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(54) **ORGANIC LIGHT EMITTING DISPLAY DEVICE AND METHOD FOR DRIVING THE SAME**

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(73) Assignee: **Samsung Display Co., Ltd.**, Yongin, Gyeonggi-Do (KR)

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(22) Filed: **Jan. 7, 2009**

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G09G 3/32 (2006.01)
G09G 3/36 (2006.01)
G09G 5/00 (2006.01)
G06F 3/038 (2006.01)

(52) **U.S. Cl.**
USPC **345/100**; 345/204; 345/211; 345/82; 345/98; 345/99

(58) **Field of Classification Search**
USPC 345/204, 211, 82, 98–100
See application file for complete search history.

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(57) **ABSTRACT**

An organic light emitting display device having low power consumption is disclosed. Power in the device is saved by precharging data lines if the data of the current frame has a higher voltage than the data of the previous frame. Accordingly, if the data lines are precharged the data line driving buffer does not need to use as much power.

19 Claims, 3 Drawing Sheets

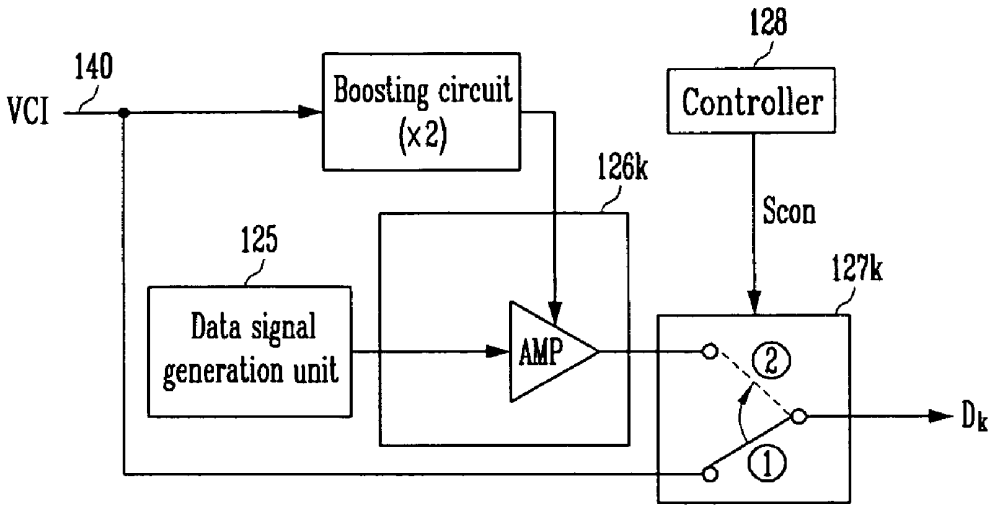


FIG. 1

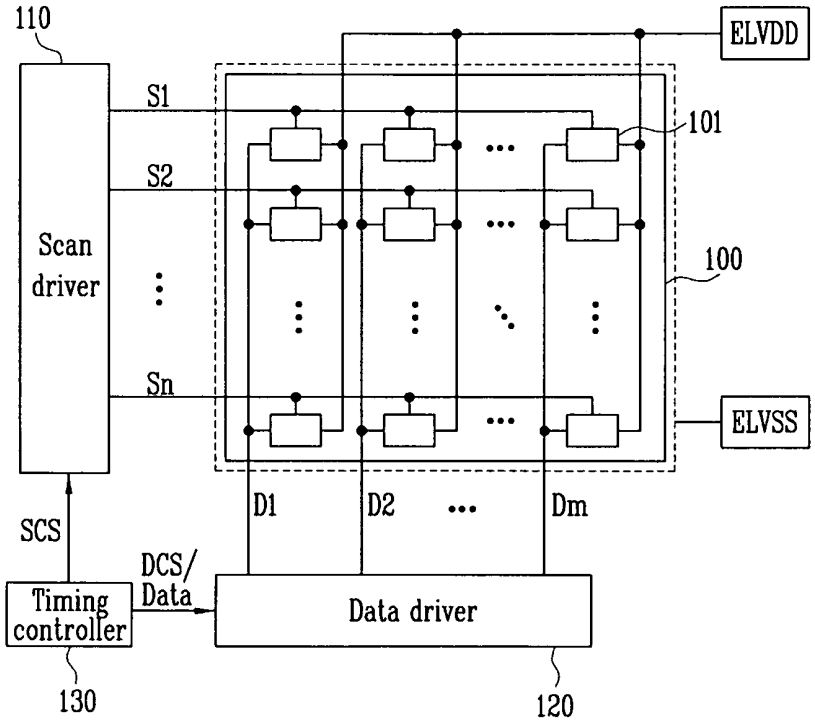

110
ELVDD
S1
101
S2
Scan driver
100
Sn
ELVSS
D1
D2
Dm
SCS
DCS/ Data
Timing controller
Data driver
130
120

FIG. 2

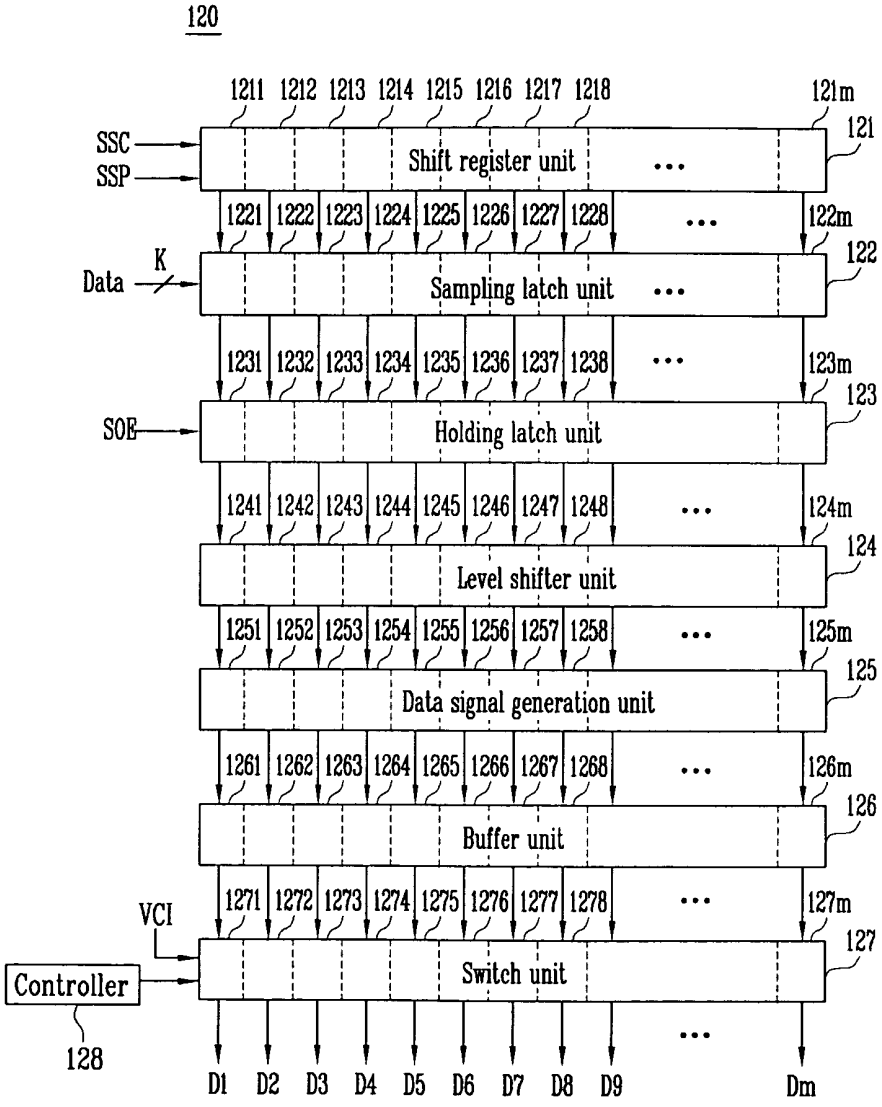

120
1211 1212 1213 1214 1215 1216 1217 1218
121m
121
SSC
SSP
Shift register unit
1221 1222 1223 1224 1225 1226 1227 1228
122m
122
Data
K
Sampling latch unit
1231 1232 1233 1234 1235 1236 1237 1238
123m
123
SOE
Holding latch unit
1241 1242 1243 1244 1245 1246 1247 1248
124m
124
Level shifter unit
1251 1252 1253 1254 1255 1256 1257 1258
125m
125
Data signal generation unit
