

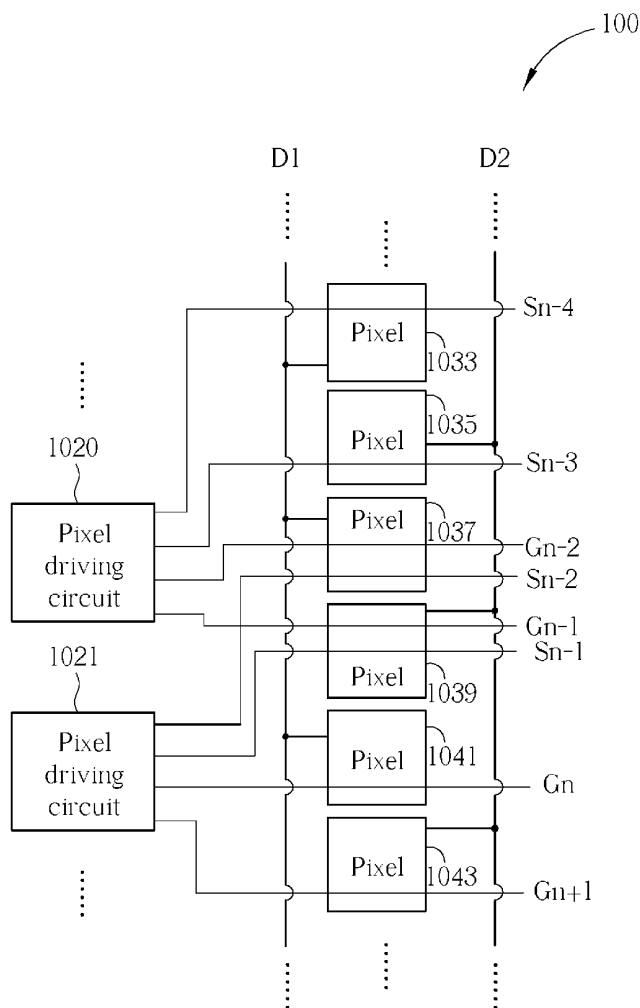


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(19) **United States**(12) **Patent Application Publication**
Lin et al.(10) **Pub. No.: US 2012/0169679 A1**(43) **Pub. Date: Jul. 5, 2012**(54) **LIQUID CRYSTAL DISPLAY DEVICE****Publication Classification**(76) Inventors: **Chih-Ying Lin**, Hsin-Chu (TW);
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Kuo-Chang Su, Hsin-Chu (TW);
Yung-Chih Chen, Hsin-Chu (TW)(51) **Int. Cl.**
G09G 3/36 (2006.01)
G06F 3/038 (2006.01)
(52) **U.S. Cl.** **345/204; 345/92**
(57) **ABSTRACT**(21) Appl. No.: **13/316,572**(22) Filed: **Dec. 12, 2011**(30) **Foreign Application Priority Data**

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A liquid crystal display device includes a plurality of pixel driving circuits and a pixel array. Each pixel driving circuit of the plurality of pixel driving circuits includes four thin film transistors and has four output terminals, where each thin film transistor is used for driving an output terminal of the four output terminals, and the four output terminals are coupled to two gate lines and two sharing lines respectively for outputting two main output signals and two sharing output signals. The phases and timings of the two main output signals and the two sharing output signals are all the same. A pixel of the pixel array is charged/discharged to a specific voltage level according to a main output signal of the two main output signals, a sharing output signal, and a signal of a data line.



