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(54) LIQUID CRYSTAL DISPLAY DEVICE AND INSPECTING METHOD OF BONDING STATE BETWEEN LIQUID CRYSTAL DISPLAY PANEL AND DRIVE IC

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(57) **ABSTRACT**

An LCD device includes a pixel part, formed on a substrate, where a plurality of gate lines and data lines are arranged perpendicular to each other and a plurality of pixels are formed. A terminal has active pads formed on a substrate which communicate a signal to respective ones of the gate lines and data lines of the pixel part. The terminal also has dummy pads formed adjacent to the active pads a transparent material is adjacent or over the dummy pads so as to check a pressed state of conductive balls. A drive IC having a terminal with pads electrically connected one-to-one to the pads of active pads formed on the substrate through the conductive balls, so s to supply a gate signal and/or a data signal to the respective gate line and/or data line.

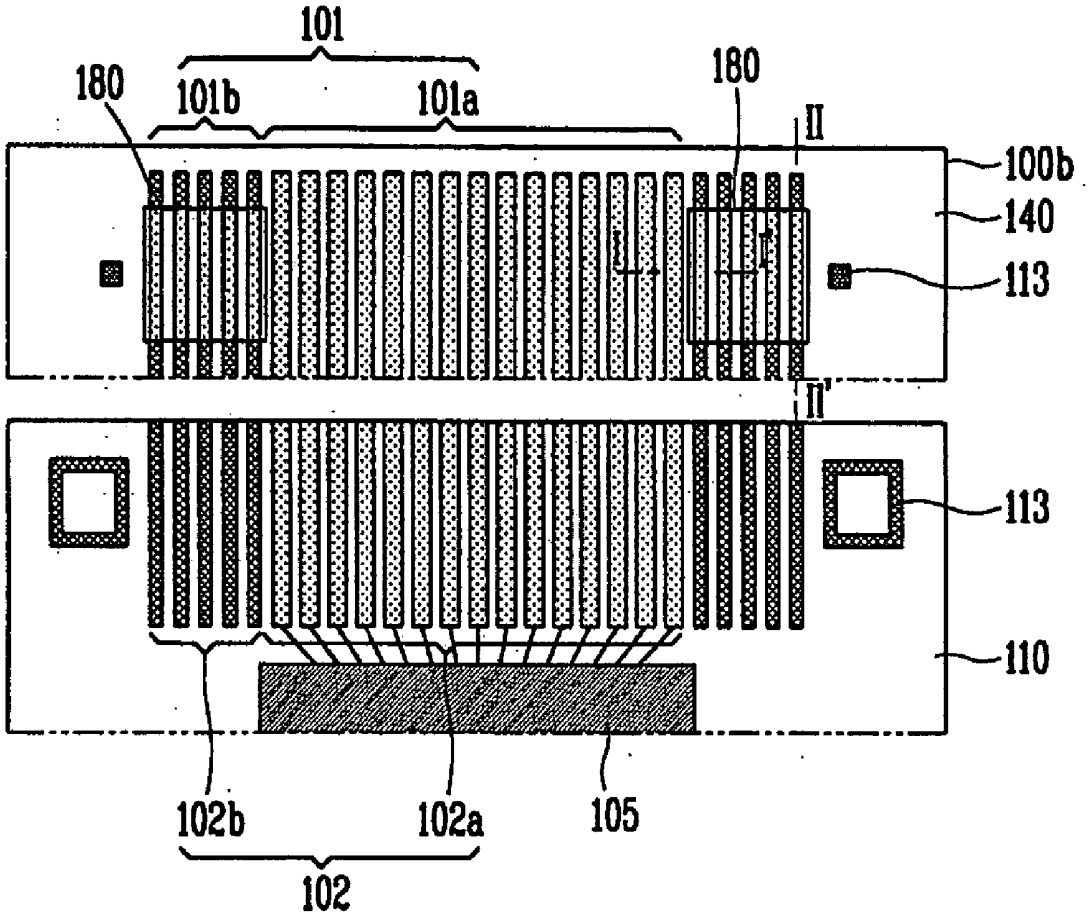


FIG. 1
RELATED ART

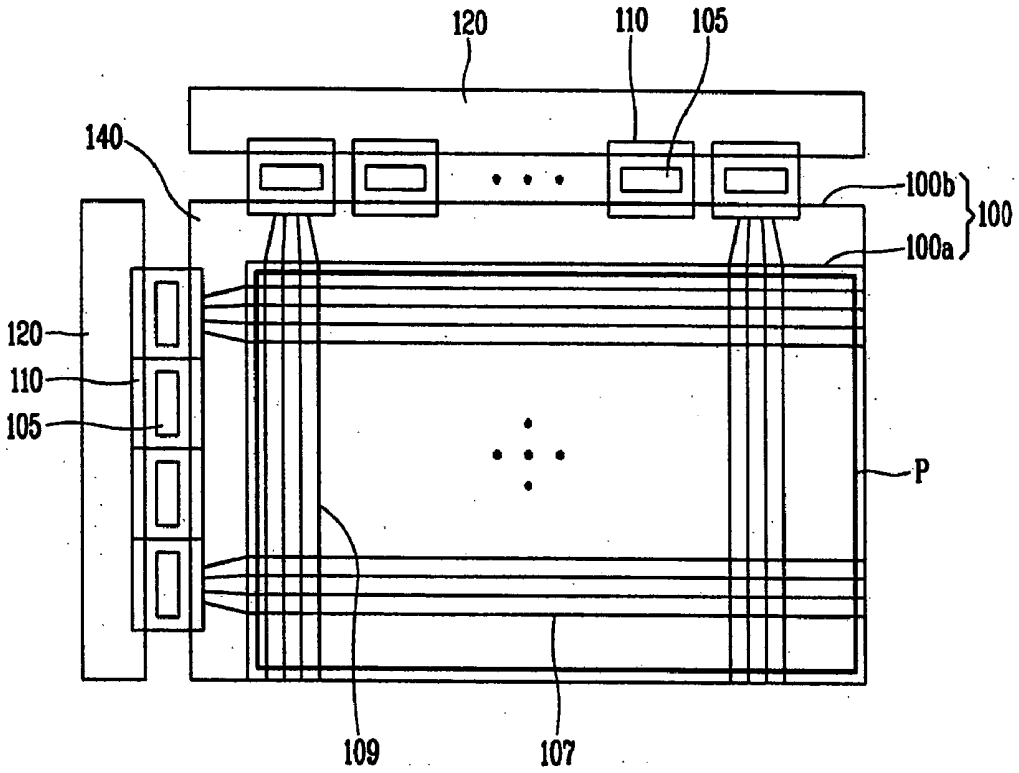


FIG. 2

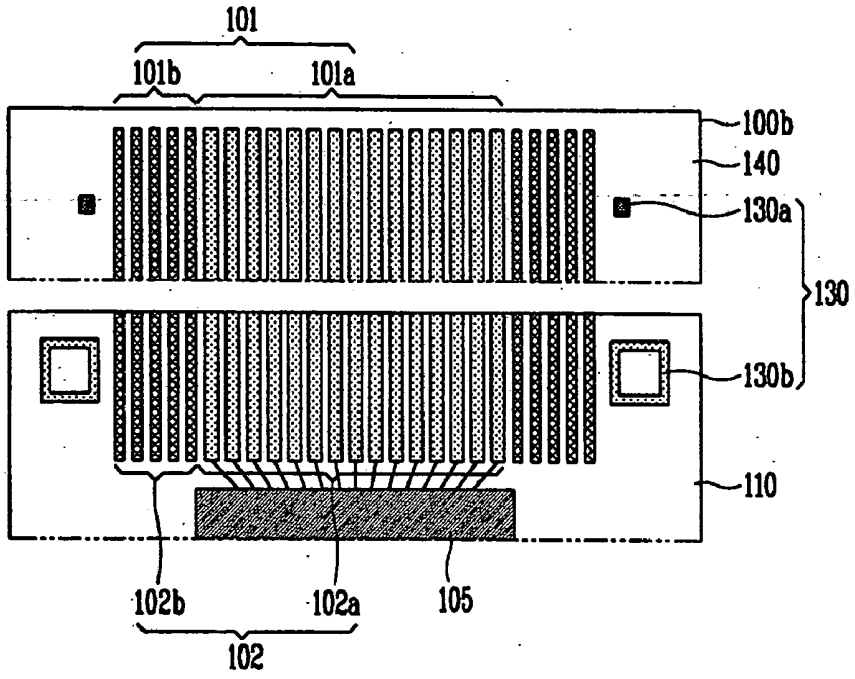


FIG. 3

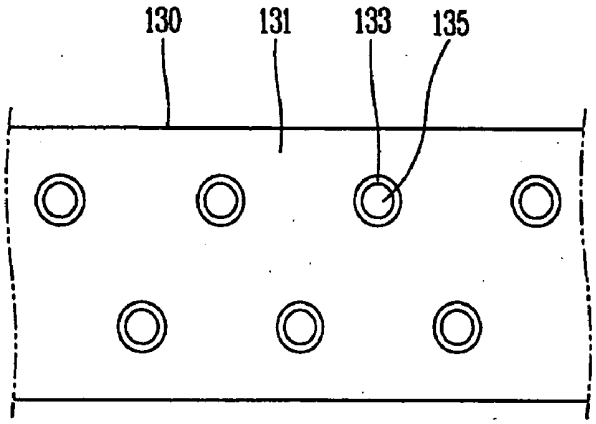


FIG. 4

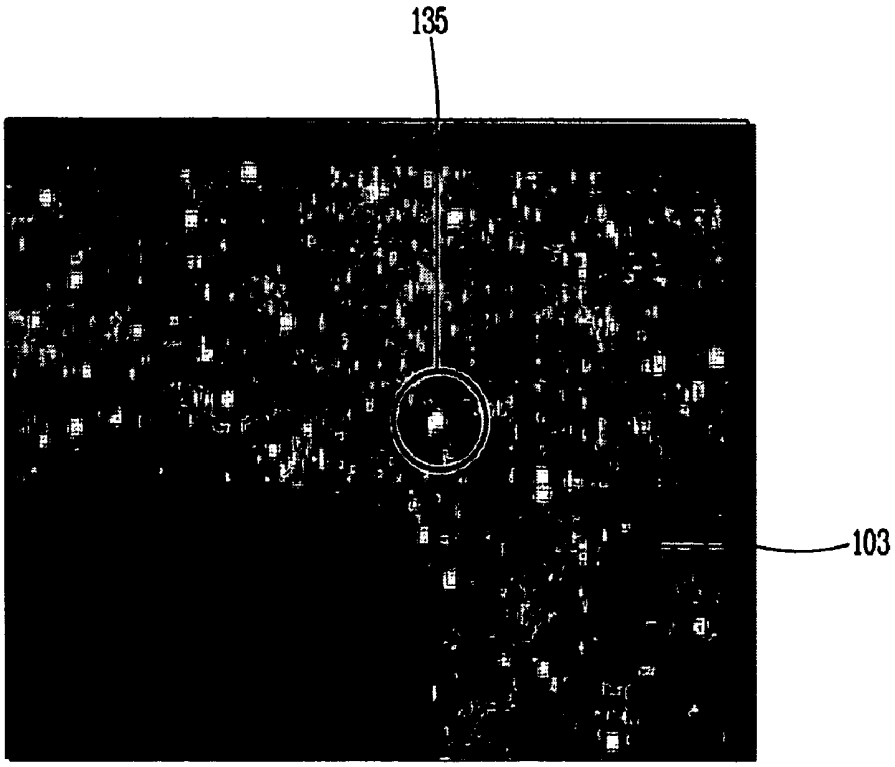


FIG. 5

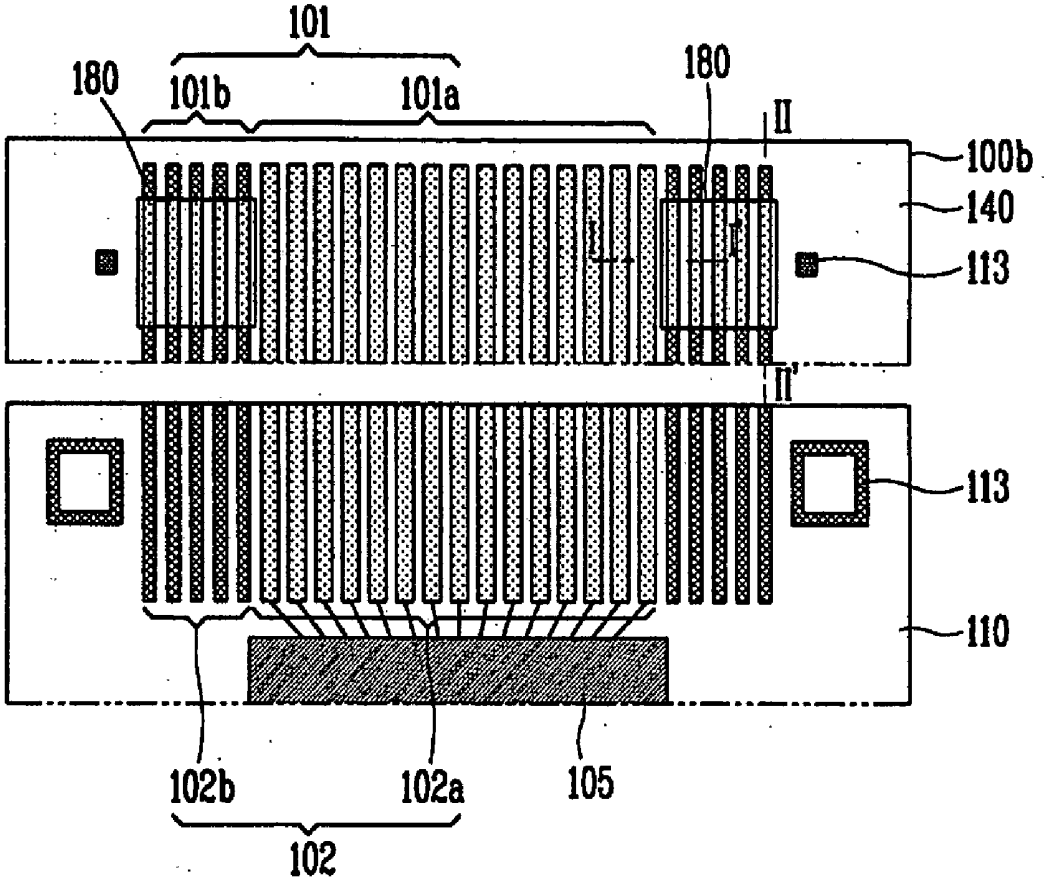

101
180
101b
101a
180
II
100b
140
113
II'
113
110
102b
102a
105
102

FIG. 6A

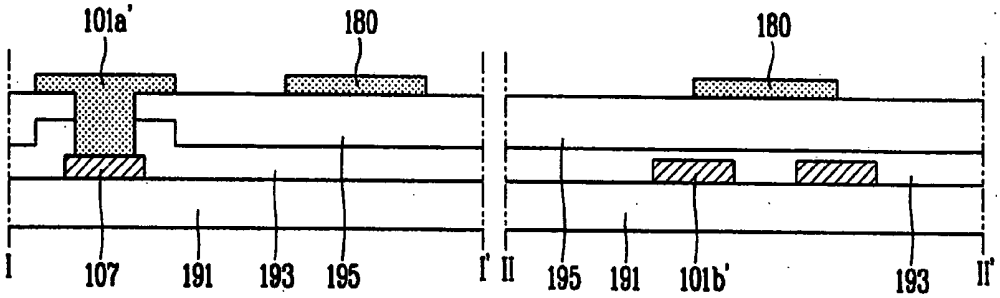
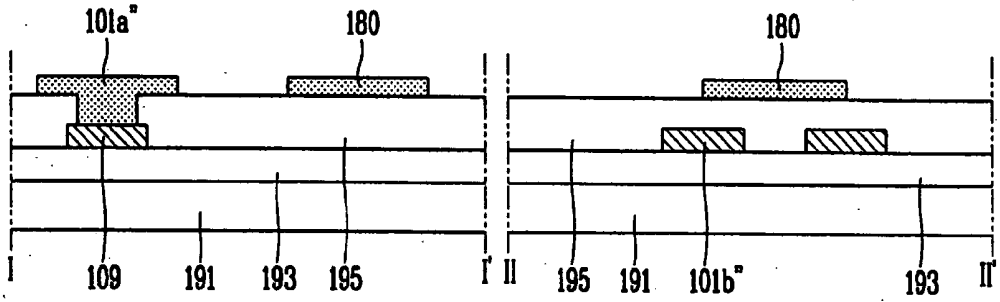

101a'
180
