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Chegal

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

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(51) **Int. Cl.**
G09G 3/30 (2006.01)

(52) **U.S. Cl.** **345/77; 345/690; 348/674**

(58) **Field of Classification Search** **345/690, 345/89, 77; 348/254, 674**
See application file for complete search history.

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KIPO Office action dated May 31, 2010, for priority Korean Patent Application No. 10-2008-0043174, noting the listed references in this IDS.

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(57) **ABSTRACT**

An organic light emitting display and a driving method thereof, capable of increasing manufacturing yield by widening a range of gamma correction. An exemplary organic light emitting display includes a display region with pixels at crossings of data and scan lines; a gamma correction unit; a data driver; and a scan driver. The gamma correction unit includes first and second register units for storing first and second gamma correction signals, the second gamma correction signal comprising a corrected first gamma correction signal; a booster unit for correcting the second gamma correction signal to generate a third gamma correction signal; and a multiplexer for selecting the second gamma correction signal or the third gamma correction signal outputted from the booster unit, and for transferring it to the gamma correction circuit.

9 Claims, 3 Drawing Sheets

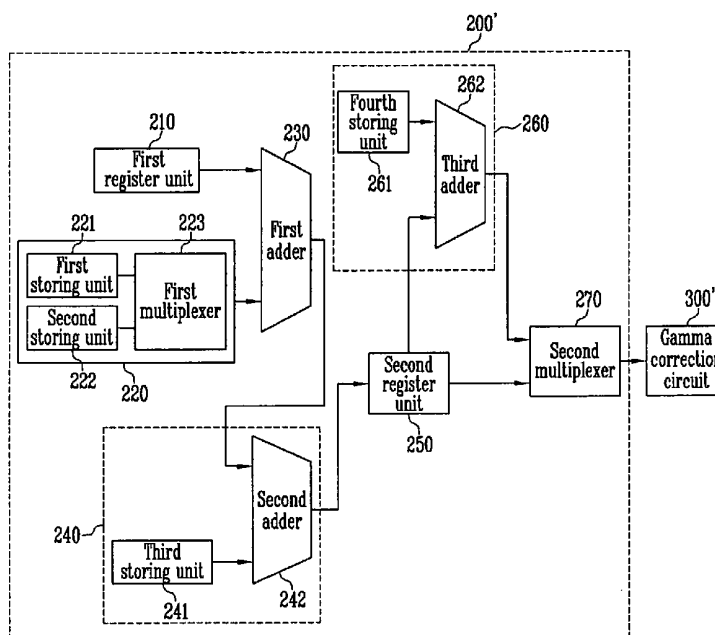


FIG. 1

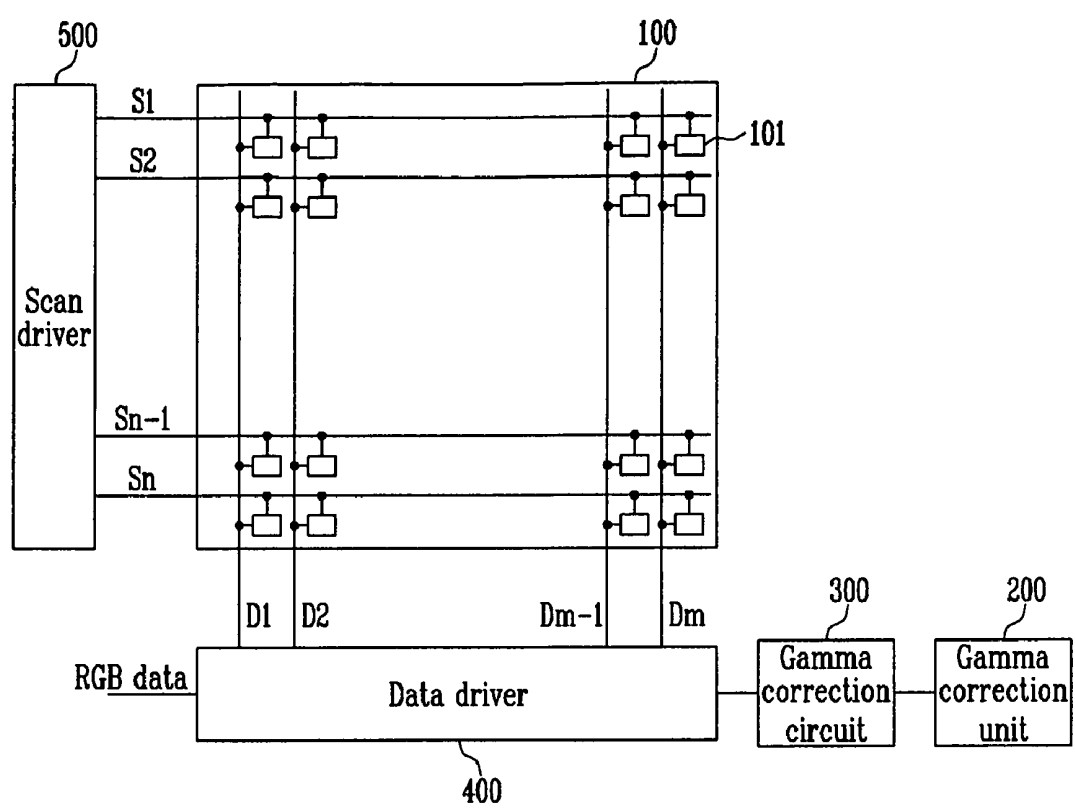


FIG. 2

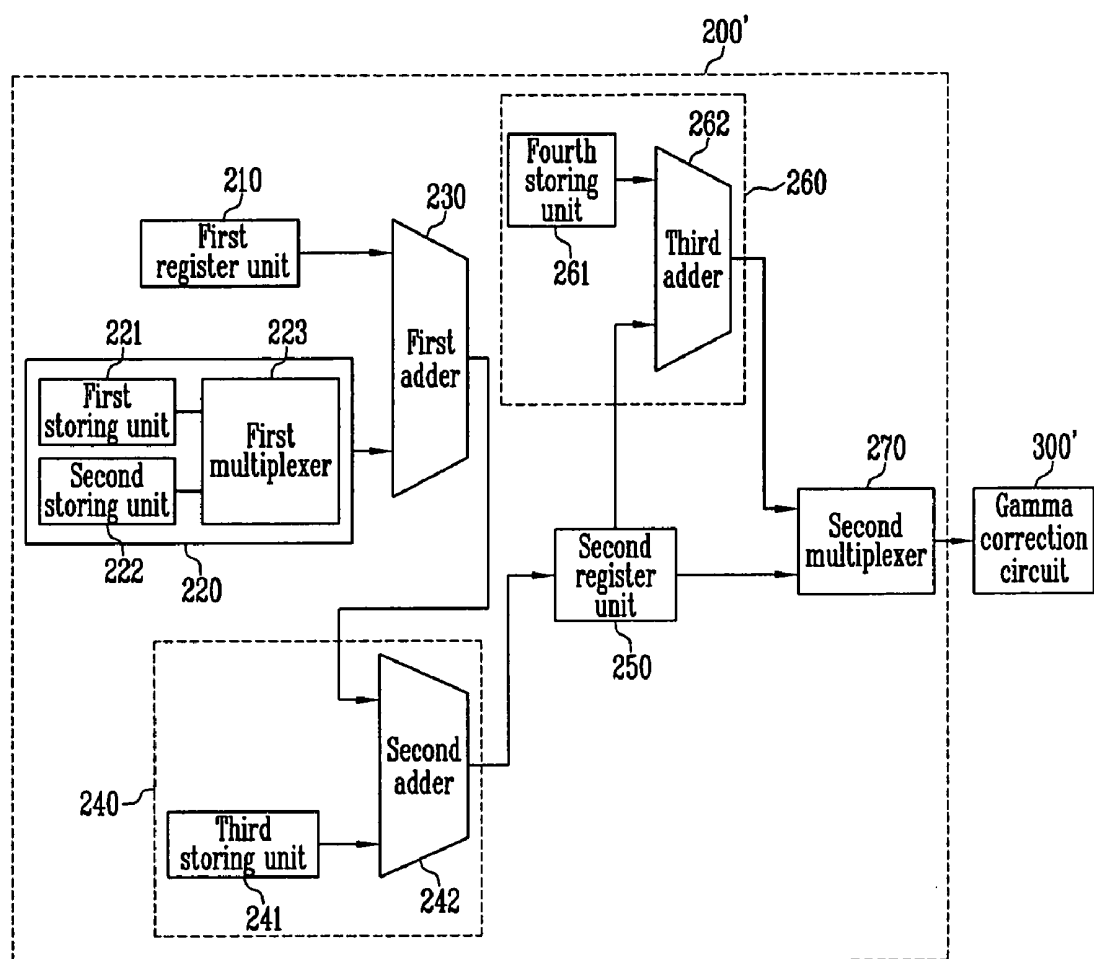
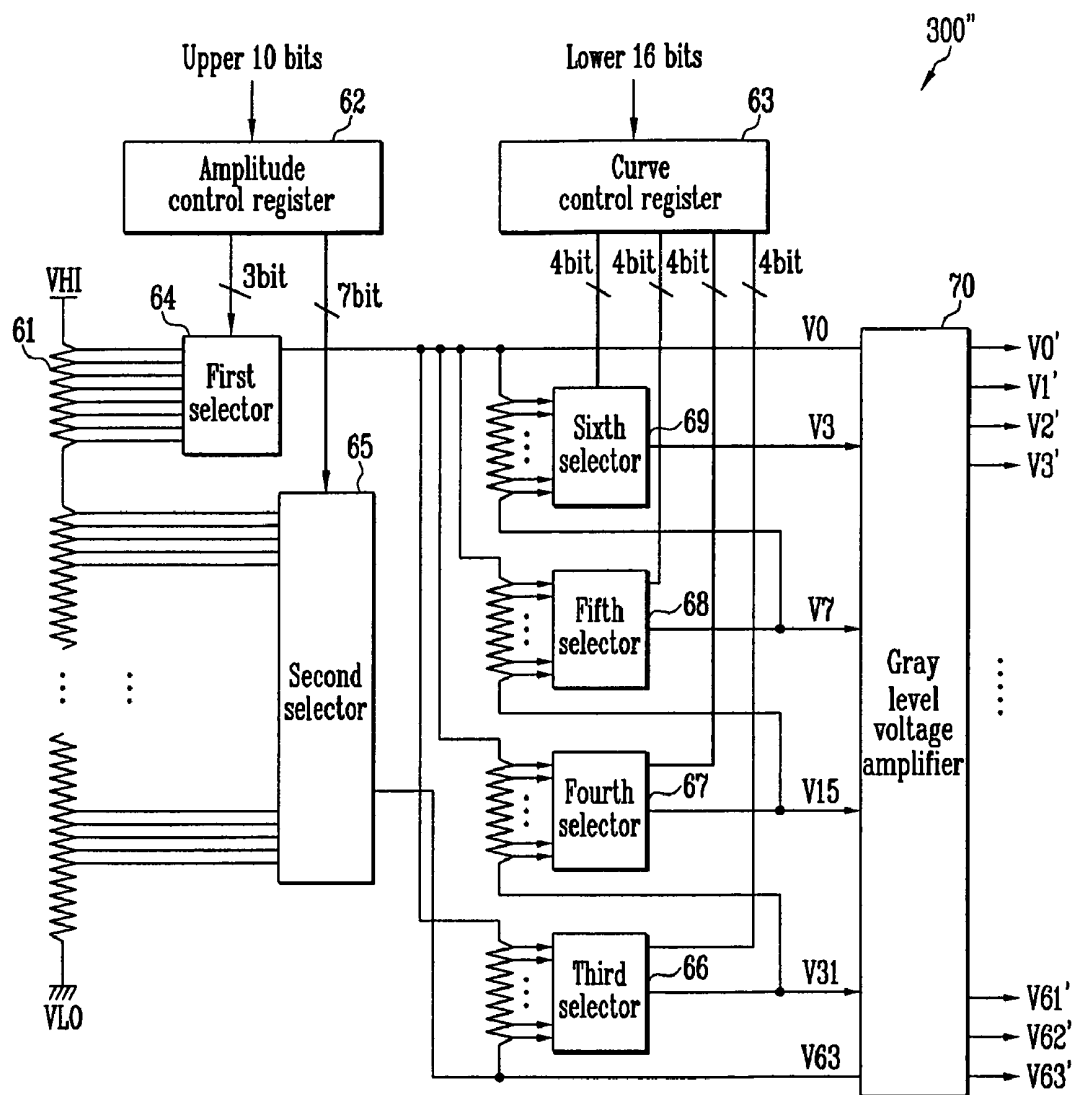