1261 1262 1263 1264 1265 1266 1267 1268
126m
126
Buffer unit
1271 1272 1273 1274 1275 1276 1277 1278
127m
127
VCI
Switch unit
Controller
128
D1 D2 D3 D4 D5 D6 D7 D8 D9 Dm

FIG. 3

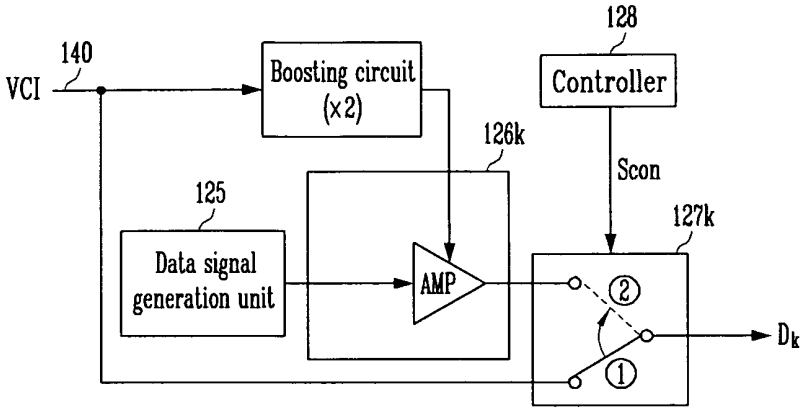


FIG. 4

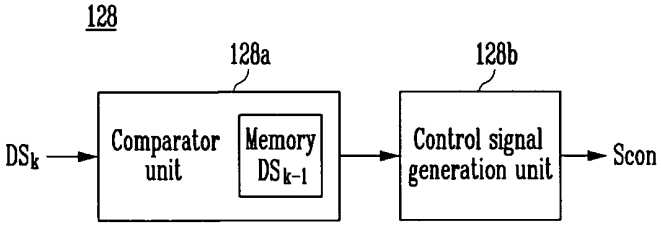
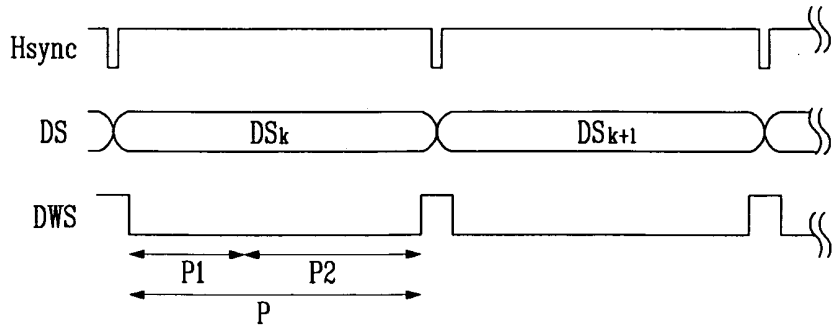


FIG. 5



ORGANIC LIGHT EMITTING DISPLAY DEVICE AND METHOD FOR DRIVING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to and the benefit of Korean Patent Application No. 10-2008-0019584, filed on Mar. 3, 2008, in the Korean Intellectual Property Office, the entire content of which is incorporated herein by reference.

BACKGROUND

1. Field

The field relates to an organic light emitting display device and a method of driving the same, and more particularly to an organic light emitting display device having low power consumption, and a method of driving the same.

