



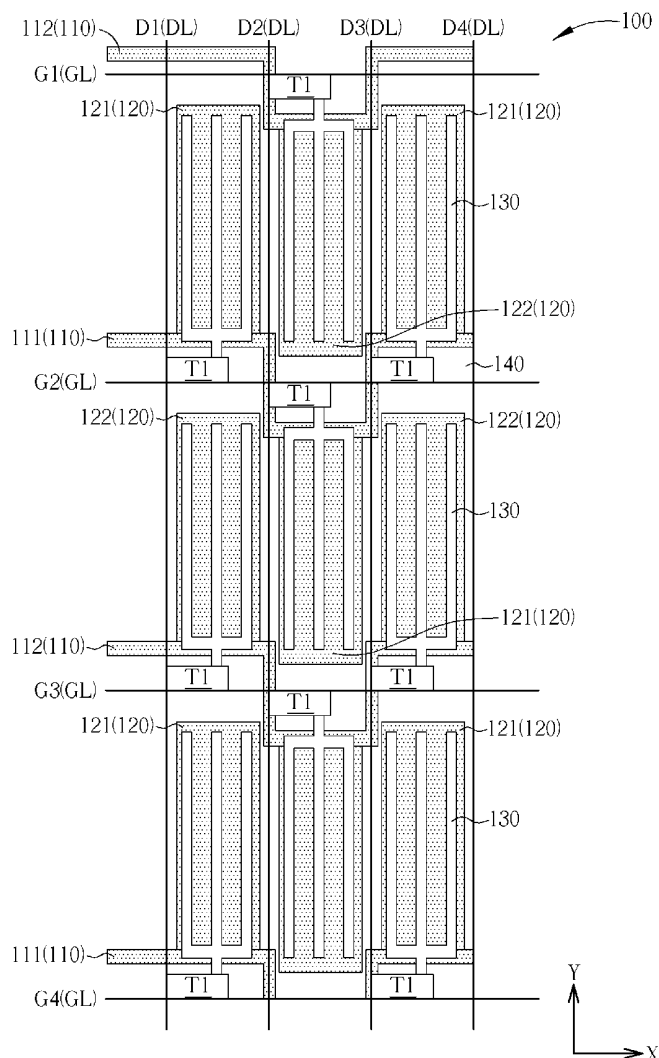
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(19) **United States**(12) **Patent Application Publication**
Pai(10) **Pub. No.: US 2012/0249943 A1**(43) **Pub. Date: Oct. 4, 2012**(54) **PIXEL ARRAY OF FRINGE FIELD
SWITCHING LIQUID CRYSTAL DISPLAY
PANEL AND DRIVING METHOD THEREOF**(52) **U.S. Cl. 349/141; 349/139**(57) **ABSTRACT**(76) **Inventor: Cheng-Chiu Pai, Hsin-Chu (TW)**(21) **Appl. No.: 13/172,766**(22) **Filed: Jun. 29, 2011**(30) **Foreign Application Priority Data**

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A pixel array of a fringe field switching (FFS) liquid crystal display panel includes a plurality of gate lines, a plurality of data line, a plurality of pixel electrodes, and a plurality of common lines. The gate lines are disposed parallel to each other along a first direction. The data lines are disposed parallel to each other along a second direction. A plurality of sub-pixel regions is defined by the gate lines and the data lines. The common lines are disposed along the first direction and electrically isolated from each other. Each of the common lines includes a plurality of common electrodes extending along the second direction. The two adjacent common electrodes of each common line are respectively disposed in the two adjacent sub-pixel regions which are located in different rows.



