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Jung et al.

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(57) **ABSTRACT**

A LOG liquid crystal display panel that is adaptive for reducing a line resistance of LOG signal line groups within a confined area. The picture display part within the panel has a plurality of liquid crystal cells arranged at the crossing between gate lines and data lines. Line-on-glass signal lines are provided at an outer area of the picture display connecting integrated circuits to each other and for applying driving signals required for driving the gate lines. The line-on-glass signal lines are separately provided at different substrates opposed to each other having a liquid crystal disposed therebetween.

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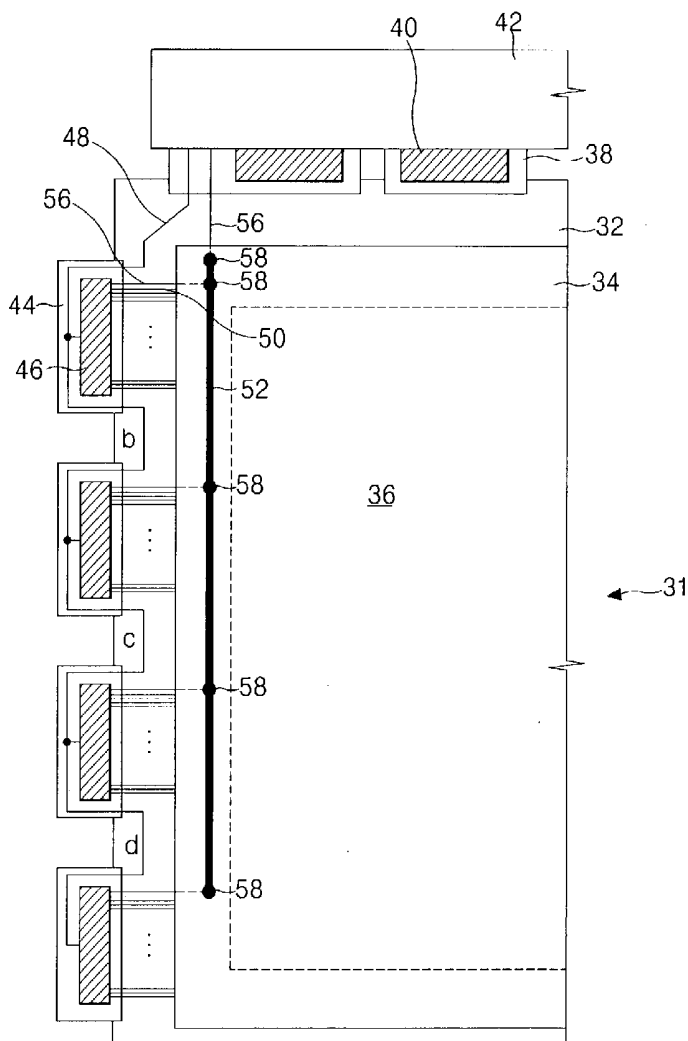
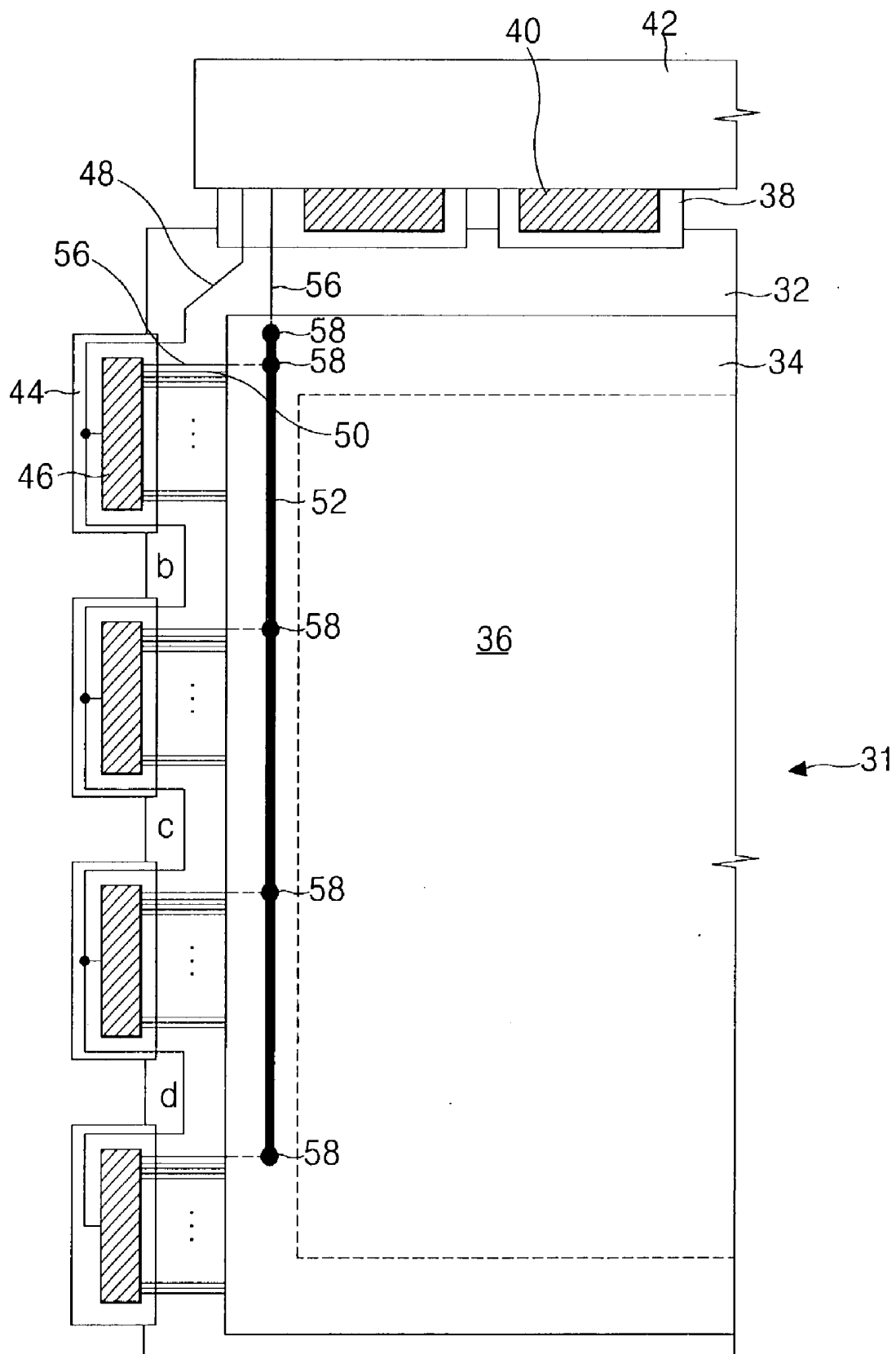


