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(54) **DISPLAY AND DRIVING METHOD THEREOF**

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(57) **ABSTRACT**

An organic electroluminescent display and driving method thereof. The organic electroluminescent display includes a demultiplexer for outputting signals provided by a data driver to a plurality of data lines according to on/off operation of analog switches. The driving method divides a frame into two parts, and drives them. Data signals are applied to pixels which are not adjacent among the pixels of each row during the former 1/2 frame, and the data signals are applied to the pixels to which no data signal has been applied in the former 1/2 frame during the latter 1/2 frame.

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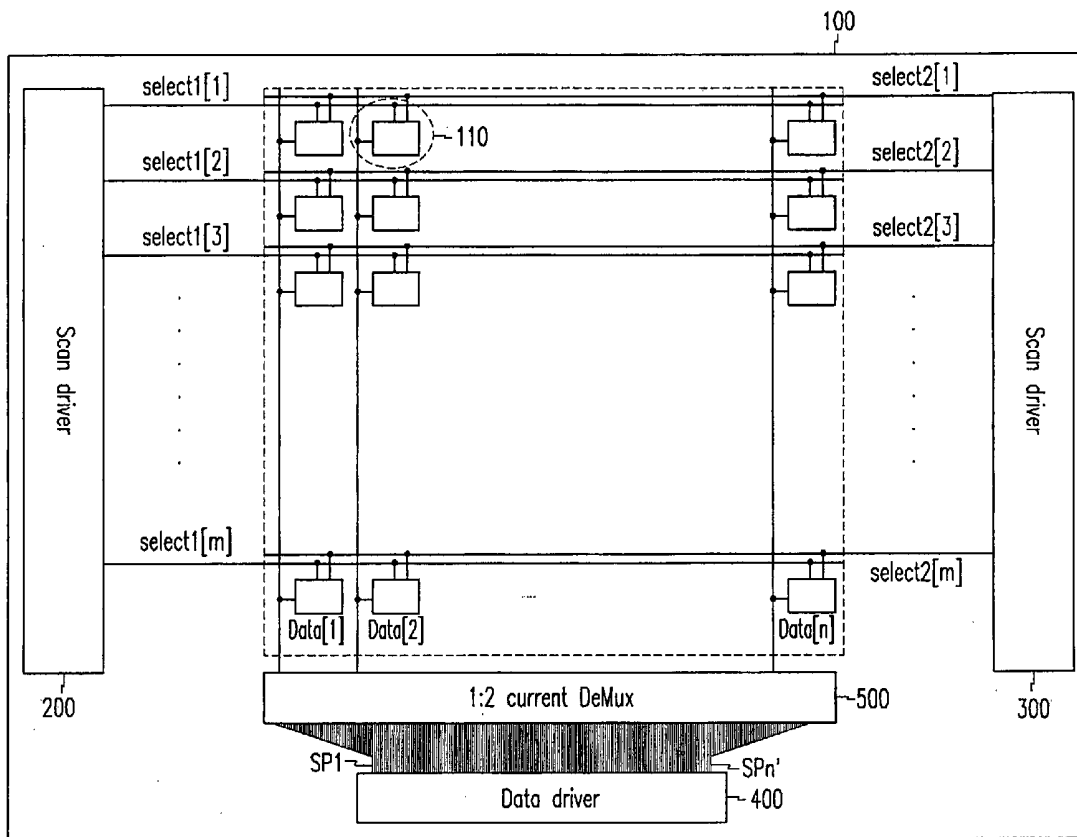