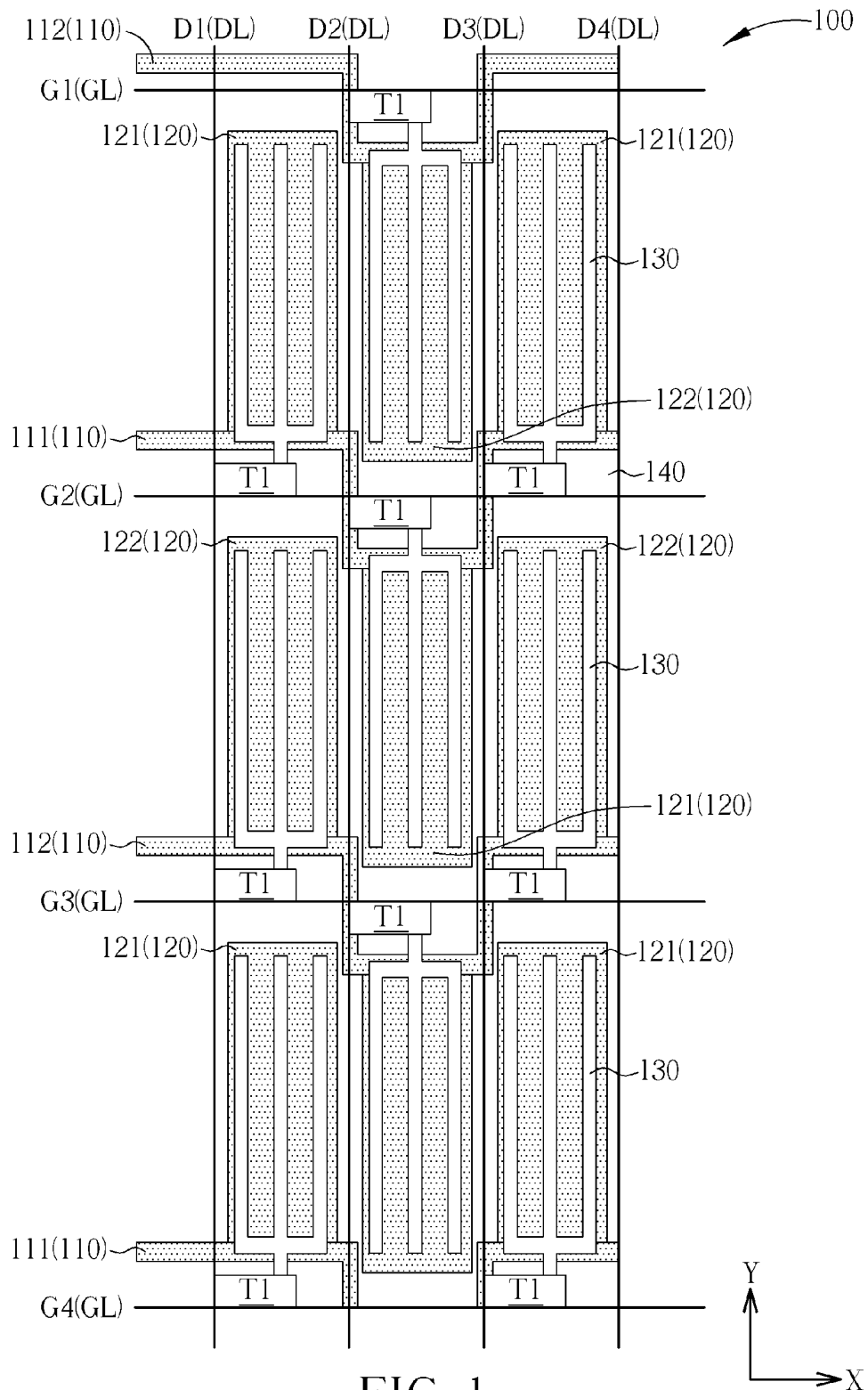
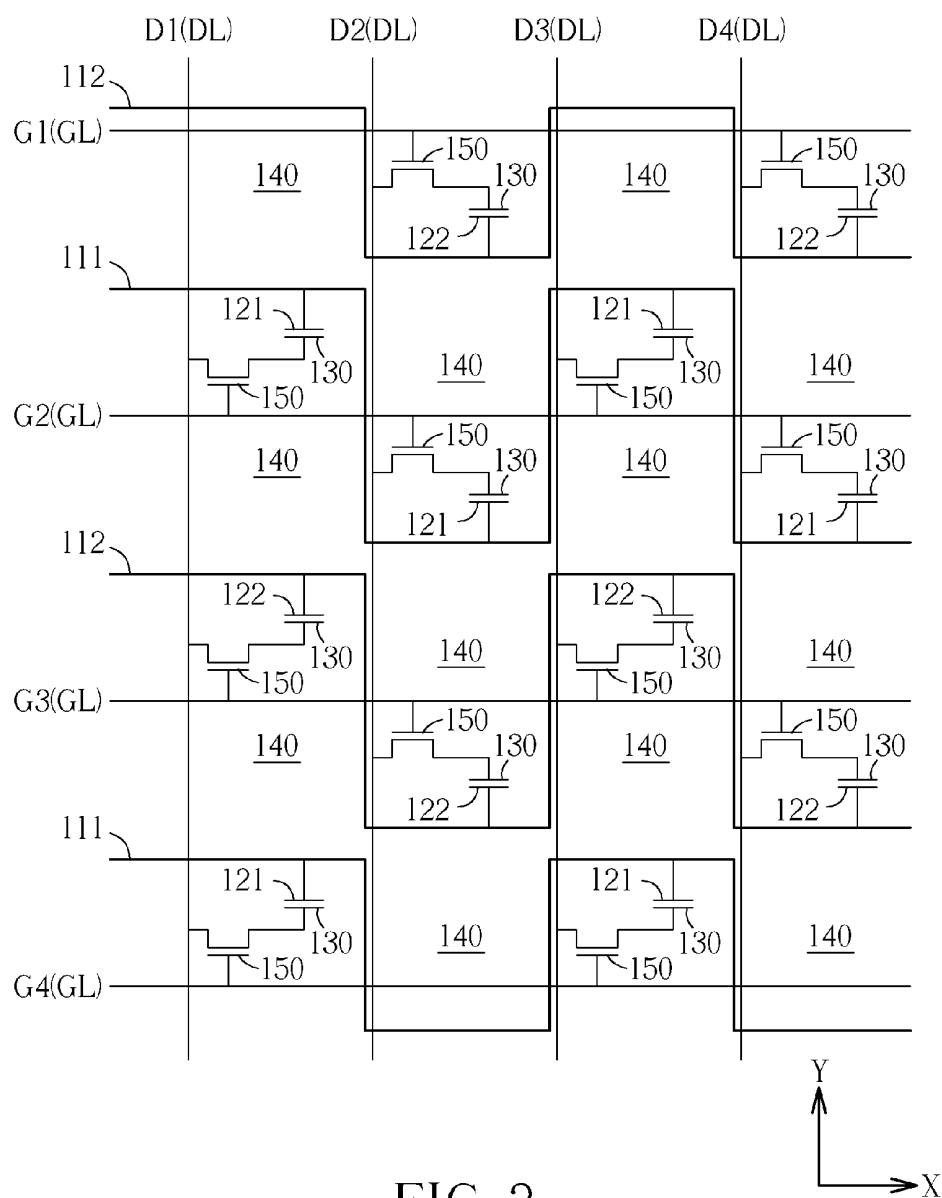
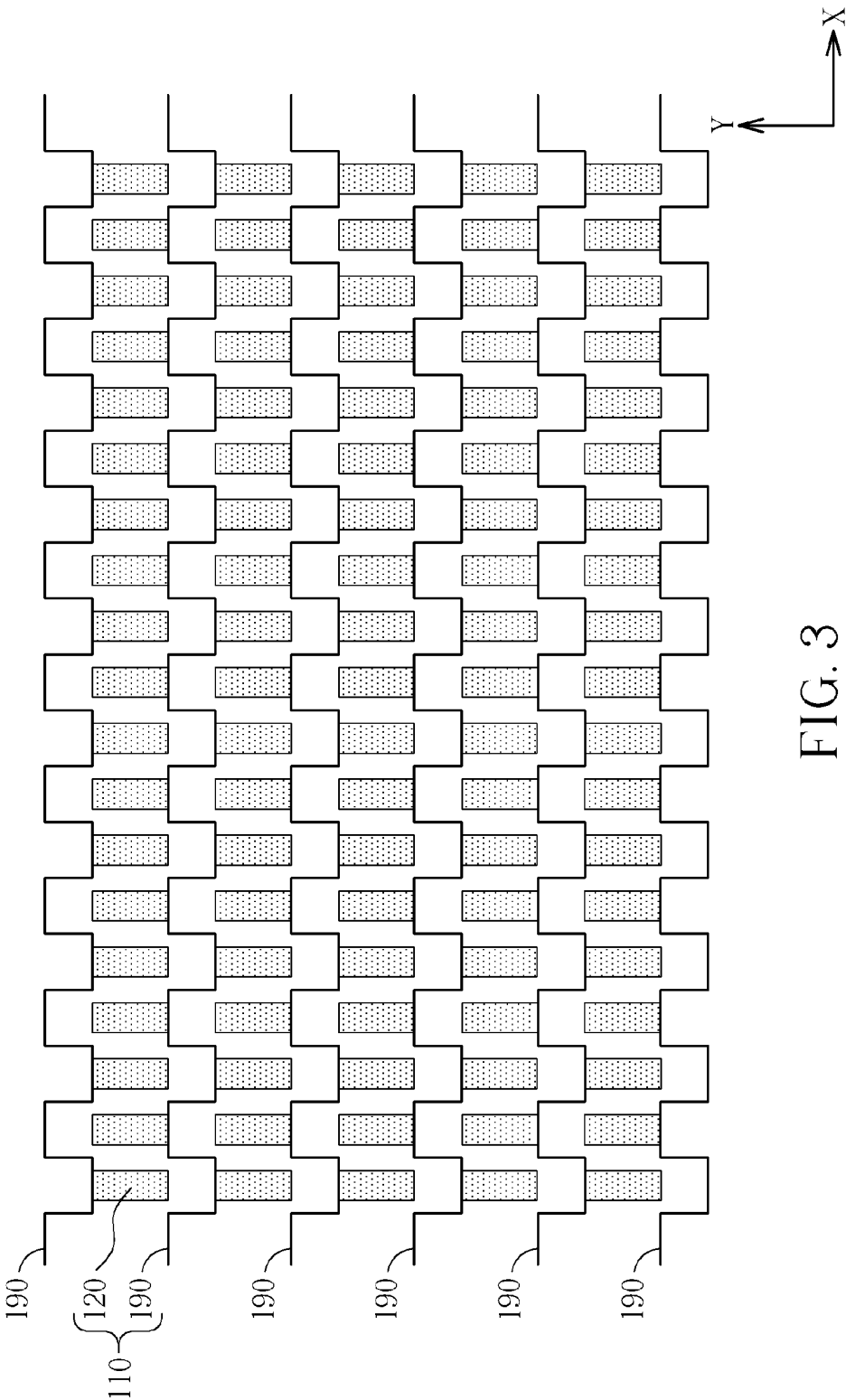


