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(54) **LIQUID CRYSTAL DISPLAY PANEL AND LIQUID CRYSTAL DISPLAY DEVICE**

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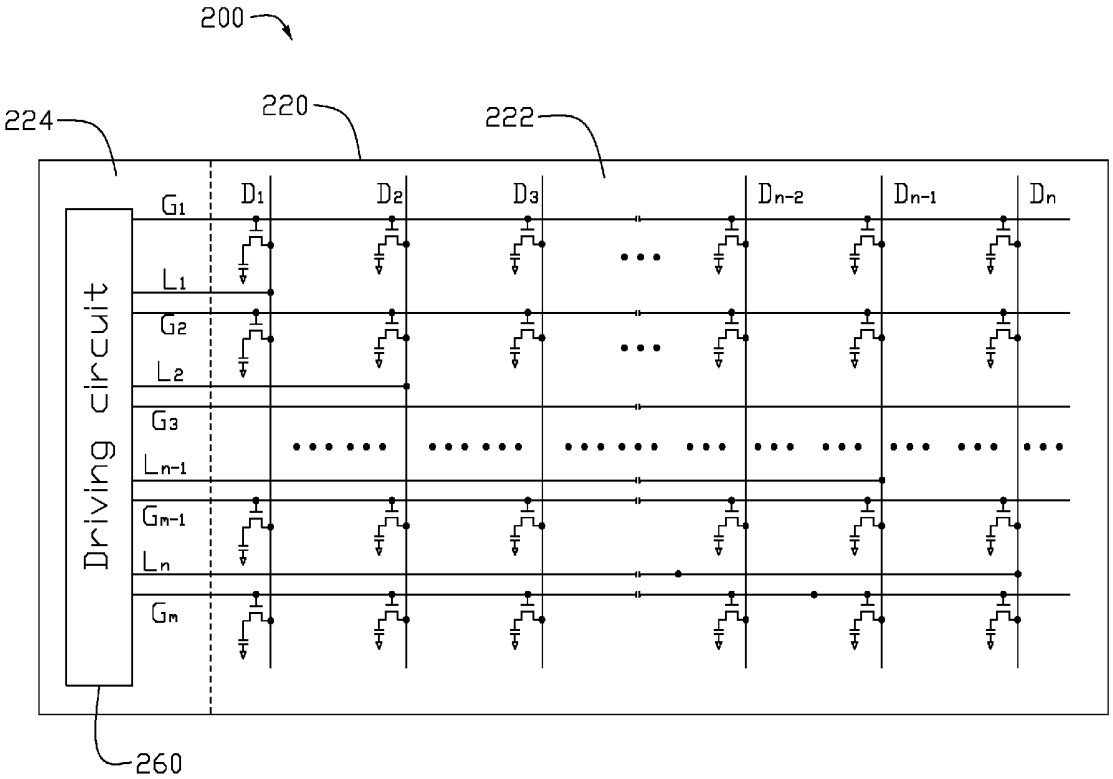
(57) **ABSTRACT**

A liquid crystal display panel includes a plurality of scan lines, a plurality of data lines perpendicular to and insulatively intersecting the scan lines and a plurality of scanning-signal transmission lines insulatively disposed between the data lines and parallel to the data lines. The scanning-signal transmission lines provide scanning signals to the scan lines.