2. Description of the Related Technology

In recent years, various flat panel displays have been developed. The flat panel displays are light-weight and small-sized as compared with cathode ray tubes. Of the flat panel display devices, the organic light emitting display device is viewed as a next-generation display device because the organic light emitting display device has excellent luminance and color purity using an organic compound as a light emitting material.

An organic light emitting display device is thin, light-weight and driven with low power consumption, and therefore it has been expected that the organic light emitting display device may be widely used in the field of portable display devices, etc.

However, the organic light emitting display device consumes a large amount of electric current to emit bright light since the light is emitted according to the amount of the electric current.

Accordingly, it is necessary to further reduce power consumption of the organic light emitting display device so as to apply to the field of various display devices.

SUMMARY OF CERTAIN INVENTIVE ASPECTS

One aspect is organic light emitting display device. The device includes a pixel unit having a plurality of pixels disposed near intersection points of scan lines and data lines, and a data driver configured to generate a data signal corresponding to received data and a data drive power source and to supply the generated data signal to the data lines. The data driver includes a data signal generation unit configured to generate a data signal corresponding to the received data, a buffer unit configured to receive the data signal and to generate a buffered data signal, a switch unit to selectively couple the data lines to the data drive power source or the buffer unit, and a controller configured to control the switch unit.

Another aspect is a method of driving an organic light emitting display device. The method includes dividing a data input period, during which a data signal is supplied to a plurality of data lines, into a plurality of periods, precharging the data lines by coupling the data lines to an input line of a data drive power source during one or more periods of the plurality of the periods, and charging the data signal in the data lines by coupling the data lines to an output line of an amplifier during the other of the plurality of periods.

Another aspect is an organic light emitting display device. The device includes a pixel unit with a plurality of pixels, each pixel associated with at least one data line, and a data driver configured to precharge the data lines if the data lines are to be driven with a voltage higher than the voltage with which the data lines were driven in the previous driving period.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, together with the specification, illustrate exemplary embodiments, and, together with the description, serve to explain certain inventive aspects.

FIG. **1** is a block diagram showing an organic light emitting display device according to one exemplary embodiment.

FIG. **2** is a block diagram showing a data driver shown in FIG. **1**.

FIG. **3** is a block diagram showing a buffer unit and a switch unit shown in FIG. **2**.

FIG. **4** is a block diagram showing a controller shown in FIGS. **2** and **3**.

FIG. **5** is a timing diagram showing a method for driving an organic light emitting display device according to one exemplary embodiment.

DETAILED DESCRIPTION OF CERTAIN INVENTIVE EMBODIMENTS

Hereinafter, certain exemplary embodiments 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 not only directly coupled to the second element but may also be indirectly coupled to the second element via a third element. Further, some of the elements that are not essential to the complete understanding of the invention are omitted for clarity. Also, like reference numerals generally refer to like elements throughout.

FIG. **1** is a block diagram showing an organic light emitting display device according to one exemplary embodiment.

Referring to FIG. **1**, the organic light emitting display device includes a pixel unit **100**, a scan driver **110**, a data driver **120**, and a timing controller **130**.

The pixel unit **100** includes a plurality of pixels **101** disposed near intersection points of scan lines (S**1** to Sn) and data lines (D**1** to Dm).

Each of the pixels **101** receives a data signal from the data lines (D**1** to Dm) when a scan signal is supplied from the scan lines (S**1** to Sn). Each of the pixels **101** further receives first and second pixel power sources (ELVDD and ELVSS) from for example, a power supply unit (not shown). The pixels **101** display an image by emitting the light with luminance corresponding to the data signal.

The scan driver **110** receives a scan drive power source, and receives a scan drive control signal (SCS) from the timing controller **130** to generate a scan signal. The scan signal generated in the scan driver **110** is sequentially supplied to the scan lines (S**1** to Sn).

The data driver **120** receives a data drive power source, and receives a data drive control signal (DCS) and data (Data) from the timing controller **130** to generate a data signal. The data signal generated in the data driver **120** is supplied to the data lines (D**1** to Dm) and are generally synchronized with the scan signal. That is to say, the data driver **120** supplies one line (one row) of the data signal during every horizontal period.

