US 20160093249A1

(19) **United States**

(12) **Patent Application Publication**

Zhou

(10) **Pub. No.: US 2016/0093249 A1**

(43) **Pub. Date: Mar. 31, 2016**

(54) **SCANNING STRUCTURE AND BI-DIRECTIONAL SCANNING METHOD FOR DRIVING A PIXEL CIRCUIT OF AN ACTIVE-MATRIX ORGANIC LIGHT-EMITTING DIODE**

(71) Applicant: **EverDisplay Optronics (Shanghai) Limited**, Shanghai (CN)

(72) Inventor: **XingYu Zhou**, Shanghai (CN)

(73) Assignee: **EverDisplay Optronics (Shanghai) Limited**

(21) Appl. No.: **14/600,285**

(22) Filed: **Jan. 20, 2015**

(30) **Foreign Application Priority Data**

Sep. 30, 2014 (CN) 201410521858.2

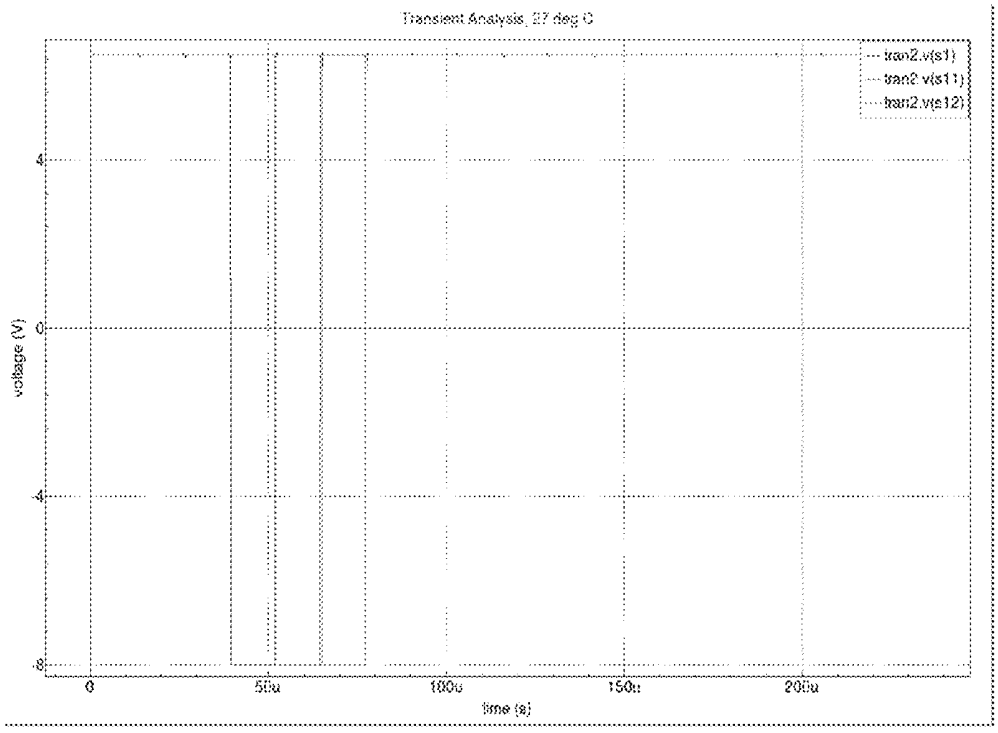
Publication Classification

(51) **Int. Cl.**
G09G 3/32 (2006.01)

(52) **U.S. Cl.**
CPC ***G09G 3/3233*** (2013.01)

(57) **ABSTRACT**

A scanning structure for driving a pixel circuit of an active-matrix organic light-emitting diode display includes a Sn−1 signal unit having a pixel driving circuit for receiving an upper scan signal with a downward scanning direction and a lower scan signal with an upward scanning direction as an input signal. The pixel driving circuit includes a first input end and a first output end. A driving signal can be received by the first input end, transformed to a first scan signal by the pixel driving circuit, and outputted by the first output end. A Sn signal unit includes a Sn pixel circuit having a second input end coupled to the first output end and a second output end. The first scan signal can be received by the Sn pixel circuit and transformed to a second scan signal, and the second scan signal can be outputted by the second output end.