FIG. 3



LIQUID CRYSTAL DISPLAY PANEL OF LINE ON GLASS TYPE

[0001] This application claims the benefit of Korean Patent Application No. P2001-81563, filed on Dec. 20, 2001, which is hereby incorporated by reference for all purposes as if fully set forth herein.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a liquid crystal display, and more particularly to a liquid crystal display panel of line on glass (LOG) type that is adaptive for enlarging a section area of a line on glass type signal line group within a confined area.

[0004] 2. Discussion of the Related Art

[0005] Generally, liquid crystal displays (LCDs) use an electric field to control light transmittance characteristics of liquid crystal material. Accordingly, LCDs typically include a liquid crystal display panel having a plurality of liquid crystal cells arranged in a matrix pattern and a driving circuit for driving the liquid crystal cells to display a picture on the liquid crystal display panel.

[0006] The plurality of liquid crystal cells are arranged on the liquid crystal panel at locations where gate lines cross data lines. Electric fields may be applied to the layer of the liquid crystal material with a pixel and common electrodes arranged on the liquid crystal display panel. Each pixel electrode is connected to a data line via source and drain electrodes of switching devices, such as thin film transistors. Gate electrodes of each of the thin film transistors are connected to corresponding gate lines and allow pixel voltage signals to be selectively applied to corresponding pixel electrodes.