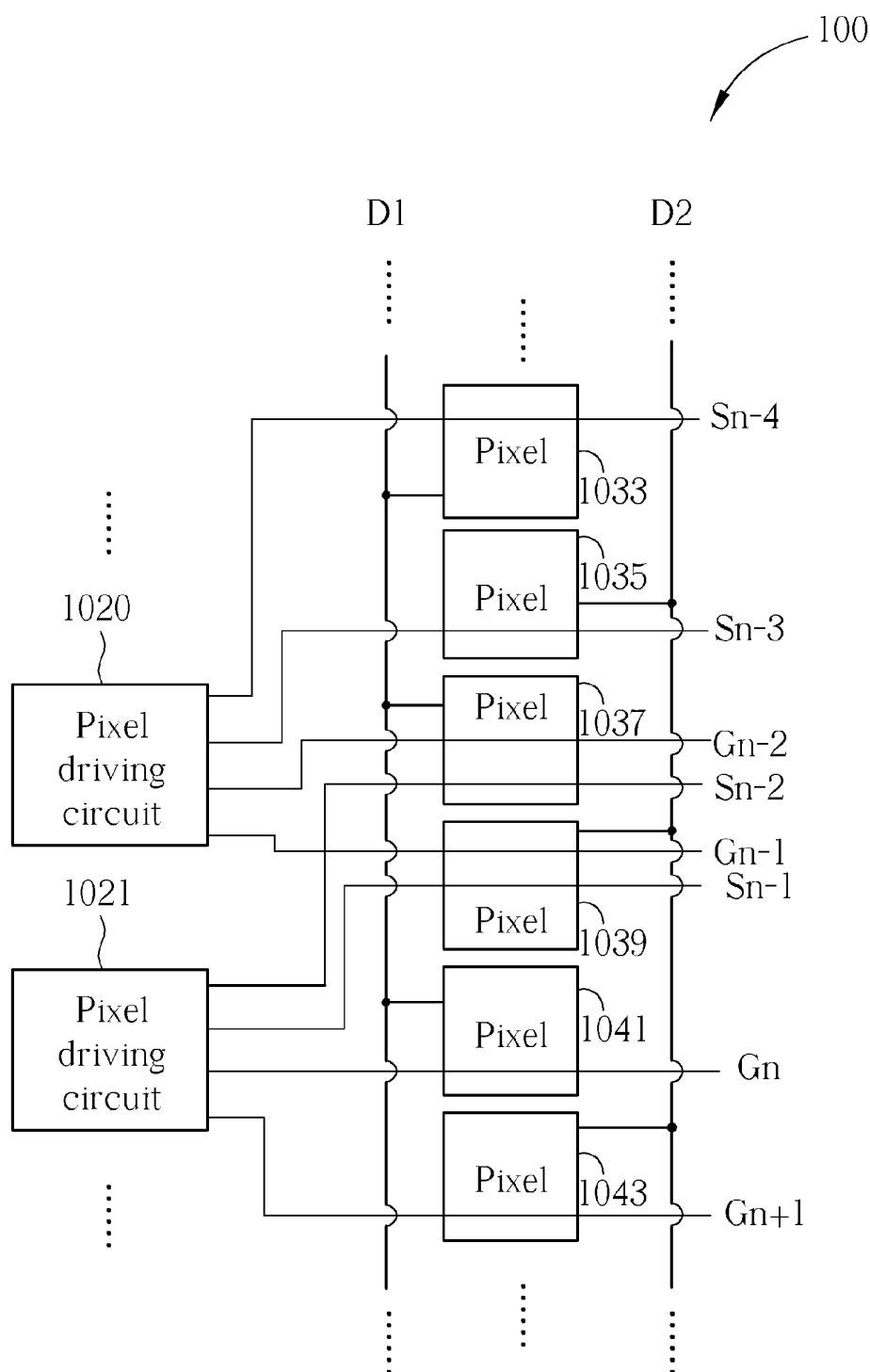


FIG. 1

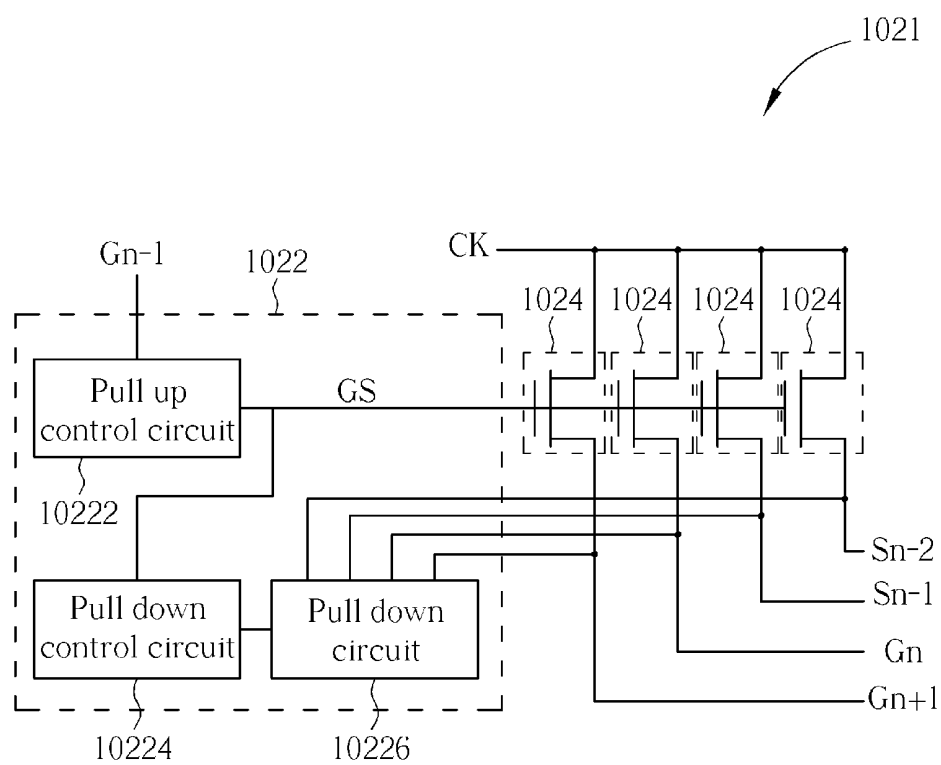


FIG. 2

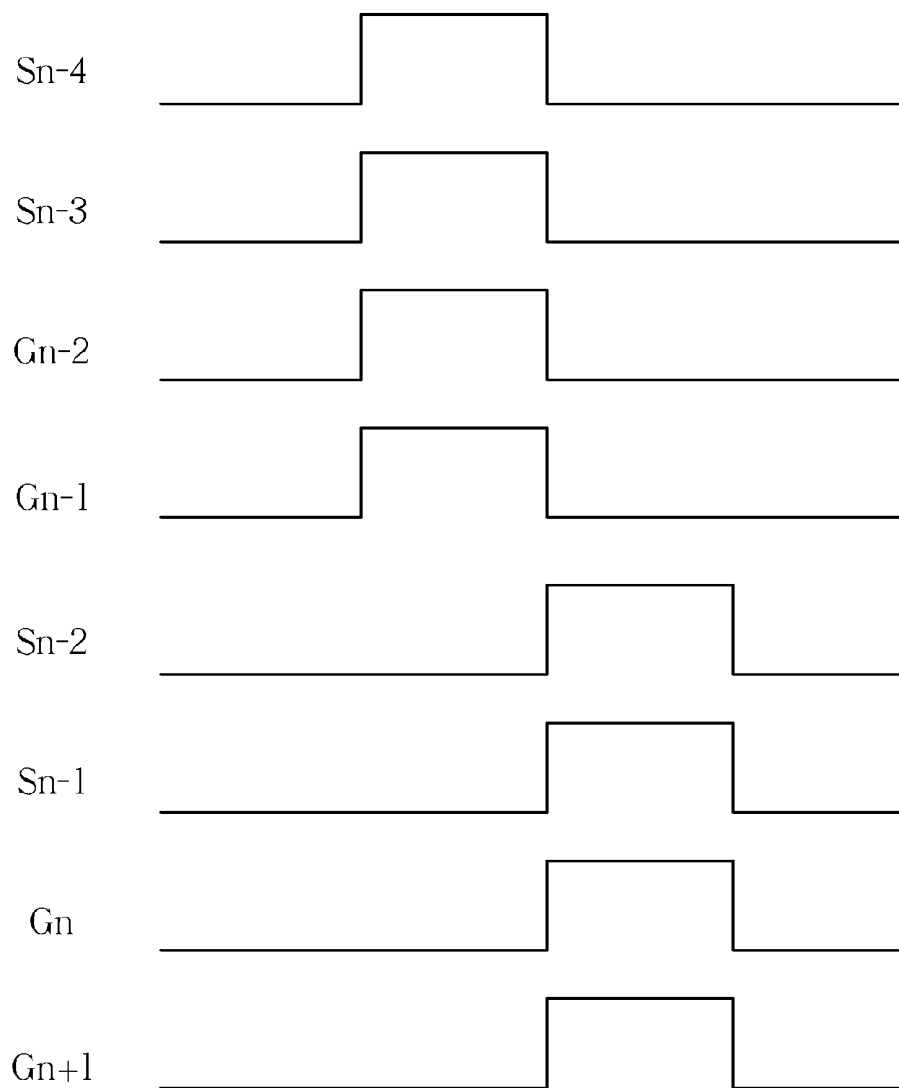


FIG. 3

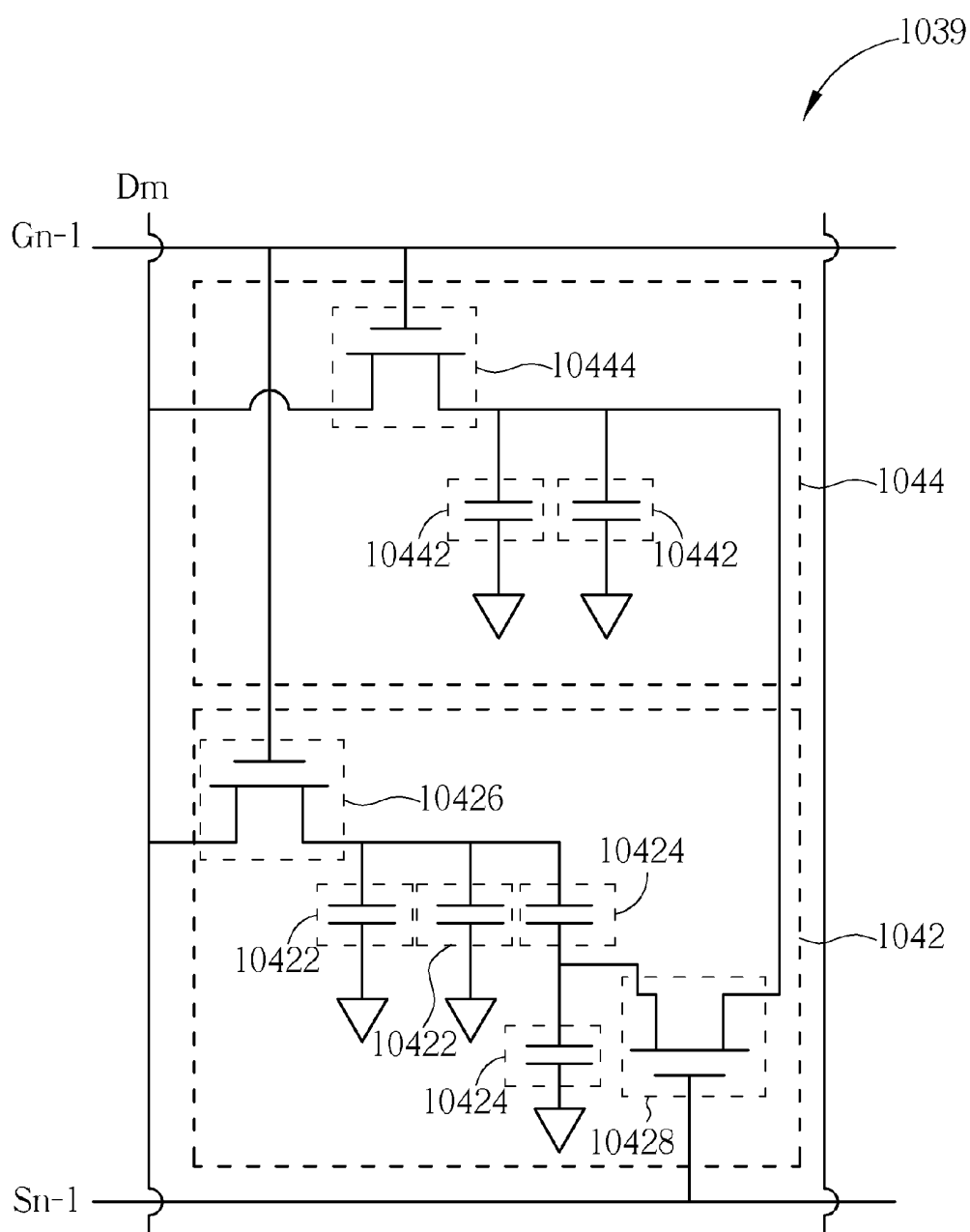


FIG. 4

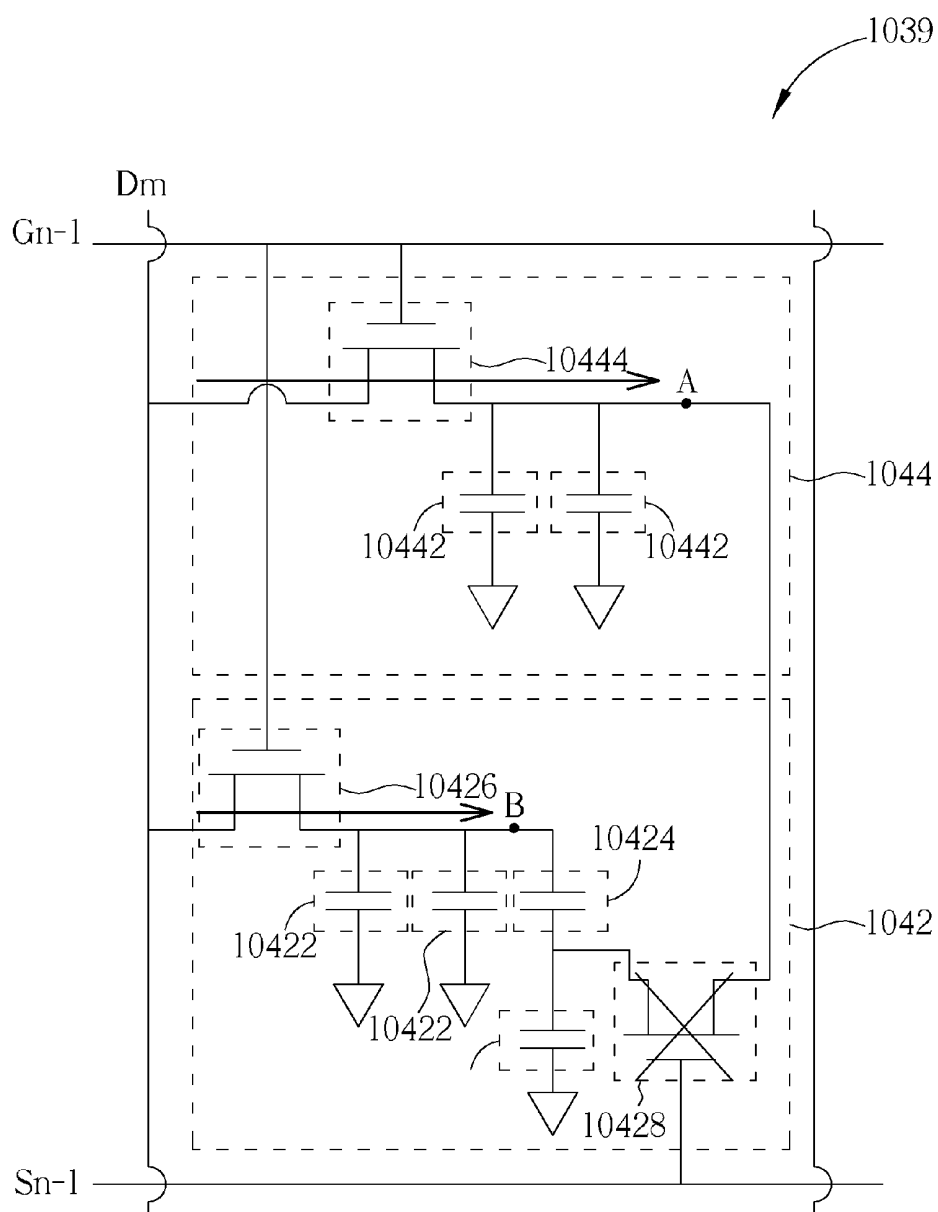


FIG. 5

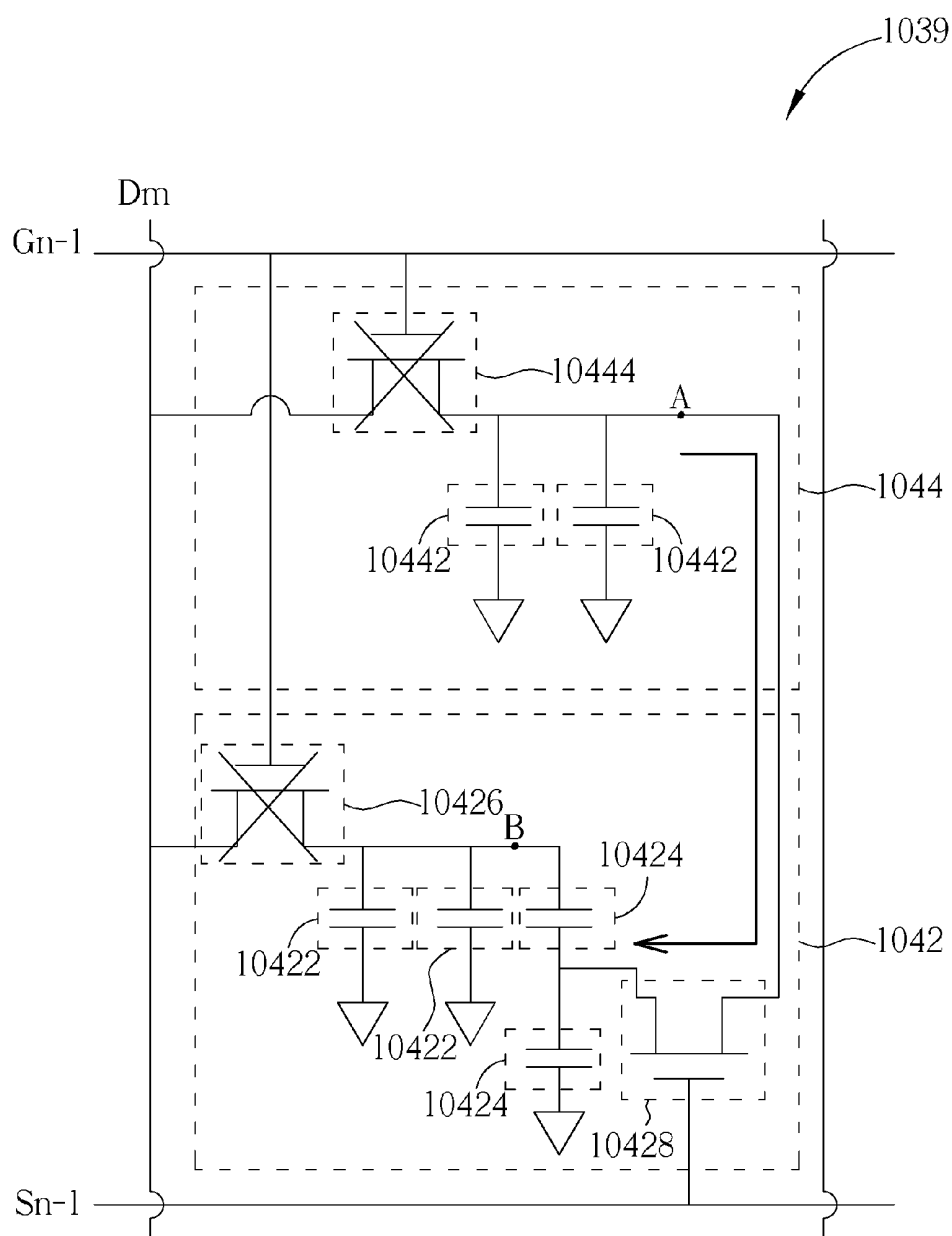


FIG. 6

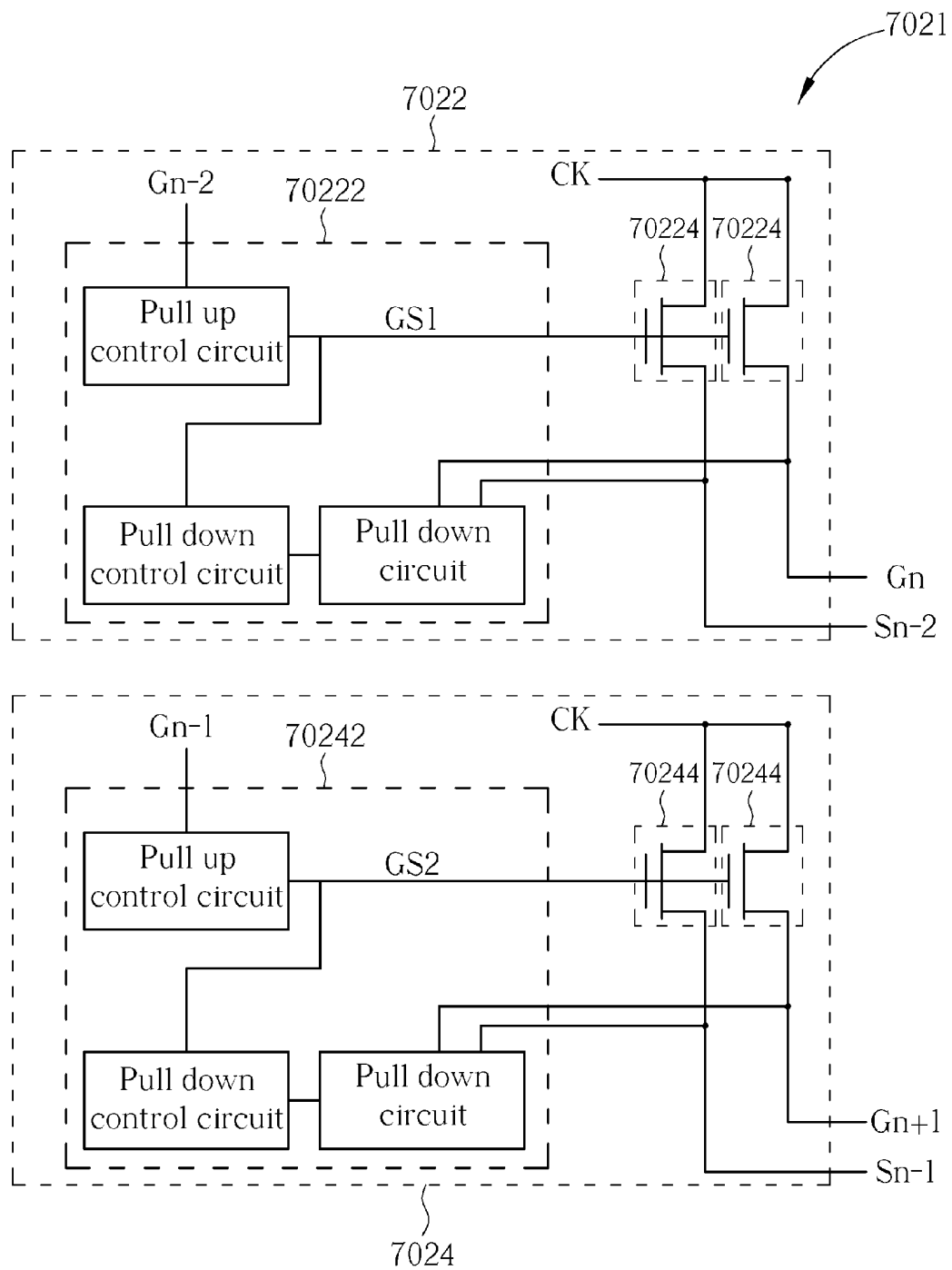


FIG. 7

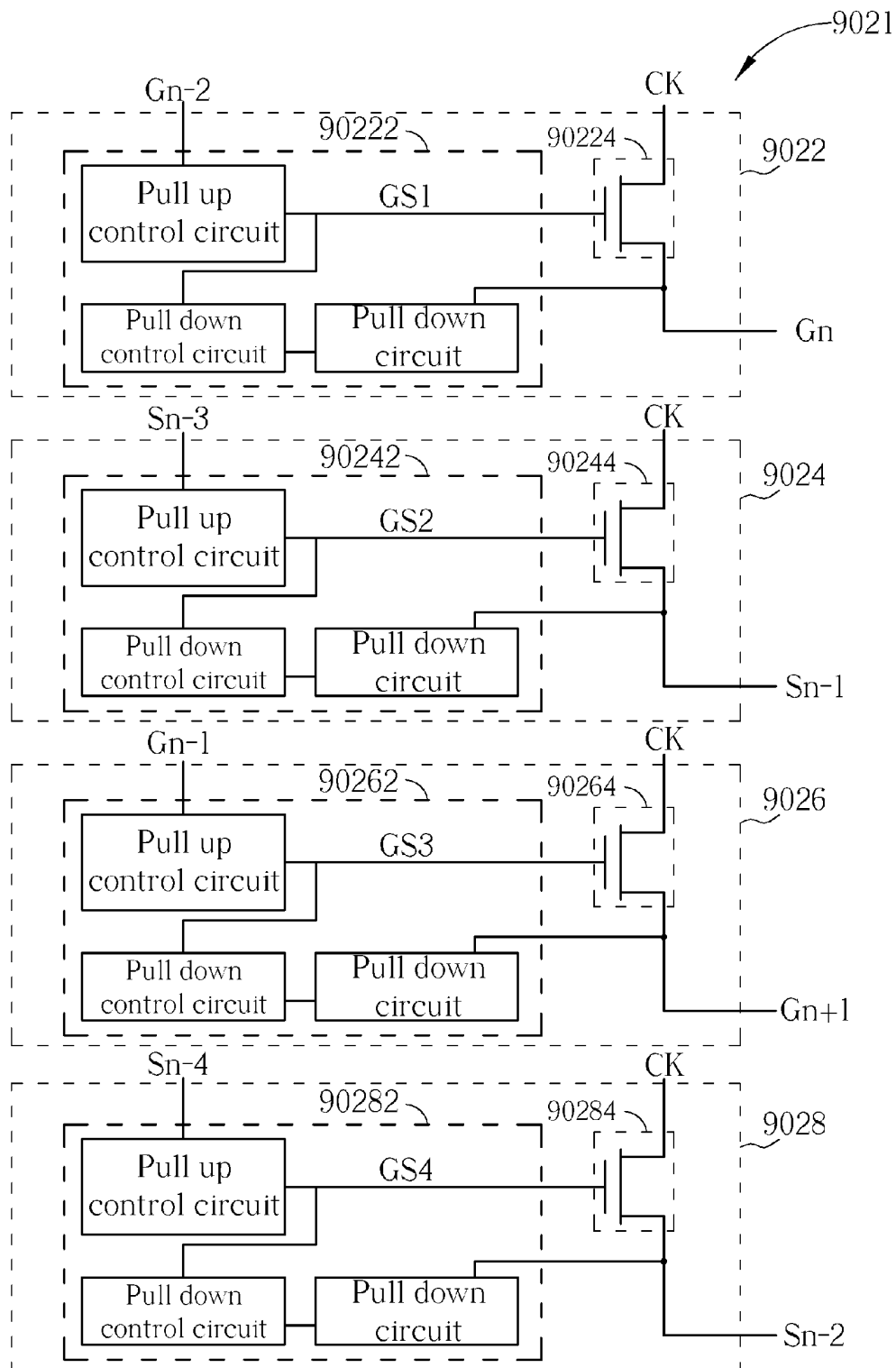


FIG. 8

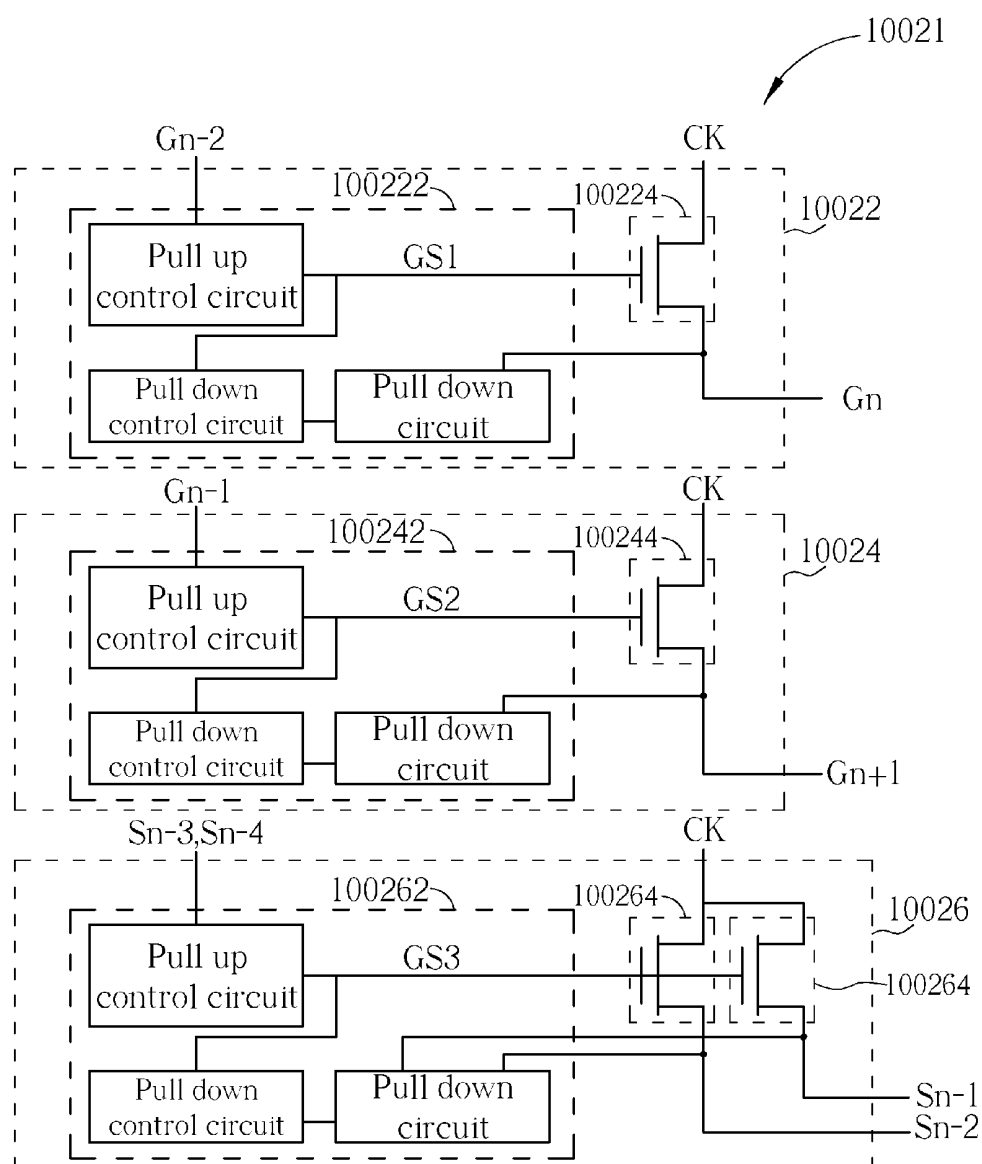


FIG. 9

LIQUID CRYSTAL DISPLAY DEVICE

BACKGROUND

[0001] 1. Technical Field

[0002] The disclosure is related to a liquid crystal display device, and particularly to a liquid crystal display device that can reduce size of a thin film transistor of an output terminal of a pixel driving circuit.

[0003] 2. Related Art

[0004] In liquid crystal panels, a gate driving circuit is gradually integrated into a glass substrate, where a gate driver on array (GOA) is a low-cost, space saving technique. A manufacturer can utilize an amorphous silicon thin film transistor (a-Si TFT) to realize the gate driver on array for saving cost of purchasing integrated circuit chips during a manufacturing process of the liquid crystal panel. However, electrical characteristics of the amorphous silicon thin film transistor are poor, because the amorphous silicon thin film transistor has low carrier mobility (μ), an unstable threshold voltage (V_{th}), and an insufficient driving current.