FIG. 1

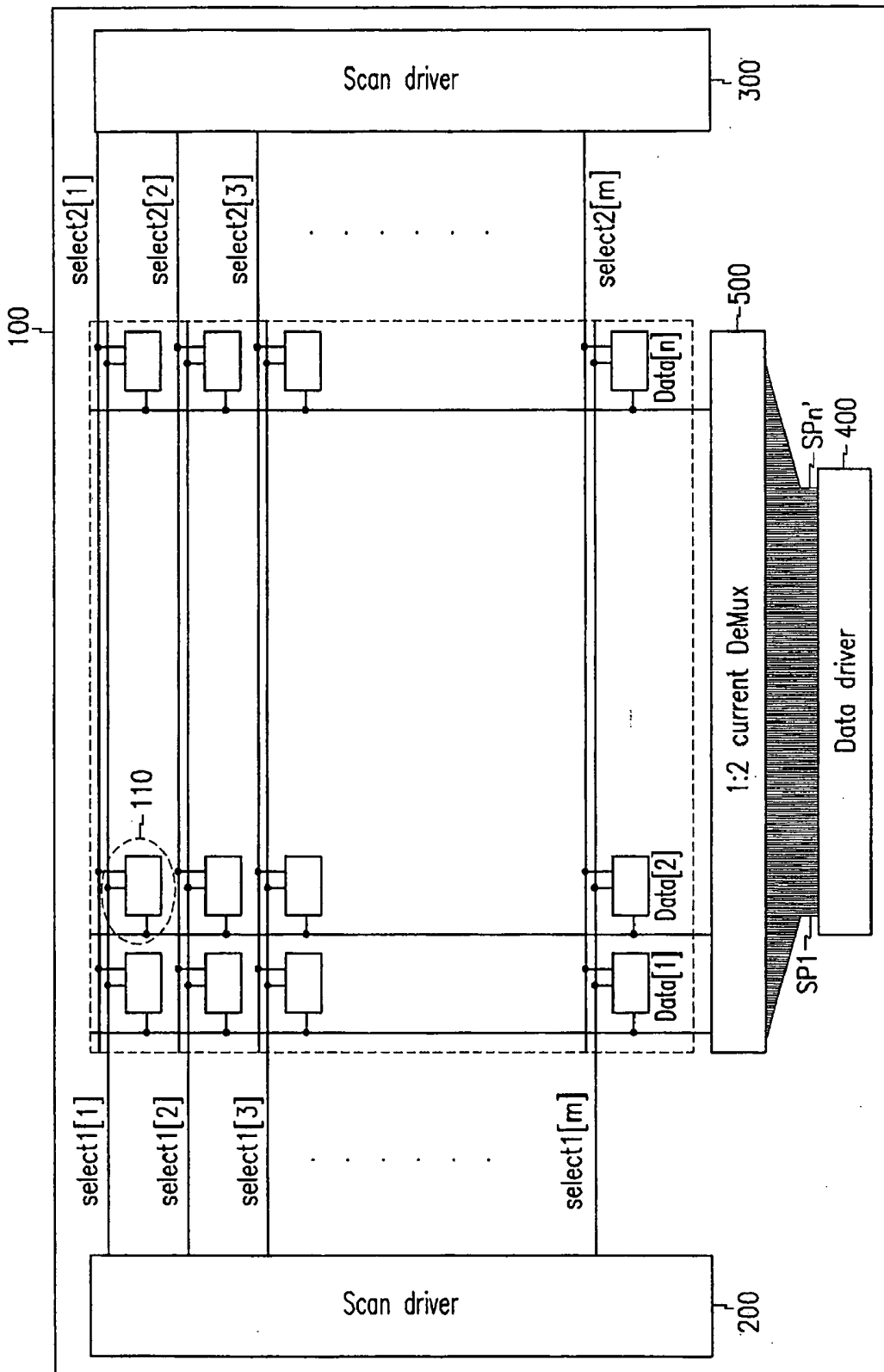


FIG. 4A

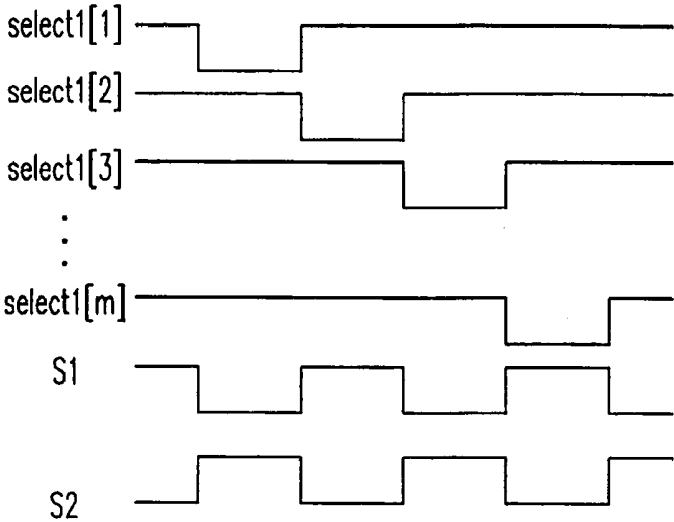


FIG. 4B

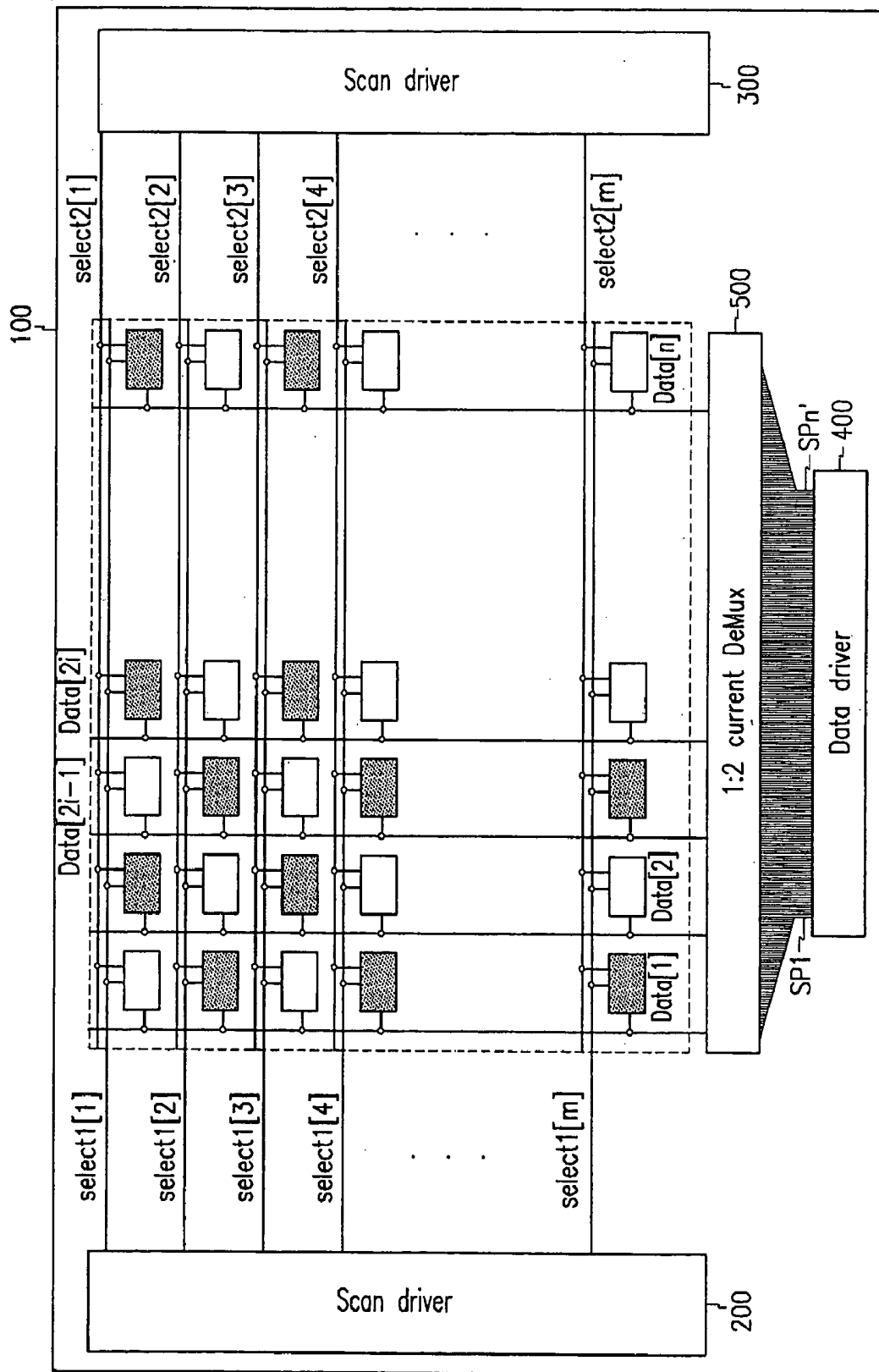


FIG. 5A

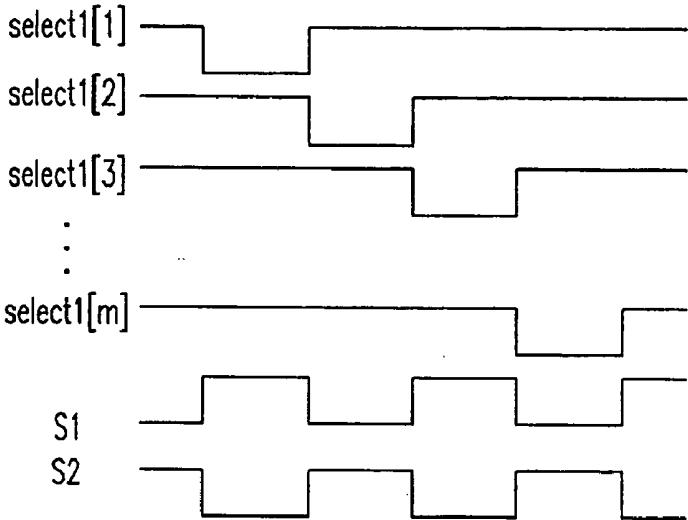


FIG. 5B

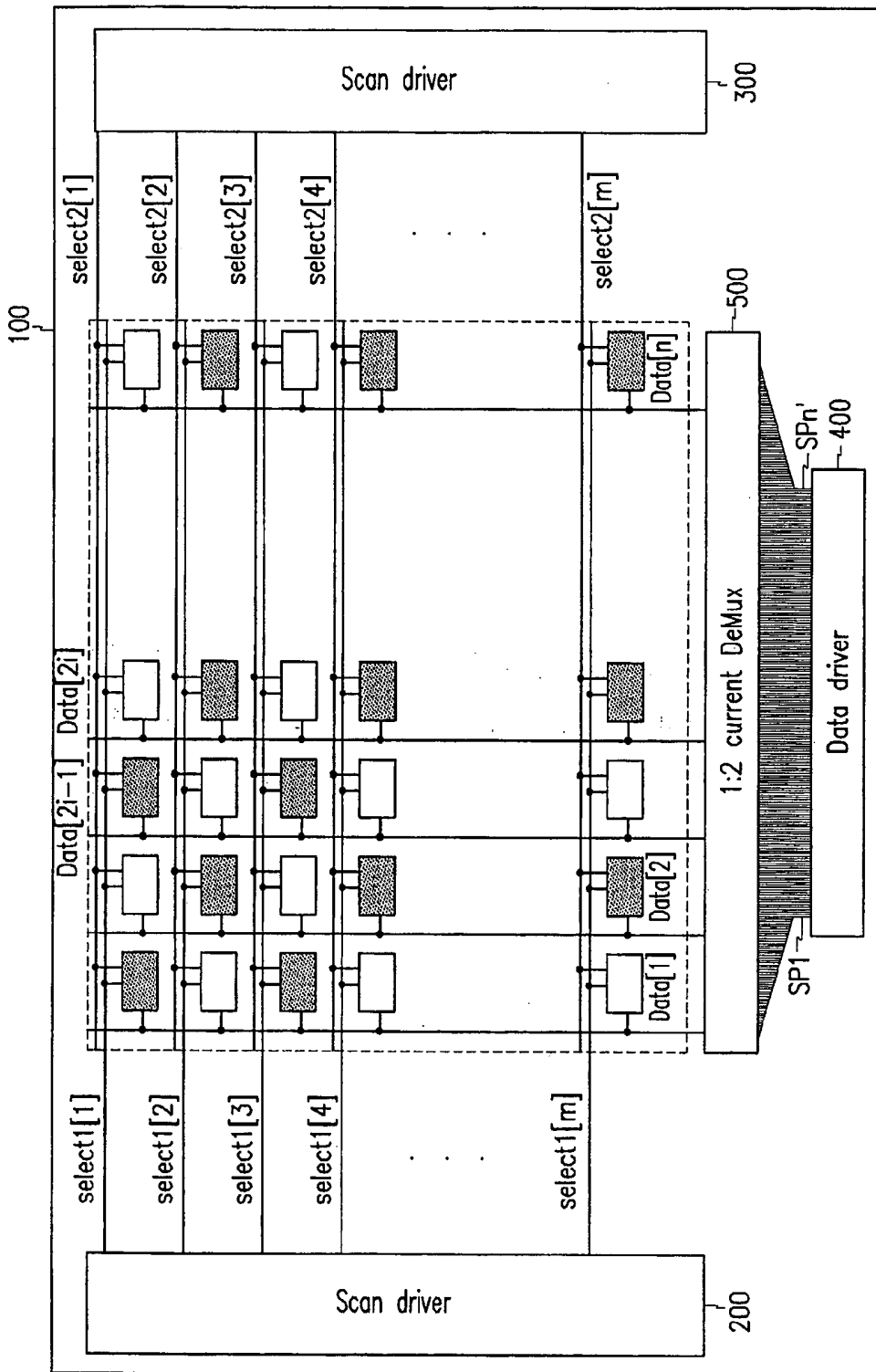


FIG. 6A

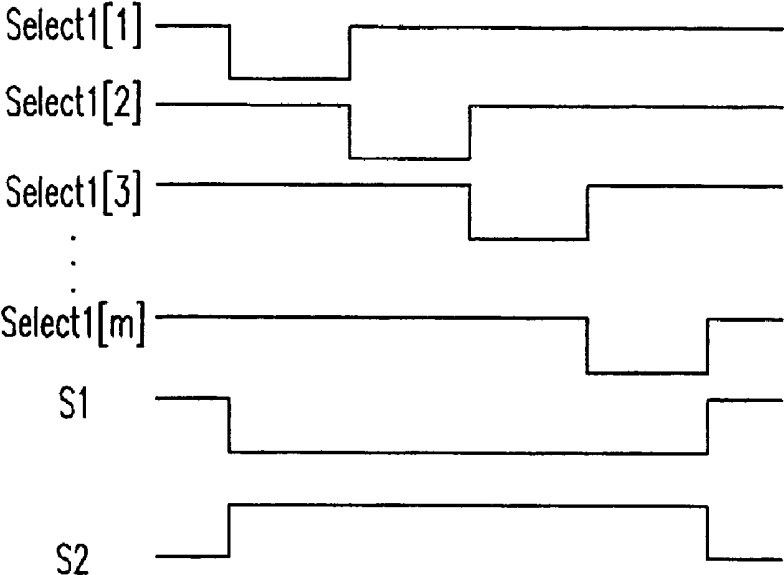


FIG. 6B

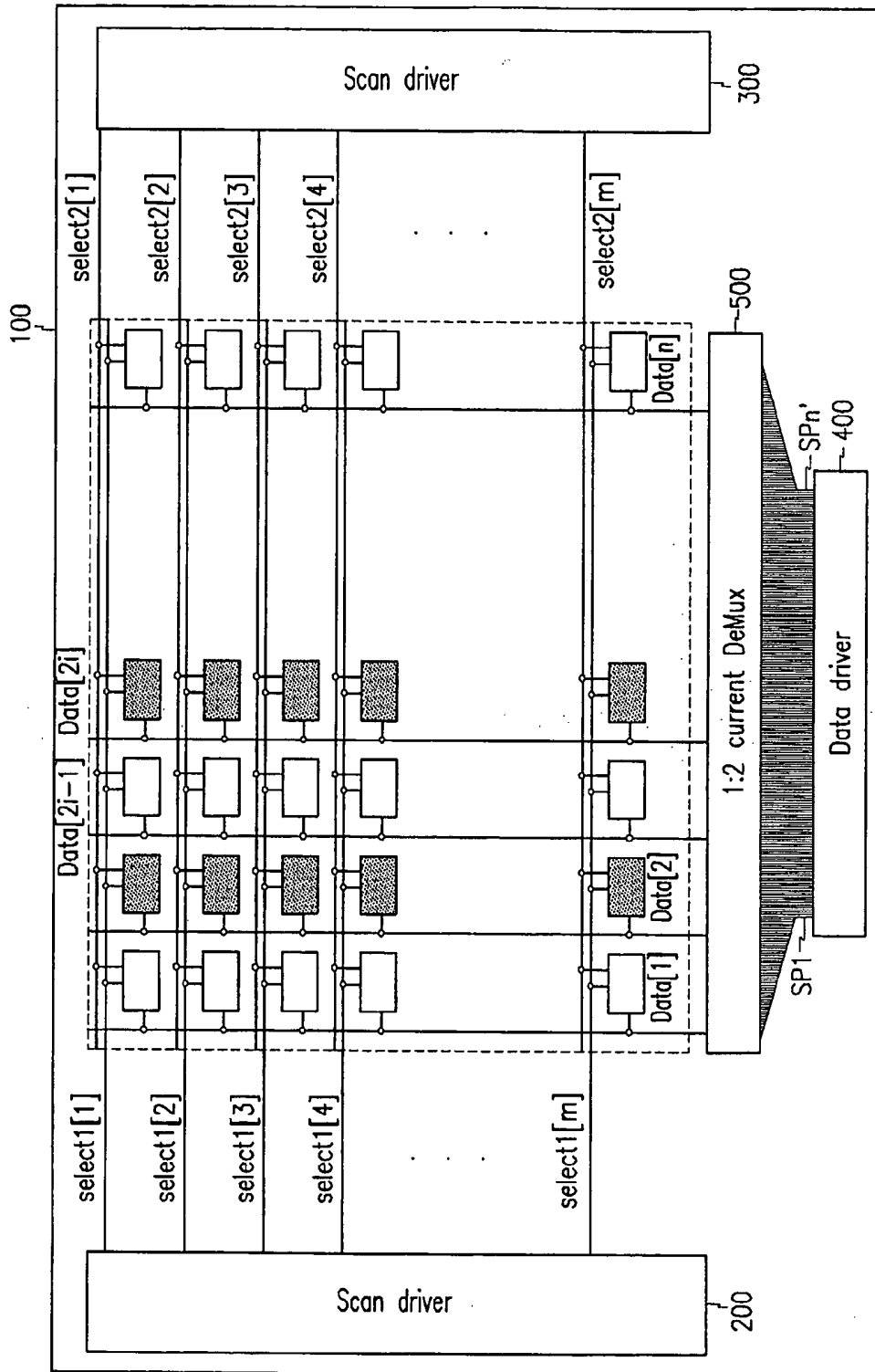


FIG. 7A

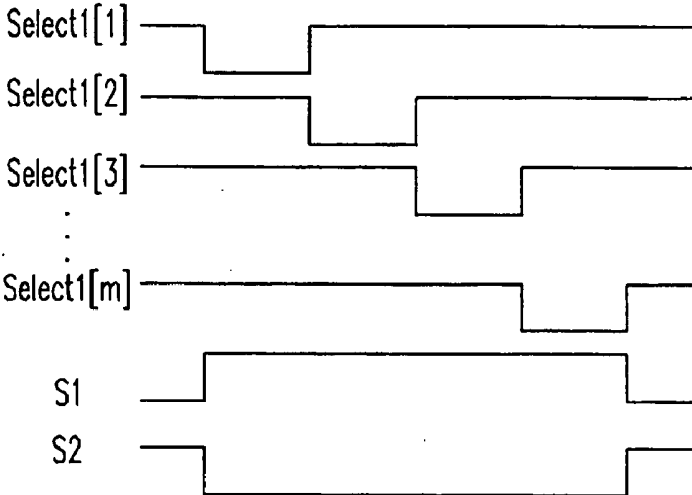
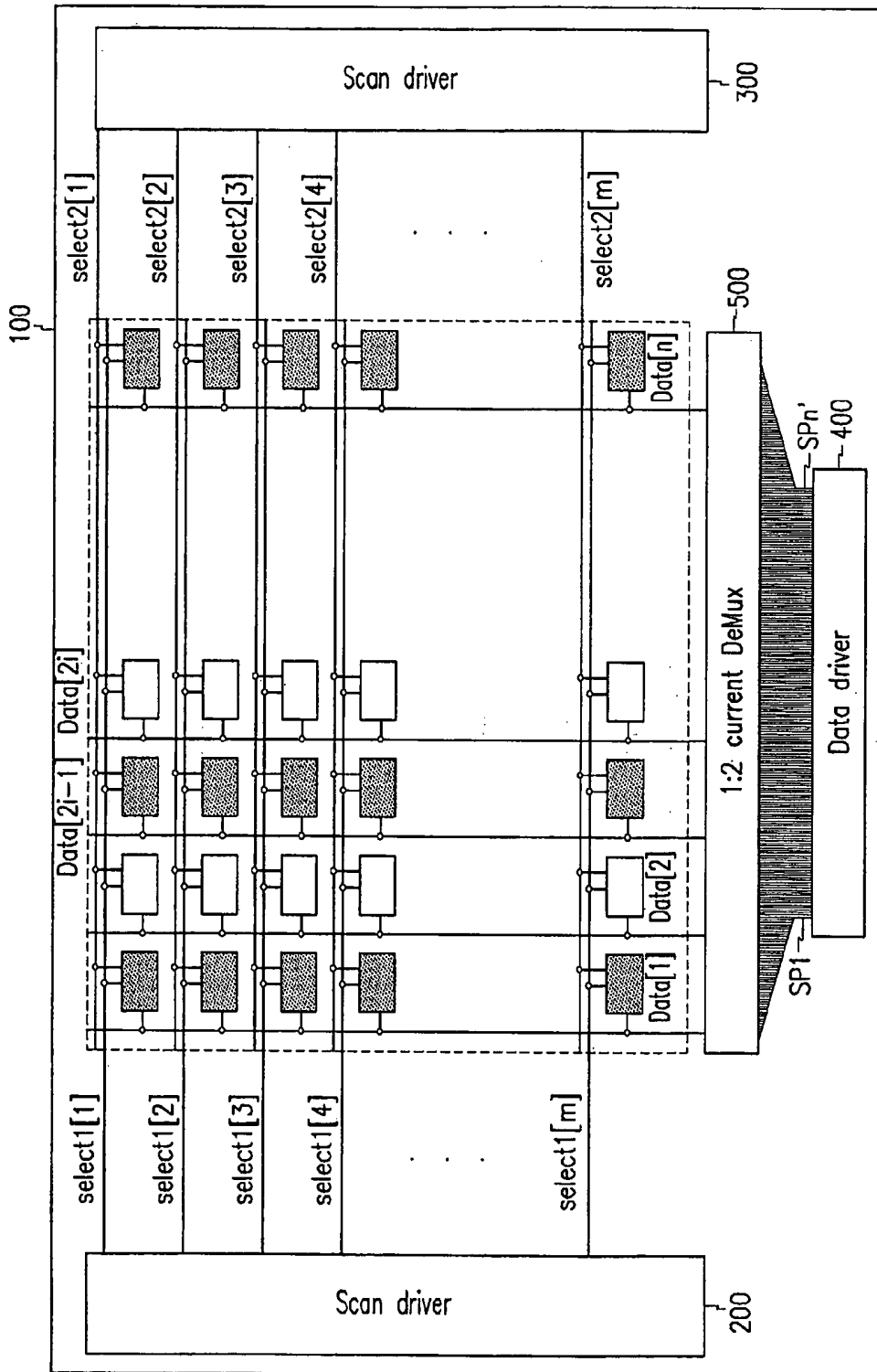


FIG. 7B



DISPLAY AND DRIVING METHOD THEREOF

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to and benefit of Korea Patent Application No. 2003-52603 filed on Jul. 30, 2003 in the Korean Intellectual Property Office, the entire disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] (a) Field of the Invention

[0003] The present invention relates to a display and a driving method thereof. More specifically, the present invention relates to an organic electroluminescent (EL) display and a driving method thereof.

[0004] (b) Description of the Related Art

[0005] In general, an organic EL display is a display device for electrically exciting fluorescent and organic compounds and emitting light therefrom, and voltage or current drives (M×N) organic emission cells to represent images. An organic emission cell includes an anode (indium tin oxide: ITO), an organic thin film, and a metallic cathode layer. The organic thin film includes an emission layer (EML), an electron transport layer (ETL), a hole transport layer (HTL) for balancing electrons and holes to improve emission efficacy, and additionally includes an electron injection layer (EIL) and a hole injection layer (HIL).

[0006] Methods for driving the above-configured organic emission cells include the passive matrix method for allowing anodes and cathodes to cross each other according to an addressing method, selecting a line, and driving the line, and the active matrix method for connecting a thin film transistor (TFT) and a capacitor with each ITO pixel electrode so as to maintain a voltage by a capacitance. The active matrix method includes a voltage programming method and a current programming method according to signal types (a voltage or a current) used by a driving circuit.