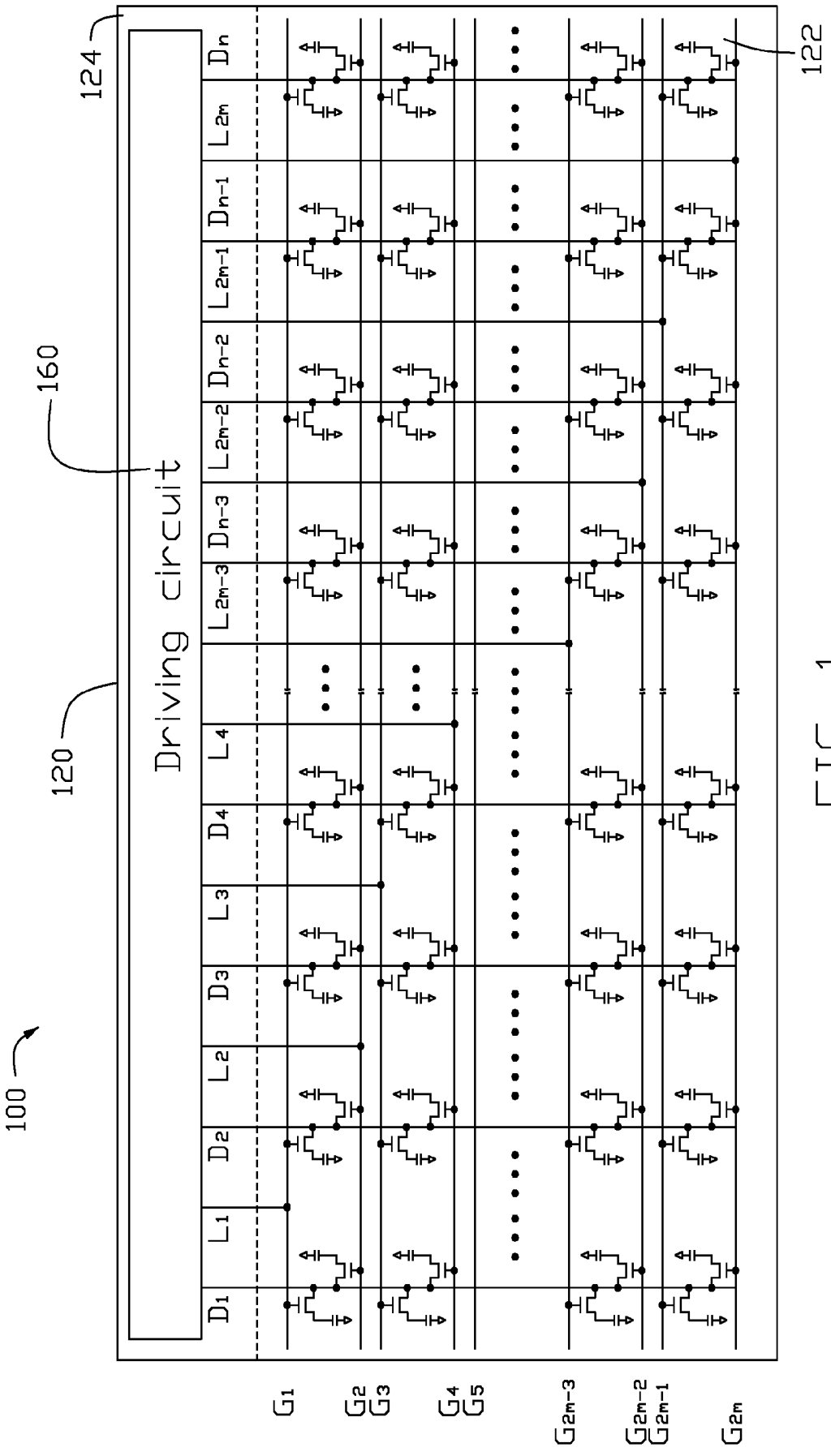

100
120
160
124
122
Driving circuit
D1
L1
D2
L2
D3
L3
D4
L4
L2m-3
Dn-3
L2m-2
Dn-2
L2m-1
Dn-1
L2m
Dn
G1
G2
G3
G4
G5
G2m-3
G2m-2
G2m-1
G2m