[0005] In a new generation display device, because a high frame rate is a major trend, the gate driving circuit has to drive two gate lines. In addition, the gate driving circuit further drives another two sharing lines in order to solve a color washout problem. The gate driving circuit has to drive the two gate lines and the two sharing lines simultaneously, so a load capacitor of an output terminal of the gate driving circuit may be large, resulting in design of the gate driving circuit being difficult.

SUMMARY

[0006] An embodiment provides a liquid crystal display device. The liquid crystal display device includes a plurality of pixel driving circuits and a pixel array. Each pixel driving circuit of the plurality of pixel driving circuits has four output terminals coupled to two gate lines and two sharing lines respectively for outputting two main output signals and two sharing output signals. The pixel driving circuit includes a gate driving circuit and four thin film transistors. The gate driving circuit has an output terminal for outputting an output signal. Gates of the four thin film transistors are coupled to the output terminal of the gate driving circuit. The four thin film transistors output the two main output signals and the two sharing output signals respectively according to a clock signal and the output signal of the gate driving circuit, where phases and timings of the two main output signals and the two sharing output signals are all the same. The pixel array includes a plurality of pixels. Each pixel includes a first pixel and a second pixel. The first pixel is used for receiving a main output signal of the two main output signals and a sharing output signal. The first pixel is coupled to a data line. The second pixel is coupled to the data line and the first pixel. The second pixel is used for receiving the main output signal and compensating a voltage of the first pixel.