FIG. 3



ORGANIC LIGHT EMITTING DISPLAY AND METHOD OF DRIVING THE SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to and the benefit of Korean Patent Application No. 10-2008-0043174, filed on May 9, 2008, in the Korean Intellectual Property Office, the entire content of which is incorporated herein by reference.

BACKGROUND

1. Field of the Invention

The present invention relates to an organic light emitting display and a method of driving the same, and more particularly to an organic light emitting display with improved image quality and a method of driving the same.

2. Description of Related Art

Recently, various flat panel display devices having a reduced weight and volume, which are unfavorable aspects of a cathode ray tube, have been developed. Examples of flat panel display devices include liquid crystal displays (LCDs), field emission displays (FEDs), plasma display panels (PDPs), organic light emitting displays, and others.

Among these flat panel display devices, an organic light emitting display displays an image using organic light emitting diodes (OLEDs) that generate light utilizing the recombination of electrons and holes.

An OLED includes an anode electrode, a cathode electrode, and a light emitting layer positioned therebetween. In the OLED, the light emitting layer emits light when current flows in a direction from the anode electrode to the cathode electrode.

Such an organic light emitting display displays the image using characteristics of the OLED. The organic light emitting display includes a plurality of pixels having a plurality of thin film transistors and one or more OLEDs, wherein the amount of current flowing to the OLEDs is controlled by the thin film transistors.

However, variations in manufacturing processes for forming organic light emitting displays may result in varying light emitting layer thicknesses, light emitting layer efficiencies, and characteristics of the thin film transistors. Accordingly, variations in luminance and color across an organic light emitting display may occur. Products with large variations in luminance and color are typically regarded as defective goods and are discarded, thereby causing a reduction in yield.

SUMMARY OF THE INVENTION

Various exemplary embodiments of the present invention include an organic light emitting display and a driving method thereof capable of increasing a yield by widening a range of gamma correction.

An organic light emitting display according to an exemplary embodiment of the present invention includes a display region with pixels at crossings of data lines and scan lines; a gamma correction unit for generating gamma a correction signal; a gamma correction circuit for controlling a gray level voltage corresponding to the gamma correction signal; a data driver for generating data signals corresponding to image signals and to the gray level voltage, and for transferring the data signals to the data lines; and a scan driver for generating scan signals and for transferring the scan signals to the scan lines. The gamma correction unit includes a first register unit for storing a first gamma correction signal; a second register

unit for storing a second gamma correction signal, the second gamma correction signal comprising a corrected first gamma correction signal; a booster unit for receiving and correcting the second gamma correction signal stored in the second register unit to generate a third gamma correction signal; and a multiplexer for selecting one signal from the group consisting of the second gamma correction signal stored in the second register unit and the third gamma correction signal outputted from the booster unit, and for transferring the selected signal to the gamma correction circuit.

A method for driving an organic light emitting display according to another exemplary embodiment of the present invention includes adding a first correction value to a first gamma correction signal to correct the first gamma correction signal and to generate a second gamma correction signal; storing the second gamma correction signal; generating a third gamma correction signal by correcting the second gamma correction signal utilizing a second correction value; and outputting a signal selected from the group consisting of the second gamma correction signal and the third gamma correction signal.

The organic light emitting display and a driving method thereof according to various embodiments of the present invention are capable of improving image quality by widening a correction range of a gamma. Also, it is capable of lowering manufacturing costs by increasing production yield.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 1 is a block diagram of an organic light emitting display according to an exemplary embodiment of the present invention.