The data signal supplied to the data lines (D**1** to Dm) is transmitted to the pixels **101** selected by the scan signal. Then, each of the pixels **101** emits the light with luminance corresponding to the data signal.

The timing controller **130** generates a scan drive control signal (SCS) and a data drive control signal (DCS) according to the synchronizing signals. The scan drive control signal (SCS) generated in the timing controller **130** is supplied to the scan driver **110**, and the data drive control signal (DCS) is supplied to the data driver **120**. The scan drive control signal (SCS) may include a gate start pulse, a gate shift clock, a gate output enable signal, and the like. The data drive control signal (DCS) may include a source start pulse, a source shift clock, a source output enable signal, and the like. Also, the timing controller **130** supplies data (Data) to the data driver **120**.

FIG. **2** is a block diagram showing a data driver shown in FIG. **1**.

Referring to FIG. **2**, the data driver **120** according to one exemplary embodiment includes a shift register unit **121**, a sampling latch unit **122**, a holding latch unit **123**, a level shifter unit **124**, a data signal generation unit **125**, a buffer unit **126**, a switch unit **127**, and a controller **128**.

The shift register unit **121** receives a source shift clock (SSC) and a source start pulse (SSP) from the timing controller **130**. The shift register unit **121** receiving the source shift clock (SSC) and the source start pulse (SSP) shifts a source start pulse (SSP) to correspond to the source shift clock (SSC). Therefore, the shift register unit **121** sequentially generates m (m is an integer) sampling signals. For this purpose, the shift register unit **121** includes m shift registers (**1211** to **121***m*).

The sampling latch unit **122** sequentially stores data (Data) supplied to the sampling latch unit **122** to correspond to the sampling signal sequentially supplied from the shift register unit **121**. For this purpose, the sampling latch unit **122** includes m sampling latches **1221** to **122***m* to store m data (Data). Here, each of the sampling latches **1221** to **122***m* is set to a size to store k-bit data (Data).

The holding latch unit **123** receives data (Data) form the sampling latch unit **122** in response to a source output enable (SOE) signal supplied from the timing controller **130**, and temporally stores the source output enable (SOE) signal. The holding latch unit **123** supplies the stored data (Data) to a level shifter unit **124** at the same time. For this purpose, the holding latch unit **123** includes m holding latches **1231** to **123***m*. Here, each of the holding latches **1231** to **123***m* is set to a size to store k-bit data (Data).

The level shifter unit **124** expands a voltage range of the data (Data) by shifting up or shifting down a voltage level of the data (Data) supplied from the holding latch unit **123**. For this purpose, the level shifter unit **124** includes m level shifters **1241** to **124***m*. The data (Data) whose voltage range is expanded in the level shifter unit **124** is supplied to the data signal generation unit **125**.

The data signal generation unit **125** generates a data signal corresponding to a bit value (or grey level value) of the data (Data), and supplies the generated data signal to the buffer unit **126**. For this purpose, the data signal generation unit **125** includes m digital-analog converters (DAC) **1251** to **125***m*, one disposed in each channel.

The buffer unit **126** transmits a data signal to the data lines (D**1** to Dm) through the switch unit **127**, the data signal being supplied from the data signal generation unit **125**. For this purpose, the buffer unit **126** includes m output amplifiers **1261** to **126***m*, one disposed in each channel.

The switch unit **127** selectively couples the data lines (D**1** to Dm) to either the output lines of the output amplifiers **1261** to **126***m* during a data input period, or a power supply voltage for buffer unit **126**, where the data input period is a period that a data signal is supplied to the data lines (D**1** to Dm) according to the control signal supplied from the controller **128**. In the embodiment shown, the power supply voltage for buffer unit **126** is provided to the switch unit **127** via input VCI. The switch unit **127** includes m switches **1271** to **127***m*, one disposed in each channel to selectively couple the data lines (D**1** to Dm) to the output lines of the output amplifiers **1261** to **126***m* or to the buffer unit **126**.

The controller **128** generates a control signal controlling the switch unit **127**, and supplies the generated control signal to the switch unit **127**. Configurations and operations of the buffer unit **126**, the switch unit **127** and the controller **128** will be described later in more detail.