FIG. 1

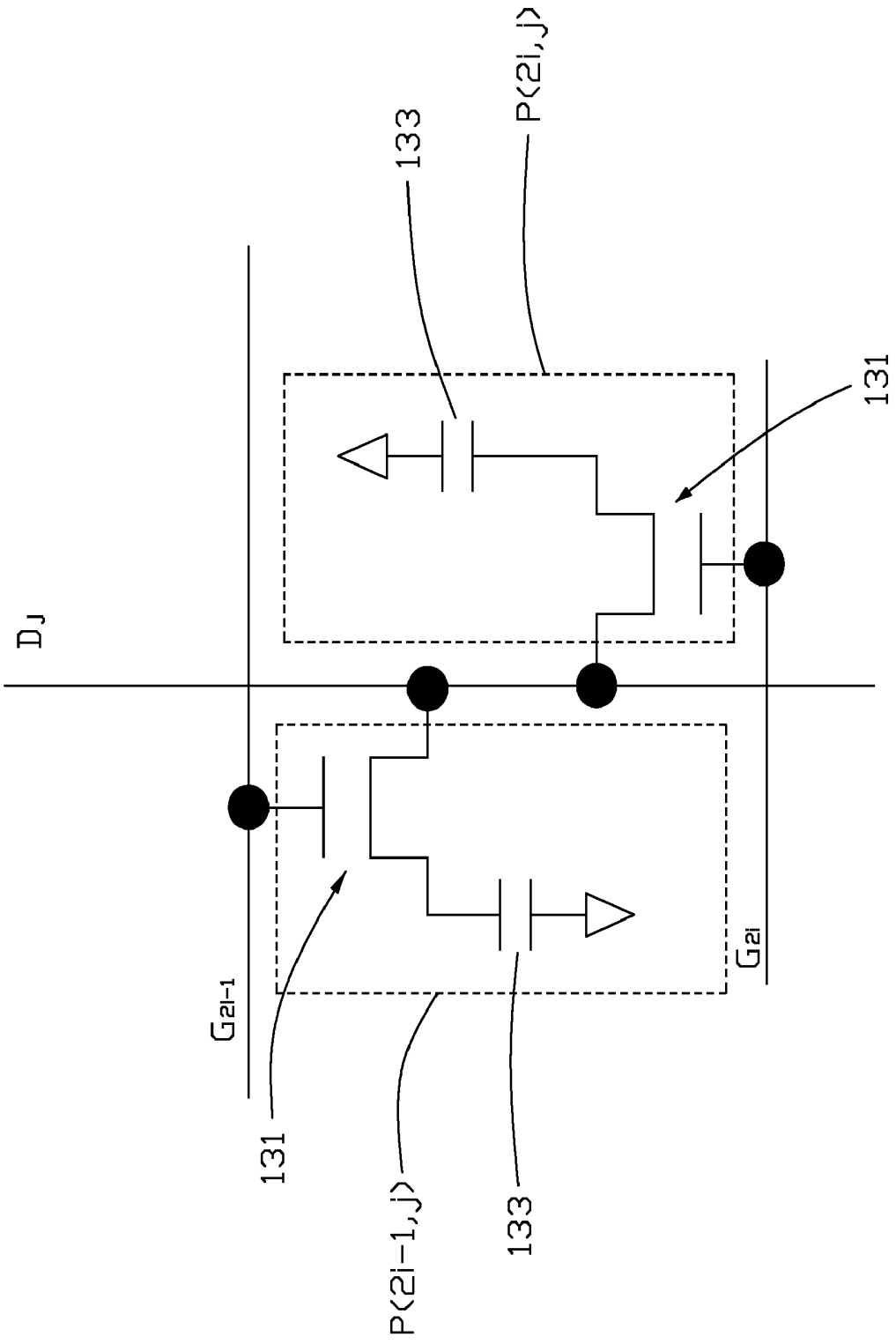


FIG. 2

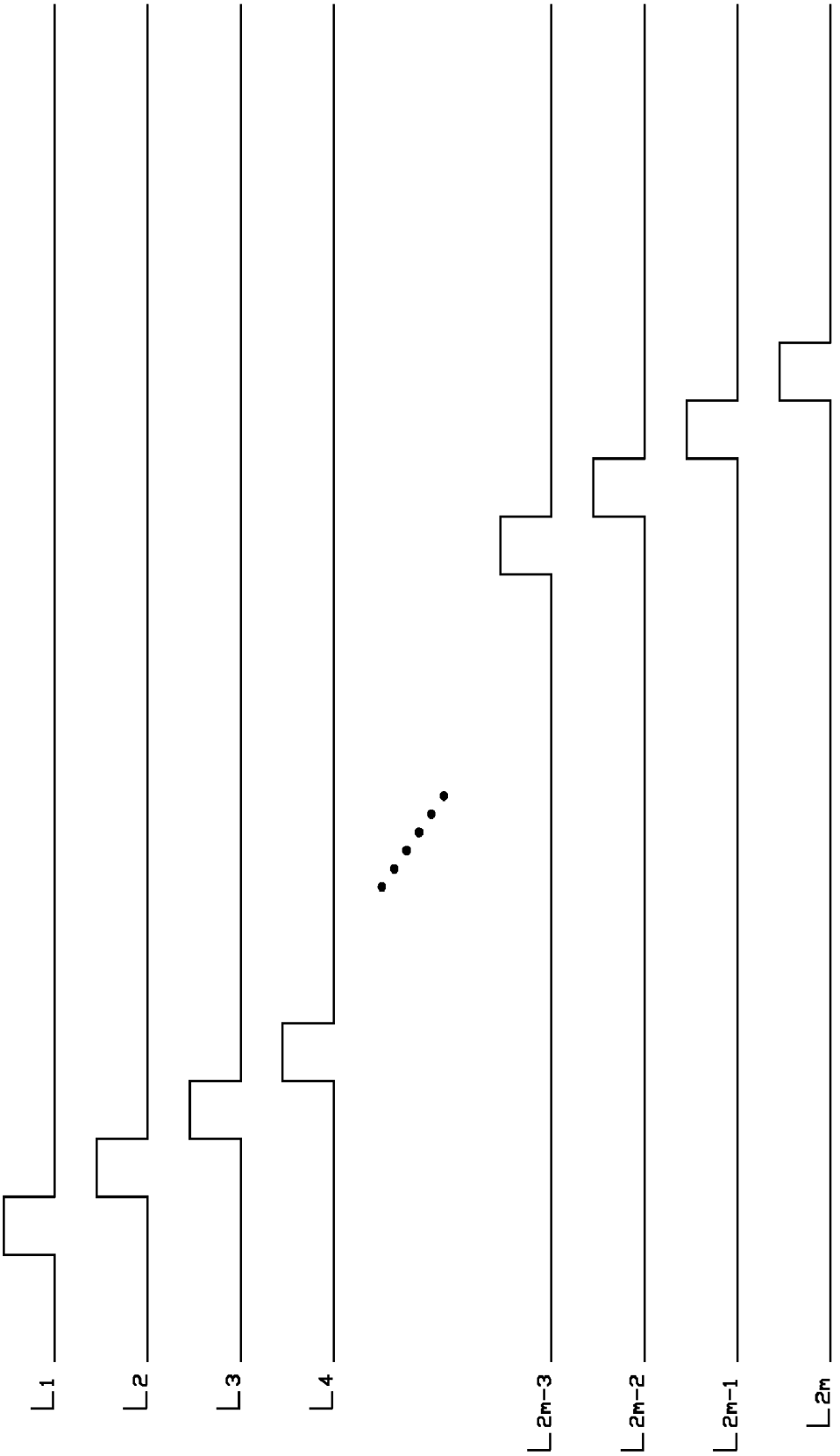


FIG. 3

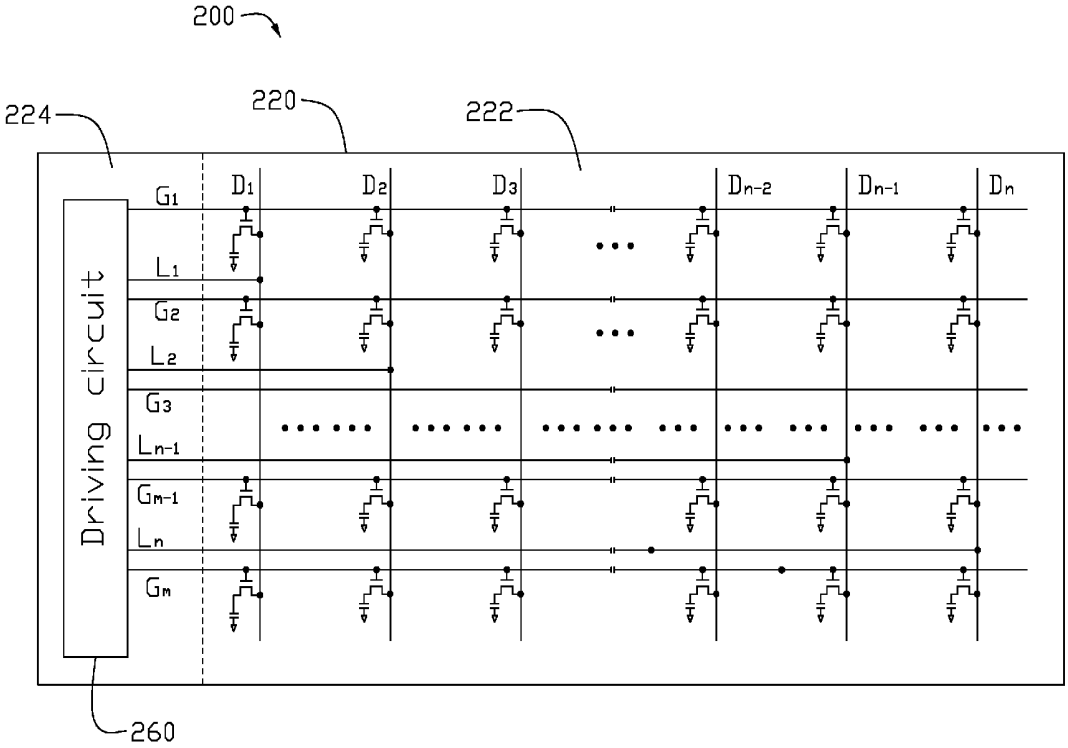

200
224
220
222
Driving circuit
G1
L1
G2
L2
G3
Ln-1
Gm-1
Ln
Gm
D1
D2
D3
Dn-2
Dn-1
Dn
260

FIG. 4

LIQUID CRYSTAL DISPLAY PANEL AND LIQUID CRYSTAL DISPLAY DEVICE

BACKGROUND

[0001] 1. Technical Field

[0002] The present disclosure relates in general to a liquid crystal display panel and a liquid crystal display device.

[0003] 2. Description of Related Art

[0004] Liquid crystal display devices have been widely applied to electronic apparatuses, such as televisions, notebook computers, mobile telephones, personal digital assistants (PDA) and the like, because they are small, lightweighted, thin and low power-consumptive, and have no flicker and low radiation.

[0005] A liquid crystal display panel of the liquid crystal display device usually includes a display region for displaying images and a non-display region for installing driving circuits and traces. At present, the driving circuit disposed in the non-display region includes a data driving circuit and a scan driving circuit. Data lines and scan lines inside the liquid crystal display panel are perpendicular to each other. Thus, the data driving circuit and its layout and the scan driving circuit and its layout are respectively disposed in two regions outside the display region and extending in two different directions. Consequently, the liquid crystal display panel has a larger non-display region. Correspondingly, the size of the display region is also restricted so that the user cannot enjoy wider and comfortable visual feeling.

SUMMARY

[0006] According to a first exemplary embodiment of the present disclosure, a liquid crystal display panel is provided. The liquid crystal display panel includes a plurality of parallel scan lines, a plurality of parallel data lines perpendicular to and insulatively intersecting the scan lines and a plurality of scanning-signal transmission lines disposed between the data lines and insulatively to and parallel to the data lines. The scanning-signal transmission lines provide scanning signals to the scan lines.

[0007] According to a second exemplary embodiment of the present disclosure, a liquid crystal display panel is provided. The liquid crystal display panel includes a plurality of parallel first signal lines, and a plurality of parallel second signal lines perpendicular to and insulatively intersecting the first signal lines. The first signal lines are scan lines and the second signal lines are data lines. Alternatively, the first signal lines are data lines and the second signal lines are scan lines. The liquid crystal display panel further includes a plurality of second signal transmission lines disposed between the first signal lines and insulatively to and parallel to the first signal lines, and the second signal transmission lines provides second signals to the second signal lines.