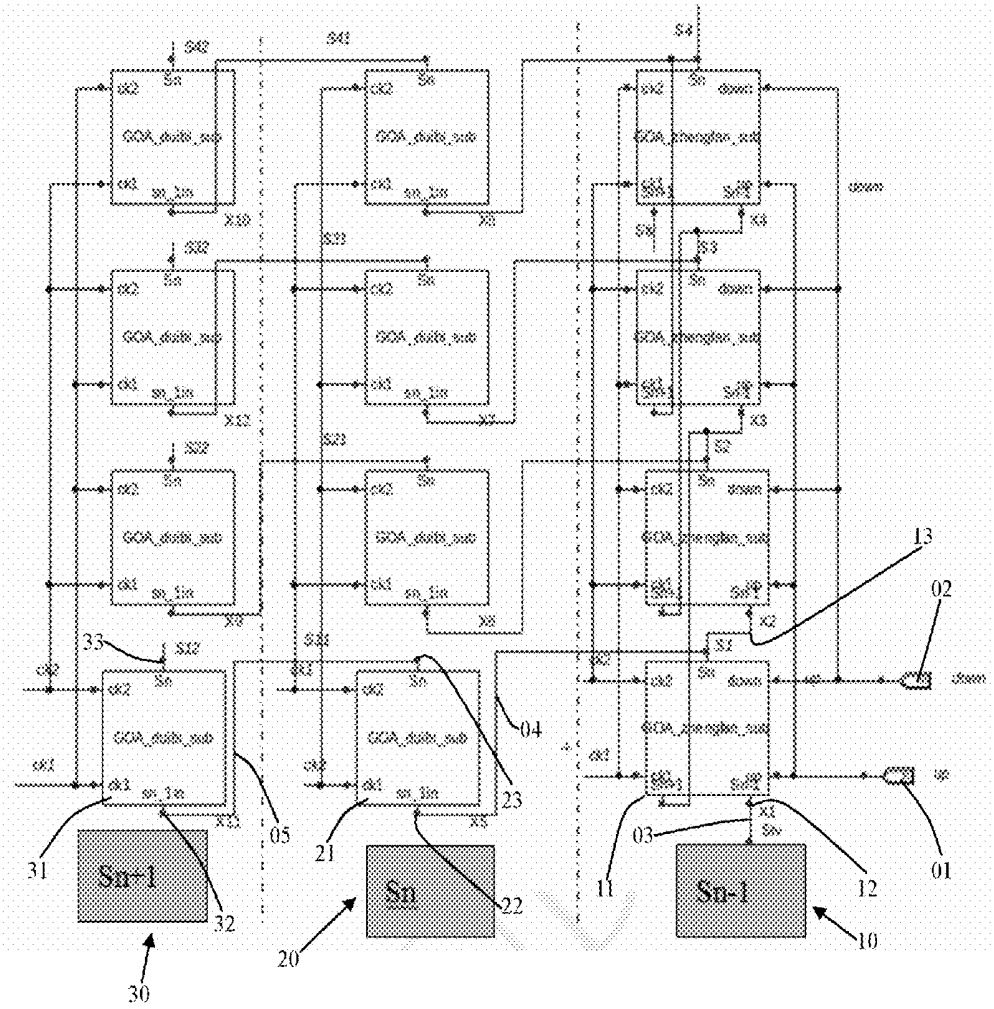


Fig. 1

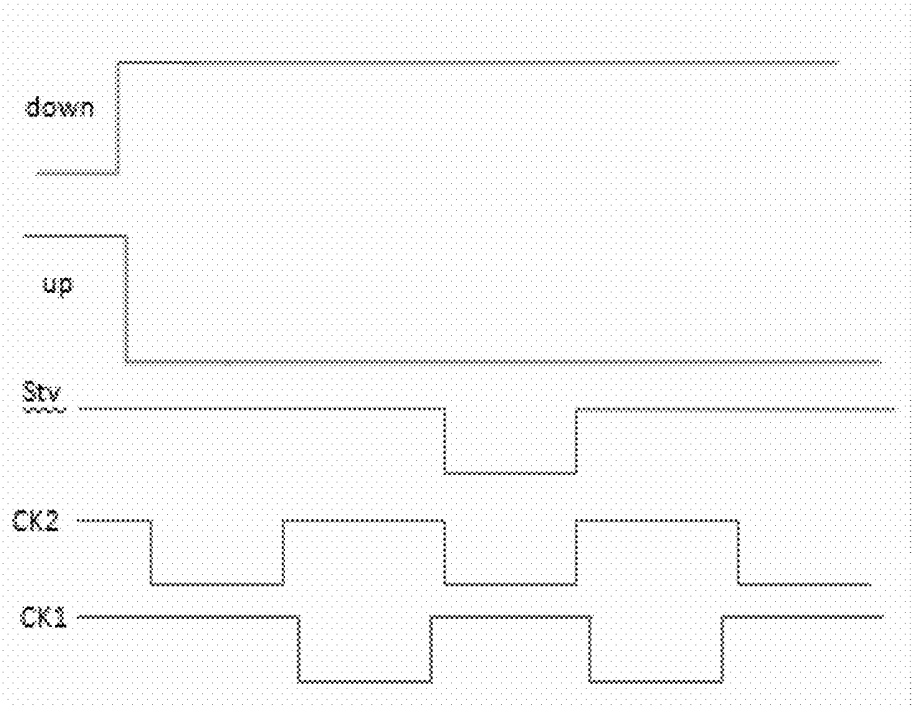


Fig. 2

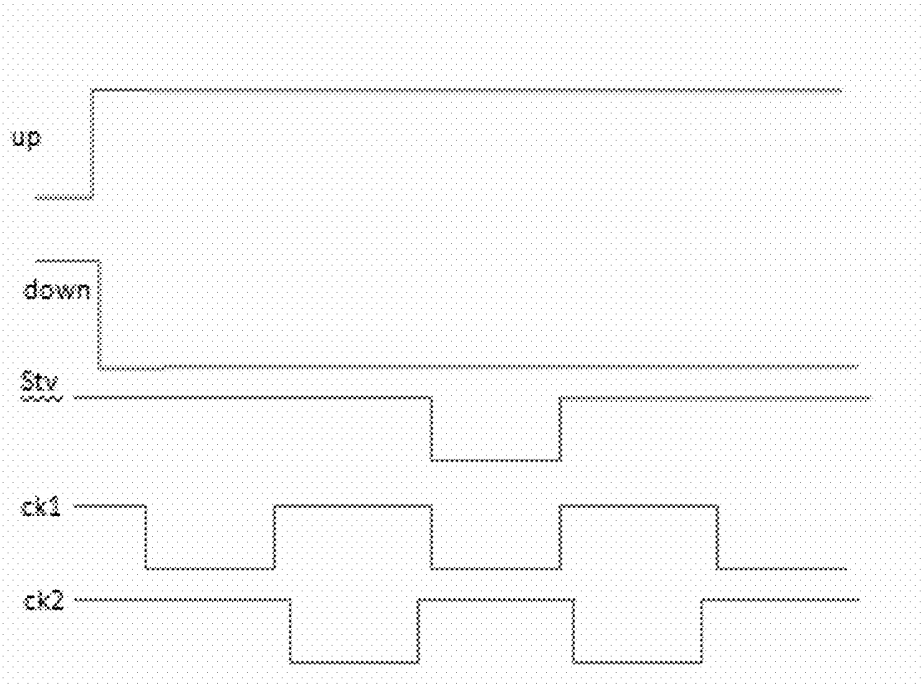


Fig. 3

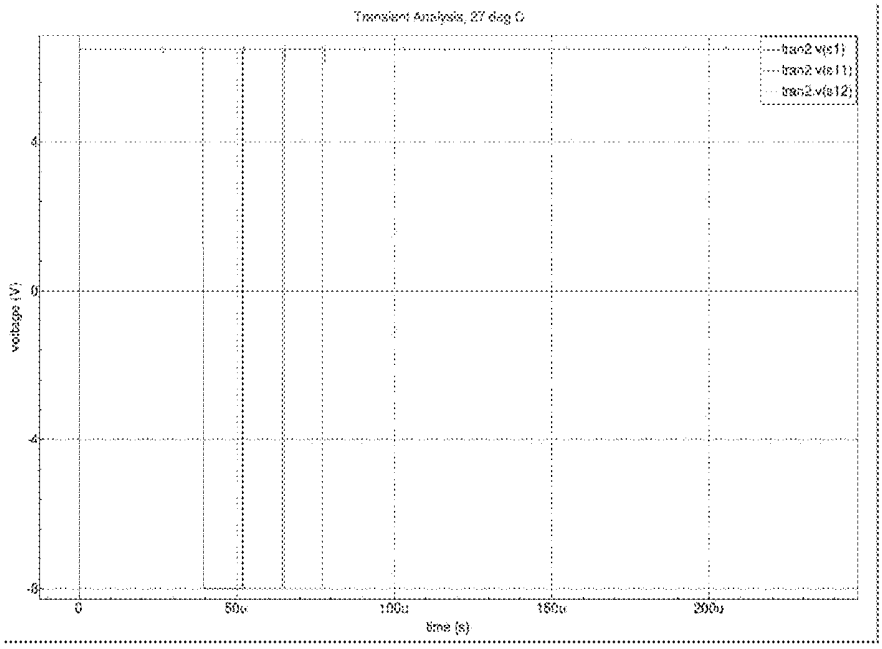

Transient Analysis, 27 deg C
tran2.v(s1)
tran2.v(s11)
tran2.v(s12)
voltage (V)
4
0
-4
-8
0
50u
100u
150u
200u
time (s)

Fig. 4

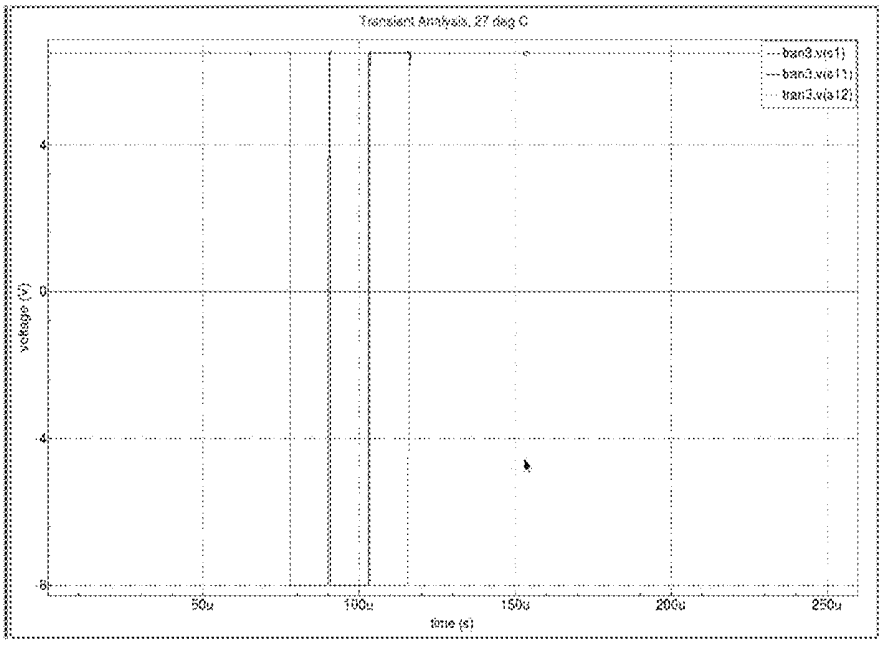

Transient Analysis, 27 deg C
tran3.v(s1)
tran3.v(s11)
tran3.v(s12)
voltage (V)
4
0
-4
-8
50u
100u
150u
200u
250u
time (s)

Fig. 5

SCANNING STRUCTURE AND BI-DIRECTIONAL SCANNING METHOD FOR DRIVING A PIXEL CIRCUIT OF AN ACTIVE-MATRIX ORGANIC LIGHT-EMITTING DIODE

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a scanning structure and a bi-directional scanning method for driving a pixel circuit of an active-matrix organic light-emitting diode and, more particularly, to a scanning structure and a bi-directional scanning method for a display of an active-matrix organic light-emitting diode.

[0002] Currently, the scanning structure for active-matrix organic light-emitting diodes scans in a single direction. Nevertheless, liquid crystal displays use positive scan and reverse scan to provide a bi-directional scan in both of the positive and reverse directions. Thus, a need exists for achieving positive and reverse scans on the displays of active-matrix organic light-emitting diodes to increase the competitiveness of the active-matrix organic light-emitting diodes.

BRIEF SUMMARY OF THE INVENTION

[0003] The present invention provides a bi-directional scanning structure that can be applied on active-matrix organic light-emitting diodes to increase the competitiveness of the active-matrix organic light-emitting diodes.