FIG. 2 is a block diagram of a gamma correction unit according to an exemplary embodiment of the present invention.

FIG. 3 is a block diagram of a gamma correction circuit shown in FIG. 2.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

Hereinafter, certain exemplary embodiments according to the present invention are described with reference to the accompanying drawings. Here, when a first element is described as being coupled to a second element, the first element may be directly coupled to the second element, or may be indirectly coupled to the second element via a third element. Further, some of the elements that are not essential to a complete understanding of the invention are omitted for clarity. Also, like reference numerals refer to like elements throughout.

FIG. 1 is a block diagram of an organic light emitting display according to an exemplary embodiment of the present invention. With reference to FIG. 1, the organic light emitting display according to this embodiment includes a display region 100, a gamma correction unit 200, a gamma correction circuit 300, a data driver 400, and a scan driver 500.

The display region 100 includes a plurality of pixels 101 that each include an OLED (not shown) for emitting light corresponding to the flow of current in each pixel. N scan lines (S1, S2, . . . Sn-1, and Sn) extend in a row direction for

transferring scan signals, and m data lines (D1, D2, . . . D m -1, and D m) extend in a column direction for transferring data signals.

The display region 100 is driven by receiving first power ELVDD and second power ELVSS from the outside. Accordingly, the display region 100 displays images using the scan signals and the data signals, and generates light by driving a current generated by the first power ELVDD and the second power ELVSS to the organic light emitting diode.

The gamma correction unit 200 generates gamma correction signals according to gamma characteristics of the organic light emitting display and, through the gamma correction circuit 300, applies the gamma correction signals to the data signals. The data signal applied with the gamma correction signal has a ratio of gray levels to luminance with a curve of a logarithmic function or an exponential function.

Since the data signal applied with the gamma correction signal displays an image signal according to the gamma characteristics of the organic light emitting display, it should better correspond to the actually desired color and luminance.

The gamma correction signal is applied with a correction value according to luminance and color displayed in the display region 100. In other words, luminance and color displayed in the display region 100 substantially correspond to the actually desired luminance and color by correcting the gamma correction signal.

The gamma correction unit 200 stores the gamma correction signal applied with the correction value and transfers the stored gamma correction signal to the gamma correction circuit 300, thereby setting a voltage corresponding to each gray level in the gamma correction circuit 300. The data driver 400 transforms the image signal (RGB data) into the data signal by using the voltages set by the gamma correction circuit 300. A detailed description of the gamma correction circuit 300 will be described below with reference to FIG. 3.

Even when the data signal generated by the data driver 400 is corrected by the gamma correction signal, the displayed image may not have the actually desired luminance and color. More specifically, when manufacturing the organic light emitting display, although the same gamma correction signal is applied, the image may appear different from the actually desired luminance and color due to process variations, etc. That is, in the organic light emitting display, because variations may occur in a thickness of the light emitting layer, an efficiency of the light emitting layer, operational characteristics of the thin film transistor, etc., a sufficient correction may not be made by utilizing the same correction value on all displays. Thus, during production, a correction value may be applied to the corrected gamma correction signal once more to enable implementation of a wide correction range.

The data driver 400 generates data signals using the image signal (RGB data) and the gamma correction signal from the gamma correction circuit 300. The data driver 400 is coupled to the data lines D1, D2, . . . D m -1, and D m of the display region 100 to apply the generated data signals to the display region 100.

The scan driver 500, which generates scan signals, is coupled to the scan lines S1, S2, . . . S n -1, and S n to transfer the scan signals to respective rows of the display region 100. The data signal output from the data driver 400 is transferred to the pixel 101 receiving the scan signal so that a driving current is generated, wherein the generated driving current flows to the OLED.

FIG. 2 is a block diagram of a gamma correction unit 200' according to an exemplary embodiment of the present invention. In certain embodiments, the gamma correction unit 200' may be utilized in the place of the gamma correction unit 200

of FIG. 1. Referring to FIG. 2, the gamma correction unit 200' includes a first register unit 210, an offset unit 220, a first adder 230, a correction unit 240, a second register unit 250, a booster unit 260, first to fourth storing units 221, 222, 241, and 261, a first multiplexer 223, and a second multiplexer 270. The output of the second multiplexer is sent to the gamma correction circuit 300'. In some embodiments, the gamma correction circuit 300' may be utilized as the gamma correction circuit 300 of FIG. 1.