FIG. **3** is a block diagram showing a data signal generation unit **125**, a buffer unit **126***k* and a switch unit **127***k* such as those shown in FIG. **2**. A k^{th} channel of the switch unit **127** and the buffer unit **126** to supply a data signal to a k^{th} data line (Dk) are shown in FIG.**3**.

Referring to FIG. **3**, the buffer unit **126***k* includes an output amplifier (hereinafter, referred to as an AMP) **126***k* coupled to an output of the data signal generation unit **125**. AMP **126***k* amplifies and supplies an electric current while substantially maintaining a voltage level of the data signal supplied from the data signal generation unit **125**.

Here, a drive power source having a voltage level greater than the voltage level of the data signal should be supplied to the AMP **126***k* so as to drive the AMP **126***k*. However, a voltage level of the data drive power source (VCI) supplied from the power supply unit may be lower than the voltage level to drive the AMP **126***k*. Therefore, a boosting circuit to boost the data drive power source (VCI) is further provided in the data driver **120** in this case. The AMP **126***k* is driven by receiving a boost power source boosted in the boosting circuit.

For example, assume that a voltage level of the data signal is in a range of 1 to 4.2 V, and a voltage level of the data drive power source (VCI) supplied from the power supply unit is 2.8 V. A boosting circuit may be provided in the data driver **120**, where the boosting circuit functioning to boost a voltage level of the data drive power source (VCI) by a factor of two to supply a drive power source of 5.6V for AMP **126***k*. In this case, if an electric current consumed at AMP **126***k* is I (mA), an input current of the data drive power source (VCI) needs 2I (mA) or more. That is to say, when a data signal is supplied to the data line (Dk) by coupling the data line (Dk) to the output lines of the AMP **126***k* during a data input period, an electric current consumed in the AMP **126***k* is increased, which leads to the increase in the power consumption.

Therefore, a switch unit **127** coupled between the buffer unit **126** and the data lines (D) is provided to prevent the increase in the power consumption. Switch unit **127** includes a switch **127***k* to selectively couple the data line (Dk) to an output line of the AMP **126***k* or an input line **140** of the data drive power source (VCI).

An operation of the switch unit **127** will be described. As an example, the data signal of the previous frame has a lower voltage level than the data signal of the current frame. In this case, the switch unit **127** may precharge the data line (Dk) and/or the storage capacitors of the pixels according to the control signal (Scon) supplied from the controller **128** by coupling the data line (Dk) to the input line **140** of the data drive power source (VCI) as shown in $\hat{1}$ of FIG. **3** during one period of the data input period. The switch unit **127** may supply a data signal to the data line (Dk) by coupling the data line (Dk) to an output line of the AMP **126***k* as shown in $\hat{2}$ of FIG. **3** during other periods of the data input period.

As described above, when the data input period is divided into a plurality of periods and the data line (Dk) and/or the

storage capacitor of the pixel are precharged during one period, a current path is formed in the output line of the AMP **126***k* during the precharge period, and therefore it is possible to reduce consumption in the electric current of the AMP **126***k*. That is to say, the power consumption of the organic light emitting display device may be reduced since the boost power source to boost a data drive power source (VCI) is not used during the precharge period.

In addition, an operation of the switch unit **127** will be described where the data signal of the previous frame has a higher voltage level than the data signal of the current frame. In this case, the switch unit **127** couples the data line (Dk) only to output line of the AMP **126***k*, but not to the input line **140** of the drive power source (VCI) during the data input period. Therefore, it is possible to prevent a voltage level of the data line (Dk) from being unnecessarily reduced to the data drive power source (VCI) in this case.

The operation of the switch unit **127** is carried out by the control signal (Scon) supplied from the controller **128**. For this purpose, the controller **128** is configured as shown in FIG. **4**.

FIG. **4** is a block diagram showing a controller shown in FIGS. **2** and **3**.

Referring to FIG. **4**, the controller **128** includes a comparator unit **128***a* and a control signal generation unit **128***b*.