FIG. 1





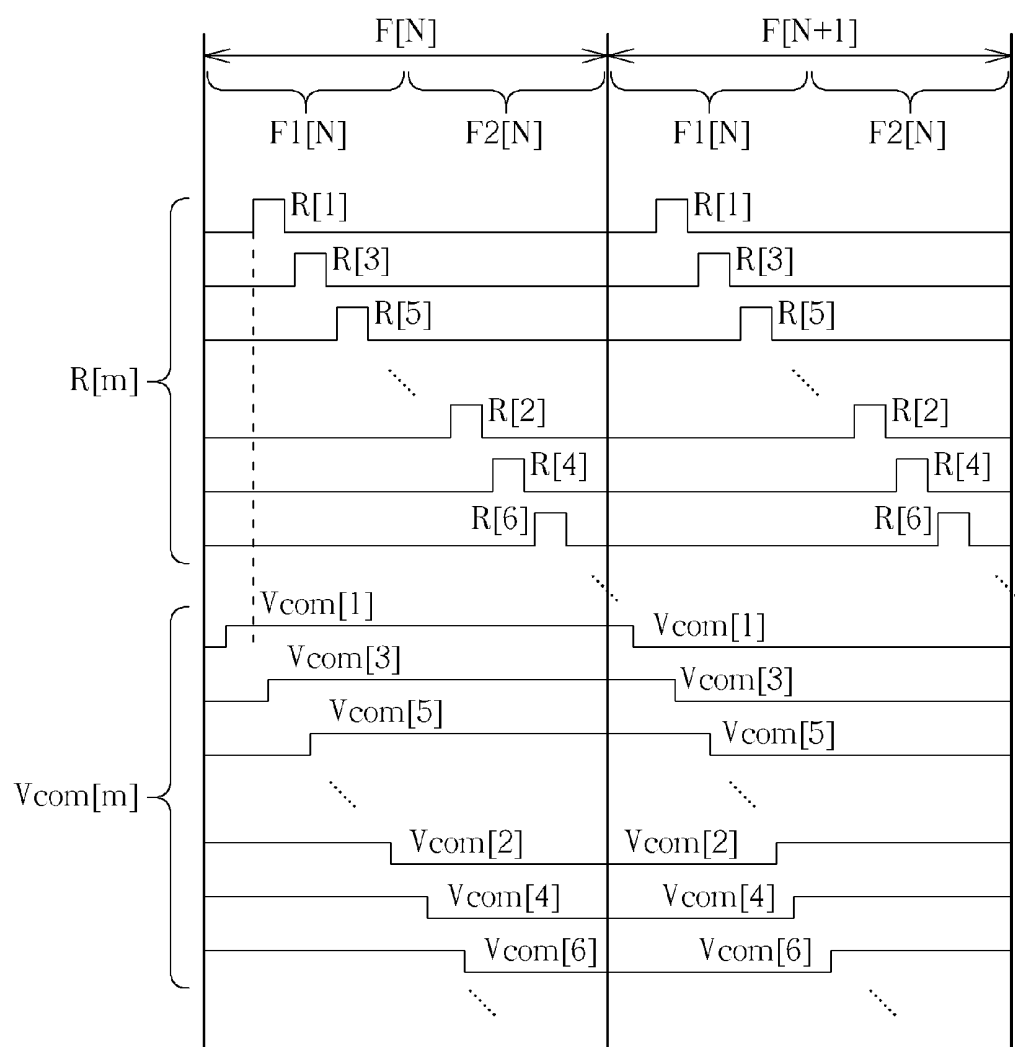


FIG. 4

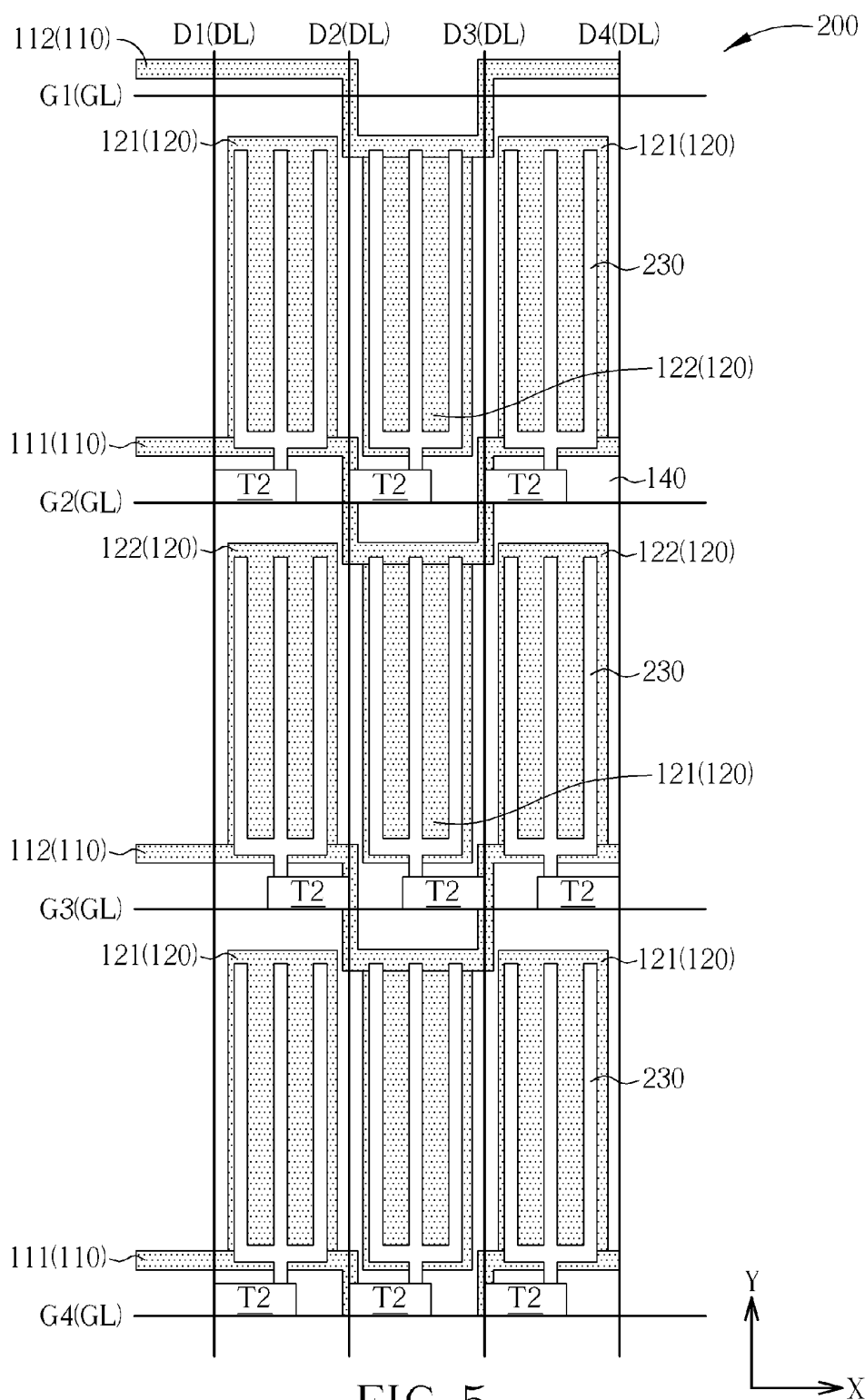


FIG. 5

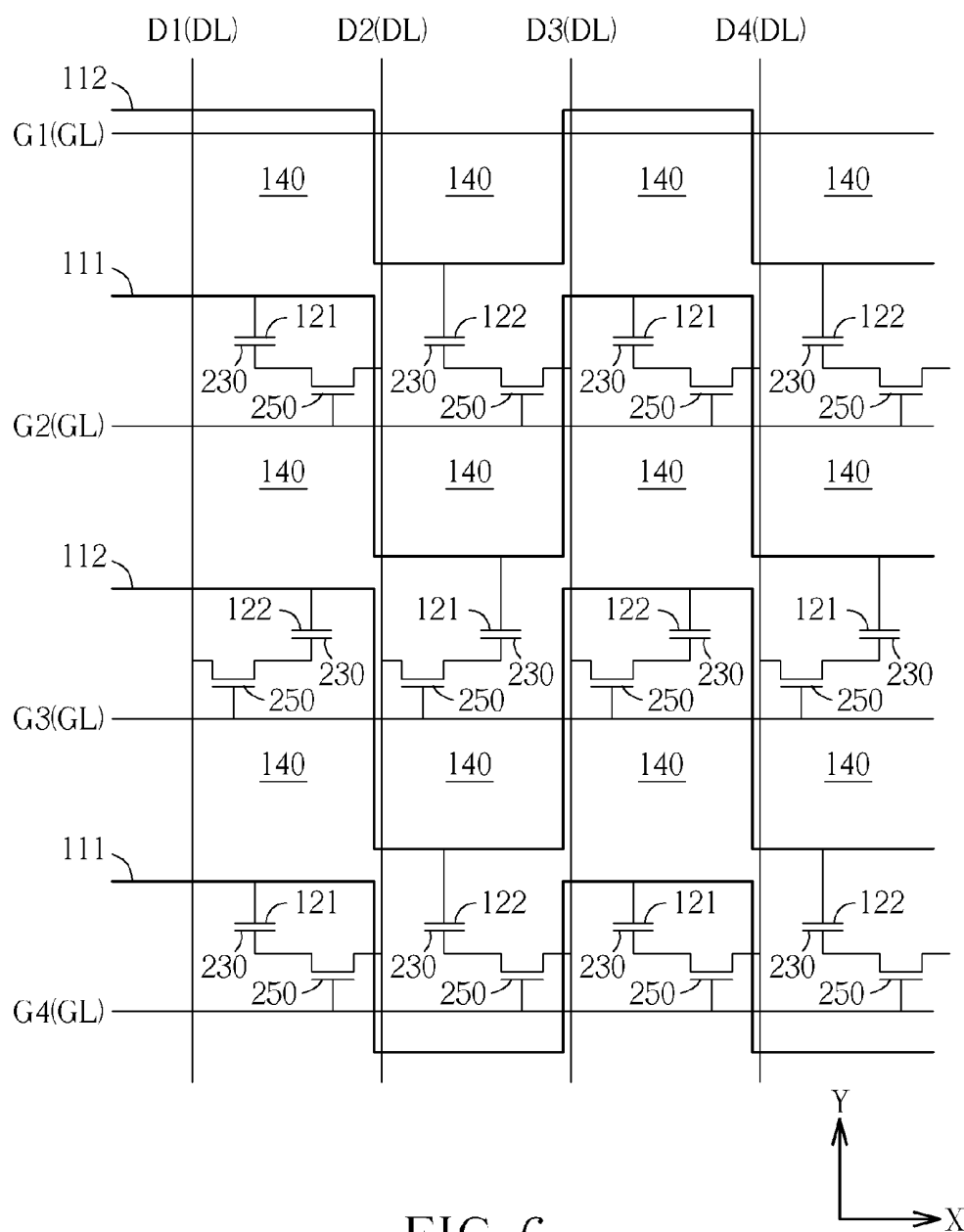


FIG. 6

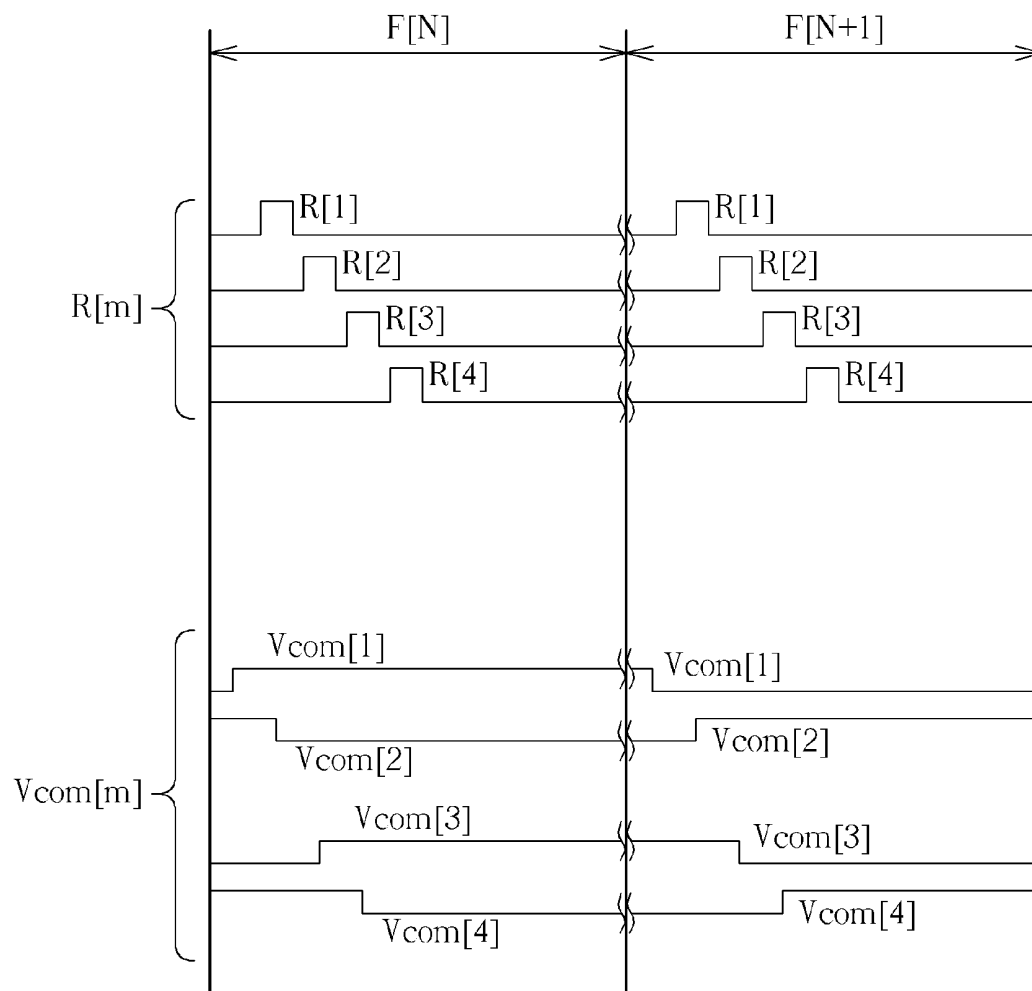


FIG. 7

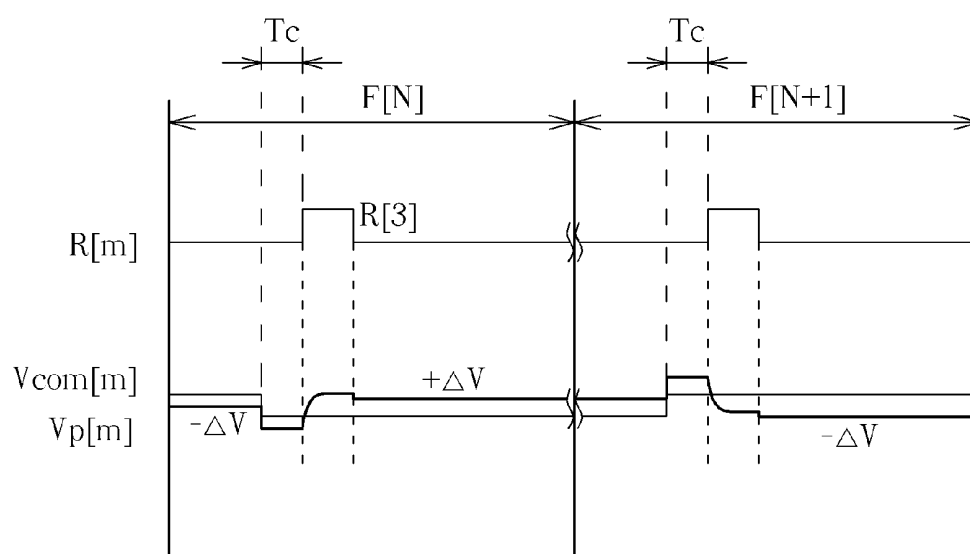


FIG. 8

PIXEL ARRAY OF FRINGE FIELD SWITCHING LIQUID CRYSTAL DISPLAY PANEL AND DRIVING METHOD THEREOF

BACKGROUND

[0001] 1. Technical Field

[0002] The disclosure relates to a pixel array of a fringe field switching liquid crystal display panel and a driving method thereof, and more particularly, to a pixel array of a fringe field switching liquid crystal display panel with a plurality of common lines and a driving method thereof.

[0003] 2. Description of Related Art

[0004] Liquid crystal display panels are applied in many kinds of consumer electronics such as flat TVs, laptop computers, and cell phones. Fringe field switching (FFS) liquid crystal display panels have been developed for improving narrow viewing angle issues in liquid crystal display panels. The main features of the FFS liquid crystal display panel include that common electrodes and pixel electrodes are disposed in different layers of an array substrate (also called a thin film transistor substrate), and a wide viewing angle effect may be achieved by an electrical field generated by the common electrode and the pixel electrode. However, in conventional fringe field switching liquid crystal display panels, a plurality of common lines, which connect to the common electrodes, are electrically connected to each other and may not be driven independently. Therefore, driving methods of the array substrate have to be more complicated for presenting different display driving effects, such as a dot inversion driving effect. This results in driving up the cost of integrated circuits (ICs) and high power consumption for driving the array substrate, also leads away from goals of energy saving and carbon reduction.

SUMMARY OF THE DISCLOSURE

