



US 20050018121A1

(19) **United States**(12) **Patent Application Publication**  
Jen et al.(10) **Pub. No.: US 2005/0018121 A1**(43) **Pub. Date: Jan. 27, 2005**(54) **LIQUID CRYSTAL DISPLAY PANEL WITH  
REDUCED FLICKER**(52) **U.S. Cl. .... 349/151**(76) **Inventors: Tean-Sen Jen, Pingjhen City (TW);  
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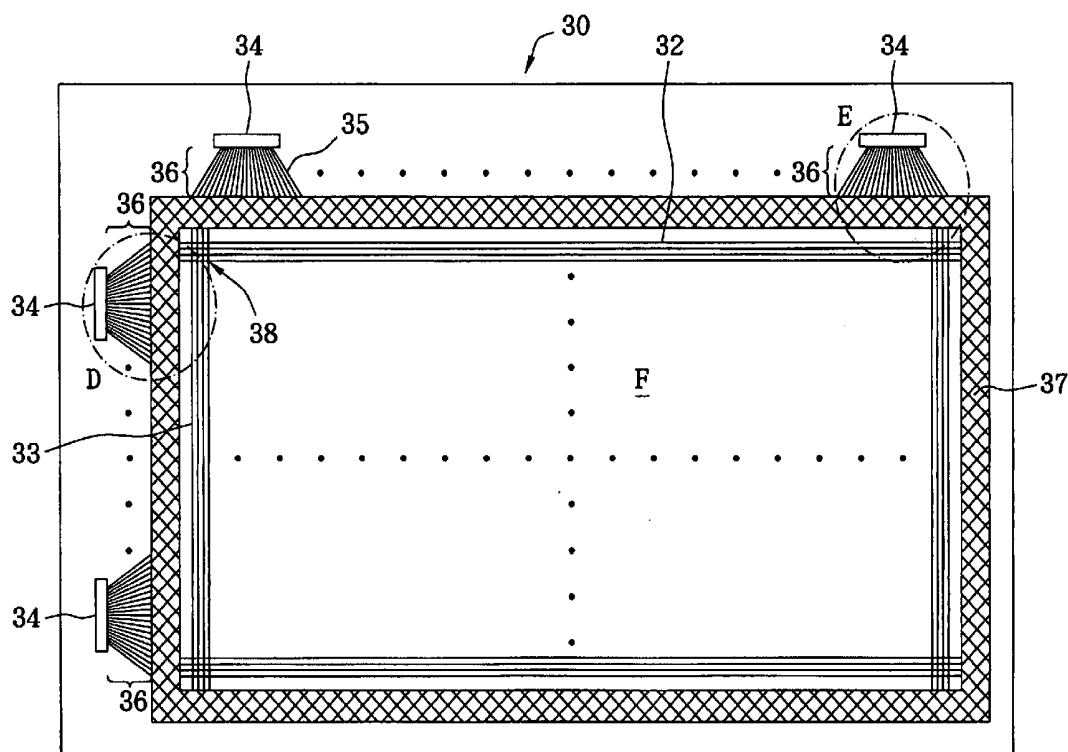
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MOUNTAIN VIEW, CA 94041 (US)**(21) **Appl. No.: 10/848,243**(22) **Filed: May 17, 2004**(30) **Foreign Application Priority Data**

Jul. 23, 2003 (TW)..... 092120096

**Publication Classification**(51) **Int. Cl.<sup>7</sup> ..... G02F 1/1345**(57) **ABSTRACT**

A liquid crystal display panel with reduced flicker comprises an active matrix substrate equipped with a plurality of thin film transistors. The active matrix substrate has an active area that is formed with a plurality of first signal lines and a plurality of second signal lines crossing each other. The active area includes a plurality of pixels arranged in a matrix. There are outer-lead bonding areas around the active area. There are a plurality of pad areas within the outer-lead bonding areas. A plurality of second wires arranged in a fan-out configuration extend from the pad areas and stretch toward the active area. The second wires are connected to their respective first signal lines by their serpentine or zigzag routes resulting in various wire lengths. A frame-like lead overlaps the second wires, and a capacitor exists between each of the second wires and the closed frame-like lead. The induced capacitor and the resistance of the corresponding second wire together result in a compensation effect so as to uniform the time constants of the plurality of first signal lines.