180
I
107
191
193
195
I'
II
195
191
101b'
193
II'

FIG. 6B


101a"
180
180
I
109
191
193
195
I'
II
195
191
101b"
193
II'

LIQUID CRYSTAL DISPLAY DEVICE AND INSPECTING METHOD OF BONDING STATE BETWEEN LIQUID CRYSTAL DISPLAY PANEL AND DRIVE IC

[0001] The present application claims, under 35 U.S.C. § 119, the benefit of Korean Patent Application No. 2003-78772 filed Nov. 7, 2003, the entire contents of which are herein fully incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a liquid crystal display (LCD) device. More particularly, the present invention related to a method of inspecting a bonding state between a liquid crystal display panel and a drive IC and a structure enabling easy checking of a pressed state of conduct balls of anisotropic conductive film electrically connecting a pad part and a drive IC of a liquid crystal panel.

[0004] 2. Description of the Background Art

[0005] Liquid crystal displays (LCDs) are becoming lighter and thinner, they can operate with relatively low power consumption, and their picture quality continues to improve with enhancements of liquid crystal materials and development of fine pixel processing techniques. As such, LCDs have a wide variety of applications and their use continues to expand.

[0006] An LCD can be divided into a liquid crystal panel and a drive IC. The liquid crystal panel includes liquid crystal cells arranged in a matrix form between two sheets of glass substrates (namely, an upper glass and a lower glass), and switching devices (namely, a TFT array) for switching signals supplied to the liquid crystal cells. The drive IC is mounted on a printed circuit board (PCB) and drives the liquid crystal panel.