The first register unit 210 stores a first gamma correction signal for generating light having a brightness corresponding to each gray level according to the characteristics of the OLEDs and the organic light emitting display. In the case of a display with 64 gray levels, the first gamma correction signal utilizes a voltage of an upper level and voltage of a lower level to generate 64 voltages V0, V1 . . . V62, and V63.

The offset unit 220 changes the first gamma correction signal in the first register unit 210. The offset unit 220 includes the first storing unit 221 and the second storing unit 222, wherein each of the first storing unit 221 and the second storing unit 222 stores offset values. That is, a first offset value stored in the first storing unit 221 is utilized to correct the first gamma correction signal stored in the first register unit 210, or a second offset value stored in the second storing unit 222 is utilized to correct the first gamma correction signal stored in the first register unit 210, as selected by the first multiplexer 223.

Therefore, in an exemplary embodiment utilizing 64 gray levels, the 64 voltages generated according to the first offset value stored in the first storing unit 221 have different values than the 64 voltages generated according to the second offset value in the second storing unit 222. The offset unit 220 further includes the first multiplexer 223, and outputs one of the offset values stored in the first storing unit 221 and the second storing unit 222 by the operation of the first multiplexer 223. The offset value is utilized to control an offset of the highest level voltage and the lowest level voltage. Therefore, a difference in a slope occurs between a second gamma correction signal, to which the offset value was applied, and the first gamma correction signal.

The first adder 230 adds the first gamma correction signal stored in the first register unit 210 to the offset value output from the offset unit 220 to correct the first gamma correction signal, thereby generating a second gamma correction signal. That is, the first gamma correction signal is corrected by the offset value by utilizing the first adder 230 to generate the second gamma correction signal.

The correction unit 240 performs a role of further correcting the second gamma correction signal corrected by the offset unit 220 to allow the second gamma correction signal to be more accurately corrected. The correction unit 240 includes the third storing unit 241 for storing a correction value and a second adder 242 for adding the second gamma correction signal output from the first adder 230 and the correction value stored in the third storing unit 241. The correction value is set during production by a designer after assessing the color sense and brightness of an image displayed in the display region. The correction unit 240 adds the second gamma correction signal to the correction value utilizing the second adder 242 to generate a third gamma correction signal.

The second register unit 250 stores the third gamma correction signal generated in the correction unit 240. The third gamma correction signal stored in the second register unit 250 is transferred to the booster unit 260 and the second multiplexer 270.

The booster unit **260** receives the third gamma correction signal from the second register unit **250**. The booster unit **260** includes the fourth storing unit **261** for storing a second correction value. In some embodiments, the second correction value stored in the fourth storing unit **261** is the same correction value as the correction value set in the correction unit **240**. The booster unit **260** further includes a third adder **262** for adding the third gamma correction signal to the correction value stored in the fourth storing unit **261**. Therefore, the booster unit **260** corrects the third gamma correction signal using the correction value stored in the fourth storing unit **261** to generate a fourth gamma correction signal. That is, the third gamma correction signal stored in the second register unit **250** is corrected once more, so that a correction range of the image is further widened.

The second multiplexer **270** selects one of either the third gamma correction signal stored in the second register unit **250** or the fourth gamma correction signal from the booster unit **260** to transfer to the gamma correction circuit **300'**. That is, in the case where a correction result from the correction unit **240** is sufficient, the second multiplexer **270** outputs the third gamma correction signal stored in the second register unit **250**. In the case where the correction result corrected in the correction unit **240** is not sufficient, the second multiplexer **270** outputs the fourth gamma correction signal output from the booster unit **260**. In one embodiment, the decision to transfer the third gamma correction signal or the fourth gamma correction signal to the gamma correction circuit **300'** is also made by the designer during production.