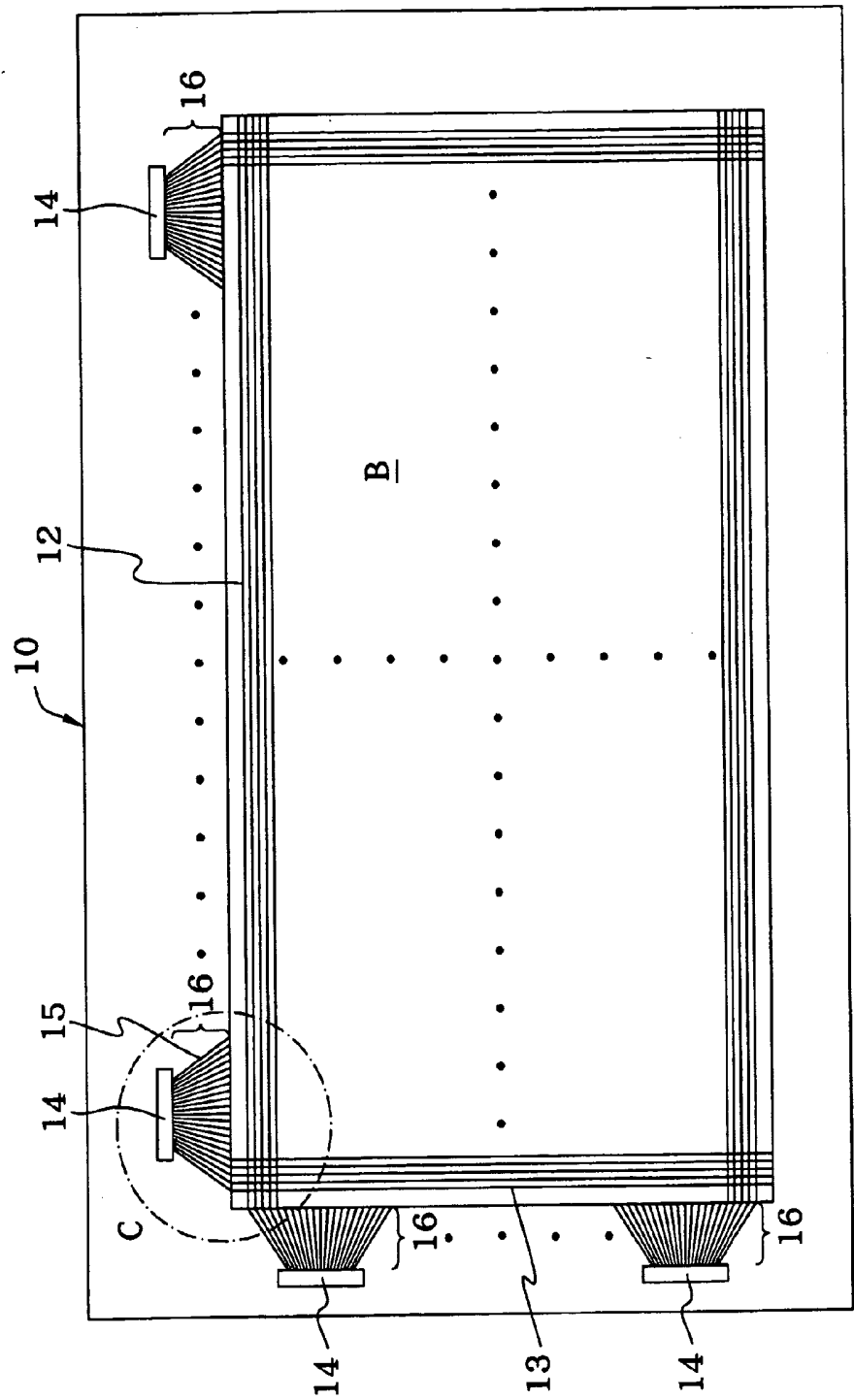


FIG. 1 (Background Art)

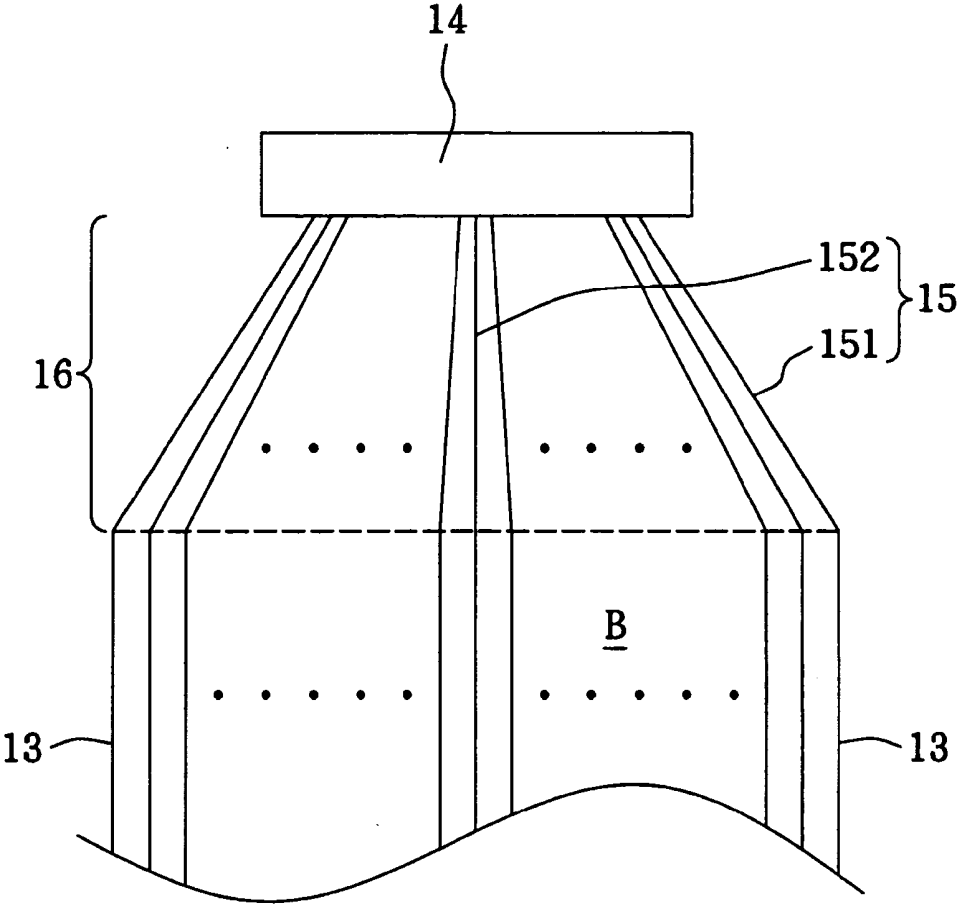
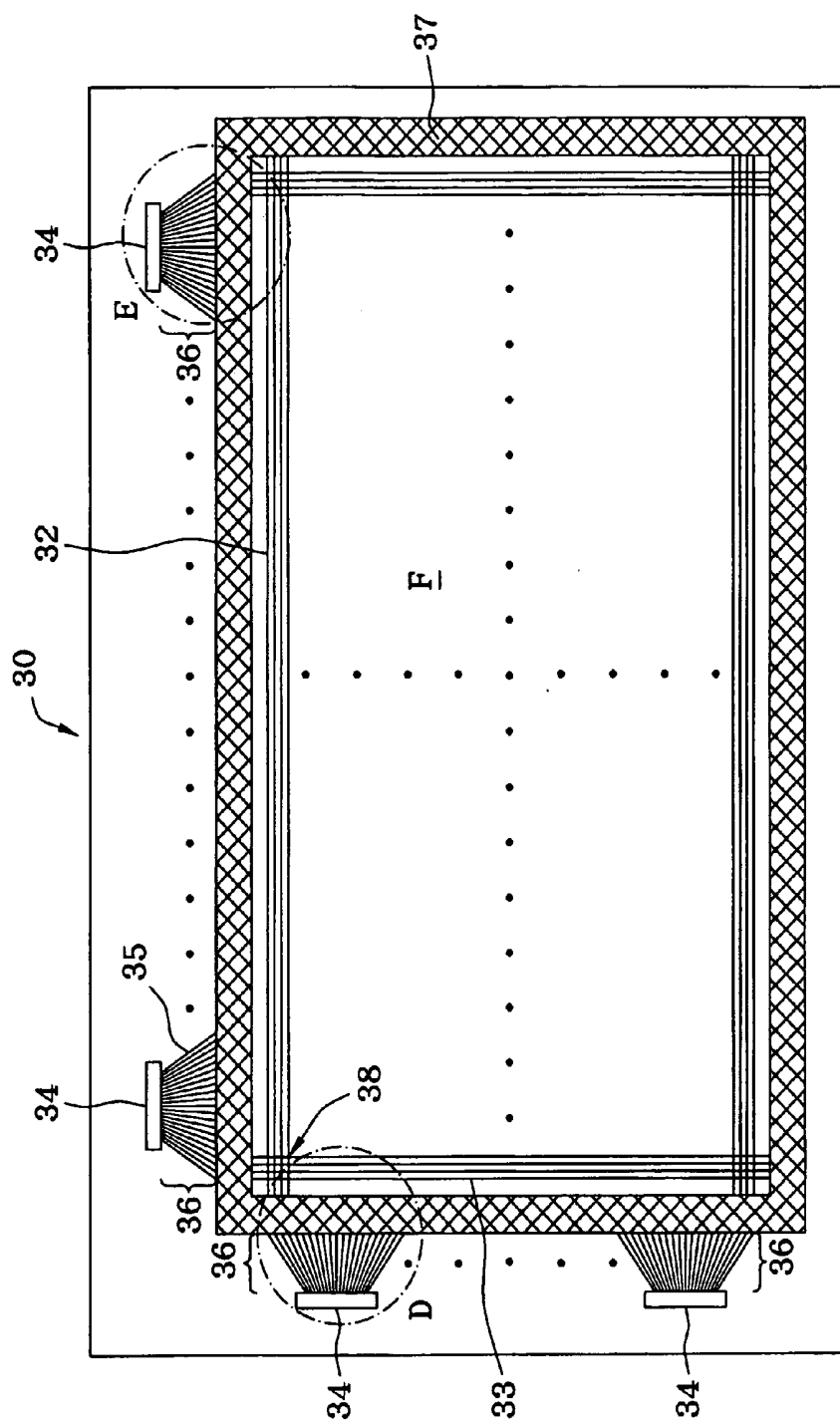