[0007] A TCP (Tape Carrier Package) is used to transfer a signal between the liquid crystal panel and the PCB. The TCP is directly attached to the lower glass and the printed circuit board by using a conductive resin such as an anisotropic conductive film (ACF) or the like. In this case, the ACF includes conductive balls having conductivity.

[0008] When the TCP is pressed with a certain pressure so as to be attached to an attachment portion (namely, a contact portion between the TCP and the lower glass or between the TCP and the PCB), the conductive balls in the ACF provides conductivity between the two attached surfaces. In this respect, however, when the conductive balls are pressed, if they fail to be pressed adequately to a state suitable for signal transmission, a distortion occurs in signal transmissions.

[0009] In a related art, in order to monitor the pressed state of the conductive balls, a measurement unit is used, or the pressed state is visually checked by the naked eye by using pressurization paper. Thus, the expense is increased according to employing the measurement unit, and/or the fabrication process is delayed due to the additional process of checking the state of the conductive balls by using the pressurization paper.

SUMMARY OF THE INVENTION

[0010] Therefore, an object of the present invention is to provide a liquid crystal display (LCD) device and a method for easily inspecting a pressed state of conductive balls in an ACF when connecting a pad part (gate pad and data pad) of an LCD device and a TCP by using the ACF.

[0011] To achieve these and other advantages in accordance with the present invention, as embodied and broadly described herein, there is provided an LCD device including: a substrate; a pixel part formed on the substrate; a plurality of pixels formed on the pixel part and connected to a plurality of gate lines and plurality of data lines; a plurality of active gate pads, forming a gate connection terminal on the substrate, the plurality of active gate pads being connected to respective ones of the plurality of gate lines; a plurality of active data pads, forming a data connection terminal on the substrate, the plurality of data pads being connected to respective ones of the plurality of data lines; a first dummy pad formed on a first side of at least one of the gate connection terminal and the data connection terminal; and a second dummy pad formed on a second side of the at least one of the gate connection terminal and the data connection terminal, wherein a first portion of the substrate, proximate the at least one first dummy pad, is formed of a transparent material, and wherein a second portion of the substrate, proximate the at least one second dummy pad, is formed of a transparent material.