[0004] In a first aspect, a scanning structure for driving a pixel circuit of an active-matrix organic light-emitting diode display includes:

[0005] a Sn−1 signal unit including a pixel driving circuit, adapted to receive an upper scan signal with a downward scanning direction and a lower scan signal with an upward scanning direction as an input signal of the pixel driving circuit, wherein the pixel driving circuit includes a first input end and a first output end, such that a driving signal is able to be received by the first input end, transformed to a first scan signal by the pixel driving circuit, and outputted by the first output end; and

[0006] a Sn signal unit including a Sn pixel circuit, and the Sn pixel circuit including a second input end and a second output end, wherein the second input end is coupled to the first output end of the pixel driving circuit, such that the first scan signal is able to be received by the Sn pixel circuit and transformed to a second scan signal, and the second scan signal is able to be outputted by the second output.

[0007] The second scan signal and the first scan signal can have the same scanning direction.

[0008] The n of each of the Sn−1 signal unit and the Sn signal unit is a positive integer.

[0009] The scanning structure for driving a pixel circuit of an active-matrix organic light-emitting diode can further include a Sn+1 signal unit including a Sn+1 pixel circuit, and the Sn+1 pixel circuit can include a third input end and a third output end. The third input end is coupled to the second output end of the Sn pixel circuit, such that the second scan signal is able to be received by the Sn+1 pixel circuit to control the Sn+1 pixel circuit.

[0010] A scanning direction of the second scan signal is in accordance with that of the first scan signal, such that scanning directions of the Sn+1 signal unit and the Sn signal unit are in accordance with that provided by Sn−1 signal unit.

[0011] The n of each of the Sn−1 signal unit, the Sn signal unit, and the Sn+1 signal unit is a positive integer.

[0012] In a second aspect, a scanning structure for driving a pixel circuit of an active-matrix organic light-emitting diode includes:

[0013] a Sn−1 signal unit including a pixel driving circuit, adapted to receive an upper scan signal with a downward scanning direction and a lower scan signal with an upward scanning direction as an input signal of the pixel driving circuit, wherein the pixel driving circuit includes a first input end and a first output end, such that a driving signal is able to be received by the first input end, transformed to a first scan signal by the pixel driving circuit, and outputted by the first output end;

[0014] a Sn signal unit including a Sn pixel circuit, and the Sn pixel circuit including a second input end and a second output end, wherein the second input end is coupled to the first output end of the pixel driving circuit, such that the first scan signal is able to be received by the Sn pixel circuit and transformed to a second scan signal, and the second scan signal is able to be outputted by the second output, and wherein the Sn pixel circuit is controlled by the first scan signal; and

[0015] a Sn+1 signal unit including a Sn+1 pixel circuit, and the Sn+1 pixel circuit including a third input end and a third output end, wherein the third input end is coupled to the second output end of the Sn pixel circuit, such that the second scan signal is able to be received by the Sn+1 pixel circuit to control the Sn+1 pixel circuit.

[0016] A scanning direction of the second scan signal is in accordance with that of the first scan signal, such that scanning directions of the Sn+1 signal unit and the Sn signal unit are in accordance with that provided by Sn−1 signal unit.

[0017] The n of each of the Sn−1 signal unit, the Sn signal unit **2**, and the Sn+1 signal unit is a positive integer.

[0018] In a third aspect, a method of bi-directional scanning is provided to drive a pixel circuit of an active-matrix organic light-emitting diode. The method is adapted to be used with a Sn−1 signal unit having a pixel driving circuit and a Sn signal unit having a Sn pixel circuit. The method includes:

[0019] providing an input signal to the pixel driving circuit of the Sn−1 signal unit, wherein the input signal comprises an upper scan signal with a downward scanning direction and a lower scan signal with an upward scanning direction;

[0020] providing a driving signal to the pixel driving circuit of the Sn−1 signal unit, and converting the driving signal to output a first scan signal; and

[0021] providing the first scan signal to the Sn pixel circuit of the Sn signal unit, and converting the first scan signal to output a second scan signal.

[0022] The input signal can be received by a first input end of the pixel driving circuit.

[0023] The first scan signal can be outputted by a first output end of the pixel driving circuit and received by a second input end of the Sn pixel circuit.