[0007] The driving circuit includes a gate driver for driving the gate lines, a data driver for driving the data lines, a timing controller for controlling the gate driver and data drivers, and a power supply for supplying various driving voltages used in the LCD. The timing controller controls the gate and data drivers by controlling a driving timing of the gate driver and data drivers and by applying pixel data signals to the data driver. Driving voltages generated by power supply include, for example, common voltage (Vcom), gate high voltage (Vgh), and gate low voltage (Vgl). The gate driver sequentially applies scanning signals to the gate lines to sequentially drive the liquid crystal cells within the liquid crystal display panel one line at a time. The data driver applies data voltage signals to each of the data lines whenever a gate line receives a gate signal. Accordingly, LCDs control transmittance characteristics of liquid crystal material using electric fields applied to pixel and common electrodes in accordance with pixel voltage signals specific to a liquid crystal cell to display an image.

[0008] Data and gate drivers are directly connected to the liquid crystal display panel and are provided as a plurality of integrated circuits (ICs). Each of the gate driver ICs and data driver ICs are mounted to the liquid crystal display using tape carrier package (TCP) or chip on glass (COG) techniques. Further TCP-type gate and driver ICs are connected to the liquid crystal display panel via a tape automated bonding (TAB) technique.

[0009] The TCP-type driver ICs are connected to the liquid crystal panel by the TAB technique and receive control signals and direct current (DC) voltage signals transmitted from over signal lines on a printed circuit board (PCB). For example, each of the data driver ICs are connected to each other via signal lines mounted in series on the data PCB, receive control signals from the timing controller, and receive pixel data signals and driving voltages from the power supply. Gate driver ICs are connected to each other in series via signal lines mounted onto the gate PCB, receive control signals from the timing controller, and receive driving voltages from the power supply.

[0010] COG-type gate and data driver ICs are connected to each other via signal lines formed using a line-on-glass (LOG) technique. The signal lines are arranged on the lower glass substrate of the liquid crystal display panel. The signal lines may be formed using LOG technique and receive control signals from the timing controller and driving voltages from the power supply.

[0011] Even when the various driver ICs are connected to the liquid crystal display panel by the TAB technique, the LOG technique is typically adopted to eliminate the PCB and provide a thinner overall liquid crystal display. For example, signal lines connecting the gate driver ICs are relatively small and are provided directly on the liquid crystal display panel by the LOG technique. Accordingly, gate driver ICs are connected to liquid crystal display via the TAB technique, thereby eliminating the PCB system. That is, gate driver ICs are connected to each other in series via signal lines mounted on a lower glass substrate of the liquid crystal display panel, and receive control and driving voltage signals (e.g., gate driving signals).

[0012] Referring to FIG. 1, liquid crystal display including LOG-type signal lines (formed without the gate PCB) typically include a liquid panel 1, a plurality of data TCPs 8 connected between the liquid crystal display panel 1 and a data PCB 12, a plurality of gate TCPs connected to other side of the liquid crystal display panel 1, data driver ICs 10 mounted in the data TCPs 8, and gate driver ICs 16 arranged on the gate TCPs 14.

[0013] The liquid crystal display panel 1 includes a lower substrate 2 supporting various signal lines and a thin film transistor array, an upper substrate 4 supporting a color filter array, and liquid crystal injected between the lower substrate 2 and the upper substrate 4. The liquid crystal display panel 1 further includes a picture display area 21 including liquid crystal cells arranged provided at crossings between gate lines 20 and data lines 18.

[0014] Data pads and gate pads (not shown) are arranged at respective ends of data 18 and gate 20 lines. At an outer portion of the lower substrate 2, outside the picture display area 21 LOG signal line group 26 is positioned and transmits gate driving signals applied to the gate driver ICs 16.

[0015] Data TCPs 8 is mounted with the data driver IC 10 and includes input pads 24 and output pads 25 and electrically connected to the data driver IC 10 mounted thereon to the data PCB 12. The input pads 24 of the data TCP 8 are electrically connected to the output pads of the data PCB 12 while the output pads 25 of the data TCP 8 are electrically connected to the data pads arranged on the lower substrate 2. A first data TCP 8 is further provided with a gate driving

signal transmission line group **22**. The gate driving signal transmission group **22** electrically connects the LOG signal line group **26** on the lower substrate to the timing controller and power supply via the data PCB **12**.

[0016] The data driver ICs **10** convert digital pixel data signals into analog pixel voltage signals and apply the analog pixel voltage signals to the data lines **18**.