[0012] An other aspect of the present invention, there is also provided an LCD device including: a substrate; a pixel part formed on the substrate a plurality of pixels formed on the pixel part and connected to a plurality of gate lines and plurality of data lines; a plurality of active gate pads, forming a gate connection terminal on the substrate, the plurality of active gate pads being connected to respective ones of the plurality of gate lines; a plurality of active data pads, forming a data connection terminal on the substrate, the plurality of data pads being connected to respective ones of the plurality of data lines; a first dummy pad formed on a first side of at least one of the gate connection terminal and the data connection terminal; a second dummy pad formed on a second side of the at least one of the gate connection terminal and the data connection terminal; a drive IC having a plurality of signal pads for connection with the plurality of active pads of the at least one of the gate connection terminal and the data connection terminal, wherein a first portion of the drive IC, proximate a first side of the signal pads, is formed is of a transparent material, and wherein a second portion of the drive IC, proximate a second side of the signal pads, is formed is of a transparent material.

[0013] An other aspect of the present invention, there is also provided an method of checking a bonding during the assembly of an LCD device including : a substrate; a pixel part formed on the substrate; a plurality of pixels formed on the pixel part and connected to a plurality of gate lines and plurality of data lines; a plurality of active gate pads, forming a gate connection terminal on the substrate, the plurality of active gate pads being connected to respective ones of the plurality of gate lines; a plurality of active data pads, forming a data connection terminal on the substrate, the plurality of data pads being connected to respective ones of the plurality of data lines; a first dummy pad formed on a first side of at least one of the gate connection terminal and the data connection terminal; a second dummy pad formed on a second side of the at least one of the gate connection terminal and the data connection terminal; a drive IC having a plurality of signal pads for connection with the plurality of

active pads of the at least one of the gate connection terminal and the data connection terminal, the method comprising the steps of: positioning an anisotropic conductive film between the plurality of active pads of the at least one of the gate connection terminal and the data connection terminal and the plurality of signal pads of the drive IC; aligning the plurality of signal pads of the drive IC with the plurality of active pads of the at least one of the gate connection terminal and the data connection terminal; bonding the plurality of signal pads of the drive IC with the plurality of active pads of the at least one of the gate connection terminal and the data connection terminal; and inspecting the anisotropic conductive film via at least one transparent portion formed in at least one of the drive IC and the substrate.

[0014] The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] 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.

[0016] In the drawings:

[0017] **FIG. 1** shows an LCD device, in accordance with the present invention;

[0018] **FIG. 2** shows one embodiment of a pad part, in accordance with the present invention;

[0019] **FIG. 3** shows an anisotropic conductive film;

[0020] **FIG. 4** shows a pressed state of conductive balls of the anisotropic conductive film observed through a monitoring window;

[0021] **FIG. 5** shows another embodiment of the pad part, in accordance with the present invention; and

[0022] **FIGS. 6A and 6B** are cross sectional views taken along lines I-I' and II-II' of **FIG. 5**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0023] **FIG. 1** shows a schematic plane structure of an LCD in accordance with the present invention, and **FIG. 2** shows a schematic structure of a pad part formed on a thin film transistor substrate of **FIG. 1**.

[0024] As shown, the LCD device includes a liquid crystal panel **100** including a color filter substrate **110***a* and a thin film transistor substrate **100***b*. The LCD device also includes IC **105** for driving the liquid crystal panel **100**.

[0025] A liquid crystal layer is formed between the two substrates **100***a* and **100***b*. A color filter and a black matrix (not shown) are formed on the color filter substrate **100***a*.

[0026] A plurality of gate lines **107** and a plurality of data lines **109** are arranged perpendicular to each other, vertically and horizontally, to form a pixel part (P) defining a plurality of pixel. A thin film transistor is formed at each pixel.

[0027] A pad part **140** includes a plurality of pads which are connected to one side of respective gate/data lines **107** and **109**. The pad part is formed at an edge of the thin film transistor substrate **100***b*, not covered by the color filter substrate **100***a*. Matching pads are connected to a TCP **110**. The TCP **110** has the drive IC **105** mounted thereon in order to drive the liquid crystal panel **100**. The TCP **110** is also connected to a PCB (Printed Circuit Board) **120**. The PCB **120** includes various elements and integrated circuits and generates various control signals and data signals to drive the liquid crystal panel **100**.

[0028] With reference to **FIG. 2**, a terminal **101** includes an active pad **101***a* (or connection terminal) and a dummy pad **101***b*. Individual pads of the active pad **101***a* are connected to respective gate lines and/or data lines. The active pad **101***a* and dummy pad **101***b* are formed on the pad part **140** of the thin film transistor substrate **100***b*.

[0029] On the TCP **110**, an active pad **102***a* (or connection terminal) and dummy pad **102***b* are connected to each terminal of the driving IC **105**. The active pad **102***a* and dummy pad **102***b* are formed to correspond one-to-one to pads **101***a*, **101***b* of the terminal **100** on the pad part **140**. Monitoring windows **130** are formed at right and left sides of the dummy pads **101***b* and **102***b*.

[0030] The TCP **110** is connected to the pad part **140** of the TFT substrate **100***b*. The TCP **110** can be connected to the pad part **140** of the substrate **100***b* by an adhesive anisotropic conductive film (ACF) including conductive particles on the pad part **140**, adjusting the terminal **102** of the TCP **110** to the terminal **101** of the pad part **140** to assure proper alignment and then applying an appropriate heat and pressure.

[0031] As shown in **FIG. 3**, the ACF includes several conductive balls **135** covered by an insulating coating film **133** inside the anisotropic film **131**.