[0007] An organic EL display comprises an organic EL display panel, a scan driver, and a data driver. The organic EL display panel includes a plurality of data lines for transmitting data signals that represent image signals, a plurality of scan lines for transmitting select signals, and pixel circuits each formed at a pixel area defined by two adjacent scan lines and two adjacent data lines. When the scan driver applies a select signal to a scan line, a transistor is turned on by the select signal, data signals for representing image signals are applied through the data lines to a gate of the transistor from the data driver, and a current flows to an organic EL element through the transistor to emit light.

[0008] In order to reduce the number of data driver ICs, demultiplexers or shift registers are used, and a current sample/hold circuit is used when the panel is driven according to the current programming method. It is usual for the current programming method that requires much time of programming data to pixels to use the current sample/hold circuit so as to realize high resolution. However, since the conventional sample/hold circuit uses TFTs as active devices for sampling and holding the current, the available current range is limited because of the TFT characteristics. Also, the sampled current and the held current are different

because of the kickback phenomenon that is caused when switching the TFTs, and the output current of the driver IC and the current for driving the data lines become different.

[0009] Control the output current of the driver IC is then so as to eliminate the current variation, and hence, a gamma correction process is needed. A deviation of the hold current caused by the deviation of the TFT characteristics is generated during the gamma correction process, and the images may not be uniform.

SUMMARY OF THE INVENTION

[0010] In accordance with the present invention an EL display is provided using a demultiplexer based analog switch, and a driving method thereof.