The comparator unit **128***a* receives a data signal during every frame period, and outputs a comparison signal by comparing the data signal of the previous frame with the data signal (voltage level) of the current frame. For this purpose, the comparator unit **128***a* includes a memory to store frame data signals.

The control signal generation unit **128***b* generates a control signal (Scon) corresponding to the comparison signal supplied from the comparator unit **128***a*, the control signal (Scon) functioning to control the switch unit **127**.

An operation of the controller **128** will be described where the data signal of the previous frame has a lower voltage level than the data signal of the current frame. In this case, the controller **128** couples the data line (Dk) to the input line **140** of the data drive power source (VCI) during one period out of the data input period. The controller **128** controls the switch unit **127** so that the data line (Dk) can be coupled to the output line (an output line of the AMP **126***k*) of the buffer unit **126** during the other periods.

Also, the operation of the controller **128** will be described where the data signal of the previous frame has a higher voltage level than the data signal of the current frame. In this case, the controller **128** controls the switch unit **127** so that the data line (Dk) is coupled to the output line (an output line of the AMP **126***k)* of the buffer unit **126** during the data input period.

FIG. **5** is a timing view showing a method for driving an organic light emitting display device according to one exemplary embodiment.

Referring to FIG. **5**, a data input period (P) in which a data write signal (DWS) to control the supply time of the data signal (Data signal, DS) is set within a first horizontal period as defined by the horizontal synchronizing signal (Hsync).

However, when a data signal of the previous frame has a lower voltage level than a data signal of the current frame, the data input period (P) is divided into a plurality of periods. The data lines (D) and/or the storage capacitors of the pixels are precharged by coupling the data lines (D) to the input lines **140** of the data drive power source (VCI) during one period (P**1**) out of the plurality of periods. Then, the data signal is charged in-the data lines (D) by coupling the data lines (D) to output lines of the AMP in the buffer unit **126** during the other data input period (P**2**), the buffer unit **126** being coupled to an output end of the data signal generation unit **125**.

The procedure is preferably carried out only when the data signal of the previous frame has a lower voltage level than the data signal of the current frame. Therefore, a step to generate a control signal controlling the precharging of the data lines (D) and/or the storage capacitors of the pixels by comparing a voltage level of the data signal of the previous frame with a voltage level of the data signal of the current frame should be carried out prior to the step to generate a control signal.

While the present invention has been described in connection with certain exemplary embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements.

What is claimed is:

1. An organic light emitting display device, comprising:

a pixel unit including a plurality of pixels disposed near intersection points of scan lines and data lines; and

a data driver configured to generate a data signal corresponding to received data and to a power voltage, wherein the power voltage is based on a voltage of a data drive power source, wherein the power voltage is different from the voltage of the data drive power source, and wherein the data driver is further configured to supply the generated data signal to the data lines,

wherein the data driver comprises:

a data signal generation unit configured to generate a data signal corresponding to the received data;

a boosting circuit configured to generate the power voltage based on the voltage of the data drive power source;

a buffer unit configured to receive the data signal and to generate a buffered data signal;

a switch unit configured to selectively couple the data lines either directly to the data drive power source or to the buffer unit; and

a controller configured to control the switch unit.

2. The organic light emitting display device according to claim **1**, wherein the controller comprises a comparator unit configured to output a comparison signal based on comparing a data signal of a current frame with a data signal of the previous frame; and a control signal generation unit to generate a control signal that controls the switch unit according to the comparison signal.

3. The organic light emitting display device according to claim **1**, wherein the controller controls the switch unit so that the data lines are coupled to the input line of the data drive power source during one period of the data input period and the data lines are coupled to the output line of the buffer unit during another period of the data input period if the data signal of the previous frame has a lower voltage level than the data signal of the current frame.

4. The organic light emitting display device according to claim **1**, wherein the controller controls the switch unit so that the data lines are coupled to the output line of the buffer unit if the data signal of the previous frame has a higher voltage level than the data signal of the current frame.