[0032] After the ACF is attached to the pad part **140**, the pads of the terminal **102** of the TCP **110** are arranged to correspond to the pads of the terminal **101** of the substrate **100***b*, and then heat and pressure are applied. As the conductive balls **135** are pressed, the insulating coating films **133** covering the conductive balls **135** are broken which allows the conductive balls **135** to electrically connect the pad terminals on a one-to-one basis.

[0033] In order to make the pads of the terminal **101** of the substrate **100***b* and the pads of the terminal **102** of the TCP **110** correspond or align with each other, the monitoring windows **130** are positioned at both sides of the terminals **102**, **101**, more especially at both sides of the dummy pads **101***b* and **102***b* and function as an alignment key.

[0034] In bonding the pads of the terminal **102** of the TCP **110** to the liquid crystal panel, if the insulating coating film **133** is not broken due to insufficient pressing of the conductive balls **135**, contact resistance between the pads of the terminal **101** and **102** is increased so that signal transmission is deteriorated.

[0035] Thus, in the present invention, the windows **130***b* formed on the TCP **110** are formed of a transparent material such as indium tin oxide (ITO) or indium zinc oxide (IZO) in order to monitor the pressed state of the conductive balls

135 in bonding. By this arrangement, the bonding state between the liquid crystal panel 100 and the TCP 110 can be checked efficiently.

[0036] FIG. 4 shows a pressed state of conductive balls 135 observed through a monitoring window 130*b*. As shown, the pressed state of the conductive balls 135 can be observed through the monitoring window 130*b* formed of a transparent material. The monitoring windows 130*a* are formed of a translucent material to assist in viewing the conductive balls 135. The pressed state of the conductive balls 135 is monitored by counting the number of pressed conductive balls 135 as observed through the monitoring window 130*b*. Namely, if the number of conductive balls 135 observed through the monitoring window 130*b* positioned at both sides of the dummy pad 102*b* is different, it is determined that a pressure has not been applied uniformly. For example, if more conductive balls 135 are counted through the right window 130*b* than the left window 130*b*, it can be seen that more pressure and/or heat was applied to the right side.

[0037] In addition, even though uniform pressure is applied to the pad part 140, the applied pressure can be less than a pre-set required pressure. In this case, the number of pressed conductive balls 135 measured through the left and right monitoring windows 130*b* is compared with the pre-set number, and if the number of the pressed conductive balls 135 is less than the pre-set number, it is determined that an insufficient pressure or heat has been applied and thus the bonding has not been made properly.

[0038] As mentioned above, by forming the monitoring window 130*b* of a transparent material and by providing a monitoring window 130*b* at both sides of the terminal 102, the pressed state of the conductive balls 135 can be easily checked.

[0039] However, since the position of the monitoring windows 130*b* are not a region where the terminal 102 actually is formed, the checked pressed state of the conductive balls 135 and an actual pressed state of the conductive balls 135 in the terminal 102 can be different. This degrades the reliability of the inspection.

[0040] In order to solve such a problem, in an LCD device of another embodiment of the present invention, a monitoring window 180 for checking a pressed state of the conductive balls 135 is formed above or below the dummy pads 101*b* and 102*b* adjacent to the active pads 101*a* and 101*b*, to thereby improve the reliability of the inspection of the conductive balls 135.

[0041] As shown in FIG. 5, a pad part 140, to which the plurality of gate lines 107 and the plurality of data lines 109 are connected, includes a plurality of active pads 101*a* connected to the active pads 102*a* of the TCP 110 and dummy pads 101*b*, which are not directly connected to the gate lines and data lines, formed at left and right sides of the active pads 101*a*. The pad part 140 has a region formed of a transparent material. The region formed of the transparent material is a monitoring window 180, through which inspection of the conductive balls 135 is made. The monitoring window 180 can be formed in the TFT substrate 100*b* at the dummy pads 101*b* or at the dummy pads 102*b* of the TCP 110. A region corresponding or facing to the monitoring window 180 may be formed of a translucent material.

[0042] An alignment key 113 is formed at left and right sides of the dummy pads 101*b* and 102*b* of the TCP 110 and the substrate 100*b*. By making the alignment keys 113 correspond to each other, the terminal 101 and 102 of the substrate 100*b* and the TCP 110 will be aligned.

[0043] The dummy pads 101*b* and 102*b* are not electrically connected to the gate lines and/or the data lines, but they have the same structure as the active pads 101*a* and 102*a*. Since the dummy pads 101*b* and 102*b* are positioned adjacent to the active pads 101*a* and 102*a*, the pressed state of the conductive balls 135 in the region is almost similar to the state at the active pads 101*a* and 102*a*.

[0044] Therefore, compared to the monitoring window 130 positioned at left and right sides of the dummy pads 101*b* and 102*b* in the former embodiment (refer to FIG. 2), the pressed state of the conductive balls through the monitoring window 180 formed at portion of the dummy pads 101*b* and 102*b* provides a more reliably indication of the bonding state of the active pads 101*a* and 101*b*.

[0045] Also at this time, by comparing the number of pressed conductive balls 135 observed through the monitoring windows 180 disposed at left and right sides of the active pads 101*a* and 102*a*, the overall uniformly pressed state of the terminals 101 and 103 is determined.

[0046] FIGS. 6A and 6B show sections of I-I' and II-II' of the active pad 101*a* and the monitoring window 180 of the gate pad part and the data pad part of FIG. 5.