[0024] The second scan signal can be outputted by a second output end of the Sn pixel circuit.

[0025] Since the scanning structure for driving a pixel circuit of an active-matrix organic light-emitting diode is bi-directional, the competitiveness of the active-matrix organic light-emitting diode can greatly be increased.

[0026] The present invention will become clearer in light of the following detailed description of illustrative embodiments of this invention described in connection with the drawings.

DESCRIPTION OF THE DRAWINGS

[0027] FIG. **1** is a diagrammatic view of a scanning structure for driving a pixel circuit of an active-matrix organic light-emitting diode of an embodiment according to the present invention.

[0028] FIG. **2** is a timing diagram of an upper scan signal of the scanning structure for driving a pixel circuit of an active-matrix organic light-emitting diode according to the present invention.

[0029] FIG. **3** is a timing diagram of a lower scan signal of the scanning structure for driving a pixel circuit of an active-matrix organic light-emitting diode according to the present invention.

[0030] FIG. **4** is a simulation of the timing program of the upper scan signal of the scanning structure for driving a pixel circuit of an active-matrix organic light-emitting diode according to the present invention.

[0031] FIG. **5** is a simulation of the timing program of the lower scan signal of the scanning structure for driving a pixel circuit of an active-matrix organic light-emitting diode according to the present invention.

REFERENCE NUMBERS

[0032] **10** Sn−1 signal unit
[0033] **11** pixel driving circuit
[0034] **12** first input
[0035] **13** first output
[0036] **20** Sn signal unit
[0037] **21** Sn pixel circuit
[0038] **22** second input
[0039] **23** second output
[0040] **30** Sn+1 signal unit
[0041] **31** Sn+1 pixel circuit
[0042] **32** third input
[0043] **33** third output
[0044] **01** upper scanning signal
[0045] **02** lower scanning signal
[0046] **03** driving signal
[0047] **04** first scan signal
[0048] **05** second scan signal

DETAILED DESCRIPTION OF THE INVENTION

[0049] With reference to FIG. **1**, a scanning structure for driving a pixel circuit of an active-matrix organic light-emitting diode of an embodiment according to the present invention can be used on a display of an active-matrix organic light-emitting diode. The scanning structure for driving a pixel circuit of an active-matrix organic light-emitting diode includes a Sn−1 signal unit **10**, a Sn signal unit **20**, and a Sn+1 signal unit **30** including at least one Sn+1 pixel circuit **31**.

[0050] The Sn−1 signal unit **10** includes at least one pixel driving circuit **11**. The at least one pixel driving circuit **11** can receive an upper scan signal **01** and a lower scan signal **02** as a signal input for the at least one pixel driving circuit **11**. The upper scan signal **01** scans downwards. The lower scan signal **02** scans upwards. The at least one pixel driving circuit **11** includes a first input **12** and a first output **13**. The first input **12** can receive a driving signal **03**. The at least one pixel driving circuit **11** can convert the driving signal **03** into a first scan signal **04**. The first scan signal **04** can be outputted via the first output **13**.

[0051] The Sn signal unit **20** includes at least one Sn pixel circuit **21**. The at least one Sn pixel circuit **21** includes a second input **22** and a second output **23**. The second input **22** is coupled to the first output **13** of the at least one pixel driving circuit **11**. Thus, the at least one Sn pixel circuit **21** can receive the first scan signal **04** and can be controlled by the first scan signal **04**. The first scan signal **04** is converted by the at least one Sn pixel circuit **21** into a second scan signal **05**. The second scan signal **05** can be outputted via the second output **23**.

[0052] The Sn+1 signal unit **30** includes at least one Sn+1 pixel circuit **31**. The at least one Sn+1 pixel circuit **31** includes a third input **32** and a third output **33**. The third input **32** of the at least one Sn+1 pixel circuit **31** is coupled to the second output **23** of the at least one Sn pixel circuit **21**. Thus, the at least one Sn+1 pixel circuit **31** can receive the second scan signal **05** and can be controlled by the second scan signal **05**.

[0053] Conversion of the first scan signal **04** will cause conversion of the second scan signal **05**. Thus, the second scan signal **05** scans in a scanning direction of the first scan signal **04**. As a result, the Sn+1 signal unit **30** and the Sn signal unit **20** scan in a signal scanning direction provided by Sn−1 signal unit **10**.