[0008] According to a third exemplary embodiment of the present disclosure, a liquid crystal display device including a liquid crystal display panel and a driving circuit is provided. The liquid crystal display panel includes a display region and a non-display region. The display region includes a plurality of scan lines extending in a first direction; a plurality of data lines extending in a second direction perpendicular to the first direction; and a plurality of scanning-signal transmission lines disposed between the data lines and parallel to the data lines. The data lines and the scanning-signal transmission lines extend to one side of the display region in the second direction to define the non-display region. The driving circuit is disposed in the non-display region. The driving circuit is electrically connected to the data lines and electrically connected to the scan lines through the scanning-signal transmission lines.

[0009] The above and other aspects of the disclosure will become better understood with regard to the following detailed description of the preferred but non-limiting embodiment(s). The following description is made with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. **1** is a schematic circuit diagram showing a liquid crystal display device according to a first embodiment of the disclosure.

[0011] FIG. **2** is a schematically partially enlarged view showing the liquid crystal display device of FIG. **1**.

[0012] FIG. **3** shows waveforms of driving signals of the liquid crystal display device of FIG. **1**.

[0013] FIG. **4** is a schematic circuit diagram showing a liquid crystal display device according to a second embodiment of the disclosure.

DETAILED DESCRIPTION

First Embodiment

[0014] FIG. **1** is a schematic circuit diagram showing a liquid crystal display device **100** according to a first embodiment of the disclosure. FIG. **2** is a schematically partially enlarged view showing the liquid crystal display device **100** of FIG. **1**. Referring to FIGS. **1** and **2**, the liquid crystal display device **100** includes a liquid crystal display panel **120** and a driving circuit **160**. The liquid crystal display panel **120** includes a plurality of parallel scan lines G_1 to G_{2m}, a plurality of parallel data lines D_1 to D_n perpendicular to and insulatively intersecting the scan lines, and m and n are natural numbers.

[0015] Neighboring two of the scan lines G_{2i-1} and G_{2i} are defined as one scan line set. Each scan line set G_{2i-1} and G_{2i} and the data lines D_1 to D_n define a plurality of pixel units. A pixel unit P(2i−1,j) connected to the data line D_j and a pixel unit P(2i,j) connected to the data line D_j are respectively disposed on two sides of the data line D_j, and i and j are natural numbers, $1 \leqq i \leqq m$, and $1 \leqq j \leqq n$. The pixel unit P(2i−1,j) is connected to the scan line G_{2i-1} and the pixel unit P(2i,j) is connected to the scan line G_{2i}. In other words, the pixel unit P(2i−1,j) and the pixel unit P(2i,j) share the same data line D_j under the control of different scan lines G_{2i-1} and G_{2i}. Each pixel unit includes a thin film transistor **131** and a liquid crystal capacitor **133**. The thin film transistor **131** of the pixel unit P(2i−1,j) has a gate connected to the scan line G_{2i-1}, a source connected to the data line D_j and a drain connected to the corresponding liquid crystal capacitor **133**. The thin film transistor **131** of the pixel unit P(2i,j) has a gate connected to the scan line G_{2i}, a source also connected to the data line D_j and a drain connected to the corresponding liquid crystal capacitor **133**.

[0016] The liquid crystal display panel **120** further includes a plurality of scanning-signal transmission lines L_1 to L_{2m} insulatively disposed between the data lines D_1 to D_n and parallel to the data lines D_1 to D_n. The scanning-signal transmission lines L_1 to L_{2m} are respectively connected to the scan lines in a one-to-one manner. In this embodiment, $n \leqq 2m+1$, and the scanning-signal transmission line L_i is disposed

between the neighboring two data lines D_j and D_{j+1}, and $1 \leqq i \leqq 2m$ and $1 \leqq j \leqq n-1$. At most one scanning-signal transmission line is disposed between the neighboring two data lines D_j and D_{j+1}.

[0017] When n=2m+1, preferably, one scanning-signal transmission line L_i is just disposed between the neighboring two data lines D_j and D_{j+1}. When n>2m+1, there would be no scanning-signal transmission line disposed between at least two neighboring data lines D_j and D_{j+1}. At this time, preferably, no scanning-signal transmission line is disposed between the data lines in the middle region, and the scanning-signal transmission lines and the data lines in the regions on two sides of the middle region are disposed symmetrically. More specifically, the 1^{st} to m^{th} scanning-signal transmission lines L_1 to L_m are disposed between the 1^{st} to $(m+1)^{th}$ data lines D_1 to D_{m+1}, the $(m+1)^{th}$ to $(2m)^{th}$ scanning-signal transmission lines L_{m+1} to L_{2m} are disposed between the last 1^{st} to $(m+1)^{th}$ data lines D_n to $D_{n-(m+1)}$, and no scanning-signal transmission line is disposed between the $(m+1)^{th}$ data line and the last $(m+1)^{th}$ data lines D_{m+1} to $D_{n-(m+1)}$. For example, when m=272 and n=720, no scanning-signal transmission line is disposed between the data lines D_{273} and D_{448}, and in the region having the data lines D_1 to D_{273} and in the region having the data lines D_{448} to D_{720}, the scanning-signal transmission lines and the data lines are disposed symmetrically.