[0011] In one aspect of the present invention, a display apparatus includes a display area having first and second data lines for transmitting data signals that represent video signals, a first scan line for transmitting a select signal, a first pixel circuit coupled to the first data line and the first scan line, and a second pixel circuit coupled to the second data line and the first scan line; a data driver for outputting data signals corresponding to the first and second data lines through signal lines; a scan driver for outputting the select signal; and a demultiplexer for transmitting the data signals from the signal lines to the respective first and second data lines. A single frame includes first and second fields. The data signal from the first data line is programmed to the first pixel circuit during a first period of the first field, and the data signal from the second data line is programmed to the second pixel circuit during a second period of the second field.

[0012] In another aspect of the present invention, a display apparatus includes a display area having first and second data lines formed in one direction, first and second adjacent scan lines formed to cross the first and second data lines, a first pixel circuit coupled to the first data line and the first scan line, a second pixel circuit coupled to the second data line and the first scan line, a third pixel circuit coupled to the first data line and the second scan line, and a fourth pixel circuit coupled to the second data line and the second scan line; a data driver for outputting data signals corresponding to the first and second data lines through signal lines; and a demultiplexer for transmitting the data signals from the signal lines to the first and second data lines. A single frame includes first and second fields. The first pixel circuit displays images during the first field. The second pixel circuit displays images during the second field. The third pixel circuit displays images during a third field generated by moving the second field for a predetermined time. The fourth pixel circuit displays images during a fourth field generated by moving the first field for a predetermined time.