[0005] An embodiment provides a pixel array of a fringe field switching liquid crystal display panel. The pixel array of the fringe field switching liquid crystal display panel comprises a plurality of gate lines, a plurality of data lines, a plurality of pixel electrodes, and a plurality of common lines. The gate lines are disposed parallel to each other substantially along a first direction. The data lines are disposed parallel to each other substantially along a second direction. A plurality of sub-pixel regions, which are aligned in an array configuration, are defined by the gate lines and the data lines. Each of the pixel electrodes is respectively disposed in each of the sub-pixel regions. The common lines are disposed substantially along the first direction and electrically isolated from each other. Each of the common lines includes a plurality of common electrodes extending along the second direction. The two adjacent common electrodes of each common line are respectively disposed in the two adjacent sub-pixel regions located in different rows.

[0006] Another embodiment provides a driving method of a fringe field switching liquid crystal display panel. The driving method of the fringe field switching liquid crystal display panel comprises the following steps. Firstly a pixel array is provided. The pixel array includes a plurality of gate lines, a plurality of data lines, a plurality of sub-pixel regions aligned in an array configuration, a plurality of pixel electrodes respectively disposed in each of the sub-pixel regions, and a plurality of common lines. The common lines are electrically isolated from each other. Each of the common lines includes

a plurality of common electrodes. The two adjacent common electrodes of each common line are respectively disposed in the two adjacent sub-pixel regions located in different rows. A plurality of common signals is then provided to the common lines for driving the pixel array. Within one frame time, a level of the common signals provided to the odd common lines is different from a level of the common signals provided to the even common lines.