FIG. 3 is a block diagram of a gamma correction circuit **300''** according to an exemplary embodiment of the present invention in which 64 gray level voltages are utilized. In some embodiments, the gamma correction circuit **300''** may be utilized as the gamma correction circuit **300'** shown in FIG. 2 or as the gamma correction circuit **300** shown in FIG. 1. Referring to FIG. 3, the gamma correction circuit **300''** includes a ladder resistor **61**, an amplitude control register **62**, a curve control register **63**, first through sixth selectors **64** through **69**, and a gray level voltage amplifier **70**.

The ladder resistor **61** defines the highest level voltage **V_H** supplied from the outside as a reference voltage and includes a plurality of variable resistors coupled in series between the lowest level voltage **V_L** and the reference voltage **V_H**. A plurality of gray level voltages are generated through the ladder resistor **61**. Also, when making a value of the ladder resistor small, an amplitude control range becomes narrow, whereas an amplitude control accuracy increases. On the other hand, when making the value of the ladder resistor large, an amplitude control range becomes wide, whereas an amplitude control accuracy decreases.

In the described embodiment, the gamma correction signal from the gamma correction unit **200** includes 26 bits, wherein the upper 10 bits are input to the amplitude control register **62** and the lower 16 bits thereof are input to the curve control register **63** and selected as register setting values.

The amplitude control register **62** receives the signal of the upper 10 bits, outputs 3 bits of the upper 10 bits of the gamma correction signal to the first selector **64**, and outputs the remaining 7 bits of the upper 10 bits of the gamma correction signal to the second selector **65**. At this time, it is possible to increase the number of selectable gray levels by increasing the number of setting bits.

The curve control register **63** receives the lower 16 bits of the gamma correction signal, and outputs 4 bits of the lower 16 bits of the gamma correction signal to each of the respective third through sixth selectors **66** to **69**.

The first selector **64** selects a gray level voltage **V₀** from among the plurality of gray level voltages distributed through the ladder resistor **61**, the gray level voltage **V₀** corresponding to a value of 3 bits of the gamma correction signal stored in the amplitude control register **62**, to output as the highest gray level voltage.

The second selector **65** selects a gray level voltage **V₆₃** from among the plurality of gray level voltages distributed through the ladder resistor **61**, the gray level voltage **V₆₃** corresponding to a value of 7 bits of the gamma correction signal stored in the amplitude control register **62**, to output as the lowest gray level voltage.

The third selector **66** distributes the gray level voltage **V₀** output from the first selector **64** and the gray level voltage **V₆₃** output from the second selector **65** into a plurality of gray level voltages through a plurality of resistor columns, and selects and outputs a gray level voltage **V₃₁** corresponding to a value of 4 bits of the gamma correction signal.

The fourth selector **67** selects and outputs a gray level voltage **V₁₅** corresponding to a value of 4 bits of the gamma correction signal from among the gray level voltages between the output of the first selector **64** and the output of the third selector **66**.

The fifth selector **68** selects and outputs a gray level voltage **V₇** corresponding to a value of 4 bits of the gamma correction signal from among the gray level voltages between the output of the first selector **64** and the output of the fourth selector **67**.

The sixth selector **69** selects and outputs a gray level voltage **V₃** corresponding to a value of 4 bits of the gamma correction signal from among a plurality of gray level voltages between the output of the first selector **64** and the output of the fifth selector **68**.

With operation as described above, it is possible to control gamma characteristics to suit characteristics of each light emitting display by enabling curve control of an intermediate gray level unit according to a register setting value of the curve control register **63**. Also, when it is intended to make the gamma curve characteristics concave, as a lower gray level is displayed, a potential difference between each gray level is set to be larger. On the other hand, when it is intended to make gamma curve characteristics convex, as a lower gray level is displayed, potential difference between each gray level is set to be smaller.

The gray level voltage amplifier **70** outputs a plurality of gray level voltages **V_{0'}**, **V_{1'}**, . . . **V_{63'}**, corresponding to each of the gray levels to be displayed in the display region **100**.

In an exemplary embodiment of the present invention, the above-mentioned operation is performed by installing a gamma correction circuit as described above for each of R, G, and B groups so that R, G, and B light emitting devices obtain substantially the same brightness, in consideration of variations in the characteristics of each of the R, G, and B light emitting devices themselves. Thereby, it is possible to differently set the amplitude and curve through the curve control register **63** and the amplitude control register **62** by R, G, and B.