FIG. 2 (Background Art)



**FIG. 3(a)**

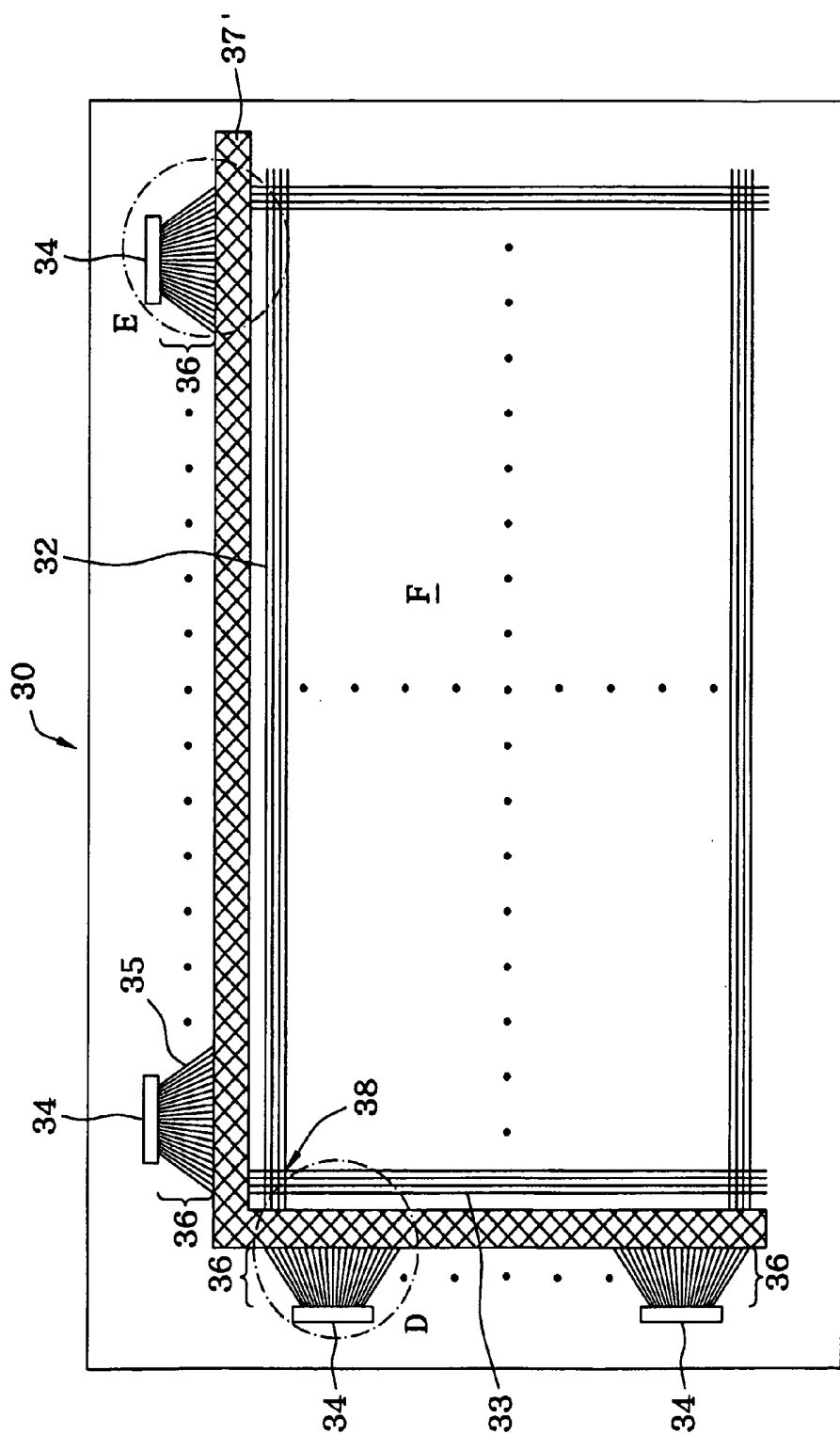


FIG. 3(b)

