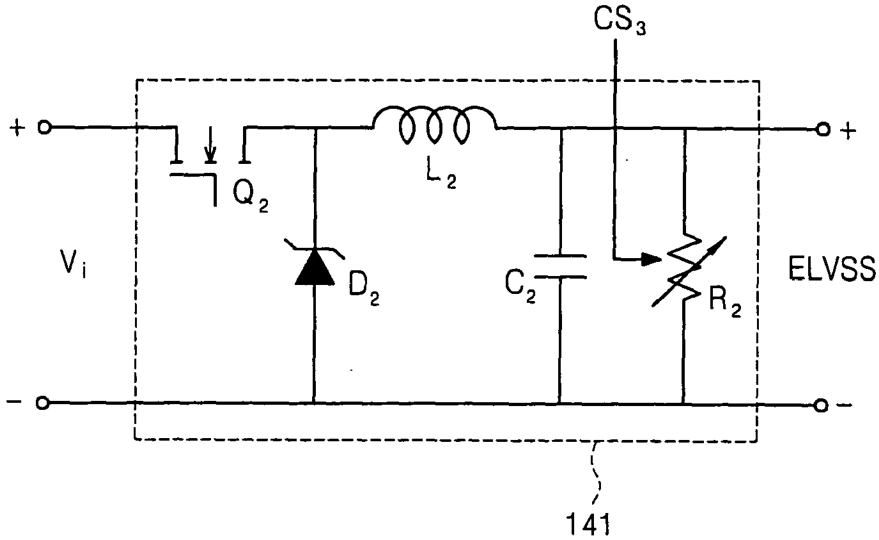
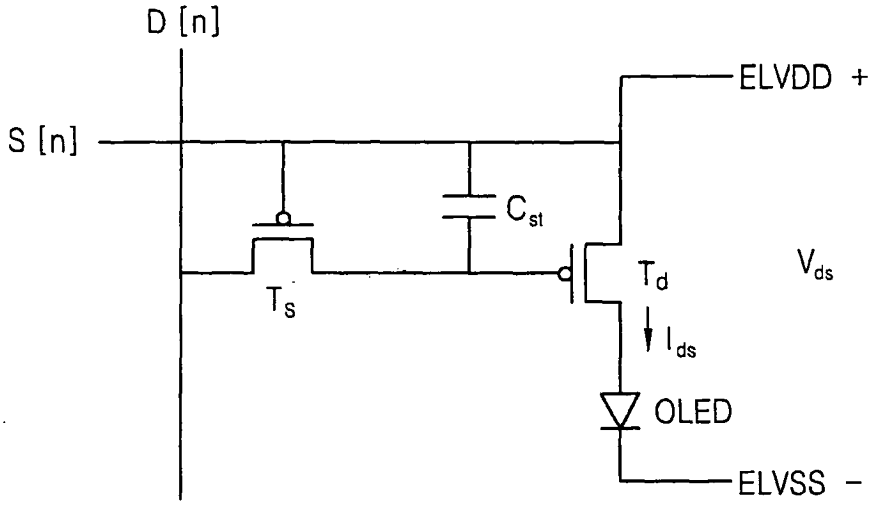


FIG. 6



专利名称(译)	有机发光二极管（OLED）显示器及其驱动方法		
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摘要(译)

有机发光二极管（OLED）显示器包括：照度感测单元，被配置为感测外部照度;亮度确定单元，被配置为根据由照度感测单元感测的照度来确定OLED显示器的亮度;驱动电压确定单元被配置为确定与OLED显示器的当前饱和点对应的驱动电压，驱动电压至少部分地基于由亮度确定单元确定的驱动电流和亮度来确定，电压转换单元被配置为接收输入电压，产生高于输入电压的第一电压，并产生低于输入电压的第二电压，以及显示单元，被配置为从电压转换单元接收第一和第二电压并显示图像。

FIG. 1