[0017] Each of the gate TCPs **14** includes a gate driving signal transmission line group **28** and output pads **30** electrically connecting the gate driver ICs **16** mounted thereon to the LOG signal line group **26** and the gate lines **20**, respectively. The output pads **30** are electrically connected to the gate pads arranged on the lower substrate **2**.

[0018] Each gate driver IC **16** sequentially applies a scanning signal (e.g., a gate high voltage signal (V_{gh})) to each of the gate lines **20** in response to inputted control signals. Further, the gate driver ICs **16** apply a gate low voltage signal (V_{gl}) to each of the gate lines **20** that do not receive the gate high voltage signal (V_{gh}).

[0019] The LOG signal line group **26** typically consists of signal transmission lines for supplying direct current voltage signals, for example, gate high voltage signals (V_{gh}), gate low voltage signals (V_{gl}), common voltage signals (V_{com}), ground voltage signals (GND), supply voltage signals (V_{cc}), and gate control signals. The gate control signals include, for example, gate start pulse (GSP), gate shift clock signals (GSC), and gate enable signals (GOE).

[0020] Individual signal lines within the LOG signal line group **26** are arranged in a fine parallel pattern and provided within a narrow space, similar to a space where signal lines in gate and data pads are positioned at outer portions of the picture display area **21**. The individual signal lines within the LOG signal line group **26** are formed from a gate metal layer, which is similar to the gate lines **20**. Metals having a relatively large resistivity (e.g., 0.046 ohms), such as AlNd can be used in forming the gate metal. The LOG signal line group **26** also includes a larger resistance component than the signal lines formed from a copper film at an existent gate PCB. As the resistance values of the signal transmission lines within the LOG signal line group **26** are proportional to their line lengths, the resistance of the signal transmission lines increases as the distance from the data PCB **12** increases. Accordingly, gate driving signals transmitted via the LOG signal line group become attenuated and distorted due to the variation in the line voltage value. As a result the quality of a picture displayed on the picture display area **21** is deteriorated.

[0021] For example, distortion of the gate low voltage signal (V_{gl}) applied via the LOG signal line group **26** affects the picture quality displayed within the picture display area **21**. Gate low voltage signals (V_{gl}) maintain the pixel voltage charged within the liquid crystal cell between intervals when the gate high voltage (V_{gh}) is charged within the pixel. Accordingly, as the gate low voltage signal is distorted, the pixel voltage within the liquid crystal cell also becomes distorted.

[0022] Referring to FIG. 2, the LOG gate low voltage transmission lines VGLL supply gate low voltage signals (V_{gl}) and include a plurality of LOG gate low voltage transmission lines. These LOG gate low voltage transmission lines include first to fourth LOG gate low voltage

transmission lines VGLL1 to VGLL4 and are connected between a first data TCP **8** and first to fourth gate TCPs **14A** to **14D**, respectively. The first to fourth LOG gate low voltage transmission lines VGLL1 to VGLL4 have line resistance values a, b, c, and d proportional to their respective line lengths, and are connected to each other in series via the first to fourth TCPs **14A** to **14D**. The line resistance values a, b, c, and d of the LOG gate low voltage transmission lines (VGLL1 to VGLL4) distort gate low voltage signals (V_{gl}) supplied to each gate driver **16**.

[0023] For example, the first gate low voltage VGL1 is dropped in proportion to the first line resistance value (a) of the first LOG gate low voltage transmission line VGLL1. The first gate low voltage VGL1 is applied to the first gate driving IC **16** and gate lines at a first horizontal line block A.

[0024] The gate driver **16** mounted in the second gate TCP **14B** is supplied with a second gate low voltage VGL1, which drops proportionally to the sum of the first and second line resistance values (a+b) of the first (VGLL1) and second (VGLL2) LOG gate low voltage transmission line, which are connected to each other in series. The second gate low voltage VGL2 is applied to the second gate driving IC **16** and gate lines at a second horizontal line block B.

[0025] The gate driver **16** mounted in the third gate TCP **14C** and supplied with a third gate low voltage VGL3 is dropped in proportion to the sum of the first, second and third line resistance value (a+b+c) of the first (VGLL1), second (VGLL2) and third (VGLL3) LOG gate low voltage transmission lines, which are connected to each other in series. The third gate low voltage VGL3 is applied to the third gate driving IC **16** and gate lines at a third horizontal line block C.