[0007] In the pixel array of the fringe field switching liquid crystal display panel, the common lines, which may be driven independently, are employed with the allocation approaches of the common electrodes in the sub-pixel regions for presenting a dot inversion driving effect by a simplified driving method. Costs of the driving ICs may then be reduced, and the power consumption of the fringe field switching liquid crystal display panel may be also improved.

[0008] These and other objectives of the disclosure 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

[0009] FIG. 1 is a schematic diagram illustrating a pixel array of a fringe field switching liquid crystal display panel according to an embodiment.

[0010] FIG. 2 is a schematic diagram illustrating electrical circuits of a pixel array of a fringe field switching liquid crystal display panel according to an embodiment.

[0011] FIG. 3 is a schematic diagram illustrating common lines and common electrodes of a fringe field switching liquid crystal display panel according to an embodiment.

[0012] FIG. 4 is a schematic diagram illustrating timings of a driving method of a fringe field switching liquid crystal display panel according to an embodiment.

[0013] FIG. 5 is a schematic diagram illustrating a pixel array of a fringe field switching liquid crystal display panel according to another embodiment.

[0014] FIG. 6 is a schematic diagram illustrating electrical circuits of a pixel array of a fringe field switching liquid crystal display panel according to another embodiment.

[0015] FIG. 7 is a schematic diagram illustrating timings of a driving method of a fringe field switching liquid crystal display panel according to another embodiment.

[0016] FIG. 8 is a schematic diagram illustrating timings of a driving method of a fringe field switching liquid crystal display panel according to another embodiment.

DETAILED DESCRIPTION

[0017] To provide a better understanding to skilled users in the technology, the embodiments will be detailed as follows. The embodiments are illustrated in the accompanying drawings with numbered elements to elaborate the contents and effects to be achieved.