5. The organic light emitting display device according to claim **1**, wherein the buffer unit is coupled between the data signal generation unit and the switch unit, and comprises an output amplifier driven by the boosting circuit.

6. A method of driving an organic light emitting display device, the method comprising:

dividing a data input period, during which a data signal is supplied to a plurality of data lines, into a plurality of periods;

precharging the data lines by coupling the data lines to an input line of a boosting circuit during one or more periods of the plurality of the periods;

generating a power voltage based on a voltage at the input line;

generating the data signal based on the power voltage with an amplifier; and

supplying the data signal to the data lines by coupling the data lines to an output line of the amplifier during the other of the plurality of periods.

7. The method of driving an organic light emitting display device according to claim **6**, further comprising generating a control signal that controls the precharging of the data lines by comparing a voltage level of a data signal of a current frame with a voltage level of a data signal of the previous frame.

8. The method of driving an organic light emitting display device according to claim **7**, wherein the data lines are precharged if the data signal of the previous frame has a lower voltage level than the data signal of the current frame.

9. The method of driving an organic light emitting display device according to claim **7**, wherein the data lines are not precharged if the data signal of the previous frame does not have a lower voltage level than the data signal of the current frame.

10. The method of driving an organic light emitting display device according to claim **7**, wherein the data lines are driven with voltages corresponding to input data if the data signal of the previous frame does not have a lower voltage level than the data signal of the current frame.

11. An organic light emitting display device, comprising:

a pixel unit including a plurality of pixels, each pixel associated with at least one data line;

a data driver configured to precharge the data lines if the data lines are to be driven with a voltage higher than the voltage with which the data lines were driven in the previous driving period, wherein the data lines are precharged by connecting the data lines directly to a power source of the data driver;

a data buffer, configured to drive the data lines with data voltages, wherein the data voltages are based on received data and on a power voltage, wherein the power voltage is based on a voltage of the data driver power source, and wherein the power voltage is different from the voltage of the data driver power source; and

a boosting circuit configured to generate the power voltage based on the voltage of the data driver power source.

12. The display of claim **11**, wherein the data driver is configured to drive the data lines with voltages corresponding to input data subsequent to precharging the data lines.

13. The display of claim **11**, wherein the data driver is configured to not precharge the data lines if the data lines are to be driven with a voltage which is not higher than the voltage with which the data lines were driven in the previous frame.

14. The display of claim **11**, wherein the data driver is configured to precharge the data lines to a voltage provided by a power supply.

15. The display of claim **11**, wherein the data driver comprises a plurality of switches, wherein each switch is configured to connect one of the data lines to either the data driver power source or the data buffer.

16. The display of claim **15**, wherein the voltage of the data driver power source is substantially equal to half of the power voltage.

17. The display of claim **11**, wherein the data driver comprises:

a comparator unit configured to output a comparison signal based on comparing a data signal of a current frame with a data signal of the previous frame; and

a control signal generation unit to generate a control signal that indicates whether the data lines are to be precharged.

18. The display of claim **11**, wherein the data driver is configured to drive the data lines during a plurality of time periods, wherein during at least one of the time periods the data lines are conditionally precharged, and during others of the time periods the data lines are driven with voltages corresponding to input data.

19. The display of claim **18**, wherein the data driver is configured to drive the data lines with voltages corresponding to input data during the at least one time period for conditionally precharging the data lines if the data lines are to not be precharged.

* * * * *

专利名称(译)	有机发光显示装置及其驱动方法		
公开(公告)号	US8466868	公开(公告)日	2013-06-18
申请号	US12/319625	申请日	2009-01-07
[标]申请(专利权)人(译)	LEE SOO KYOUNG 李旭		
申请(专利权)人(译)	李KYOUNG-SOO 李旭		
当前申请(专利权)人(译)	三星DISPLAY CO.，LTD.		
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摘要(译)

公开了一种具有低功耗的有机发光显示装置。如果当前帧的数据具有比前一帧的数据更高的电压，则通过预充电数据线来节省设备中的功率。因此，如果数据线被预充电，则数据线驱动缓冲器不需要使用那么多的功率。