[0007] Another embodiment provides a liquid crystal display device. The liquid crystal display device includes a plurality of pixel driving circuits and a pixel array. Each pixel driving circuit of the plurality of pixel driving circuits has four output terminals coupled to two gate lines and two sharing lines respectively for outputting two main output signals and two sharing output signals. Each pixel driving circuit includes a first pixel driving sub-circuit and a second pixel driving sub-circuit. The first pixel driving sub-circuit includes a first

gate driving circuit and two first thin film transistors. Gates of the two first thin film transistors are coupled to an output terminal of the first gate driving circuit. The second pixel driving sub-circuit includes a second gate driving circuit and two second thin film transistors. Gates of the two second thin film transistors are coupled to an output terminal of the second gate driving circuit. Phases and timings of the two main output signals and the two sharing output signals are all the same. The pixel array includes a plurality of pixels. Each pixel includes a first pixel and a second pixel. The first pixel is used for receiving a main output signal of the two main output signals and a sharing output signal. The first pixel is coupled to a data line. The second pixel is coupled to the data line and the first pixel. The second pixel is used for receiving the main output signal and compensating a voltage of the first pixel. The first gate driving circuit is the same as the second gate driving circuit.

[0008] Another embodiment provides a liquid crystal display device. The liquid crystal display device includes a plurality of pixel driving circuits and a pixel array. Each pixel driving circuit of the plurality of pixel driving circuits has four output terminals coupled to two gate lines and two sharing lines respectively for outputting two main output signals and two sharing output signals, where phases and timings of the two main output signals and the two sharing output signals are all the same. Each pixel driving circuit includes a first pixel driving sub-circuit. The first pixel driving sub-circuit includes a first gate driving circuit and a first thin film transistor. The first thin film transistor has a gate coupled to an output terminal of the first gate driving circuit. The first thin film transistor outputs a main output signal according to a clock signal and an output signal of the first gate driving circuit. The pixel array includes a plurality of pixels, where each pixel includes a first pixel and a second pixel. The first pixel is used for receiving a main output signal of the two main output signals and a sharing output signal. The first pixel is coupled to a data line. The second pixel is coupled to the data line and the first pixel. The second pixel is used for receiving the main output signal and compensating a voltage of the first pixel.