[0013] In still another aspect of the present invention, a display apparatus includes a display area having first and second data lines formed in one direction, first and second adjacent scan lines formed to cross the first and second data lines, a first pixel circuit coupled to the first data line and the first scan line, a second pixel circuit coupled to the second data line and the first scan line, a third pixel circuit coupled to the first data line and the second scan line, and a fourth pixel circuit coupled to the second data line and the second scan line; a data driver for outputting data signals corresponding to the first and second data lines through signal

lines; and a demultiplexer for transmitting the data signals from the signal lines to the first and second data lines. A single frame includes first and second fields. The first pixel circuit displays images during the first field. The second pixel circuit displays images during the second field. The third pixel circuit displays images during a third field generated by moving the first field for a predetermined time. The fourth pixel circuit displays images during a fourth field generated by moving the second field for a predetermined time.

[0014] In still yet another aspect of the present invention, in a driving method of a display apparatus including a plurality of first data lines, second data lines formed between the adjacent first data lines, first scan lines, second scan lines formed between the adjacent first scan lines, and pixels formed by one of the first and second data lines and one of the first and second scan lines and each having an emission element, the driving method divides the data signals applied through signal lines to the first and second data lines, and applies the divided data signals. A frame is divided into a plurality of fields, and the fields are driven. Data signals are applied to a pixel through the first data line during a first field among the fields, the pixel being formed along the first data line and formed on an area defined by the first scan line and the first data line. Data signals are applied to a pixel through the second data line during a second field among the fields, the pixel being formed along the second data line and formed on an area defined by the first scan line and the second data line.

[0015] In a still further aspect of the present invention, a display apparatus includes a plurality of groups formed of a plurality of data lines and scan lines, and pixels coupled to respective data lines and scan lines. The display apparatus includes a data driver for outputting data signals corresponding to the respective data lines of each group through a signal line; and a demultiplexer for transmitting the data signals from the signal line to the data lines. A single frame includes first and second fields. The pixel circuit coupled to a first data line among the data lines and a first scan line among the scan lines in the group displays images during the first field. The pixel circuit coupled to a second data line and the first scan line in the group displays images during the second field. The pixel circuit coupled to a third data line among the data lines and a second scan line in the group displays images during a third field generated by moving the first field for a predetermined time. The pixel circuit coupled to a fourth data line among the data lines except the third data line and the second scan line displays images during a fourth field generated by moving the second field for a predetermined time.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] FIG. 1 shows a brief diagram of an organic EL display according to an exemplary embodiment of the present.

[0017] FIG. 2 shows a demultiplexer coupled to a data driver of the organic EL display according to an exemplary embodiment of the present.

[0018] FIG. 3 shows two pixel circuits coupled to the demultiplexer of FIG. 2.

[0019] FIGS. 4A, 4B, 5A, and 5B show timing diagrams of signals that follow the organic EL display driving method,

and pixels that are turned on according to a first exemplary embodiment of the present invention.

[0020] FIGS. 6A, 6B, 7A, and 7B show timing diagrams of signals that follow the organic EL display driving method, and pixels that are turned on according to a first exemplary embodiment of the present invention.

DETAILED DESCRIPTION

[0021] FIG. 1 shows a brief diagram of an organic EL display according to an exemplary embodiment of the present invention.

[0022] As shown, the organic EL display comprises organic EL display panel 100, scan drivers 200 and 300, data driver 400, and demultiplexer 500.

[0023] Organic EL display panel 100 comprises a plurality of data lines Data[1] to Data[n] for transmitting data signals that represent video signals, a plurality of scan lines select1[1] to select1[m] and select2[1] to select2[m], and a plurality of pixel circuits 110. Data lines Data[1] to Data[n] transmit data signals that represent video signals to pixel circuits 110, scan lines select1[1] to select1[m] transmit select signals for selecting pixel circuits 110 to pixel circuits 110, and scan lines select2[1] to select2[m] transmit emit signals for emitting light to pixel circuits 110. Pixel circuits 110 are respectively formed at a plurality of pixels surrounded by data lines Data[1] to Data[n] and scan lines select1[1] to select1[m]. Organic EL display panel 100 forms a display area, and scan drivers 200 and 300, data driver 400, and/or demultiplexer 500 can be formed on organic EL display panel 100.

[0024] Scan driver 200 sequentially applies select signals to scan lines select1[1] to select1[m], and scan driver 300 sequentially applies emit signals to scan lines select2[1] to select2[m]. Data driver 400 applies data signals for representing video signals to demultiplexer 500, and demultiplexer 500 has a 1:2 format, and divides the data signals sequentially applied through a single line from data driver 400 into two data lines.

[0025] FIG. 2 shows a representative portion of demultiplexer 500 coupled to the data driver of the organic EL display according to an exemplary embodiment of the present invention.

[0026] Demultiplexer 500 is coupled to data driver 400 through signal lines SP1 to SPn', and transmits the data signals sequentially applied through a single signal line SP1 to SPn' to two data lines Data[2i-1] and Data[2i]. One signal line SP1 to SPn' is coupled to two switches, and the two switches are respectively coupled to a single data line. For example, two switches S1 and S2 are coupled to signal line SPi, and switches S1 and S2 are respectively coupled to data lines Data[2i-1] and Data[2i]. The switches are alternately turned on to transmit the data signal from signal line SPi to respective data lines Data[2i-1] and Data[2i]. Switches S1 and S2 can be formed with NMOS transistors, PMOS transistors, or other similar types of transistors.

[0027] Referring to FIG. 3, a method for driving the organic EL display using demultiplexer 500 according to an exemplary embodiment of the present invention will be described. For ease of description, two pixel circuits 110a

and **110b** coupled to $(2i-1)^{\text{th}}$ and $2i^{\text{th}}$ data lines $\text{Data}[2i-1]$ and $\text{Data}[2i]$ and a j^{th} scan line $\text{select1}[j]$ will be depicted.

[0028] Data lines $\text{Data}[2i-1]$ and $\text{Data}[2i]$ of two pixel circuits **110a** and **110b** are coupled to signal line SP_i from data driver **400** through switches **S1** and **S2**. Pixel circuit **110a** comprises four transistors **M1** to **M4**, capacitor Cst , and organic EL element OLED. Pixel circuit **110b** comprises four transistors $\text{M1}'$ to $\text{M4}'$, capacitor Cst' , and an organic EL element OLED'.

[0029] When switch **S1** is turned on while transistors **M1**, **M2**, $\text{M1}'$, and $\text{M2}'$ are turned on by the select signal from scan line $\text{select1}[j]$, a data signal from signal line SP_i is applied to pixel circuit **110a** through data line $\text{Data}[2i-1]$. Since transistor **M3** is diode-connected by turned-on transistors **M1** and **M2**, a voltage corresponding to the data signal from data line $\text{Data}[2i-1]$ is programmed to capacitor Cst .

[0030] When switch **S2** is turned on, the data signal from signal line SP_i is applied to pixel circuit **110b** through data line $\text{Data}[2i]$. The voltage corresponding to the data signal from data line $\text{Data}[2i]$ is programmed to capacitor Cst' since transistor **M3'** is diode-connected by turned-on transistors $\text{M1}'$ and $\text{M2}'$. In this instance, since switch **S1** is turned off and the current of 0A is transmitted through data line $\text{Data}[2i-1]$, the voltage (a blank signal) corresponding to 0A is programmed to capacitor Cst .

[0031] Therefore, when transistors **M4** and $\text{M4}'$ are turned on by an emit signal from scan line $\text{select2}[j]$ to allow pixel circuits **110a** and **110b** to emit light, current of 0A from pixel circuit **110a** flows to organic EL element OLED. That is, pixel circuit **110a** fails to display the original gray and enters into a blank state.