[0054] Note that n of each of the Sn−1 signal unit **10**, the Sn signal unit **20**, and the Sn+1 signal unit **30** is a positive integer.

[0055] FIG. **2** is a timing diagram of the upper scan signal **01** of the scanning structure for driving a pixel circuit of an active-matrix organic light-emitting diode according to the present invention, wherein ck1 and ck2 represent the frequency control. The upper scan signal **01** generated is inputted to the at least one pixel driving circuit **11**.

[0056] FIG. **3** is a timing diagram of the lower scan signal **02** of the scanning structure for driving a pixel circuit of an active-matrix organic light-emitting diode according to the present invention, wherein ck1 and ck2 represent the frequency control. The lower scan signal **02** generated is inputted to the at least one pixel driving circuit **11**.

[0057] FIGS. **4** and **5** are simulations of the timing programs of the upper scan signal **01** and the lower scan signal **02** of the scanning structure for driving a pixel circuit of an active-matrix organic light-emitting diode according to the present invention. As can be seen from FIGS. **4** and **5**, in both of the upper scan signal **01** and the lower scan signal **02**, each signal generated follows the previous signal, assuring the timing sequences required by the same pixel driving circuit **11** are the same and, thus, assuring normal operation of the pixels.

[0058] Conclusively, a method of bi-directional scanning is provided to drive a pixel circuit of an active-matrix organic light-emitting diode. The method is adapted to be used with a Sn−1 signal unit **10** having a pixel driving circuit **11** and a Sn signal unit **20** having a Sn pixel circuit **21**. The method includes:

[0059] providing an input signal to the pixel driving circuit **11** of the Sn−1 signal unit **10**, wherein the input signal comprises an upper scan signal **01** with a downward scanning direction and a lower scan signal **02** with an upward scanning direction;

[0060] providing a driving signal **03** to the pixel driving circuit **11** of the Sn−1 signal unit **10**, and converting the driving signal **03** to output a first scan signal **04**; and

[0061] providing the first scan signal **04** to the Sn pixel circuit **21** of the Sn signal unit **20**, and converting the first scan signal **04** to output a second scan signal **05**.

[0062] The input signal can be received by a first input end **12** of the pixel driving circuit **11**.

[0063] The first scan signal **04** can be outputted by the first output end **13** of the pixel driving circuit **11** and received by a second input end **22** of the Sn pixel circuit **21**.

[0064] The second scan signal **05** can be outputted by a second output end **23** of the Sn pixel circuit **21**.

[0065] Although specific embodiments have been illustrated and described, numerous modifications and variations are still possible without departing from the scope of the invention. The scope of the invention is limited by the accompanying claims.

1. A scanning structure for driving a pixel circuit of an active-matrix organic light-emitting diode display, the scanning structure comprising:

a Sn−1 signal unit including a pixel driving circuit, adapted to receive an upper scan signal with a downward scanning direction and a lower scan signal with an upward scanning direction as an input signal of the pixel driving circuit, wherein the pixel driving circuit includes a first input end and a first output end, such that a driving signal is able to be received by the first input end, transformed to a first scan signal by the pixel driving circuit, and outputted by the first output end; and

a Sn signal unit including a Sn pixel circuit, and the Sn pixel circuit including a second input end and a second output end, wherein the second input end is coupled to the first output end of the pixel driving circuit, such that the first scan signal is able to be received by the Sn pixel circuit and transformed to a second scan signal, and the second scan signal is able to be outputted by the second output.

2. The scanning structure according to claim **1**, wherein the second scan signal and the first scan signal have the same scanning direction.

3. The scanning structure according to claim **1**, wherein n of each of the Sn−1 signal unit and the Sn signal unit is a positive integer.

4. The scanning structure according to claim **1**, further comprising: a Sn+1 signal unit including a Sn+1 pixel circuit, and the Sn+1 pixel circuit including a third input end and a third output end, wherein the third input end is coupled to the second output end of the Sn pixel circuit, such that the second scan signal is able to be received by the Sn+1 pixel circuit to control the Sn+1 pixel circuit.

5. The scanning structure according to claim **4**, wherein a scanning direction of the second scan signal is in accordance with that of the first scan signal, such that scanning directions of the Sn+1 signal unit and the Sn signal unit are in accordance with that provided by Sn−1 signal unit.