[0018] The liquid crystal display panel **120** is divided into a display region **122** and a non-display region **124**. The scan lines G_1 to G_{2m}, the data lines D_1 to D_n and the scanning-signal transmission lines L_1 to L_{2m} are disposed in the display region **122**. The data lines D_1 to D_n and the scanning-signal transmission lines L_1 to L_{2m} extend to one side of the display region **122** in an extending direction thereof to define the non-display region **124**.

[0019] The driving circuit **160**, disposed in the non-display region **124**, drives the data lines D_1 to D_n and drives the scan lines G_1 to G_{2m} through the scanning-signal transmission lines L_1 to L_{2m}. The driving circuit **160** includes 2m scanning signal output terminals (not labeled) and n data signal output terminals (not labeled). The 2m scanning signal output terminals are respectively electrically connected to the scanning-signal transmission lines L_1 to L_{2m} in a one-to-one manner. The n data signal output terminals are respectively electrically connected to the data lines D_1 to D_n in a one-to-one manner. The driving circuit **160** may be a driving chip having 2m scanning signal output terminals and n data signal output terminals, and 2m scanning signal output terminals output scanning signals which are transmitted to the scan lines G_1 to G_{2m} through the scanning-signal transmission lines L_1 to L_{2m}, and n data signal output terminals output data signals to the data lines D_1 to D_n.

[0020] FIG. **3** shows waveforms of driving signals on the scanning-signal transmission lines L_1 to L_{2m}, i.e. the waveforms of the scanning signals on the scan lines G_1 to G_{2m}. When the liquid crystal display device **100** is in normal operation, the 2m scanning signal output terminals of the driving circuit **160** sequentially output a series of scanning signals which are transmitted to the scan lines G_1 to G_{2m} through the scanning-signal transmission lines L_1 to L_2 m. At the same time, the n data signal output terminals of the driving circuit **160** also sequentially output a plurality of data signals to the data lines D_1 to D_n.

[0021] In practice, the scanning signal is a series of high voltage pulses with the time length T. Usually, the time for the high voltage pulses to be applied to the scan lines G_1 to G_{2m} is defined as a frame time. At any moment within one frame time, only one scan line is applied with the high voltage pulse. Taking the scan line set G_{2i-1} and G_{2i} and the data line D_j as an example, the operation principle of the liquid crystal display device **100** may be briefly described in the following.

[0022] When the $(2i-1)^{th}$ scanning signal output terminal of the driving circuit **160** applies the high voltage pulse to the scan line G_{2i-1} through the scanning-signal transmission line L_{2i-1} during the time T, the thin film transistor **131** of the pixel unit P(2i−1,j) connected to the scan line G_{2i-1} turns on. At this time, the jth data signal output terminal of the driving circuit **160** outputs a first data signal which is written into the liquid crystal capacitor **133** of the pixel unit P(2i−1,j) through the data line D_j and the source and the drain of the thin film transistor **131** of the pixel unit P(2i−1,j) so that the pixel unit P(2i−1,j) displays. Next, the $(2i-1)^{th}$ scanning signal output terminal of the driving circuit **160** stops applying the high voltage pulse to the scanning-signal transmission line L_{2i-1}, and the thin film transistor **131** of the pixel unit P(2i−1,j) connected to the scan line G_{2i-1} turns off. Moreover, the $(2i)^{th}$ scanning signal output terminal of the driving circuit **160** applies the high voltage pulses to the scan line G_{2i} through the scanning-signal transmission line L_{2i}, so that the thin film transistor **131** of the pixel unit P(2i,j) connected to the scan line G_{2i} turns on. At this time, the j^{th} data signal output terminal of the driving circuit **160** outputs a second data signal which is written into the liquid crystal capacitor **133** of the pixel unit P(2i,j) through the data line D_j and the source and the drain of the thin film transistor **131** of the pixel unit P(2i,j) so that the pixel unit P(2i,j) displays.

[0023] Compared with the prior art, the liquid crystal display panel **120** and the liquid crystal display device **100** according to the first embodiment of the disclosure include the scanning-signal transmission lines L_1 to L_{2m} disposed between the data lines D_1 to D_n and parallel to the data lines D_1 to D_n. The scanning-signal transmission lines L_1 to L_{2m} can transmit the scanning signals to the scan lines G_1 to G_{2m}, so that it is enough to install the driving circuit **160**, driving the data lines D_1 to D_n and driving the scan lines G_1 to G_{2m} through the scanning-signal transmission lines L_1 to L_{2m}, in one region on one side of the display region **122**. Compared with the prior art, in which the non-display region has two regions disposed outside the display region and extending in two different directions, the area of the non-display region **124** of the first embodiment of the disclosure is smaller so that the ratio of the area of the display region **122** to the area of the non-display region **124** is increased, the advantageous effect of the narrow side can be achieved, and the user can enjoy wide and comfortable visual feeling. Meanwhile, in the first embodiment of the disclosure, the functions of the scan driving circuit and the data driving circuit are integrated into the driving circuit **160**, so that the packaging process of the first embodiment of the disclosure is simpler than that of the prior art, in which two driving circuits are provided.