[0047] First, as shown in FIG. 6A, as for the section of the gate pad part, the gate line 107 and the dummy pad 101*b*' are formed on a transparent substrate 191, on which a gate insulation film 193 and a passivation film 195 are sequentially formed. And then, the gate pad 101*a*', electrically connected with the gate line 107 is formed thereon. The gate pad 101*a*' and the monitoring window 180 are formed together on the passivation film 195. The gate pad 101*a*' and the monitoring window 180 are formed of a transparent material such as ITO or IZO.

[0048] As shown in FIG. 6B, as for the section of the data pad part, the gate insulation film 193 is formed on the transparent substrate 191, on which the data line 109 and the dummy pad 101*b*" are formed. And then, a passivation film 195 is formed at an upper surface of the data line 109 and the gate insulation film 193.

[0049] On the passivation film 195, there are formed the data pad 101*a*", which is electrically connected with the data line 109, and the monitoring window 180. The data pad 101*a*" and the monitoring window 180 are formed of a transparent material such as ITO or IZO.

[0050] As afore-mentioned, the present invention provides a liquid crystal display wherein a pressed state of the conductive balls can be easily checked via monitoring windows at the pad part. The monitoring windows can be formed either at the TCP or at the liquid crystal panel. By forming the monitoring windows at a portion of the dummy pads, the reliability of judging a conductive state of the conductive balls at the active pads can be improved.

[0051] As so far described, the LCD display device and its inspecting method of a bonding state between a liquid crystal display panel and a drive IC of the present invention have the following advantages.

[0052] In fabricating an LCD device, when bonding is performed for signal connection with the drive IC, it is easy to inspect whether their electric connection has been made properly. In particular, by forming the monitoring window, formed of a transparent material, at the dummy pad of the drive IC, a pressed state of conductive balls can be easily observed and thus a reliable inspection can be made.

[0053] As the present invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalence of such metes and bounds are therefore intended to be embraced by the appended claims.

What is claimed is:

1. An LCD device comprising:

a substrate;

a pixel part formed on the substrate a plurality of pixels formed on the pixel part and connected to a plurality of gate lines and plurality of data lines;

a plurality of active gate pads, forming a gate connection terminal on the substrate, the plurality of active gate pads being connected to respective ones of the plurality of gate lines;

a plurality of active data pads, forming a data connection terminal on the substrate, the plurality of data pads being connected to respective ones of the plurality of data lines;

a first dummy pad formed on a first side of at least one of the gate connection terminal and the data connection terminal; and

a second dummy pad formed on a second side of the at least one of the gate connection terminal and the data connection terminal,

wherein a first portion of the substrate, proximate the at least one first dummy pad, is formed of a transparent material, and

wherein a second portion of the substrate, proximate the at least one second dummy pad, is formed of a transparent material.

2. The LCD device of claim 1, wherein the transparent material is indium tin oxide (ITO) or indium zinc oxide (IZO).

3. The LCD device of claim 1, wherein the first portion of the substrate is adjacent to a side of the first dummy pad; and

wherein the second portion of the substrate formed of a transparent material is adjacent to a side of the second dummy pad.

4. The LCD device of claim 1, wherein the first portion of the substrate is above or below the first dummy pad; and

wherein the second portion of the substrate is above or below the second dummy pad.

5. The LCD device of claim 1, further comprising:

a drive IC having a plurality of signal pads for connection with the plurality of active pads of the at least one of the gate connection terminal and the data connection terminal.

6. The LCD device of claim 5, wherein portions of the drive IC, which overlay the first and second portions of the substrate formed of a transparent material, are formed of a opaque material.

7. The LCD device of claim 5, wherein the drive IC is mounted on a tape carrier package(TCP).

8. The LCD device of claim 7, further comprising:

an alignment key having first portions formed on the TCP and second portions formed on the substrate to permit initial accurate alignment of the plurality of signal pads with the plurality of active pads of the at least one of the gate connection terminal and the data connection terminal.

9. The LCD device of claim 5, further comprising:

an anisotropic conductive film connecting the plurality of signal pads to the plurality of active pads of the at least one of the gate connection terminal and the data connection terminal.

10. The LCD device of claim 9, wherein the anisotropic conductive film includes a plurality of conductive balls.

11. The LCD device of claim 1, wherein the first dummy pad is not connected to a gate line or a data line, and the second dummy pad is not connected to a gate line or a data line.

12. An LCD device comprising:

a substrate;

a pixel part formed on the substrate

a plurality of pixels formed on the pixel part and connected to a plurality of gate lines and plurality of data lines;

a plurality of active gate pads, forming a gate connection terminal on the substrate, the plurality of active gate pads being connected to respective ones of the plurality of gate lines;

a plurality of active data pads, forming a data connection terminal on the substrate, the plurality of data pads being connected to respective ones of the plurality of data lines;

a first dummy pad formed on a first side of at least one of the gate connection terminal and the data connection terminal;

a second dummy pad formed on a second side of the at least one of the gate connection terminal and the data connection terminal;

a drive IC having a plurality of signal pads for connection with the plurality of active pads of the at least one of the gate connection terminal and the data connection terminal,

wherein a first portion of the drive IC, proximate a first side of the signal pads, is formed is of a transparent material, and

wherein a second portion of the drive IC, proximate a second side of the signal pads, is formed is of a transparent material.