[0032] To solve this problem, an additional scan line can be used for pixel circuits **110a** and **110b**, but the additional usage of a scan line increases wiring, reduces an aperture ratio, and further needs a scan driver for controlling the added scan line, thereby raising the cost.

[0033] To remedy this problem, the method for driving the organic EL display divides a single frame into first and second fields, and drives switches **S1** and **S2** coupled to signal line SP_i so that two adjacent pixels coupled to two data lines $\text{Data}[2i-1]$ and $\text{Data}[2i]$ to which the data signal output from single signal line SP_i is applied may be respectively turned on during the first and second fields. A driving method for the organic EL display according to the exemplary embodiment of the present invention will be described.

[0034] FIGS. 4A, 4B, 5A, and 5B show timing diagrams of signals that follow the organic EL display driving method, and pixels that are turned on according to a first exemplary embodiment of the present invention.

[0035] Referring to FIGS. 4A and 4B, switches **S1** and **S2** are alternately turned on and off during the first field so that the data signal may be alternately applied to two adjacent data lines $\text{Data}[2i-1]$ and $\text{Data}[2i]$ while the select signal output through scan driver **200** is sequentially applied to respective scan lines $\text{select1}[1]$ to $\text{select1}[m]$.

[0036] That is, when the select signal is applied to scan line $\text{select1}[1]$, switch **S1** is turned on, and switch **S2** is turned off. As a result, the data signal is applied to data line $\text{Data}[2i-1]$, and supply of the data signal to data line

$\text{Data}[2i]$ is intercepted. Therefore, when an emit signal is applied to scan line $\text{select2}[1]$, the pixel circuit coupled to scan line $\text{select1}[1]$ and data line $\text{Data}[2i-1]$ emits light, and the pixel circuit coupled to scan line $\text{select1}[1]$ and data line $\text{Data}[2i]$ becomes blank and emits no light. It is desirable to apply the emit signal to scan line $\text{select2}[1]$ after an enable period of the select signal applied to scan line $\text{select1}[1]$ is finished. In another way, it is possible to allow the pixel circuit to emit light when the enable period of the select signal is finished, by eliminating scan lines $\text{select2}[1]$ to $\text{select2}[m]$ for emit signal transmission, changing transistors **M4** and $\text{M4}'$ in the pixel circuit of FIG. 3 with NMOS transistors, and driving the NMOS transistors through scan lines $\text{select1}[1]$ to $\text{select1}[m]$.

[0037] Next, when the select signal is applied to scan line $\text{select1}[2]$, switch **S2** is turned on, and switch **S1** is turned off. As a result, the data signal is applied to data line $\text{Data}[2i]$, and supply of the data signal to data line $\text{Data}[2i-1]$ is intercepted. Therefore, when an emit signal is applied to scan line $\text{select2}[2]$, the pixel circuit coupled to scan line $\text{select1}[2]$ and data line $\text{Data}[2i]$ emits light, and the pixel circuit coupled to scan line $\text{select1}[2]$ and data line $\text{Data}[2i-1]$ becomes blank and emits no light.

[0038] Switches **S1** and **S2** are alternately turned on/off to sequentially apply a data signal to data lines $\text{Data}[2i-1]$ and $\text{Data}[2i]$ while a select signal is applied to scan lines $\text{select}[3]$ to $\text{select}[m]$. Accordingly as shown in FIG. 4B, the data signal is programmed to the pixel circuit coupled to odd scan line $\text{select}[2j-1]$ and odd data line $\text{Data}[2i-1]$ and the pixel circuit coupled to even scan line $\text{select}[2j]$ and even data line $\text{Data}[2i]$ in the first field. The pixel circuits to which the data signal is programmed emit light until they become blank by a second field, that is, during a half of the single frame period. Further, the emission period of the pixel circuits can be reduced by controlling the timing of the emit signal.

[0039] Next, referring to FIGS. 5A and 5B, in the second field, switches **S1** and **S2** are alternately turned on/off in the opposite manner of the first field case as shown in FIG. 5A so that the data signal may be applied to two adjacent data lines $\text{Data}[2i-1]$ and $\text{Data}[2i]$ while the select signal output through scan driver **200** is sequentially applied to respective scan lines $\text{select1}[1]$ to $\text{select1}[m]$.

[0040] As shown in FIG. 5A, when a select signal is applied to scan line $\text{select1}[1]$, switch **S2** is turned on, and switch **S1** is turned off. As a result, the data signal is applied to data line $\text{Data}[2i]$, and supply of the data signal to data line $\text{Data}[2i-1]$ is intercepted. Therefore, when an emit signal is applied to scan line $\text{select2}[1]$, the pixel circuit coupled to scan line $\text{select1}[1]$ and data line $\text{Data}[2i]$ emits light, and the pixel circuit coupled to scan line $\text{select1}[1]$ and data line $\text{Data}[2i-1]$ becomes blank and emits no light. As described in the operation of the first field, it is desirable to apply the emit signal to scan line $\text{select2}[1]$ after an enable period of the select signal applied to scan line $\text{select1}[1]$ is finished. In another way, it is possible to allow the pixel circuit to emit light when the enable period of the select signal is finished, by eliminating scan lines $\text{select2}[1]$ to $\text{select2}[m]$ for emit signal transmission, changing transistors **M4** and $\text{M4}'$ in the pixel circuit of FIG. 3 with NMOS transistors, and driving the NMOS transistors through scan lines $\text{select1}[1]$ to $\text{select1}[m]$.

[0041] Next, when the select signal is applied to scan line select1[2], switch S1 is turned on, and switch S2 is turned off. As a result, the data signal is applied to data line Data[2i-1], and supply of the data signal to data line Data[2i] is intercepted. Therefore, when an emit signal is applied to scan line select2[2], the pixel circuit coupled to scan line select1[2] and data line Data[2i-1] emits light, and the pixel circuit coupled to scan line select1[2] and data line Data[2i] becomes blank and emits no light.

[0042] Switches S1 and S2 are alternately turned on/off to sequentially apply a data signal to data lines Data[2i-1] and Data[2i] while a select signal is applied to scan lines select[3] to select[m]. Accordingly as shown in FIG. 5B, the data signal is programmed to the pixel circuit coupled to odd scan line select1[2j-1] and even data line Data[2i] and the pixel circuit coupled to even scan line select1[2j] and odd data line Data[2i-1] in the second field. The pixel circuits to which the data signal is programmed emit light after they become blank by the first field, that is, during a half the single frame period. Further, the emission period of the pixel circuits can be reduced by controlling the timing of the emit signal.

[0043] As described, since the driving method according to the first exemplary embodiment uses the duty driving method for emitting light during the half period of a single frame, the data signal (the current) is doubled compared to the conventional driving methods, thereby solving the problem of the reduced available programming time. Also, the duty driving method according to the first exemplary embodiment improves the flicker phenomenon generated from the conventional duty driving methods since it sequentially emits the odd pixels and the even pixels.

[0044] Also, the organic EL display driving method according to the first exemplary embodiment alternately turns on/off switches S1 and S2 so that the data signal may be alternately applied to the two adjacent data lines Data[2i-1] and Data[2i] while the select signal output through scan driver 200 is sequentially applied to respective scan lines select1[1] to select1[m], and in addition, the method can turn on/off switches S1 and S2 so that the data signal may be programmed to the pixel circuit coupled to odd scan line select1[2j-1] and even data line select[2i] and the pixel circuit coupled to even scan line select[2j] and odd data line Data[2i-1] during the first field, and the data signal may be programmed to the pixel circuit coupled to odd scan line select1[2j-1] and odd data line Data[2i-1] and the pixel circuit coupled to even scan line select[2j] and even data line Data[2i] during the second field.

[0045] The organic EL display driving method according to the second exemplary embodiment alternately allows the pixel circuit coupled to the odd data line and the pixel circuit coupled to the even data line to emit light respectively during the first and second fields.

[0046] FIGS. 6A, 6B, 7A, and 7B show timing diagrams of signals that follow the organic EL display driving method, and pixels that are turned on according to a second exemplary embodiment of the present invention.