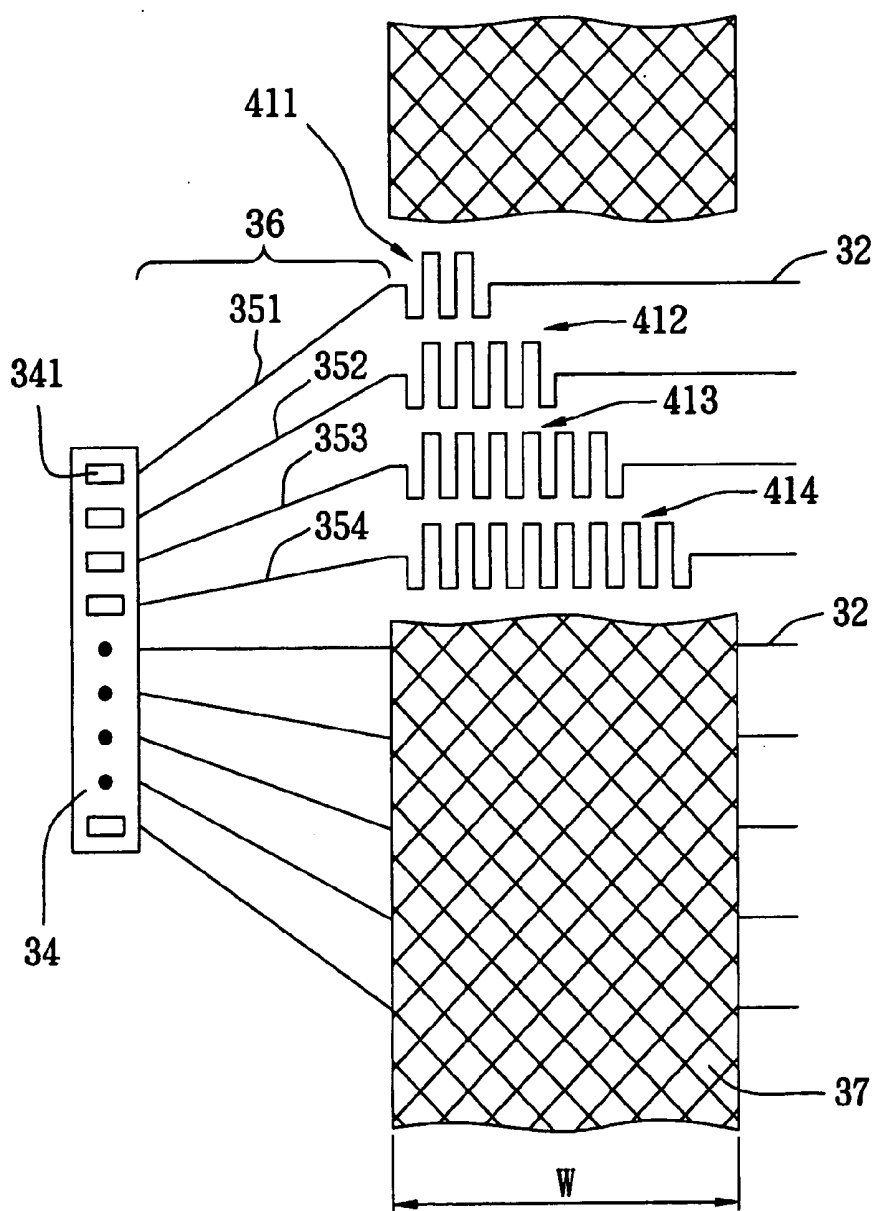


FIG. 4

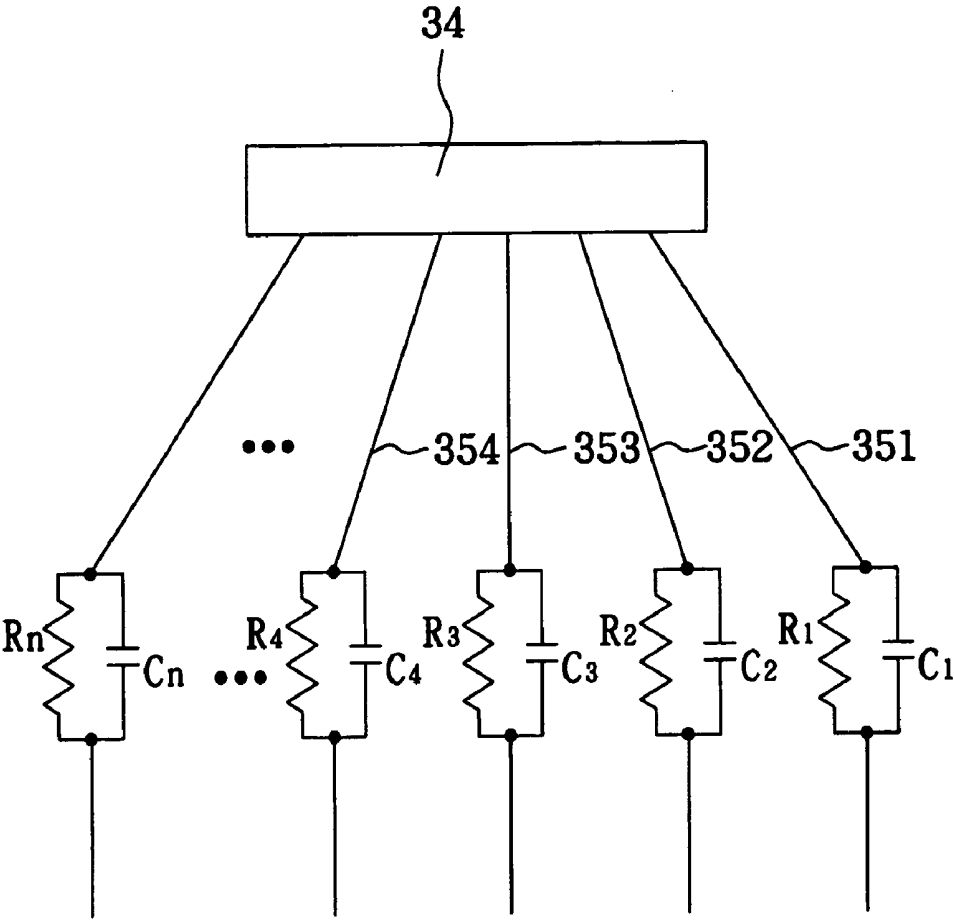


FIG. 5

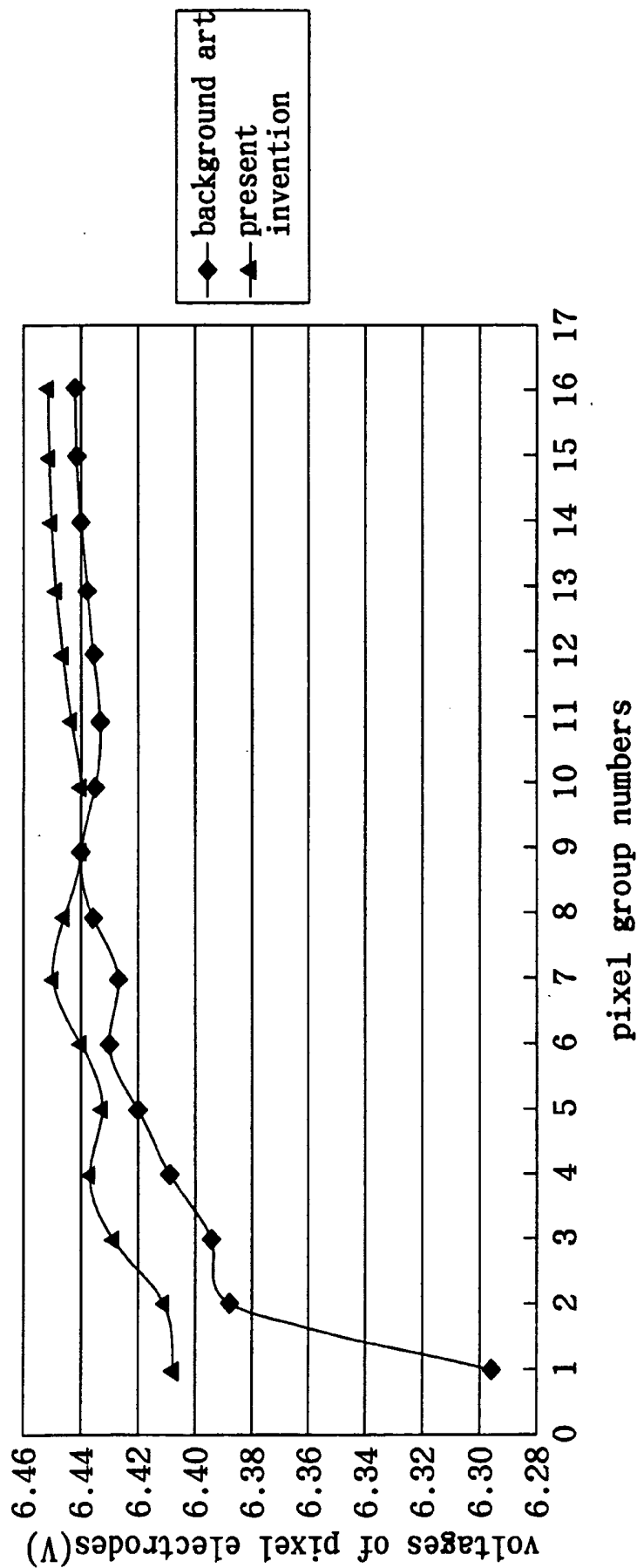


FIG. 6

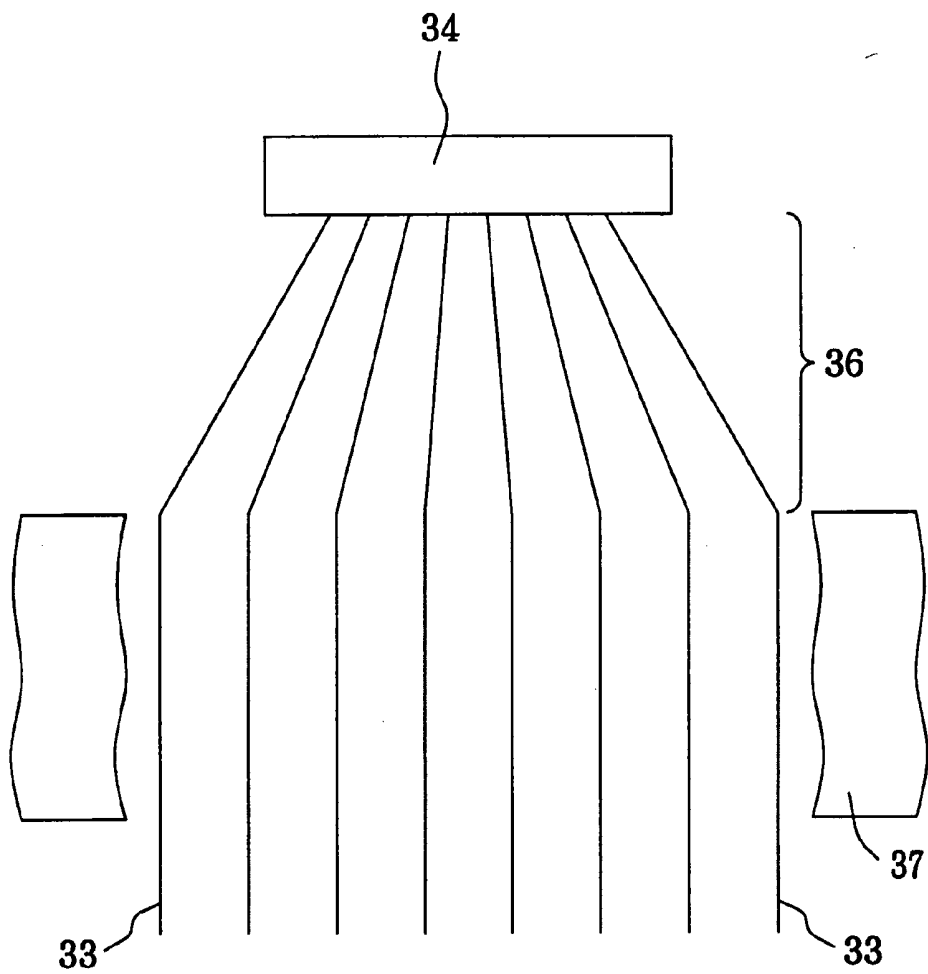


FIG. 7

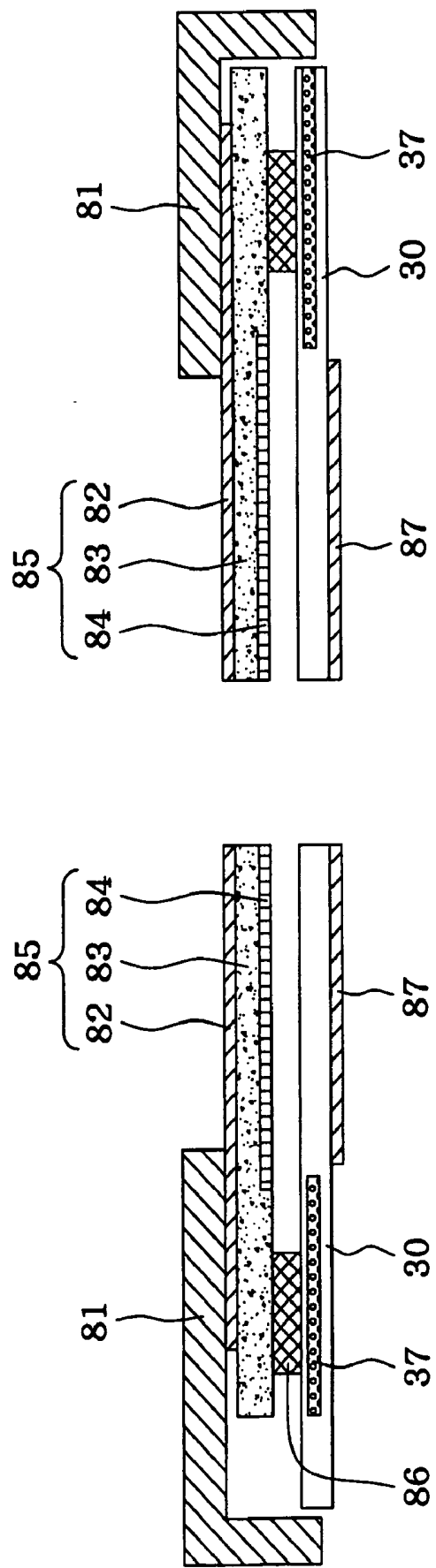


FIG. 8

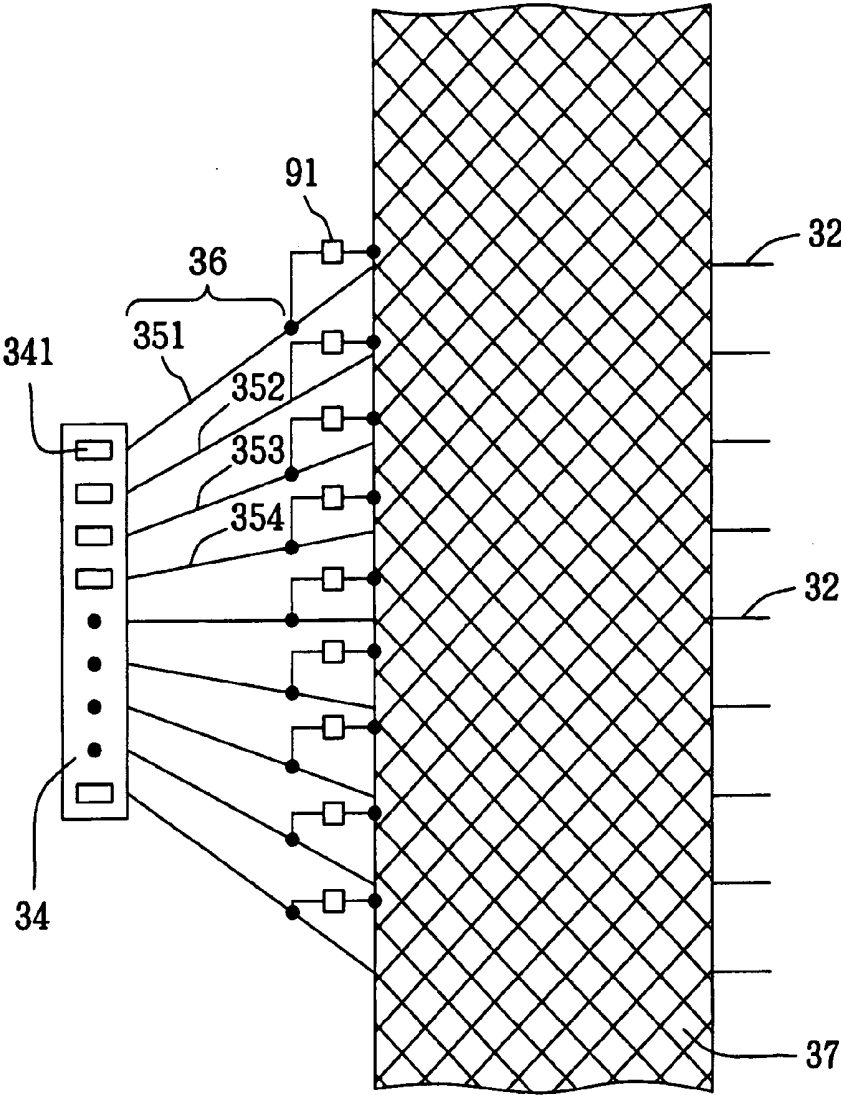


FIG. 9

# LIQUID CRYSTAL DISPLAY PANEL WITH REDUCED FLICKER

## BACKGROUND OF THE INVENTION

### [0001] 1. Field of the Invention

[0002] The present invention relates to a liquid crystal display (LCD) panel with reduced flicker and more particularly to a compensation circuit for enabling scanning lines or data lines of the liquid crystal display panel to have the same time constants.

### [0003] 2. Description of the Related Art

[0004] A conventional liquid crystal display panel comprises an active matrix substrate **10**, as shown in **FIG. 1**. The active matrix substrate **10** has a plurality of data lines **13** and a plurality of scanning lines **12**; the data lines **13** and the scanning lines **12** cross each other to form a plurality of pixels arranged in a matrix. In addition, a plurality of thin film transistors (TFTs) are formed within an active area **B**, which is the area where the data lines **13** and the scanning lines **12** cross perpendicularly.

[0005] There are a plurality of outer-lead bonding (OLB) areas **14** surrounding the active area **B**. A plurality of pads are formed within the outer-lead bonding areas **14**, so that driving devices can be connected to the outer-lead bonding areas **14**. And a fan-out area **16** arranged a plurality of wires **15** is disposed next to the inner side of each outer-lead bonding area **14**.