[0026] The gate driver **16** mounted in the fourth gate TCP **14D** and supplied with a fourth gate low voltage VGL4 which is dropped proportionally to the sum of the first, second, third, and fourth line resistance values (a+b+c+d) of the first (VGLL1), second (VGLL2), third (VGLL3), and fourth (VGLL4) LOG gate low voltage transmission lines, which are connected to each other in series. The fourth gate low voltage VGL4 is applied to the gate lines at a fourth horizontal line block D via the fourth gate driving IC **16**.

[0027] A brightness difference is generated between the horizontal line blocks A to D connected to different gate driver ICs because of the difference among the gate low voltages VGL1 to VGL4. This brightness distortion causes a cross line (32) phenomenon dividing the screen when viewed by an observer and deteriorates the picture quality. Particularly, as it goes from the first gate driving IC **16** toward the fourth gate driving IC **16**, line resistance values a, b, c and d of the LOG-type gate low voltage transmission lines VGLL are added to each other, thereby allowing the first to fourth gate low voltages VGL1 to VGL4 applied to the horizontal line blocks A to D to have a relationship of VGL1>VGL2>VGL3>VGL4.

[0028] In order to prevent a reduction of gate driving signals, particularly a gate low voltage caused by a line resistances of the LOG signal line group **26**, a section area of the LOG signal line group **26** must be enlarged and/or the resistivity value thereof must be reduced. However, since the outer area of the picture display part **21** provided with the

LOG signal line group **26** is confined, there exists a limit to enlarging a section view of the LOG signal line group **26**. Furthermore, since the LOG-type signal line group **26** is formed from a gate metal layer, there are inherent limits in reducing the resistivity value.

[0029] As a result, a scheme capable of reducing a line resistance of the LOG-type signal line group **26** formed in a fine pattern within the confined area is required.

SUMMARY OF THE INVENTION

[0030] Accordingly, the present invention is directed to liquid crystal display panel of line-on-glass type that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

[0031] An advantage of the present invention is to provide a LOG liquid crystal display panel which is adaptive for reducing a line resistance of LOG signal line groups.

[0032] Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0033] To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described, a line on glass type liquid crystal display panel according to an embodiment of the present invention includes a picture display part having a plurality of liquid crystal cells, each of which is arranged at each crossing area between gate lines and data lines; and line on glass type signal lines, being provided at an outer area of the picture display part by a line on glass system, for applying driving signals required for drive integrated circuits for driving the gate lines and the data lines and for connecting the drive integrated circuits to each other, wherein the line on glass type signal lines are separately provided at different substrates opposed to each other with having a liquid crystal therebetween.

[0034] In the line on glass type liquid crystal display panel, the line on glass type signal lines supply gate driving signals required for a gate drive integrated circuit for driving the gate lines and a common voltage required for a common electrode included in the picture display part.

[0035] A gate low voltage transmission line for supplying a gate low voltage signal, of the line on glass type signal lines, is provided at an outer area of a first substrate while gate driving signal lines for transferring the remaining gate driving voltage signals excluding the gate low voltage.

[0036] The line on glass type liquid crystal display panel further includes a connection dot for electrically connecting any one of the gate low voltage transmission line and the line on glass type signal lines for transferring the remaining gate driving signal at a second substrate.

[0037] The gate low voltage transmission line is provided such that it has a section area as large as possible at the outer area of the first substrate.

[0038] It is to be understood that both the foregoing general description and the following detailed description

are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWING

[0039] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

[0040] In the drawings:

[0041] **FIG. 1** is a schematic view of a related art line-on-glass type liquid crystal display;

[0042] **FIG. 2** is a schematic view for explaining a separation phenomenon between horizontal line blocks caused by a line resistance of the line-on-glass signal line group shown in **FIG. 1**; and

[0043] **FIG. 3** is a schematic plan view of line-on-glass liquid crystal display panels according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

[0044] Reference will now be made in detail to an embodiment of the present invention, example of which is illustrated in the accompanying drawings.

[0045] **FIG. 3** illustrates a LOG liquid crystal display according to an embodiment of the present invention.