[0009] These and other objectives of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment that is illustrated in the various figures and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a diagram illustrating a liquid crystal display device according to an embodiment of the present invention.

[0011] FIG. 2 is a diagram illustrating the pixel driving circuit.

[0012] FIG. 3 is a diagram illustrating the timings of the two main output signals and the two sharing output signals of the pixel driving circuit.

[0013] FIG. 4 is a diagram illustrating the pixel.

[0014] FIG. 5 and FIG. 6 are diagrams illustrating charging processes of the first pixel and the second pixel.

[0015] FIG. 7 is a diagram illustrating a pixel driving circuit according to a second embodiment of the present invention.

[0016] FIG. 8 is a diagram illustrating a pixel driving circuit according to a third embodiment of the present invention.

[0017] FIG. 9 is a diagram illustrating a pixel driving circuit according to a fourth embodiment of the present invention.

DETAILED DESCRIPTION

[0018] Please refer to FIG. 1. FIG. 1 is a diagram illustrating a liquid crystal display device 100 according to an embodiment of the present invention. The liquid crystal display device 100 includes a plurality of pixel driving circuits and a pixel array. As shown in FIG. 1, a pixel driving circuit 1020 has four output terminals coupled to two gate lines and two sharing lines respectively for outputting two main output signals Gn-1, Gn-2 and two sharing output signals Sn-3, Sn-4. The two main output signal Gn-1, Gn-2 are used for turning on pixels 1039, 1037, and two sharing output signals Sn-3, Sn-4 are used for performing charge sharing on pixels 1035, 1033. Phases and timings of the two main output signals Gn-1, Gn-2 and the two sharing output signals Sn-3, Sn-4 are all the same. But, the present invention is not limited to the two sharing output signals Sn-3, Sn-4 performing the charge sharing on the pixels 1035, 1033. That is to say, charge sharing may be performed on the pixels 1035, 1033 by other sharing output signals. The pixel driving circuit 1021 has four output terminals coupled to two gate lines and two sharing lines, respectively, for outputting two main output signals Gn, Gn+1 and two sharing output signals Sn-1, Sn-2. The two main output signals Gn, Gn+1 are used for turning on pixels 1041, 1043, and the two sharing output signal Sn-1, Sn-2 are used for performing charge sharing on the pixels 1039, 1037. But, the present invention is not limited to the two sharing output signals Sn-1, Sn-2 performing the charge sharing on the pixels 1039. That is to say, the charge sharing can be performed on the pixels 1039, 1037 by other sharing output signals. Phases and timings of the two main output signals Gn, Gn+1 and the two sharing output signals Sn-1, Sn-2 are all the same. But, the present invention is not limited to two pixel driving circuits and six pixels. In addition, as shown in FIG. 1, D1 and D2 are data lines used for charging pixels according to voltages corresponding to display data for the pixels to display luminance and colors corresponding to the display data when the pixels are turned on by the gate lines and the sharing lines.

[0019] Please refer to FIG. 2 and FIG. 3. FIG. 2 is a diagram illustrating the pixel driving circuit 1021, and FIG. 3 is a diagram illustrating the timings of the two main output signals Gn-1, Gn-2 and the two sharing output signals Sn-3, Sn-4 of the pixel driving circuit 1020, and the timings of the two main output signals Gn, Gn+1 and the two sharing output signals Sn-1, Sn-2 of the pixel driving circuit 1021. As shown in FIG. 2, the pixel driving circuit 1021 includes a gate driving circuit 1022 and four thin film transistors 1024. The gate driving circuit 1022 includes a pull up control circuit 10222, a pull down control circuit 10224, and a pull down circuit 10226. The pull up control circuit 10222 is used for receiving the main output signal Gn-1 of the pixel driving circuit 1020, and outputting a gate control signal GS to gates of the four thin film transistors 1024. The pull down control circuit 10224 is used for receiving the gate control signal GS. The pull down circuit 10226 is used for pulling down voltages of source terminals of the four thin film transistors 1024 to a reference low voltage to turn off the four thin film transistors 1024 according to an output signal of the pull down control circuit 10224. The gates of the four thin film transistors 1024 are coupled to an output terminal of the gate driving circuit 1022. The four thin film transistors 1024 drive the two main

output signals Gn, Gn+1 and the two sharing output signals Sn-1, Sn-2 respectively according to a clock signal CK and the gate control signal GS outputted by the gate driving circuit 1022. Therefore, as shown in FIG. 3, because the four thin film transistors 1024 are coupled to the output terminal of the gate driving circuit 1022, phases and timings of the two main output signals Gn, Gn+1 and the two sharing output signals Sn-1, Sn-2 are all the same. Similarly, phases and timings of the two main output signals Gn-1, Gn-2 and two sharing output signals Sn-3, Sn-4 of the pixel driving circuit 1020 are all the same.

[0020] Please refer to FIG. 4. FIG. 4 is a diagram illustrating the pixel 1039. The pixel 1039 includes a first pixel 1042 and a second pixel 1044. The first pixel 1042 is used for receiving the main output signal Gn-1 and the sharing output signal Sn-1 of the pixel driving circuit 1021. The first pixel 1042 is coupled to the data line Dm, but the pixel 1039 is not limited to being performed the charge sharing by the sharing output signal Sn-1. The second pixel 1044 is used for receiving the main output signal Gn-1 of the pixel driving circuit 1020. The second pixel 1044 is coupled to the data line Dm and the first pixel 1042 for compensating a voltage of the first pixel 1042. The first pixel 1042 includes two second capacitors 10422, two third capacitors 10424, a second switch 10426, and a third switch 10428. The second pixel 1044 includes two first capacitors 10442, and a first switch 10444. Further, structures of the pixels 1043, 1041, 1037, 1035, 1033 are the same as structure of the pixel 1039, so further descriptions thereof are omitted for simplicity.

[0021] Please refer to FIG. 5 and FIG. 6. FIG. 5 and FIG. 6 are diagrams illustrating charging processes of the first pixel 1042 and the second pixel 1044. As shown in FIG. 5, when the main output signal Gn-1 is changed from a logic-low voltage to a logic-high voltage, the first switch 10444 is turned on, so that a signal of the data line Dm charges the two first capacitors 10442 to a first voltage V1 through the first switch 10444. Meanwhile, a voltage of a node A is at the first voltage V1. Similarly, the second switch 10426 is turned on, so that the signal of the data line Dm charges the two second capacitors 10422 to the first voltage V1 through the second switch 10426. Meanwhile, a voltage of a node B is also at the first voltage V1. In addition, the third switch 10428 is controlled by the sharing output signal Sn-1. Meanwhile, because the sharing output signal Sn-1 is not enabled, the third switch 10428 is not turned on yet. As shown in FIG. 6, when the sharing output signal Sn-1 is changed from the logic-low voltage to the logic-high voltage (the main output signal Gn-1 is changed from the logic-high voltage to the logic-low voltage, so the first switch 10444 and the second switch 10426 are turned off), the third switch 10428 is turned on. Meanwhile, charges stored in the two first capacitors 10442 and the two third capacitors 10424 are redistributed by the third switch 10428, so the voltage of the node A is decreased and the voltage of the node B is increased. Thus, the present invention can solve a washout problem of a liquid crystal panel by making the voltage of the node A different from the voltage of the node B.