[0006] **FIG. 2** is a magnified schematic view of the portion **C** in **FIG. 1**. Each wire **15** extends from the outer-lead bonding area **14** so as to be connected, along a straight line, to a scanning line **13** of the active area **B**.

[0007] Since the length of the outermost wire **151** is far different from that of the central wire **152**, it is understood that a maximum resistance and a minimum resistance are found in the outermost wire **151** and the central wire **152**, respectively. That may be the resistance of the wire **15** calculated as follows:

$$R = \rho \frac{L}{S},$$

[0008] where  $\rho$ ,  $L$  and  $S$  respectively represent resistance, length, and cross sectional area of the wire **15**.

[0009] The product of resistance  $R$  and capacitance  $C$  is directly related to the delay time of a signal transmitted by either one of the data lines **13** or one of the scanning lines **12**. So, the wires **15** have different RC time constants between them whenever driving signals are sent from the driving devices connected to the outer-lead bonding areas **14**; as a result, the driving signals are subjected to varying degrees of delay effect when carried by the wires **15**.

[0010] A primary cause of the flickers that occur in liquid crystal display panels is the above-mentioned delay effect. On one hand, delay time constants vary from one scanning line **12** to another scanning line **12** and thus flicker points are visible if watched specially along the vertical direction; on the other hand, relatively great delay effect is accumulated at the end of the same scanning line **12** opposite to the

respective driving device, thus scanning signals are distorted when they reach the distal end of the scanning line **12** and, in consequence, the corresponding pixels fails to display a current gray level changed from a previous gray level within the right period as scheduled, resulting in flicker points visible to an individual watching along the horizontal direction.

[0011] In short, there is great demand for a liquid crystal display panel free from flickers and therefore conducive to quality display.

## SUMMARY OF THE INVENTION

[0012] The first objective of the present invention is to provide a liquid crystal display panel with reduced flicker wherein delay states between scanning lines are almost made uniform effect through a compensation circuit, eliminating the flickers that may otherwise occur because of the discrepancies in the time constants of the scanning lines.

[0013] The second objective of the present invention is to provide a liquid crystal display panel without lateral light leaks, wherein a frame-like lead of the compensation circuit hides the light leaks that may otherwise be visible if watched in an oblique direction around 45° to the rim of an upper fixed frame. Therefore, the image quality of the liquid crystal display panel is quite improved.