[0047] Referring to FIGS. 6A and 6B, switch S1 is turned on and switch S2 is turned off during the first field while the select signal output through scan driver 200 is sequentially applied to respective scan lines select1[1] to select1[m]. As

a result, the data signal is applied to data line Data[2i-1], and supply of a data signal to data line Data[2i] is intercepted. Therefore, when the emit signal is sequentially applied to scan lines select2[1] to select2[m], the pixel circuits coupled to scan lines select1[1] to select1[m] and odd data line Data[2i-1] sequentially emit light, and the pixel circuits coupled to scan lines select1[1] to select1[m] and even data line Data[2i] become blank and emit no light as shown in FIG. 6B.

[0048] It is desirable to apply the emit signal to scan lines select2[1] to select2[m] when the enable period of the select signal applied to scan lines select1[1] to select1[m] is finished. Further, it is possible to eliminate scan lines select2[1] to select2[m] for transmitting the emit signal, change the transistors M4 and M4' of FIG. 3 with NMOS transistors, drive the NMOS transistors through scan lines select1[1] to select1[m], and thereby allow the pixel circuit to emit light when the enable period of the select signal is finished.

[0049] Also, the pixel circuits to which the data signal is programmed emit light until they become blank by the second field described later, that is, during about a half the single frame. Further, the period during which the pixel circuits emit light can be reduced by controlling the timing of the emit signal.

[0050] Referring to FIGS. 7A and 7B, switch S1 is turned off and switch S2 is turned on in the second field opposite to the case of the first field while the select signal output through scan driver 200 is sequentially applied to respective scan lines select1[1] to select1[m]. Therefore, when the emit signal is sequentially applied to scan lines select2[1] to select2[m], the pixel circuits coupled to scan lines select1[1] to select1[m] and even data line Data[2i] sequentially emit light, and the pixel circuits coupled to scan lines select1[1] to select1[m] and odd data line Data[2i-1] become blank and emit no light.

[0051] It is desirable to apply the emit signal to scan lines select2[1] to select2[m] when the enable period of the select signal applied to select1[1] to select1[m] is finished. Further, it is possible to allow the pixel circuit to emit light when the enable period of the select signal is finished, by eliminating scan lines select2[1] to select2[m] for emit signal transmission, changing the transistors M4 and M4' in the pixel circuit of FIG. 3 with NMOS transistors, and driving the NMOS transistors through scan lines select1[1] to select1[m].

[0052] Also, the pixel circuits to which the data signal is programmed emit light after they become blank by the first field, that is, during about a half the single frame period. Further, the emission period of the pixel circuits can be reduced by controlling the timing of the emit signal.

[0053] Since the data signal is applied to even data line Data[2i] after it is applied to odd data line Data[2i-1], and the duty driving method is used in the second exemplary embodiment, the time for programming the data signal can be shortened by doubling the data current.

[0054] Also, by turning on switch S2 and turning off switch S1 while the select signal output through scan driver 200 is sequentially applied to respective scan lines select1[1] to select1[m] in the first field, and turning on switch S1 and turning off switch S2 in the second field, the organic EL display driving method according to the second exemplary

embodiment allows the pixel circuits coupled to scan lines select1[1] to select1[m] and even data line Data[2i] to emit light during the first field, and allows the pixel circuits coupled to scan lines select1[1] to select1[m] and odd data line Data[2i-1] to emit light during the second field.

[0055] While this invention has been described in connection with what is presently considered to be 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.

[0056] For example, a 1:2 demultiplexer is shown in the exemplary embodiments, but the present invention can be applied to 1:N demultiplexers. In the case of using a 1:3 demultiplexer, a single frame would be divided into first to third fields, and three switches (not illustrated) coupled to a signal line SPi would be driven so that three adjacent pixels coupled to three data lines to which the data signal output from single signal line SPi emit light respectively during the first to third fields.

[0057] Further, by the driving method according to the first exemplary embodiment, the data signal would be programmed to the pixel circuit coupled to scan line select1[3j-2] and data line Data[3i-2], the pixel circuit coupled to scan line select1[3j-1] and data line Data[3i-1], and the pixel circuit coupled to scan line select1[3j] and data line Data[3i] during the first field, the data signal would be programmed to the pixel circuit coupled to scan line select1[3j-2] and data line Data[3i-1], the pixel circuit coupled to scan line select1[3j-1] and data line Data[3i], and the pixel circuit coupled to scan line select1[3j] and data line Data[3i-2] during the second field, and the data signal would be programmed to the pixel circuit coupled to scan line select1[3j-2] and data line Data[3i], the pixel circuit coupled to scan line select1[3j-1] and data line Data[3i-2], and the pixel circuit coupled to scan line select1[3j] and data line Data[3i-1] during the third field.

[0058] Also, by the driving method according to the second exemplary embodiment, the pixel circuits coupled to scan lines select1[1] to select1[m] and data line Data[3i-2] sequentially emit light during the first field, the pixel circuits coupled to scan lines select1[1] to select1[m] and data line Data[3i-1] sequentially emit light during the second field, and the pixel circuits coupled to scan lines select1[1] to select1[m] and data line Data[3i] sequentially emit light during the third field.

[0059] As described above, since the current supply is doubled by driving the organic EL display apparatus according to the present invention, the problem of reduced programming time is overcome. In addition, the flicker phenomenon caused by the duty driving is improved by dividing a single frame into a plurality of fields, and the time for programming the data is shortened.

What is claimed is:

1. A display apparatus comprising:

a display area including a first data line and a second data line for transmitting data signals that represent video signals, a first scan line for transmitting a select signal, a first pixel circuit coupled to the first data line and the

first scan line, and a second pixel circuit coupled to the second data line and the first scan line;

a data driver for outputting data signals corresponding to the first data line and the second data line through signal lines;

a scan driver for outputting the select signal; and

a demultiplexer for transmitting the data signals from the signal lines to the respective first data line and second data line, and wherein

a single frame includes a first field and a second field, and

the data signal from the first data line is programmed to the first pixel circuit during a first period of the first field, and the data signal from the second data line is programmed to the second pixel circuit during a second period of the second field.

2. The display apparatus of claim 1, wherein a select signal is applied to the first scan line during the first period and the second period, and

a blank signal is programmed to the second pixel circuit while the data signal is programmed to the first pixel circuit during the first period, and a blank signal is programmed to the first pixel circuit while the data signal is programmed to the second pixel circuit during the second period.

3. The display apparatus of claim 2, wherein the data signal is a signal supplied in the form of current, and

the data signal applied to the second pixel circuit is intercepted to program a blank signal to the second pixel circuit during the first period, and the data signal applied to the first pixel circuit is intercepted to program a blank signal to the first pixel circuit during the second period.

4. The display apparatus of claim 3, wherein the first pixel circuit and the second pixel circuit respectively include an emission element corresponding to respectively programmed data signals, and

the emission element of the first pixel circuit emits light during the first field, and the emission element of the second pixel circuit emits light during the second field.

5. The display apparatus of claim 1, wherein a data signal from the first data line is programmed to a third pixel circuit coupled to a second scan line for receiving a select signal, and the first data line during a third period of the first field, and

a data signal from the second data line is programmed to a fourth pixel circuit coupled to the second scan line and the second data line during a fourth period of the second field.

6. The display apparatus of claim 5, wherein a blank signal is programmed to the fourth pixel circuit while the data signal is programmed to the third pixel circuit during the third period, and a blank signal is programmed to the third pixel circuit while the data signal is programmed to the fourth pixel circuit during the fourth period.

7. The display apparatus of claim 1, wherein a data signal from the first data line is programmed to a third pixel circuit coupled to a second scan line for receiving a select signal, and the first data line during a third period of the second field, and

a data signal from the second data line is programmed to a fourth pixel circuit coupled to the second scan line and the second data line during a fourth period of the first field.