[0022] Please refer to FIG. 7. FIG. 7 is a diagram illustrating a pixel driving circuit 7021 according to a second embodiment of the present invention. The pixel driving circuit 7021 includes a first pixel driving sub-circuit 7022 and a second pixel driving sub-circuit 7024. The first pixel driving sub-circuit 7022 includes a first gate driving circuit 70222 and two first thin film transistors 70224. The first gate driving circuit

70222 is the same as the gate driving circuit **1022**, so further description thereof is omitted for simplicity. Gates of the two first thin film transistors **70224** are coupled to an output terminal of the first gate driving circuit **70222**. The two first thin film transistors **70224** drive the main output signal G_n and the sharing output signal S_{n-1} respectively according to the clock signal CK and a gate control signal GS1 outputted by the first gate driving circuit **70222**. The second pixel driving sub-circuit **7024** includes a second gate driving circuit **70242** and two second thin film transistors **70244**. The second gate driving circuit **70242** is the same as the gate driving circuit **1022**, so further description thereof is omitted for simplicity. Gates of the two second thin film transistors **70244** are coupled to an output terminal of the second gate driving circuit **70242**. The two second thin film transistors **70244** drive the main output signal G_{n+1} and the sharing output signal S_{n-2} according to the clock signal CK and a gate control signal GS2 outputted by the second gate driving circuit **70242**. The timings of the two main output signals G_n , G_{n+1} and the two sharing output signals S_{n-1} , S_{n-2} driven by the gates of the two first thin film transistors **70224** and the two second thin film transistors **70244** are as shown in FIG. 3. But the pixel driving circuit **7021** is not limited to the above mentioned signal output method. In another method of outputting signals in the pixel driving circuit **7021**, the first pixel driving sub-circuit **7022** outputs the main output signal G_n and the sharing output signal S_{n-2} , and the second pixel driving sub-circuit **7024** outputs the main output signal G_{n+1} and the sharing output signal S_{n-1} , or the first pixel driving sub-circuit **7022** outputs the main output signal G_n , G_{n+1} and the second pixel driving sub-circuit **7024** outputs the sharing output signal S_{n-1} , S_{n-2} .

[**10023**] Please refer to FIG. 8. FIG. 8 is a diagram illustrating a pixel driving circuit **9021** according to a third embodiment of the present invention. The pixel driving circuit **9021** includes a first pixel driving sub-circuit **9022**, a second pixel driving sub-circuit **9024**, a third pixel driving sub-circuit **9026**, and a fourth pixel driving sub-circuit **9028**. The first pixel driving sub-circuit **9022** includes a first gate driving circuit **90222** and a first thin film transistor **90224**. The first gate driving circuit **90222** is the same as the gate driving circuit **1022**, so further description thereof is omitted for simplicity. The first thin film transistor **90224** has a gate coupled to an output terminal of the first gate driving circuit **90222**, and the first thin film transistor **90224** drives the main output signal G_n according to the clock signal CK and a gate control signal GS1 outputted by the first gate driving circuit **90222**. The second pixel driving sub-circuit **9024** includes a second gate driving circuit **90242** and a second thin film transistor **90244**. The second gate driving circuit **90242** is the same as the gate driving circuit **1022**, so further description thereof is omitted for simplicity. The second thin film transistor **90244** has a gate coupled to an output terminal of the second gate driving circuit **90242**, and the second thin film transistor **90244** drives the sharing output signal S_{n-1} according to the clock signal CK and a gate control signal GS2 outputted by the second gate driving circuit **90242**. The third pixel driving sub-circuit **9026** includes a third gate driving circuit **90262** and a third thin film transistor **90264**. The third gate driving circuit **90262** is the same as the gate driving circuit **1022**, so further description thereof is omitted for simplicity. The third thin film transistor **90264** has a gate coupled to an output terminal of the third gate driving circuit **90262**, and the third thin film transistor **90264** drives the main

output signal G_{n+1} according to the clock signal CK and a gate control signal GS3 of the third gate driving circuit **90262**. The fourth pixel driving sub-circuit **9028** includes a fourth gate driving circuit **90282** and a fourth thin film transistor **90284**. The fourth gate driving circuit **90282** is the same as the gate driving circuit **1022**, so further description thereof is omitted for simplicity. The fourth thin film transistor **90284** has a gate coupled to an output terminal of the fourth gate driving circuit **90282**, and the fourth thin film transistor **90284** drives the sharing output signal S_{n-2} according to the clock signal CK and a gate control signal GS4 of the fourth gate driving circuit **90282**. The timings of the two main output signals G_n , G_{n+1} and the two sharing output signals S_{n-1} , S_{n-2} driven by the gates of the first thin film transistor **90224**, the second thin film transistor **90244**, the third thin film transistor **90264**, and the fourth thin film transistor **90284** are as shown in FIG. 3. But the pixel driving circuit **9021** is not limited to the above mentioned signal output method.

[**10024**] Please refer to FIG. 9. FIG. 9 is a diagram illustrating a pixel driving circuit **10021** according to a fourth embodiment of the present invention. The pixel driving circuit **10021** includes a first pixel driving sub-circuit **10022**, a second pixel driving sub-circuit **10024**, and a third pixel driving sub-circuit **10026**. The first pixel driving sub-circuit **10022** includes a first gate driving circuit **100222** and a first thin film transistor **100224**. The first gate driving circuit **100222** is the same as the gate driving circuit **1022**, so further description thereof is omitted for simplicity. The first thin film transistor **100224** has a gate coupled to an output terminal of the first gate driving circuit **100222**, and the first thin film transistor **100224** drives the main output signal G_n according to the clock signal CK and a gate control signal GS1 of the first gate driving circuit **100222**. The second pixel driving sub-circuit **10024** includes a second gate driving circuit **100242** and a second thin film transistor **100244**. The second gate driving circuit **100242** is the same as the gate driving circuit **1022**, so further description thereof is omitted for simplicity. The second thin film transistor **100244** has a gate coupled to an output terminal of the second gate driving circuit **100242**, and a second thin film transistor **100244** drives the sharing output signal S_{n-1} according to the clock signal CK and a gate control signal GS2 of the second gate driving circuit **100242**. The third pixel driving sub-circuit **10026** includes a third gate driving circuit **100262** and two third thin film transistors **100264**. The third gate driving circuit **100262** is the same as the gate driving circuit **1022**, so further description thereof is omitted for simplicity. Gates of the third thin film transistor **100264** are coupled to an output terminal of the third gate driving circuit **100262**. The two third thin film transistors **100264** drive the main output signal G_{n+1} and the sharing output signal S_{n-2} according to the clock signal CK and a gate control signal GS3 of the third gate driving circuit **100262**. The timings of the two main output signals G_n , G_{n+1} and the two sharing output signals S_{n-1} , S_{n-2} driven by the gates of the first thin film transistor **100224**, the second thin film transistor **100244**, and the two third thin film transistors **100264** are as shown in FIG. 3. But the pixel driving circuit **10021** is not limited to the above mentioned outputting signals method.

[**10025**] To sum up, the liquid crystal display device utilizes each gate driving circuit cooperating with four thin film transistors, each gate driving circuit cooperating with two thin film transistors, or each gate driving circuit cooperating with a thin film transistor to drive the two main output signals and

the two sharing output signals. Each thin film transistor of the above mentioned signal output method drives one of the two main output signals and the two sharing output signals. The phases and the timings of the two main output signals and the two sharing output signals are all the same. Therefore, the present invention can solve a large load capacitor problem of the output terminal of the pixel driving circuit in the prior art. Thus, the present invention divides the thin film transistor of the output terminal into a plurality of small thin film transistors to reduce size of the thin film transistor of the output terminal.

[0026] Those skilled in the art will readily observe that numerous modifications and alterations of the device and method may be made while retaining the teachings of the invention. Accordingly, the above disclosure should be construed as limited only by the metes and bounds of the appended claims.

What is claimed is:

1. A liquid crystal display device, comprising:
 - a plurality of pixel driving circuits, each pixel driving circuit having four output terminals coupled to two gate lines and two sharing lines respectively for outputting two main output signals to the two gate lines and two sharing output signals to the two sharing lines, the pixel driving circuit comprising:
 - a gate driving circuit having an output terminal for outputting an output signal; and
 - four thin film transistors, gates of the four thin film transistors coupled to the output terminal of the gate driving circuit, the four thin film transistors for outputting the two main output signals and the two sharing output signals respectively according to a clock signal and the output signal of the gate driving circuit, wherein phases and timings of the two main output signals and the two sharing output signals are all the same; and
 - a pixel array comprising a plurality of pixels, wherein each pixel comprises:
 - a first pixel for receiving a main output signal of the two main output signals, and a sharing output signal of two sharing output signals of a next stage pixel driving circuit of the pixel driving circuits, the first pixel being coupled to a data line; and
 - a second pixel for receiving the main output signal of the two main output signals, the second pixel being coupled to the data line and the first pixel for compensating a voltage of the first pixel.
2. The liquid crystal display device of claim 1, wherein the second pixel comprises:
 - two first capacitors; and
 - a first switch having a control terminal for charging the two first capacitors to a first voltage according to the main output signal and a signal of the data line.
3. The liquid crystal display device of claim 1, wherein the first pixel comprises:
 - two second capacitors;
 - two third capacitors;
 - a second switch having a control terminal for charging the two second capacitors to the first voltage according to the main output signal and the signal of the data line; and
 - a third switch having a control terminal for redistributing charges stored in the two first capacitors and the two

third capacitors by the two third capacitors according to the sharing output signal of the next stage pixel driving circuit.