13. The LCD device of claim 12, wherein the transparent material is indium tin oxide (ITO) or indium zinc oxide (IZO).

14. The LCD device of claim 12, wherein the first portion of the drive IC will overlay to a side of the first dummy pad when plurality of signal pads are connected with the plurality of active pads of the at least one of the gate connection terminal and the data connection terminal; and

wherein the second portion of the drive IC will overlay to a side of the second dummy pad when plurality of signal pads are connected with the plurality of active pads of the at least one of the gate connection terminal and the data connection terminal.

15. The LCD device of claim 12, wherein the first portion of the drive IC will directly overlay the first dummy pad when plurality of signal pads are connected with the plurality of active pads of the at least one of the gate connection terminal and the data connection terminal; and

wherein the second portion of the drive will directly overlay the second dummy pad when plurality of signal pads are connected with the plurality of active pads of the at least one of the gate connection terminal and the data connection terminal.

16. The LCD device of claim 12, wherein portions of the substrate, which overlay the first and second portions of the drive IC formed of an opaque material.

17. The LCD device of claim 12, wherein the drive IC is mounted on a tape carrier package(TCP).

18. The LCD device of claim 17, further comprising:

an alignment key having first portions formed on said TCP and second portions formed on said substrate to permit initial accurate alignment of said plurality of signal pads with said plurality of active pads of said at least one of said gate connection terminal and said data connection terminal.

19. The LCD device of claim 12, further comprising:

an anisotropic conductive film connecting the plurality of signal pads to the plurality of active pads of the at least one of the gate connection terminal and the data connection terminal.

20. The LCD device of claim 19, wherein the anisotropic conductive film includes a plurality of conductive balls.

21. The LCD device of claim 12, wherein the first dummy pad is not connected to a gate line or a data line, and the second dummy pad is not connected to a gate line or a data line.

22. A method of checking a bonding during the assembly of an LCD device comprising:

a substrate;

a pixel part formed on the substrate

a plurality of pixels formed on the pixel part and connected to a plurality of gate lines and plurality of data lines;

a plurality of active gate pads, forming a gate connection terminal on the substrate, the plurality of active gate pads being connected to respective ones of the plurality of gate lines;

a plurality of active data pads, forming a data connection terminal on the substrate, the plurality of data pads being connected to respective ones of the plurality of data lines;

a first dummy pad formed on a first side of at least one of the gate connection terminal and the data connection terminal;

a second dummy pad formed on a second side of the at least one of the gate connection terminal and the data connection terminal;

a drive IC having a plurality of signal pads for connection with the plurality of active pads of the at least one of the gate connection terminal and the data connection terminal,

the method comprising the steps of:

positioning an anisotropic conductive film between the plurality of active pads of the at least one of the gate connection terminal and the data connection terminal and the plurality of signal pads of the drive IC;

aligning the plurality of signal pads of the drive IC with the plurality of active pads of the at least one of the gate connection terminal and the data connection terminal;

bonding the plurality of signal pads of the drive IC with the plurality of active pads of the at least one of the gate connection terminal and the data connection terminal; and

inspecting the anisotropic conductive film via at least one transparent portion formed in at least one of the drive IC and the substrate.

23. The method of claim 22, wherein the aligning step includes using an alignment key having first portions formed on the drive IC and second portions formed on the substrate to permit initial accurate alignment of the plurality of signal pads with the plurality of active pads of the at least one of the gate connection terminal and the data connection terminal.

24. The method of claim 22, wherein the bonding step includes applying pressure and heat to the anisotropic conductive film.

25. The method of claim 22, wherein the inspecting step includes evaluating a number and state of conductive balls in the anisotropic conductive film as viewed through the at least one transparent portion.

26. The method of claim 22, wherein the at least one transparent portion includes a first transparent portion formed in the substrate, proximate at least one first dummy pad, and a second transparent portion formed in the substrate, proximate at least one second dummy pad.

27. The method of claim 22, wherein the at least one transparent portion includes a first transparent portion formed in the substrate, above or below at least one first dummy pad, and a second transparent portion formed in the substrate, above or below at least one second dummy pad.

28. The method of claim 22, wherein the at least one transparent portion includes a first transparent portion formed in the drive IC, to reside proximate at least one first dummy pad, and a second transparent portion formed in the drive IC, to reside proximate at least one second dummy pad.

29. The method of claim 22, wherein the at least one transparent portion includes a first transparent portion formed in the drive IC substrate, to overlay at least one first dummy pad, and a second transparent portion formed in the drive IC, to overlay at least one second dummy pad.

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专利名称(译)	液晶显示装置和液晶显示面板与驱动IC之间的粘接状态的检查方法		
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摘要(译)

LCD装置包括形成在基板上的像素部分，其中多条栅极线和数据线彼此垂直布置，并且形成多个像素。端子具有形成在基板上的有源焊盘，其将信号传送到像素部分的相应的栅极线和数据线。端子还具有与有源焊盘相邻形成的虚设焊盘，透明材料与虚设焊盘相邻或在虚设焊盘上方，以便检查导电球的受压状态。一种驱动IC，具有带有焊盘的端子，所述焊盘通过导电球与形成在基板上的有源焊盘的焊盘一对一地电连接，因此s将栅极信号和/或数据信号提供给相应的栅极线和/或或数据线。