[0018] Please refer to FIGS. 1-3. FIG. 1 is a schematic diagram illustrating a pixel array of a fringe field switching liquid crystal display panel according to an embodiment. FIG. 2 is a schematic diagram illustrating electrical circuits of the pixel array of the fringe field switching liquid crystal display panel according to this embodiment. FIG. 3 is a schematic diagram illustrating common lines and common electrodes of the fringe field switching liquid crystal display panel according to this embodiment. Please note that the figures are

only for illustration and the figures may not be to scale. The scale may be further modified according to different design considerations. As shown in FIG. 1, in this embodiment, a pixel array 100 of a fringe field switching liquid crystal display panel is provided. The pixel array 100 includes a plurality of gate lines GL, a plurality of data lines DL, a plurality of pixel electrodes 130, and a plurality of common lines 110. The gate lines GL are disposed parallel to each other substantially along a first direction X. The data lines DL are disposed parallel to each other substantially along a second direction Y. A plurality of sub-pixel regions 140, which are aligned in an array configuration, are defined by the gate lines GL and the data lines DL. Each of the pixel electrodes 130 is respectively disposed in each of the sub-pixel regions 140. As shown in FIG. 1, in this embodiment, each of the pixel electrodes 130 includes a plurality of stripe structures for driving the fringe field switching liquid crystal display panel, but the pixel electrode 130 is not limited to this and may be other appropriate structures. As shown in FIG. 1 and FIG. 3, the common lines 110 are disposed substantially along the first direction X and electrically isolated from each other. Each of the common lines 110 includes a plurality of common electrodes 120 extending along the second direction Y. The two adjacent common electrodes 120 of each common line 110 are respectively disposed in the two adjacent sub-pixel regions 140 located in different rows. It is worth noticing that, as shown in FIG. 3, the common line 110 may include a common lead 190 and a plurality of common electrodes 120. In the embodiment, each of the common lines 110 may consist of at least one transparent conductive material such as indium tin oxide (ITO), but the embodiment is not limited to this. In other words, the common lead 190 and the common electrode 120 may be made of an identical transparent conductive material, or the common lead 190 may be made of a non-transparent conductive material while the common electrode 120 is made of a transparent conductive material. For example, if a concern of electrical resistances of the common lines in the fringe field switching liquid crystal display panel is relatively important, metal conductive materials with lower electrical resistance may be used to form the common leads 190. The common leads 190 made of metal conductive materials are electrically connected to the common electrode 120 made of transparent conductive materials for forming the common lines 110. The electrical resistance of the common lines 110 can be reduced. On the other hand, if a concern of an aperture ratio of the pixel array in the fringe field switching liquid crystal display panel is relatively important, the common lead 190 and the common electrode 120 may be made of an identical transparent conductive material for enhancing the aperture ratio of the pixel array. Purposes of design simplification and process reduction may also be achieved because no additional designs and processes are required for electrically connecting the common leads 190 and the common electrodes 120. In addition, as shown in FIGS. 1-2, the gate lines include a gate line G1, a gate line G2, a gate line G3, and a gate line G4. The data lines include a data line D1, a data line D2, a data line D3, and a data line D4. In this embodiment, an area between the gate line G1 and the gate line G2 is defined as an odd row, an area between the gate line G2 and the gate line G3 is defined as an even row, an area between the gate line G3 and the gate line G4 is also defined as an odd row, and other areas between the gate lines are also defined by this rule. Additionally, an area between the data line D1 and the data line D2 is defined as an odd column, an area between the data line D2

and the data line D3 is defined as an even column, an area between the data line D3 and the data line D4 is also defined as an odd column, and other areas between the data lines are also defined by this rule. In this embodiment, the common lines 110 include a plurality of first common lines 111 and a plurality of second common lines 112. Each of the first common lines 111 includes a plurality of first common electrodes 121 disposed respectively in the sub-pixel regions 140 located in all odd columns of a corresponding odd row and the sub-pixel regions 140 located in all even columns of a corresponding even row. Each of the second common lines 112 includes a plurality of second common electrodes 122 disposed respectively in the sub-pixel regions 140 located in all odd columns of a corresponding even row and the sub-pixel regions 140 located in all even columns of a corresponding odd row. Additionally, it is worth noticing that each of the gate lines GL includes a plurality of gate electrodes 150, the two adjacent gate electrodes 150 of each gate line GL are respectively disposed in the two adjacent sub-pixel regions 140 located in different rows. The pixel electrodes 130 disposed in the sub-pixel regions 140 in an identical column are electrically connected to an identical data line DL. In other words, as shown in FIG. 1, the pixel array 100 may further include a plurality of switching devices T1 respectively disposed in each of the sub-pixel regions 140. Each of the switching devices T1 is electrically connected to the gate lines GL, the data lines DL, and the pixel electrodes 130. Each of the pixel electrodes 130 may be controlled by providing signals to each of the corresponding switching devices T1 via the gate lines GL and the data lines DL. In the embodiment, the switching device T1 may include an amorphous silicon thin film transistor (a-Si TFT), a poly silicon thin film transistor (poly-Si TFT), an oxide semiconductor thin film transistor (oxide TFT), or other appropriate switching devices. In this embodiment, the two adjacent switching devices T1, which are electrically connected to an identical gate line GL, are electrically connected to the two adjacent pixel electrodes 130 in different rows. The two adjacent switching devices T1, which are electrically connected to an identical data line DL, are electrically connected to the two adjacent pixel electrodes 130 in an identical column. Based on the design of allocation described above, the pixel electrodes 130 connected to the gate line GL may correspond with the common electrodes 120 of the common line 110 adjacent to the gate line GL, and designs of driving signals via the gate lines GL and the common lines 110 may then become more simplified.

[0019] Please refer to FIG. 4 and refer to FIGS. 1-2 together. FIG. 4 is a schematic diagram illustrating timings of a driving method of a fringe field switching liquid crystal display panel according to an embodiment. In the driving method of the fringe field switching liquid crystal display panel of this embodiment, the structure and properties of the pixel array 100 have been detailed above and will not be redundantly described. As shown in FIG. 4 and FIGS. 1-2, in this embodiment, the driving method of the fringe field switching liquid crystal display panel includes providing a plurality of common signals Vcom[m] to the common lines 110 for driving the pixel array 100, wherein within one frame time F[N], a level of the common signals Vcom[m] provided to the odd common lines 110 is different from a level of the common signals Vcom[m] provided to the even common lines 110. Additionally, a condition of high/low level of the common signals Vcom[m] provided to the common lines 110 in one frame time F[N] is opposite to a condition of high/low

level of the common signals $V_{com}[m]$ provided to the common lines 110 in a next frame time $F[N+1]$. For example, common signals $V_{com}[1]$, $V_{com}[]$, and $V_{com}[]$ are provided to the odd common lines 110, common signals $V_{com}[]$, $V_{com}[]$, and $V_{com}[]$ are provided to the even common lines 110, and so forth. In this embodiment, within one frame time $F[N]$, $V_{com}[]$, $V_{com}[]$, and $V_{com}[]$ are orderly provided to the corresponding odd common lines 110 in high level, and $V_{com}[]$, $V_{com}[]$, and $V_{com}[]$ are orderly provided to the corresponding odd common lines 110 in low level within a next frame time $F[N+1]$. Meanwhile, within the frame time $F[N]$, $V_{com}[]$, $V_{com}[]$, and $V_{com}[]$ are orderly provided to the corresponding even common lines 110 in low level, and $V_{com}[]$, $V_{com}[]$, and $V_{com}[]$ are orderly provided to the corresponding even common lines 110 in high level within a next frame time $F[N+1]$. In addition, the driving method of the fringe field switching liquid crystal display panel provided in this embodiment may further include: dividing the frame time $F[N]$ into a first sub frame time $F1[N]$ and a second sub frame time $F2[N]$; orderly providing the common signals $V_{com}[m]$, such as $V_{com}[]$, $V_{com}[]$, and $V_{com}[]$, to the odd common lines 110 within the first sub frame time $F1[N]$; and orderly providing the common signals $V_{com}[m]$, such as $V_{com}[]$, $V_{com}[]$, and $V_{com}[]$, to the even common lines 110 within the second sub frame time $F2[N]$. Relatively, in this embodiment, a plurality of gate signals $R[m]$, such as a gate signal $R[1]$, a gate signal $R[3]$, and a gate signal $R[5]$, are orderly provided to the odd gate lines GL within the first frame time $F1[N]$, and a plurality of gate signals $R[m]$, such as a gate signal $R[2]$, a gate signal $R[4]$, and a gate signal $R[6]$, are orderly provided to the even gate lines GL within the second frame time $F2[N]$. In this embodiment, because the frame time $F[N]$ is divided into the first frame time $F1[N]$ and the second frame time $F2[N]$, a frequency of switching high/low level of the common signals $V_{com}[m]$ may become slow and loadings of signal processing may then be decreased, but the driving method of the fringe field switching liquid crystal display panel in the disclosure is not limited to this and may include orderly providing the common signals and the gate signals in a progressive (row-by-row) mode. Additionally, the driving method of the fringe field switching liquid crystal display panel provided in this embodiment may further include providing a plurality of data signals (not shown) to the data lines by a frame inversion driving approach. It is worth noticing that the common lines 110, which are electrically isolated from each other, are employed for providing different common signals, and the structure of the pixel array 100 is employed to coordinate the common signals and the gate signals. Therefore, the data signals may be provided by the frame inversion driving approach for generating a dot inversion driving effect in the fringe field switching liquid crystal display panel.