[0024] In addition, according to the above-mentioned operation principle, in the liquid crystal display device **100** of the first embodiment of the disclosure, the two scanning lines G_{2i-1} and G_{2i} are disposed on the same row and the pixel units P(2i−1,j) and P(2i,j) disposed on two side of the data line D_j may share the same data line D_j by timing division. That is, the pixel units P(2i−1,j) and P(2i,j) disposed on the same row and on the two sides of the data line D_j share the j^{th} data signal output terminal of the driving circuit **160** in a time-division manner. Thus, the number of the data lines of the liquid

crystal display device **100** is equal to one half that of the typical liquid crystal display device. Furthermore, disposition of the scanning-signal transmission lines L_1 to L_{2m} between the data lines D_1 to D_n does not increase any layout difficulty in the extension of the data line. Meanwhile, the number of the data signal output terminals of the liquid crystal display device **100** is equal to one half that of the typical liquid crystal display device. Furthermore, the disposition of the scanning signal output terminals between the data signal output terminals and alternately output of the scanning signals and the data signals from the integrated driving circuit **160** do not increase the package and layout difficulty of the driving circuit **160**.

Second Embodiment

[0025] FIG. **4** is a schematic circuit diagram showing a liquid crystal display device **200** according to a second embodiment of the disclosure. Referring to FIG. **4**, the difference between the liquid crystal display device **200** and the liquid crystal display device **100** of the first embodiment resides in that a liquid crystal display panel **220** includes a plurality of parallel scan lines G_1 to G_m, a plurality of parallel data lines D_1 to D_n perpendicular to and insulatively intersecting the scan lines G_1 to G_m, and a plurality of data signal transmission lines L_1 to L_n insulatively disposed between the scan lines G_1 to G_m and parallel to the scan lines G_1 to G_m. The data signal transmission lines L_1 to L_n are respectively electrically connected to the data lines D_1 to D_n in a one-to-one manner for providing data signals to the data lines D_1 to D_n. In this embodiment, m>n, the data signal transmission line L_j is disposed between the neighboring two scan lines G_i and G_{i+1}, and at most one data signal transmission line is disposed between the neighboring two scan lines G_i and G_{i+1}, and $1 \leqq i \leqq m-1$.

[0026] The liquid crystal display panel **220** is divided into a display region **222** and a non-display region **224**. The scan lines G_1 to G_m, the data lines D_1 to D_n and the data signal transmission lines L_1 to L_n are disposed in the display region **222**. The scan lines G_1 to G_m and the data signal transmission lines L_1 to L_n extend to one side of the display region **222** in an extending direction thereof to define the non-display region **224**.

[0027] In this embodiment, the liquid crystal display panel **220** and the liquid crystal display device **200** include the data signal transmission lines L_1 to L_n disposed between the scan lines G_1 to G_m and parallel to the scan lines G_1 to G_m. The data signal transmission lines L_1 to L_n transmit data signals to the data lines D_1 to D_n and a driving circuit **260**, disposed in a region on one side of the display region **222**, is enough for driving the scan lines G_1 to G_m and the data lines D_1 to D_n. Compared with the prior art, in which the non-display region has two regions disposed outside the display region and extending in two different directions, the non-display region **222** of the second embodiment of the disclosure is smaller so that the ratio of the area of the display region **222** to the area of the non-display region **224** is increased, the advantageous effect of the narrow side can be achieved, and the user can enjoy wide and comfortable visual feeling. Meanwhile, only one driving circuit **260** is provided in the second embodiment of this disclosure. Compared with the prior art, in which two driving circuits are provided, the package processes of the second embodiment of the disclosure can be simplified.

[0028] While the disclosure has been described by way of example and in terms of the preferred embodiment(s), it is to be understood that the disclosure is not limited thereto. On the contrary, it is intended to cover various modifications and similar arrangements and procedures, and the scope of the appended claims therefore should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements and procedures.

What is claimed is:

1. A liquid crystal display panel, comprising:
- a plurality of scan lines;
- a plurality of data lines perpendicular to and insulatively intersecting the scan lines; and
- a plurality of scanning-signal transmission lines insulatively disposed between the data lines and parallel to the data lines, wherein the scanning-signal transmission lines provide scanning signals to the scan lines.

2. The liquid crystal display panel according to claim **1**, wherein the scanning-signal transmission lines are respectively connected to the scan lines in a one-to-one manner.

3. The liquid crystal display panel according to claim **2**, wherein:
- the scan lines comprise 2m scan lines;
- the data lines comprise n data lines, $(2i-1)^{th}$ and $2i^{th}$ scan lines are defined as a scan line set; and
- each scan line set and the data lines define a plurality of pixel units arranged in one row, two of the pixel units on two sides of each of the data lines and on the same row share the same data line, and the two pixel units are respectively controlled by the $(2i-1)^{th}$ and $2i^{th}$ scan lines, wherein i, m and n are natural numbers, and $1 \leqq i \leqq m$.

4. The liquid crystal display panel according to claim **3**, wherein:
- the scanning-signal transmission lines comprise 2m scanning-signal transmission lines;
- each of the scanning-signal transmission lines is disposed between neighboring two of the data lines; and
- at most one scanning-signal transmission line is disposed between neighboring two of the data lines.