[0014] In order to achieve the aforesaid objectives, the present invention discloses a liquid crystal display panel with reduced flicker, which comprises an active matrix substrate equipped with a plurality of thin film transistors. The active matrix substrate has an active area that is formed with a plurality of first signal lines and a plurality of second signal lines crossing each other. The active area includes a plurality of pixels arranged in a matrix. There are outer-lead bonding areas around the active area. There are a plurality of pad areas within the outer-lead bonding areas. A plurality of second wires arranged in a fan-out configuration extend from the pad areas and stretch toward the active area. The second wires are connected to their respective first signal lines by their serpentine or zigzag routes resulting in various wire lengths. A frame-like lead, as a closed loop, overlaps the second wires, and a capacitor exists between each of the second wires and the closed frame-like lead. The induced capacitor and the resistance of the corresponding second wire together result in a compensation effect so as to unify the time constants of the plurality of first signal lines.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The invention will be described according to the appended drawings in which:

[0016] **FIG. 1** is a circuit layout diagram of an active matrix substrate in accordance with a conventional liquid crystal display panel;

[0017] **FIG. 2** is an enlarged schematic view of the portion **C** in **FIG. 1**;

[0018] **FIG. 3(a)** is a circuit layout diagram of an active matrix substrate in accordance with the liquid crystal display panel of the present invention;

[0019] **FIG. 3(b)** is another circuit layout diagram of an active matrix substrate in accordance with the liquid crystal display panel of the present invention;

[0020] FIG. 4 is an enlarged schematic view of the portion D in FIG. 3(a);

[0021] FIG. 5 is an equivalent circuit diagram of the compensation circuit in accordance with the present invention;

[0022] FIG. 6 is a voltage distribution curve of pixel electrodes of pixels along a scanning line in accordance with the present invention;

[0023] FIG. 7 is an enlarged schematic view of the portion E in FIG. 3(a);

[0024] FIG. 8 is a schematic diagram of the structure of the assembled liquid crystal display panel in accordance with the present invention; and

[0025] FIG. 9 is a schematic diagram of an electrostatic protection circuit combined with a frame-like lead in accordance with the present invention.

#### PREFERRED EMBODIMENT OF THE PRESENT INVENTION

[0026] FIG. 3(a) is a circuit layout diagram of an active matrix substrate in accordance with the liquid crystal display panel of the present invention. The active matrix substrate 30 has a plurality of data lines 33 and a plurality of scanning lines 32. The data lines 33 (or named first signal lines) and the scanning lines 32 (or named second signal lines) cross each other to form a plurality of pixels 38 arranged in a matrix, and are all included in signal lines that are responsible to transmit various control signals. In addition, a plurality of thin film transistors (not shown in the figure) are formed within each pixel 38. The total area occupied by the pixels 38 constitutes the active area F.

[0027] There are a plurality of outer-lead bonding areas 34 around the active area F. A plurality of pads 341 (as shown in FIG. 4) are formed within the outer lead bonding areas 34, so that driving devices can be connected to the outer lead bonding areas 34 by these pads 341. A fan-out area 36 is disposed next to the inner side of each outer lead bonding area 34; a plurality of first wires 35 are arranged in a fan-out configuration inside the fan-out area 36. In addition, a closed annular or frame-like lead 37 is arranged around the active area F; the frame-like lead 37 is connected to a common electrode. As shown in FIG. 3(b), it is feasible to replace the frame-like lead 37 in FIG. 3(a) with an L-shaped lead 37' considering the circuit layout of the active matrix substrate. The L-shaped lead 37' is not closed, because it is merely arranged along the boundary between the active area F and the fan-out area 36.

[0028] FIG. 4 is an enlarged schematic view of the portion D in FIG. 3(a). A plurality of serpentine or zigzag second wires 411, 412, 413 and 414, beneath the frame-like lead 37, are connected to first wires 351, 352, 353 and 354 respectively, and other end of each of them is connected to a scanning line 32. Of these second wires, the second wire 411 is obviously the shortest, whereas the second wires 412, 413 and 414 are progressively longer in numerical order. To equalize the RC time constant of the scanning lines 32, it is necessary to keep the length of every zigzag wire under control in order to achieve a balance between the discrepancies in the length of the straight first wires 35 disposed inside the fan-out area 36. If the active area F is 337.92 mm

wide (measured in the direction of the scanning lines 32), it is recommended that the width W of the frame-like lead 37 should be 2.5 mm.

[0029] One point worthy of notice is that the frame-like lead 37 and the scanning lines 32 do not lie in the same layer. The frame-like lead 37 can be either an opaque metallic layer or a transparent electrode layer, thus a capacitor is formed between the circular lead 37 and each zigzag wire.

[0030] FIG. 5 is an equivalent circuit diagram of the compensation circuit in accordance with the present invention. A total resistor  $R_1$  of the zigzag wire 411 is connected to the first wire 351 in series, whereas an equivalent capacitor  $C_1$  formed between the frame-like lead 37 and the second wire 411 is connected to the resistor  $R_1$  in parallel. It is derived that  $R_2 > R_1$  because the second wire 412 is longer than the second wire 411. By the same token, the relations between  $R_2 - R_n$  also can be obtained.

[0031] The compensation circuit in accordance with the present invention enables a scanning line to remain consistent in the RC time constant throughout the length of the scanning line, so that the voltage of the pixel electrode of every pixel on the scanning line remains consistent after the same data were written. As shown in FIG. 6, the x-axis describes pixel group numbers; where, from right to left, all the pixels on the scanning line are sequentially divided into 16 groups. As regards the pixels of a single conventional scanning line that lacks an RC compensation circuit, the voltages of the pixel electrodes of the pixels near the fan-out area 36 are relatively low and therefore different from the voltages of the pixel electrodes of the pixels far from the fan-out area 36. However, in a single scanning line put forth in accordance with the present invention the voltages of the pixel electrodes of the pixels near the fan-out area 36 approximate to the voltages of the pixel electrodes of the pixels far from the fan-out area 36, equalizing the displayed gray levels and, in consequence, eliminating flickers.

[0032] FIG. 7 is an enlarged schematic view of the portion E in FIG. 3(a). Portion E includes the end of each data line 33 for receiving data signals from data drivers, whereas beneath the frame-like lead 37 there is the connection between the first wires 36 and the data lines 33, as opposed to the second wires shown in FIG. 4. Capacitance effect still takes place in between the frame-like lead 37 and the data line 33; however, it is too insignificant to be considered.