[0020] The following description will detail the different embodiments of the pixel array of the fringe field switching liquid crystal display panel and the driving method thereof in the disclosure. To simplify the description, the identical components in each of the following embodiments are marked with identical symbols. For making it easier to compare the difference between the embodiments, the following description will detail the dissimilarities among different embodiments and the identical features will not be redundantly described.

[0021] Please refer to FIGS. 5-6. FIG. 5 is a schematic diagram illustrating a pixel array of a fringe field switching

liquid crystal display panel according to another embodiment. FIG. 6 is a schematic diagram illustrating electrical circuits of a pixel array of a fringe field switching liquid crystal display panel according to another embodiment. Please note that the figures are only for illustration and the figures may not be to scale. The scale may be further modified according to different design considerations. As shown in FIGS. 5-6, a pixel array 200 of a fringe field switching liquid crystal display panel is provided in this embodiment. The differences between the pixel array 200 and the pixel array 100 mentioned above is that in the pixel array 200 of this embodiment, the two pixel electrodes 140 disposed in the two adjacent sub-pixel regions 230 in an identical column are electrically connected respectively to different data lines DL, each of the gate lines GL includes a plurality of gate electrodes 250, and the gate electrodes 250 of each gate line GL are disposed in the sub-pixel regions 140 located in an identical row. In other words, as shown in FIG. 5, the pixel array 200 may further include a plurality of switching devices T2 respectively disposed in each of the sub-pixel regions 140. Each of the switching devices T2 is electrically connected to the gate lines GL, the data lines DL, and the pixel electrodes 230. Each of the pixel electrodes 230 may be controlled by providing signals to each of the corresponding switching devices T2 via the gate lines GL and the data lines DL. In this embodiment, the two adjacent switching devices T2, which are electrically connected to an identical gate line GL, are electrically connected to the two adjacent pixel electrodes 230 in an identical row. The two adjacent switching devices T2, which are electrically connected to an identical data line DL, are electrically connected to the two adjacent pixel electrodes 230 in different rows. Based on the design of allocation described above, the pixel electrodes 230 connected to the data line DL may correspond with the common electrodes 120 of the corresponding common line 110 in two adjacent columns, and designs of driving signals via the data lines DL and the common lines 110 may then become more simplified.

[0022] Please refer to FIG. 7, and refer to FIGS. 5-6 together. FIG. 7 is a schematic diagram illustrating timings of a driving method of a fringe field switching liquid crystal display panel according to another embodiment. In the driving method of the fringe field switching liquid crystal display panel of this embodiment, the structure and properties of the pixel array 200 have been detailed above and will not be redundantly described. As shown in FIG. 7 and FIG. 5, in this embodiment, the driving method of the fringe field switching liquid crystal display panel includes providing a plurality of common signals $V_{com}[m]$ to the common lines 110 for driving the pixel array 200, wherein within one frame time $F[N]$, a level of the common signals $V_{com}[m]$ provided to the odd common lines 110 is different from a level of the common signals $V_{com}[m]$ provided to the even common lines 110. Additionally, a condition of high/low level of the common signals $V_{com}[m]$ provided to the common lines 110 in one frame time $F[N]$ is opposite to a condition of high/low level of the common signals $V_{com}[m]$ provided to the common lines 110 in a next frame time $F[N+1]$. For example, a common signal $V_{com}[1]$ and a common signal $V_{com}[]$ are provided to the odd common lines 110, a common signal $V_{com}[]$ and a common signal $V_{com}[]$ are provided to the even common line 110, and so forth. In this embodiment, within one frame time $F[N]$, the common signals $V_{com}[m]$, such as the common signal $V_{com}[]$ and the common signal $V_{com}[]$, are orderly provided to the corresponding even common lines

110 in low level, and the common signal $V_{com}[m]$, such as the common signal $V_{com}[]$ and the common signal $V_{com}[]$, are orderly provided to the corresponding even common lines **110** in high level within a next frame time $F[N+1]$. Meanwhile, within one frame time $F[N]$, the common signals $V_{com}[m]$, such as the common signal $V_{com}[1]$ and the common signal $V_{com}[]$, are orderly provided to the corresponding odd common lines **110** in high level, and the common signals, such as common signal $V_{com}[1]$ and the common signal $V_{com}[]$, are orderly provided to the corresponding odd common lines **110** in low level within a next frame time $F[N+1]$. In addition, the driving method of the fringe field switching liquid crystal display panel provided in this embodiment may further include orderly providing a plurality of gate signals $R[m]$, such as a gate signal $R[1]$, a gate signal $R[2]$, a gate signal $R[3]$, and a gate signal $R[4]$, to the corresponding gate lines GL. Additionally, the driving method of the fringe field switching liquid crystal display panel provided in this embodiment may further include providing a plurality of data signals (not shown) to the data lines by a column inversion driving approach. It is worth noticing that the common lines **110**, which are electrically isolated from each other, are employed for providing different common signals, and the structure of the pixel array **200** is employed to coordinate the common signals and the data signals. Therefore, the data signals may be provided by the frame inversion driving approach for generating a dot inversion driving effect in the fringe field switching liquid crystal display panel.