5. The liquid crystal display panel according to claim **4**, wherein $n \geqq 2m+1$, 1^{st} to m^{th} scanning-signal transmission lines are disposed between the 1^{st} to $(m+1)^{th}$ data lines and $(m+1)^{th}$ to $(2m)^{th}$ scanning-signal transmission lines are disposed between last 1^{st} to $(m+1)^{th}$ data lines.

6. The liquid crystal display panel according to claim **3**, wherein:
- each of the pixel units includes a thin film transistor and a liquid crystal capacitor;
- two of the pixel units, disposed in the i^{th} row and sharing the j^{th} data line, are respectively defined as a first pixel unit and a second pixel unit;
- the thin film transistor of the first pixel unit has a gate connected to the $(2i-1)^{th}$ scan line, a source connected to the j^{th} data line and a drain connected to a corresponding liquid crystal capacitor; and
- the thin film transistor of the second pixel unit has a gate connected to the $(2i)^{th}$ scan line, a source connected to the j^{th} data line and a drain connected to a corresponding liquid crystal capacitor, wherein j is a natural number and $1 \leqq j \leqq n$.

7. The liquid crystal display panel according to claim **1**, wherein:
- the liquid crystal display panel is divided into a display region and a non-display region;

the scan lines, the data lines and the scanning-signal transmission lines are disposed in the display region;

the data lines and the scanning-signal transmission lines extend to one side of the display region in an extending direction thereof to define the non-display region; and

a driving circuit electrically connected to the data lines and the scanning-signal transmission lines is disposed in the non-display region.

8. A liquid crystal display panel, comprising:

a plurality of first signal lines;

a plurality of second signal lines perpendicular to and insulatively intersecting the first signal lines, the first signal lines being scan lines and the second signal lines being data lines or the first signal lines being data lines and the second signal lines being scan lines; and

a plurality of second signal transmission lines insulatively disposed between the first signal lines and parallel to the first signal lines, wherein the second signal transmission lines are respectively connected to the second signal lines in a one-to-one manner.

9. The liquid crystal display panel according to claim **8**, wherein:

the first signal lines are the scan lines;

the second signal lines are the data lines; and

the second signal transmission lines are data signal transmission lines, each of the data signal transmission lines is disposed between neighboring two of the scan lines, and at most one data signal transmission line is disposed between neighboring two of the scan lines.

10. The liquid crystal display panel according to claim **8**, wherein:

the liquid crystal display panel is divided into a display region and a non-display region;

the scan lines, the data lines and the data signal transmission lines are disposed in the display region;

the scan lines and the data signal transmission lines extend to one side of the display region in an extending direction thereof to define the non-display region; and

a driving circuit, electrically connected to the scan lines and to the data signal transmission lines, is disposed in the non-display region.

11. A liquid crystal display device, comprising a liquid crystal display panel and a driving circuit,

the liquid crystal display panel comprising a display region and a non-display region;

the display region comprising: a plurality of scan lines extending in a first direction; a plurality of data lines extending in a second direction perpendicular to the first direction; and a plurality of scanning-signal transmission lines disposed between the data lines and parallel to the data lines;

the data lines and the scanning-signal transmission lines extending to one side of the display region in the second direction to define the non-display region; and

the driving circuit, disposed in the non-display region, electrically connected to the data lines and electrically connected to the scan lines through the scanning-signal transmission lines.

12. The liquid crystal display device according to claim **11**, wherein:

the scan lines comprise 2m scan lines;

the data lines comprise n data lines;

the $(2i-1)^{th}$ and $2i^{th}$ scan lines are defined as a scan line set, each scan line set and the data lines define a plurality of pixel units arranged in one row; and

two of the pixel units on two sides of each of the data lines and in the same row share the same data line, and the two pixel units are respectively controlled by the $(2i-1)^{th}$ and $2i^{th}$ scan lines, wherein i, m and n are natural numbers, and $1 \leqq i \leqq m$.

* * * * *

专利名称(译)	液晶显示面板和液晶显示装置		
公开(公告)号	US20110128261A1	公开(公告)日	2011-06-02
申请号	US12/915059	申请日	2010-10-29
[标]申请(专利权)人(译)	群创光电股份有限公司		
申请(专利权)人(译)	奇美群创光电		
当前申请(专利权)人(译)	群创光电		
[标]发明人	HUNG CHAO YI HSU CHIH CHIEH		
发明人	HUNG, CHAO-YI HSU, CHIH-CHIEH		
IPC分类号	G09G3/36 G09G5/00		
CPC分类号	G02F1/136286 G09G2300/0426 G09G3/3648		
优先权	200910310742.3 2009-12-01 CN		
外部链接	Espacenet USPTO		

摘要(译)

一种液晶显示面板，包括多条扫描线，垂直于扫描线并与扫描线绝缘交叉的多条数据线和多条扫描信号传输线，多条扫描信号传输线绝缘地设置在数据线之间并与数据线平行。扫描信号传输线向扫描线提供扫描信号。