[0046] The liquid crystal display device includes a liquid crystal display panel **31**, a plurality of data TCPs **38** connected to the liquid crystal display panel **31**, a data PCB **42**, a plurality of gate TCPs **44** connected to a side of the liquid crystal display panel **31**, data driving ICs **40** mounted on the data TCPs **38**, gate driving ICs **46** mounted on the gate TCPs **44**, and first **48** and second **52** LOG signal line groups. The LOG signal line groups are provided on a lower **32** and upper **34** substrates for applying a gate driving signals to the gate driver ICs **46**.

[0047] The liquid crystal display panel **31** includes a lower substrate **32** provided with a plurality of signal lines and a switching array, for example, a thin film transistor array. The upper substrate **34** is provided with a color filter array and liquid crystal injected between the lower **32** and upper **34** substrate. The liquid crystal display panel **31** is provided with a picture display area **36** that comprises liquid crystal cells provided at crossings of the gate lines and data lines for displaying a picture. Data pads (not labeled) are positioned at the outer area of the lower substrate **32**. Further, a first LOG signal line group **48** for transmitting gate driving signals to the gate driver IC **46** is positioned at the outer area of the lower substrate **32**. A second LOG signal line **52** is positioned at the outer area of the upper substrate **34**. The second LOG signal line group **52** is connected with a connection dot **58** to any of the LOG lines **56**.

[0048] The LOG signal line groups **48**, **52** and **56** usually consist of signal lines for supplying direct current (DC) voltage signals supplied from a power supply. The voltage signals include gate high voltage signals (VGH), gate low voltage signals (VGL), common voltage signals (VCOM),

ground voltage signals (GND), and supply voltage signals (VCC), and gate control signals supplied from a timing controller. The gate control signals include a gate start pulse (GSP), a gate shift clock signal (GSC), and a gate enable signal (GOE).

[0049] The LOG signal line groups **48**, **52** and **56** may be formed as large as possible within their respective confined area. Particularly, the second LOG signal line group **52** may be formed in a large size. The LOG signal line **52** is provided at the upper substrate **34** and is used as a gate low voltage signal line for transferring a gate low voltage (VGL). The line width of the gate low voltage signal line **52** is formed as large as possible. This is accomplished by using substantially the entire outer area of the upper substrate **34** when forming the gate low voltage line **52**, thereby reducing the resistance values enough to improve the picture quality. As a result, the picture quality on the picture display part of the gate driving signals is greatly improved.

[0050] Additionally, the LOG signal lines within the LOG signal line group **48** for transferring the gate driving voltages other than the gate low voltage VGL also are formed with larger line widths than the prior art and their resistance values are reduced. The gate low voltage transmission line **52** is connected via the connection dots **58** to any one of the first LOG signal line groups **48** and **56** provided on the lower substrate. That is, the gate low voltage transmission line **52** connected to a connection dot **58** and to the LOG signal line **56** receives a gate low voltage. Further, the second LOG signal line **52** transmits the gate low voltage to the gate TCPs **44** and to each gate driver IC **46**.

[0051] As described above, the LOG signal lines are formed to enlarge their sectional areas, thereby their resistance values are reduced and the signal attenuation is minimized. Particularly, the gate low voltage signal line, which has a great affect on picture quality is formed so that its line width is as large as possible within a confined outer area. Accordingly, the resistance value of the gate low voltage signal line is minimized and the difference in a gate low voltage supplied for each gate driver IC is also minimized. Thus, the cross-line phenomenon between the horizontal line blocks connected for each driver IC is reduced.

[0052] It will be apparent to those skilled in the art that various modifications and variation can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A line-on-glass (LOG) liquid crystal display device, comprising:

a picture display part having a plurality of liquid crystal cells, each of the liquid crystal cells are arranged at a crossing between gate lines and data lines; and

line-on-glass signal lines arranged at an outer area of the picture display part connecting integrated circuits to each other and for applying driving signals required for driving integrated circuits and for driving the gate lines and the data lines, wherein the line-on-glass signal lines are arranged on different substrates opposed to each other having a liquid crystal disposed therebetween.

2. The line-on-glass (LOG) liquid crystal display device of claim 1, wherein said line-on-glass signal lines supply gate driving signals.