8. The display apparatus of claim 7, wherein a blank signal is programmed to the third pixel circuit while the data signal is programmed to the fourth pixel circuit during the first field, and a blank signal is programmed to the fourth pixel circuit while the data signal is programmed to the third pixel circuit during the second field.

9. The display apparatus of claim 1, wherein the demultiplexer includes a first switch coupled between the signal line and the first data line, and a second switch coupled between the signal line and the second data line, and

the first switch is turned on and the second switch is turned off during the first period, and the second switch is turned on and the first switch is turned off during the second period.

10. The display apparatus of claim 1, wherein the first data line is an odd data line, and the second data line is an even data line.

11. The display apparatus of claim 1, wherein the first data line is an even data line, and the second data line is an odd data line.

12. A display apparatus comprising:

a display area including a first data line and a second data line formed in one direction, a first scan line and second scan line, the first scan line and the second scan line being adjacent and formed to cross the first data line and the second data line, a first pixel circuit coupled to the first data line and the first scan line, a second pixel circuit coupled to the second data line and the first scan line, a third pixel circuit coupled to the first data line and the second scan line, and a fourth pixel circuit coupled to the second data line and the second scan line;

a data driver for outputting data signals corresponding to the first data line and the second data line through signal lines; and

a demultiplexer for transmitting the data signals from the signal lines to the first data line and the second data line, and wherein

a single frame includes a first field and a second field, the first pixel circuit displays images during the first field, the second pixel circuit displays images during the second field, the third pixel circuit displays images during a third field generated by moving the second field for a predetermined time, and the fourth pixel circuit displays images during a fourth field generated by moving the first field for a predetermined time.

13. The display apparatus of claim 12, wherein the demultiplexer comprises a first switch coupled between the signal line and the first data line, and a second switch coupled between the signal line and the second data line.

14. The display apparatus of claim 12, wherein the predetermined time includes an enable period of a select signal applied through one of the first and second scan lines.

15. The display apparatus of claim 12, wherein the first pixel circuit, the second pixel circuit, the third pixel circuit and the fourth pixel circuit respectively include an emission element for emitting light corresponding to the programmed data signal, and

the emission elements of the first pixel circuit, the second pixel circuit, the third pixel circuit and the fourth pixel circuit each emit light to display the images during the respective first field, second field, third field and fourth field.

16. A display apparatus comprising:

a display area including a first data line and a second data line formed in one direction, a first scan line and a second scan line, the first scan line and the second scan line being adjacent and formed to cross the first data line and the second data line, a first pixel circuit coupled to the first data line and the first scan line, a second pixel circuit coupled to the second data line and the first scan line, a third pixel circuit coupled to the first data line and the second scan line, and a fourth pixel circuit coupled to the second data line and the second scan line;

a data driver for outputting data signals corresponding to the first data line and the second data line through signal lines; and

a demultiplexer for transmitting the data signals from the signal lines to the first data line and the second data line, and wherein

a single frame includes a first field and a second field, the first pixel circuit displays images during the first field, the second pixel circuit displays images during the second field, the third pixel circuit displays images during a third field generated by moving the first field for a predetermined time, and the fourth pixel circuit displays images during a fourth field generated by moving the second field for a predetermined time.

17. The display apparatus of claim 16, wherein the demultiplexer comprises a first switch coupled between the signal line and the first data line, and a second switch coupled between the signal line and the second data line.

18. The display apparatus of claim 16, wherein the predetermined time includes an enable period of a select signal applied through one of the first data line and the second scan line.

19. The display apparatus of claim 16, wherein the first pixel circuit, the second pixel circuit, the third pixel circuit and the fourth pixel circuit respectively include an emission element for emitting light corresponding to the programmed data signal, and

the emission elements of the first pixel circuit, the second pixel circuit, the third pixel circuit and the fourth pixel circuit each emit light to display the images during the respective first field, second field, third field and fourth field.

20. A driving method of a display apparatus including a plurality of first data lines, second data lines formed between adjacent first data lines, first scan lines, second scan lines formed between adjacent first scan lines, and pixels formed by one of the first data line and the second data line and one of the first scan line and second scan line and each having an emission element, the driving method for dividing the data signals applied through signal lines to the first data line and the second data line, and applying the divided data signals, comprising:

dividing a frame into a plurality of fields, and driving the fields;

applying data signals to a pixel through the first data line during a first field among the fields, the pixel being formed along the first data line and formed on an area defined by the first scan line and the first data line; and

applying data signals to a pixel through the second data line during a second field among the fields, the pixel being formed along the second data line and formed on an area defined by the first scan line and the second data line.

21. The driving method of claim 20, wherein the data signal provided at the pixel coupled to the second data line and the first scan line corresponding to the pixel to which the data signal is applied is eliminated while the data signal is applied through the first data line to the pixel coupled to the first scan line.

22. The driving method of claim 20, further comprising:

applying data signals to a pixel through the second data line during the first field, the pixel being formed along the second data line and formed on an area defined by the second scan line and the second data line; and

applying data signals to a pixel through the first data line during the second field, the pixel being formed along the first data line and formed on an area defined by the second scan line and the first data line.

23. The driving method of claim 20, comprising:

applying data signals to a pixel through the first data line during the first field, the pixel being formed along the first data line and formed on an area defined by the second scan line and the first data line; and

applying data signals to a pixel through the second data line during the second field, the pixel being formed along the second data line and formed on an area defined by the second scan line and the second data line.

24. The driving method of claim 20, wherein an emission element of the pixel to which the data signal is applied emits light corresponding to the data signal for a predetermined period.

25. A display apparatus including a plurality of groups formed of a plurality of data lines and scan lines, and pixels coupled to respective data lines and scan lines, the display apparatus comprising:

a data driver for outputting data signals corresponding to the respective data lines of each group through a signal line; and

a demultiplexer for transmitting the data signals from the signal line to the data lines, and wherein

a single frame includes a first field and a second field,

the pixel circuit coupled to a first data line among the data lines and a first scan line among the scan lines in the group displays images during the first field,

the pixel circuit coupled to a second data line and the first scan line in the group displays images during the second field,

the pixel circuit coupled to a third data line among the data lines and a second scan line in the group displays images during a third field generated by moving the first field for a predetermined time, and

the pixel circuit coupled to a fourth data line among the data lines except the third data line and the second scan line displays images during a fourth field generated by moving the second field for a predetermined time.

26. The display apparatus of claim 25, wherein the third data line is the first data line, and the fourth data line is the second data line.

27. The display apparatus of claim 25, wherein the third data line is the second data line.

28. The display apparatus of claim 27, wherein the fourth data line is the first data line.

29. The display apparatus of claim 27, wherein the fourth data line is a data line other than the first and second data lines.

30. The display apparatus of claim 29, wherein the frame further comprises a fifth field, and

the pixel circuit coupled to the fourth data line and the first scan line displays images during the fifth field.

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专利名称(译)	显示器及其驱动方法		
公开(公告)号	US20050024297A1	公开(公告)日	2005-02-03
申请号	US10/819687	申请日	2004-04-07
[标]申请(专利权)人(译)	SHIN董勇		
申请(专利权)人(译)	申东勇		
当前申请(专利权)人(译)	三星DISPLAY CO., LTD.		
[标]发明人	SHIN DONG YONG		
发明人	SHIN, DONG-YONG		
IPC分类号	H01L51/50 G09G3/20 G09G3/30 G09G3/32 H05B33/00 H05B33/14		
CPC分类号	G09G3/3283 G09G2300/0861 G09G2320/0223 G09G2310/0297 G09G2310/0224		
优先权	1020030052603 2003-07-30 KR		
其他公开文献	US8243057		
外部链接	Espacenet USPTO		

摘要(译)

一种有机电致发光显示器及其驱动方法。有机电致发光显示器包括多路分解器，用于根据模拟开关的接通/断开操作将由数据驱动器提供的信号输出到多条数据线。驱动方法将框架分成两部分，并驱动它们。在前1/2帧期间，数据信号被施加到在每行的像素中不相邻的像素，并且数据信号被施加到在后1/2帧期间在前1/2帧中没有施加数据信号的像素。