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 included within the spirit and scope of the appended claims, and equivalents thereof.

What is claimed is:

1. An organic light emitting display, comprising:
a display region including pixels at crossings of data lines and scan lines;

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a gamma correction unit for generating a gamma correction signal;
 a gamma correction circuit for controlling a gray level voltage corresponding to the gamma correction signal;
 a data driver for generating data signals utilizing image signals and the gray level voltage, and for transferring the data signals to the data lines; and
 a scan driver for generating scan signals and for transferring the scan signals to the scan lines,
 wherein the gamma correction unit comprises:
 a first register for storing a first gamma correction signal;
 a second register for storing a second gamma correction signal, the second gamma correction signal comprising a corrected first gamma correction signal;
 a booster for receiving and correcting the second gamma correction signal stored in the second register to generate a third gamma correction signal; and
 a multiplexer for selecting the second gamma correction signal stored in the second register or the third gamma correction signal outputted from the booster, and for transferring the selected signal to the gamma correction circuit.

2. The organic light emitting display as claimed in claim 1, further comprising:
 an offset value storage for storing an offset value; and
 a first adder for adding the offset value with the first gamma correction signal to generate a fourth gamma correction signal.

3. The organic light emitting display as claimed in claim 2, further comprising:
 a first storage for storing a first correction value; and
 a second adder for adding the first correction value with the fourth gamma correction signal to generate the second gamma correction signal.

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4. The organic light emitting display as claimed in claim 3, further comprising:
 a second storage for storing a second correction value; and
 a third adder for adding the second correction value with the second gamma correction signal to generate the third gamma correction signal.

5. The organic light emitting display as claimed in claim 4, wherein the first correction value is a same value as the second correction value.

6. The organic light emitting display as claimed in claim 4, wherein the fourth gamma correction signal and the first gamma correction signal are different in slope by the offset value.

7. A method for driving an organic light emitting display, comprising:
 adding a first correction value to a first gamma correction signal to correct the first gamma correction signal and to generate a second gamma correction signal;
 storing the second gamma correction signal;
 generating a third gamma correction signal by correcting the second gamma correction signal utilizing a second correction value; and
 selectively outputting the second gamma correction signal or the third gamma correction signal.

8. The method as claimed in claim 7, wherein the first correction value is a same value as the second correction value.

9. The method as claimed in claim 7, wherein said generating the second gamma correction signal comprises generating a fourth gamma correction signal applied with an offset value changing a slope of the first gamma correction signal and then generating the second gamma correction signal by applying the first correction value to the fourth gamma correction signal.

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专利名称(译)	有机发光显示器及其驱动方法		
公开(公告)号	US8269701	公开(公告)日	2012-09-18
申请号	US12/463278	申请日	2009-05-08
[标]申请(专利权)人(译)	CHEGAL胜元		
申请(专利权)人(译)	CHEGAL SEUNG-WON		
当前申请(专利权)人(译)	三星DISPLAY CO. , LTD.		
[标]发明人	CHEGAL SEUNG WON		
发明人	CHEGAL, SEUNG-WON		
IPC分类号	G09G3/30		
CPC分类号	G09G3/3275 G09G2320/0233 G09G2320/0276		
优先权	1020080043174 2008-05-09 KR		
其他公开文献	US20090278773A1		
外部链接	Espacenet USPTO		

摘要(译)

一种有机发光显示器及其驱动方法，能够通过扩大伽马校正的范围来提高制造产量。示例性有机发光显示器包括显示区域，该显示区域具有在数据和扫描线交叉处的像素；伽马校正单元；伽马校正电路；数据驱动程序；和扫描驱动程序。伽马校正单元包括用于存储第一和第二伽马校正信号的第一和第二寄存器单元，第二伽马校正信号包括校正的第一伽马校正信号；增强器单元，用于校正第二伽马校正信号以产生第三伽马校正信号；多路复用器，用于选择从增强器单元输出的第二伽马校正信号或第三伽马校正信号，并将其传送到伽马校正电路。