4. The liquid crystal display device of claim 1, wherein the gate driving circuit comprises:

- a pull up control circuit for receiving a main output signal of a front stage pixel driving circuit, and outputting a gate control signal to the gates of the four thin film transistors;
- a pull down control circuit for receiving the gate control signal; and
- a pull down circuit for turning off the four thin film transistors according to an output signal of the pull down control circuit.

5. A liquid crystal display device, comprising:

- a plurality of pixel driving circuits, each pixel driving circuit having four output terminals coupled to two gate lines and two sharing lines respectively for outputting two main output signals and two sharing output signals, wherein phases and timings of the two main output signals and the two sharing output signals are all the same, the pixel driving circuit comprising:

- a first pixel driving sub-circuit comprising:

- a first gate driving circuit; and
- two first thin film transistors, gates of the two first thin film transistors coupled to an output terminal of the first gate driving circuit; and

- a second pixel driving sub-circuit comprising:

- a second gate driving circuit; and
- two second thin film transistors, gates of the two second thin film transistor coupled to an output terminal of the second gate driving circuit; and

- a pixel array comprising a plurality of pixels, wherein each pixel comprises:

- a first pixel for receiving a main output signal of the two main output signals, and a sharing output signal of two sharing output signals of a next stage pixel driving circuit of the pixel driving circuit, the first pixel being coupled to a data line; and

- a second pixel for receiving the main output signal of the two main output signals, the second pixel being coupled to the data line and the first pixel for compensating a voltage of the first pixel.

6. The liquid crystal display device of claim 5, wherein the two first thin film transistors output a main output signal of the two main output signals and a sharing output signal of the two sharing output signals respectively according to a clock signal and an output signal of the first gate driving circuit, and the two second thin film transistors output another main output signal of the two main output signals and another sharing output signal of the two sharing output signals respectively according to the clock signal and the output signal of the second gate driving circuit.

7. The liquid crystal display device of claim 5, wherein the two first thin film transistors output the two main output signals according to a clock signal and an output signal of the first gate driving circuit, and the two second thin film transistors output the two sharing output signals according to the clock signal and the output signal of the second gate driving circuit.

8. The liquid crystal display device of claim 5, wherein the second pixel comprises:

- two first capacitors; and
 a first switch having a control terminal for charging the two first capacitors to a first voltage according to the main output signal and a signal of the data line.
9. The liquid crystal display device of claim 5, wherein the first pixel comprises:
 two second capacitors;
 two third capacitors;
 a second switch having a control terminal for charging the two second capacitors to the first voltage according to the main output signal and the signal of the data line; and
 a third switch having a control terminal for redistributing charges stored in the two first capacitors and the two third capacitors by the two third capacitors according to the sharing output signal of the next stage pixel driving circuit.
10. The liquid crystal display device of claim 5, wherein the first gate driving circuit comprises:
 a pull up control circuit for receiving a main output signal of a front stage pixel driving circuit, and outputting a gate control signal to the gates of the two first thin film transistors;
 a pull down control circuit for receiving the gate control signal; and
 a pull down circuit for turning off the two first film transistors according to an output signal of the pull down control circuit.
11. A liquid crystal display device, comprising:
 a plurality of pixel driving circuits, each pixel driving circuit having four output terminals coupled to two gate lines and two sharing lines respectively for outputting two main output signals and two sharing output signals, wherein phases and timings of the two main output signals and the two sharing output signals are all the same, the pixel driving circuit comprising:
 a first pixel driving sub-circuit comprising:
 a first gate driving circuit; and
 a first thin film transistor having a gate coupled to an output terminal of the first gate driving circuit, the first thin film transistor being for outputting a main output signal of the two main output signals according to a clock signal and an output signal of the first gate driving circuit; and
 a pixel array comprising a plurality of pixels, wherein each pixel comprises:
 a first pixel for receiving a main output signal of the two main output signals, and a sharing output signal of two sharing output signals of a next stage pixel driving circuit of the pixel driving circuit, and the first pixel coupled to a data line; and
 a second pixel for receiving the main output signal of the two main output signals, and the second pixel coupled to the data line and the first pixel for compensating a voltage of the first pixel.
12. The liquid crystal display device of claim 11, wherein the pixel driving circuit further comprises:
 a second pixel driving sub-circuit comprising:
 a second gate driving circuit; and
 a second thin film transistor having a gate coupled to an output terminal of the second gate driving circuit, the second thin film transistor being for outputting a sharing output signal of the two sharing output signals according to the clock signal and the output signal of the second gate driving circuit;
- a third pixel driving sub-circuit comprising:
 a third gate driving circuit; and
 a third thin film transistor having a gate coupled to an output terminal of the third gate driving circuit, the third thin film transistor being for outputting another main output signal of the two main output signals according to the clock signal and an output signal of the third gate driving circuit; and
 a fourth pixel driving sub-circuit comprising:
 a fourth gate driving circuit; and
 a fourth thin film transistor having a gate coupled to an output terminal of the fourth gate driving circuit, the fourth thin film transistor being for outputting another sharing output signal of the two sharing output signals according to the clock signal and an output signal of the fourth gate driving circuit.
13. The liquid crystal display device of claim 11, wherein the nth pixel driving circuit further comprises:
 a second pixel driving sub-circuit comprising:
 a second gate driving circuit; and
 a second thin film transistor having a gate coupled to an output terminal of the second gate driving circuit, the second thin film transistor being for outputting another main output signal of the two main output signals according to the clock signal and an output signal of the second gate driving circuit; and
 a third pixel driving sub-circuit comprising:
 a third gate driving circuit; and
 two third thin film transistors, gates of the two third thin film transistors coupled to the output terminal of the third gate driving circuit, the two third thin film transistors being for outputting the two sharing output signals according to the clock signal and an output signal of the third gate driving circuit.
14. The liquid crystal display device of claim 11, wherein the second pixel comprises:
 two first capacitors; and
 a first switch having a control terminal for charging the two first capacitors to a first voltage according to the main output signal and the signal of the data line.
15. The liquid crystal display device of claim 11, wherein the first pixel comprises:
 two second capacitors;
 two third capacitors;
 a second switch having a control terminal for charging the two second capacitors to the first voltage according to the main output signal and the signal of the data line; and
 a third switch having a control terminal for redistributing charges stored in the two first capacitors and the two third capacitors by the two third capacitors according to the sharing output signal of the next stage pixel driving circuit.
16. The liquid crystal display device of claim 11, wherein the first gate driving circuit comprises:
 a pull up control circuit for receiving a main output signal of a front stage pixel driving circuit, and outputting a gate control signal to the gate of the first thin film transistor;
 a pull down control circuit for receiving the gate control signal; and
 a pull down circuit for turning off the first film transistor according to an output signal of the pull down control circuit.

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专利名称(译)	液晶显示装置		
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摘要(译)

一种液晶显示装置，包括多个像素驱动电路和像素阵列。多个像素驱动电路的每个像素驱动电路包括四个薄膜晶体管并具有四个输出端子，其中每个薄膜晶体管用于驱动四个输出端子的输出端子，四个输出端子连接到两个栅极线和两条共用线分别用于输出两个主输出信号和两个共享输出信号。两个主输出信号和两个共享输出信号的相位和时序都是相同的。根据两个主输出信号的主输出信号，共享输出信号和数据线的信号，像素阵列的像素被充电/放电到特定电压电平。