6. The scanning structure according to claim **4**, wherein n of each of the Sn−1 signal unit, the Sn signal unit, and the Sn+1 signal unit is a positive integer.

7. A scanning structure for driving a pixel circuit of an active-matrix organic light-emitting diode, comprising:

a Sn−1 signal unit including a pixel driving circuit, adapted to receive an upper scan signal with a downward scanning direction and a lower scan signal with an upward scanning direction as an input signal of the pixel driving circuit, wherein the pixel driving circuit includes a first input end and a first output end, such that a driving signal is able to be received by the first input end, transformed to a first scan signal by the pixel driving circuit, and outputted by the first output end;

a Sn signal unit including a Sn pixel circuit, and the Sn pixel circuit including a second input end and a second output end, wherein the second input end is coupled to the first output end of the pixel driving circuit, such that the first scan signal is able to be received by the Sn pixel circuit and transformed to a second scan signal, and the second scan signal is able to be outputted by the second output, and wherein the Sn pixel circuit is controlled by the first scan signal; and

a Sn+1 signal unit including a Sn+1 pixel circuit, and the Sn+1 pixel circuit including a third input end and a third output end, wherein the third input end is coupled to the second output end of the Sn pixel circuit, such that the second scan signal is able to be received by the Sn+1 pixel circuit to control the Sn+1 pixel circuit.

8. The scanning structure according to claim **7**, wherein a scanning direction of the second scan signal is in accordance with that of the first scan signal, such that scanning directions of the Sn+1 signal unit and the Sn signal unit are in accordance with that provided by Sn−1 signal unit.

9. The scanning structure according to claim **7**, wherein n of each of the Sn−1 signal unit, the Sn signal unit **2**, and the Sn+1 signal unit is a positive integer.

10. A method of bi-directional scanning to drive a pixel circuit of an active-matrix organic light-emitting diode, the method adapted to be used with a Sn−1 signal unit having a pixel driving circuit and a Sn signal unit having a Sn pixel circuit, the method comprising:

providing an input signal to the pixel driving circuit of the Sn−1 signal unit, wherein the input signal comprises an upper scan signal with a downward scanning direction and a lower scan signal with an upward scanning direction;

providing a driving signal to the pixel driving circuit of the Sn−1 signal unit, and converting the driving signal to output a first scan signal; and

providing the first scan signal to the Sn pixel circuit of the Sn signal unit, and converting the first scan signal to output a second scan signal.

11. The method according to claim **10**, wherein the input signal is received by a first input end of the pixel driving circuit.

12. The method according to claim **11**, wherein the first scan signal is outputted by a first output end of the pixel driving circuit and received by a second input end of the Sn pixel circuit.

13. The method according to claim **12**, wherein the second scan signal is outputted by a second output end of the Sn pixel circuit.

* * * * *

专利名称(译)	用于驱动有源矩阵有机发光二极管的像素电路的扫描结构和双向扫描方法		
公开(公告)号	US20160093249A1	公开(公告)日	2016-03-31
申请号	US14/600285	申请日	2015-01-20
[标]申请(专利权)人(译)	上海和辉光电有限公司		
申请(专利权)人(译)	EVERDISPLAY OPTRONICS（上海）有限公司		
当前申请(专利权)人(译)	EVERDISPLAY OPTRONICS（上海）有限公司.		
[标]发明人	ZHOU XINGYU		
发明人	ZHOU, XINGYU		
IPC分类号	G09G3/3225 G09G3/32		
CPC分类号	G09G3/3233 G09G3/3266 G09G2310/0283		
优先权	201410521858.2 2014-09-30 CN		
外部链接	Espacenet USPTO		

摘要(译)

用于驱动有源矩阵有机发光二极管显示器的像素电路的扫描结构包括Sn-1信号单元，其具有用于接收具有向下扫描方向的上扫描信号和具有向上扫描信号的下扫描信号的像素驱动电路扫描方向作为输入信号。像素驱动电路包括第一输入端和第一输出端。驱动信号可以由第一输入端接收，由像素驱动电路转换为第一扫描信号，并由第一输出端输出。 Sn信号单元包括Sn像素电路，其具有耦合到第一输出端的第二输入端和第二输出端。第一扫描信号可以由Sn像素电路接收并变换为第二扫描信号，第二扫描信号可以由第二输出端输出。