3. The line-on-glass (LOG) liquid crystal display device of claim 2, wherein said line-on-glass signal lines supply gate driving signals transmit driving signals to the gate driver ICs.

4. The line-on-glass (LOG) liquid crystal display device of claim 2, wherein the line-on-glass signal lines includes a gate low voltage transmission lines for supplying a gate low voltage signals and gate driving signal lines for transferring gate driving voltage signals.

5. The line-on-glass (LOG) liquid crystal display device of claim 4, further comprising:

a connection dot for electrically connecting any one of the gate low voltage transmission lines and the line-on-glass type signal lines for transmitting the gate driving signal at a second substrate.

6. The line-on-glass (LOG) liquid crystal display device of claim 3, wherein said gate low voltage transmission lines are formed such that voltage drop due to resistivity is minimized.

7. A line-on-glass (LOG) liquid crystal display device, comprising:

a first substrate including a plurality of gate and data lines;

a second substrate including a color filter array, wherein liquid crystal is arranged between the first and second substrates;

a first LOG signal line group for transferring gate driving signals to gate driver ICs arranged at an outer area of the first substrate;

a second LOG signal line group arranged on the second substrate, wherein the second LOG signal line group is connected with a connection dot to a first LOG signal line group.

8. The line-on-glass (LOG) liquid crystal display device of claim 7, wherein the first LOG signal line group includes a plurality of signal lines.

9. The line-on-glass (LOG) liquid crystal display device of claim 7, wherein the second LOG signal line group includes a gate low voltage signal line.

10. The line-on-glass (LOG) liquid crystal display device of claim 8, wherein the plurality of signal lines within the first LOG signal line group are formed such that there is substantially no voltage loss between a data PCM and a gate TCP.

11. The line-on-glass (LOG) liquid crystal display device of claim 8, wherein the second LOG signal line group is formed such that there is substantially no voltage loss due to resistivity.

12. The line-on-glass (LOG) liquid crystal display device of claim 8, wherein the second LOG signal line group is formed such that there is substantially no voltage loss between the nodes.

13. A line-on-glass (LOG) liquid crystal display device, comprising:

a first substrate including a plurality of gate and data lines and a first LOG line group for transmitting gate driving signals a gate driver IC;

a second substrate including a color filter array, picture display area, and second LOG line group connected to

the first LOG line group, wherein the second LOG line group includes a gate low voltage signal line having a resistance to prevent substantial voltage drop across the gate low voltage signal line.

14. The line-on-glass (LOG) liquid crystal display device of claim 13, wherein the first LOG line group includes signal lines connected to a PCB and TCP.

15. The line-on-glass (LOG) liquid crystal display device of claim 13, wherein the first LOG line group is connected to the second LOG line group with a connecting dot.

16. The line-on-glass (LOG) liquid crystal display device of claim 13, wherein the gate driving ICs are mounted on TCPs.

17. The line-on-glass (LOG) liquid crystal display device of claim 13, wherein the first LOG line groups is arranged on the outer periphery of the first substrate.

18. The line-on-glass (LOG) liquid crystal display device of claim 13, wherein the second LOG line group is arranged on an outer periphery of the second substrate outside of the display part.

19. The line-on-glass (LOG) liquid crystal display device of claim 13, wherein the gate driver ICs includes a first, second, third and fourth gate driver IC connected to the second LOG line group at a plurality of connection dots.

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专利名称(译)	玻璃型线上的液晶显示板		
公开(公告)号	US20030117567A1	公开(公告)日	2003-06-26
申请号	US10/319672	申请日	2002-12-16
[标]申请(专利权)人(译)	郑容CHAE CHO董SOON		
申请(专利权)人(译)	郑容CHAE CHO董SOON		
当前申请(专利权)人(译)	郑容CHAE CHO董SOON		
[标]发明人	JUNG YONG CHAE CHO SOON DONG		
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摘要(译)

一种LOG液晶显示板，适用于减小受限区域内LOG信号线组的线电阻。面板内的图像显示部分具有多个液晶单元，这些液晶单元布置在栅极线和数据线之间的交叉处。玻璃上线信号线设置在将集成电路彼此连接的图像显示器的外部区域，并用于施加驱动栅极线所需的驱动信号。玻璃上线信号线分别设置在彼此相对的不同基板上，液晶设置在它们之间。