[0033] FIG. 8 is a schematic diagram of the structure of the assembled liquid crystal display panel in accordance with the present invention. Lying on both sides of the top surface are the rims of the upper fixed frame 81 that presses against a color filter 85. The color filter 85 has a glass substrate 83 with a polarizing film 82 thereon. An opaque black matrix 84 is disposed on the other surface of the color filter 85 opposite to the polarizing film 82.

[0034] As regards a conventional liquid crystal display panel, light rays passing the outer edge of the black matrix 84 are visible to a user watching in an oblique direction 45° to the inner edge of the upper fixed frame 81, deteriorating image display quality. Light leaks as such are particularly serious in those liquid crystal display panels whose liquid crystal filling process is carried out by means of the one drop filling (ODF) technique. Although the light leak problem can be solved by extending the black matrix 84 outward, this

inevitably increases the overall area of a liquid crystal display panel and thus it does not conform to the panel specifications stipulated by the standard panels working group (SPWG). Liquid crystal display panels, especially those intended for notebook, have to conform to the specifications formulated by the SPWG.

[0035] The active matrix substrate **30** and the color filter **85** put forth in accordance with the present invention are glued together with sealant **86**, and the frame-like lead **37** disposed on the active matrix substrate **30** is beneath the sealant **86**; hence, light rays passing the external edge of the black matrix **84** are invisible to a user watching in a oblique direction  $45^\circ$  to the inner edge of the upper fixed frame **81**. Beneath the active matrix substrate **30** is another polarizing film **87** that receives light rays from a backlight module.

[0036] The present invention involves using the frame-like lead **37** as the discharging end of electrostatic charges for an electrostatic protection circuit **91**, as shown in FIG. 9. One end of the electrostatic protection circuit **91** is connected to the wire **351**, whereas its other end is connected to the frame-like lead **37**.

[0037] The above-described embodiments of the present invention are intended to be illustrative only. Numerous alternative embodiments may be devised by persons skilled in the art without departing from the scope of the following claims.

What is claimed is:

1. A liquid crystal display panel with reduced flicker, comprising:

- a plurality of first signal lines;
- a plurality of second signal lines crossing the first signal lines so as to form a plurality of pixels at intersections of the first signal lines and the second signal lines;
- a plurality of outer-lead bonding areas placed at a periphery of the pixels;
- a plurality of first wires whose first ends are connected to the outer-lead bonding areas;
- a plurality of second wires whose first ends are connected to second ends of the first wires and second ends of the second wires are connected to the first signal lines; and
- a frame-like lead placed at a periphery of the pixels and overlapping the second wires.

2. The liquid crystal display panel with reduced flicker of claim 1, wherein the frame-like lead is connected to a common electrode.

3. The liquid crystal display panel with reduced flicker of claim 1, further comprising a plurality of electrostatic protection circuits whose one ends are connected to the first wires and another ends are connected to the frame-like lead.

4. The liquid crystal display panel with reduced flicker of claim 1, wherein the frame-like lead and the second wires are separately placed in different layers.

5. The liquid crystal display panel with reduced flicker of claim 1, wherein each of the outer-lead bonding areas has a plurality of pads.

6. The liquid crystal display panel with reduced flicker of claim 5, wherein the pads and the first wires are connected to each other in a fan-out configuration.

7. The liquid crystal display panel with reduced flicker of claim 1, wherein the second wire has a Z-shaped route.

8. The liquid crystal display panel with reduced flicker of claim 1, wherein the second wire has a serpentine or wave-shaped route.

9. The liquid crystal display panel with reduced flicker of claim 1, wherein the second ends of the second wires are connected to the second signal lines.

10. The liquid crystal display panel with reduced flicker of claim 1, wherein the frame-like lead can be replaced with an L-shaped lead placed in the boundary of the pixels and the first wires.

11. The liquid crystal display panel with reduced flicker of claim 1, wherein the length of the second wire is in an inverse proportion to the length of the first wire connected to the second wire.

12. The liquid crystal display panel with reduced flicker of claim 1, wherein each length of the second wire and the first wire connected the second wire is approximate.

13. The liquid crystal display panel with reduced flicker of claim 1, wherein the first signal lines are scanning lines and the second signals are data lines.

14. A liquid crystal display panel with reduced flicker, comprising a plurality of first signal lines, a plurality of second signal lines, a plurality of pixels, a frame-like lead and a plurality of outer-lead bonding areas, wherein a plurality second wires for varying resistance are included in connection wires between the outer-lead bonding areas and first signal lines or the outer-lead bonding areas and second signal lines, and the frame-like lead overlaps the second wires so as to unify a delay time of the first signal lines or the second signal lines at different places.

15. The liquid crystal display panel with reduced flicker of claim 14, wherein the frame-like lead and the second wires are separately placed in different layers.

16. The liquid crystal display panel with reduced flicker of claim 14, wherein the second wire has a Z-shaped route.

18. The liquid crystal display panel with reduced flicker of claim 14, wherein the second wire has a serpentine or wave-shaped route.

19. The driving method for a liquid crystal display panel of claim 14, wherein the frame-like lead can be replaced with an L-shaped lead placed in the boundary of the pixels and the first wires.

\* \* \* \* \*

专利名称(译)	液晶显示面板，闪烁减少		
公开(公告)号	<a href="#">US20050018121A1</a>	公开(公告)日	2005-01-27
申请号	US10/848243	申请日	2004-05-17
[标]申请(专利权)人(译)	JEN天安SEN 廖PETER 林铭田		
申请(专利权)人(译)	JEN天安森 廖PETER 林铭田		
当前申请(专利权)人(译)	瀚宇彩晶股份有限公司		
[标]发明人	JEN TEAN SEN LIAO PETER LIN MING TIEN		
发明人	JEN, TEAN-SEN LIAO, PETER LIN, MING-TIEN		
IPC分类号	G02F1/1345		
CPC分类号	G02F1/1345 G09G2320/0223 G09G2300/0426 G09G3/3611		
优先权	092120096 2003-07-23 TW		
其他公开文献	US7271871		
外部链接	<a href="#">Espacenet</a> <a href="#">USPTO</a>		

# 摘要(译)

具有减少的闪烁的液晶显示面板包括配备有多个薄膜晶体管的有源矩阵基板。有源矩阵基板具有有源区，该有源区形成有多条第一信号线和多条彼此交叉的第二信号线。有源区域包括以矩阵排列的多个像素。在活动区域周围有外引线键合区域。在外引线键合区域内存在多个焊盘区域。以扇出配置布置的多个第二导线从焊盘区域延伸并朝向有源区域伸展。第二导线通过它们的蛇形或锯齿形路径连接到它们各自的第一信号线，从而产生各种导线长度。框状引线与第二线重叠，并且在每个第二线和闭合的框状引线之间存在电容器。感应电容器和相应的第二导线的电阻一起导致补偿效果，以使多个第一信号线的时间常数均匀。