[0023] Please refer to FIG. 8, and refer to FIG. 1 and FIG. 5 together. FIG. 8 is a schematic diagram illustrating timings of a driving method of a fringe field switching liquid crystal display panel according to another embodiment. Both of the pixel array **100** and the pixel array **200** are compatible with the driving method of a fringe field switching liquid crystal display panel in this embodiment. The structures and properties of the pixel array **100** and the pixel array **200** have been detailed above and will not be redundantly described. As shown in FIG. 8, FIG. 1 and FIG. 5, in this embodiment, the driving method of the fringe field switching liquid crystal display panel includes providing a plurality of common signals $V_{com}[m]$ to the common lines **110**, and the details are similar to those in the above-mentioned embodiments and will not be redundantly described. Additionally, in this embodiment, the driving method of the fringe field switching liquid crystal display panel further includes orderly providing a plurality of gate signals $R[m]$ to the gate lines GL, wherein a timing of each common signal $V_{com}[m]$ is earlier than a timing of the corresponding gate signals $R[m]$. As shown in FIG. 8, within the frame time $F[N]$, the common signal $V_{com}[m]$ transfers from high level to low level before the corresponding gate signal $R[m]$ arrives, and a corresponding pixel voltage $V_p[m]$ is accordingly decreased for maintaining a condition of negative voltage difference ($-\Delta V$). A pixel is then charged by the gate signal $R[m]$ after one compensatory time T_c , and the pixel voltage $V_p[m]$ is accordingly increased for generating a condition of positive voltage difference ($+\Delta V$) within the frame time $F[N]$. Within a next frame time $F[N+1]$, the common signal $V_{com}[m]$ transfers from low level to high level before the corresponding gate signal $R[m]$ arrives, and a corresponding pixel voltage $V_p[m]$ is accordingly increased for maintaining a condition of positive voltage difference ($+\Delta V$). A pixel is then discharged by the gate signal $R[m]$ after one compensatory time T_c , and the pixel

voltage $V_p[m]$ is accordingly decreased for generating a condition of negative voltage difference ($-\Delta V$) within the next frame time $F[N+1]$. It is worth noticing that the driving method described above is developed mainly for a consideration that a transferring time of the common signal and a display quality of the fringe field switching liquid crystal display panel may be influenced by a conductive material, which is employed to form the common lines **110**, with higher resistivity, especially when the common lines **110** are formed by a transparent conductive material, such as indium tin oxide. However, the driving method in this embodiment is not limited to this and may be employed for improving other issues. Therefore, the display quality of the fringe field switching liquid crystal display panel may be effectively ensured by the driving method with the compensatory time T_c in this embodiment.

[0024] To summarize the above descriptions, in the pixel array of the fringe field switching liquid crystal display panel, the common lines, which may be driven independently, are employed with the interlace allocation approaches of the common electrodes in the adjacent sub-pixel regions for presenting a dot inversion driving effect by a simplified driving method. The power consumption of the fringe field switching liquid crystal display panel may then be improved. The limitation of the required specifications of the driving ICs may be eliminated, and the purpose of lowering the manufacturing cost may then be achieved.

[0025] 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 disclosure. 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 pixel array of a fringe field switching (FFS) liquid crystal display panel, comprising:

- a plurality of gate lines, disposed parallel to each other substantially along a first direction;
- a plurality of data lines, disposed parallel to each other substantially along a second direction, wherein a plurality of sub-pixel regions aligned in an array configuration are defined by the gate lines and the data lines;
- a plurality of pixel electrodes, respectively disposed in each of the sub-pixel regions; and
- a plurality of common lines, disposed substantially along the first direction and electrically isolated from each other, wherein each of the common lines includes a plurality of common electrodes extending along the second direction, and the two adjacent common electrodes of each common line are respectively disposed in the two adjacent sub-pixel regions located in different rows.

2. The pixel array of a fringe field switching liquid crystal display panel of claim 1, wherein the common lines include a plurality of first common lines and a plurality of second common lines, each of the first common lines includes a plurality of first common electrodes disposed respectively in the sub-pixel regions located in all odd columns of a corresponding odd row and the sub-pixel regions located in all even columns of a corresponding even row, and each of the second common lines includes a plurality of second common electrodes disposed respectively in the sub-pixel regions located in all odd columns of a corresponding even row and the sub-pixel regions located in all even columns of a corresponding odd row.

3. The pixel array of a fringe field switching liquid crystal display panel of claim 1, wherein each of the common lines consists of at least one transparent conductive material.

4. The pixel array of a fringe field switching liquid crystal display panel of claim 1, wherein each of the gate lines includes a plurality of gate electrodes, the two adjacent gate electrodes of each gate line are respectively disposed in the two adjacent sub-pixel regions located in different rows, and the pixel electrodes disposed in the sub-pixel regions in an identical column are electrically connected to an identical data line.

5. The pixel array of a fringe field switching liquid crystal display panel of claim 1, wherein each of the gate lines includes a plurality of gate electrodes, the gate electrodes of each gate line are disposed in the sub-pixel regions located in an identical row, and the two pixel electrodes disposed in the two adjacent sub-pixel regions in an identical column are electrically connected respectively to different data lines.

6. A driving method of a fringe field switching liquid crystal display panel, comprising:

providing a pixel array, the pixel array including:

- a plurality of gate lines;
- a plurality of data lines;
- a plurality of sub-pixel regions aligned in an array configuration;
- a plurality of pixel electrodes, respectively disposed in each of the sub-pixel regions; and
- a plurality of common lines;

wherein the common lines are electrically isolated from each other, each of the common lines includes a plurality of common electrodes, and the two adjacent common electrodes of each common line are respectively disposed in the two adjacent sub-pixel regions located in different rows; and

providing a plurality of common signals to the common lines for driving the pixel array, wherein within one frame time, a level of the common signals provided to the odd common lines is different from a level of the common signals provided to the even common lines.

7. The driving method of the fringe field switching liquid crystal display panel of claim 6, further comprising:

dividing the frame time into a first sub frame time and a second sub frame time;

orderly providing the common signals to the odd common lines within the first sub frame time; and

orderly providing the common signals to the even common lines within the second sub frame time.

8. The driving method of the fringe field switching liquid crystal display panel of claim 7, wherein each of the gate lines includes a plurality of gate electrodes, the two adjacent gate electrodes of each gate line are respectively disposed in the two adjacent sub-pixel regions located in different rows, the pixel electrodes disposed in the sub-pixel regions in an identical column are electrically connected to an identical data line, and the driving method further comprises:

orderly providing a plurality of gate signals to the odd gate lines within the first sub frame time, and orderly providing a plurality of gate signals to the even gate lines within the second sub frame time; and

orderly providing a plurality of data signals to the data lines by a frame inversion driving approach.

9. The driving method of the fringe field switching liquid crystal display panel of claim 6, further comprising orderly providing the common signals to the common lines within the frame time.

10. The driving method of the fringe field switching liquid crystal display panel of claim 9, wherein each of the gate lines includes a plurality of gate electrodes, the gate electrodes of each gate line are disposed in the sub-pixel regions located in an identical row, the two pixel electrodes disposed in the two adjacent sub-pixel regions in an identical column are electrically connected respectively to different data lines, and the driving method further comprises:

orderly providing a plurality of gate signals to the gate lines within the frame time; and

orderly providing a plurality of data signals to the data lines by a column inversion driving approach.

11. The driving method of the fringe field switching liquid crystal display panel of claim 6, further comprising orderly providing a plurality of gate signals to the gate lines within one frame time, wherein a timing of each common signal is earlier than a timing of the corresponding gate signal.

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专利名称(译)	边缘场切换液晶显示面板的像素阵列及其驱动方法		
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优先权	100110955 2011-03-30 TW		
其他公开文献	US8446552		
外部链接	Espacenet USPTO		

摘要(译)

边缘场切换 (FFS) 液晶显示面板的像素阵列包括多条栅极线，多条数据线，多个像素电极和多条公共线。栅极线沿第一方向彼此平行设置。数据线沿第二方向彼此平行设置。多个子像素区域由栅极线和数据线限定。公共线沿第一方向设置并且彼此电隔离。每条公共线包括沿第二方向延伸的多个公共电极。每条公共线的两个相邻的公共电极分别设置在位于不同行的两个相邻的子像素区域中。

