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(54) **LIQUID CRYSTAL DISPLAY DEVICE**

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(57) **ABSTRACT**

A liquid crystal display device includes a cover bottom, a support main over the cover bottom, a backlight unit surrounded by the support main, a liquid crystal panel over the backlight unit and including first and second substrates with a liquid crystal layer interposed therebetween, a driving circuit on an edge portion of the first substrate, a printed circuit board connected to the driving circuit through a connection means and bent toward one of a side surface of the support main and a rear surface of the cover bottom, and an adhesive tape covering edges of a front surface of the liquid crystal panel and including a conductive layer contacting the liquid crystal panel and the driving circuit, wherein the conductive layer is electrically connected to one of the cover bottom and the printed circuit board.

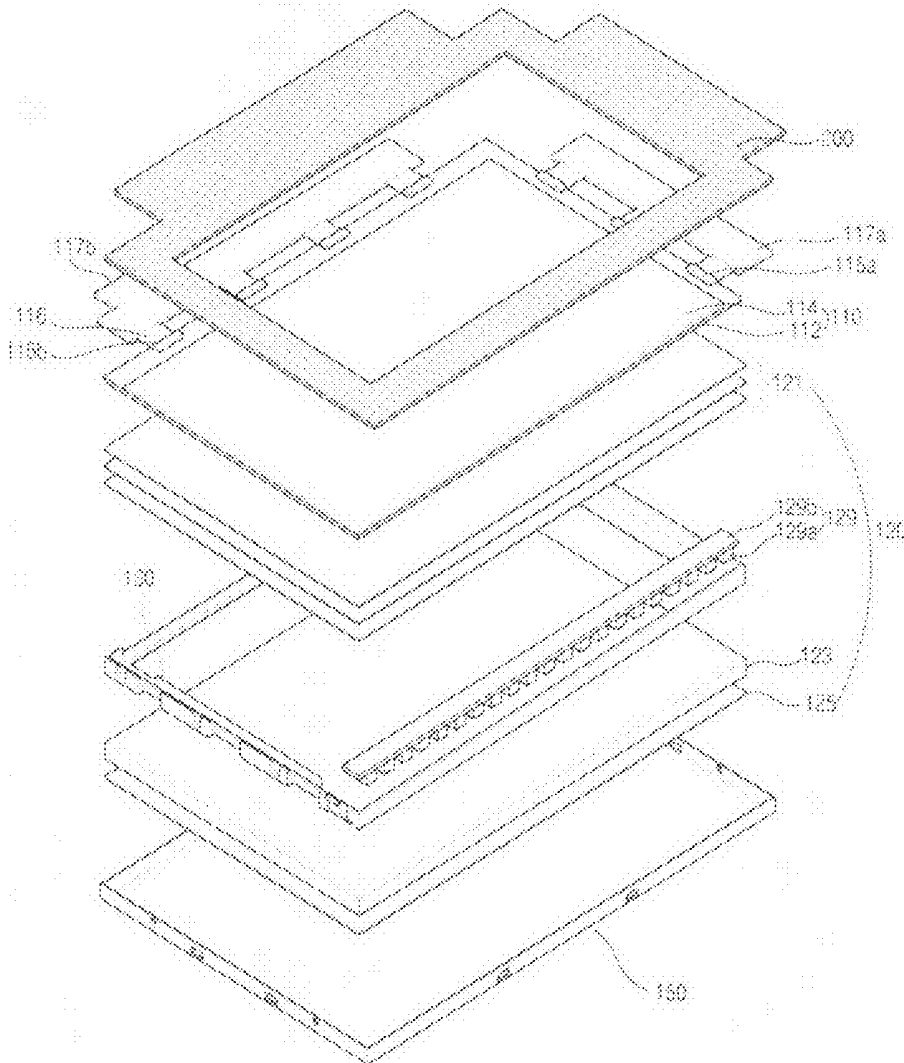
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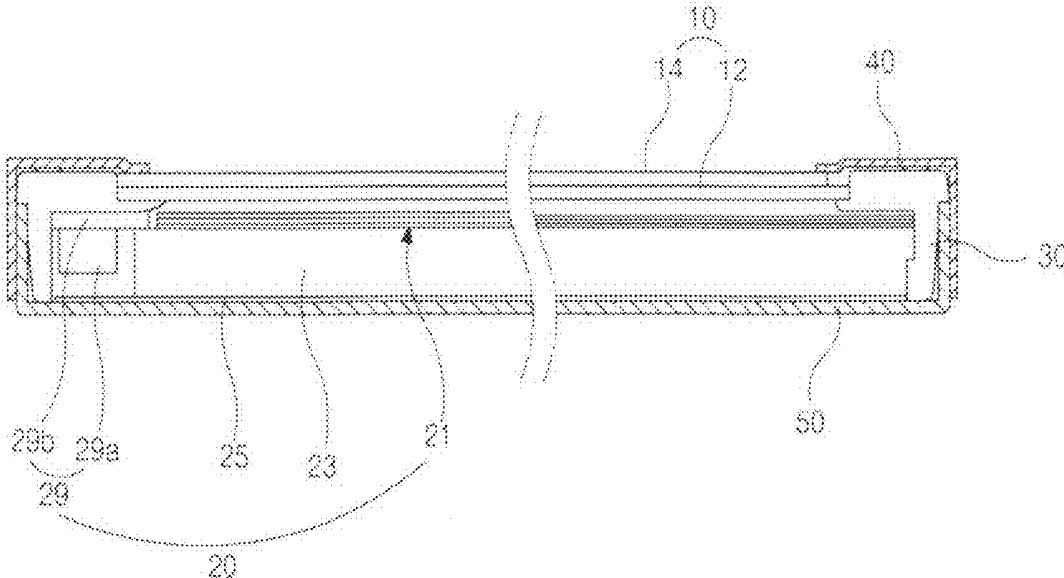


FIG. 1
Related Art

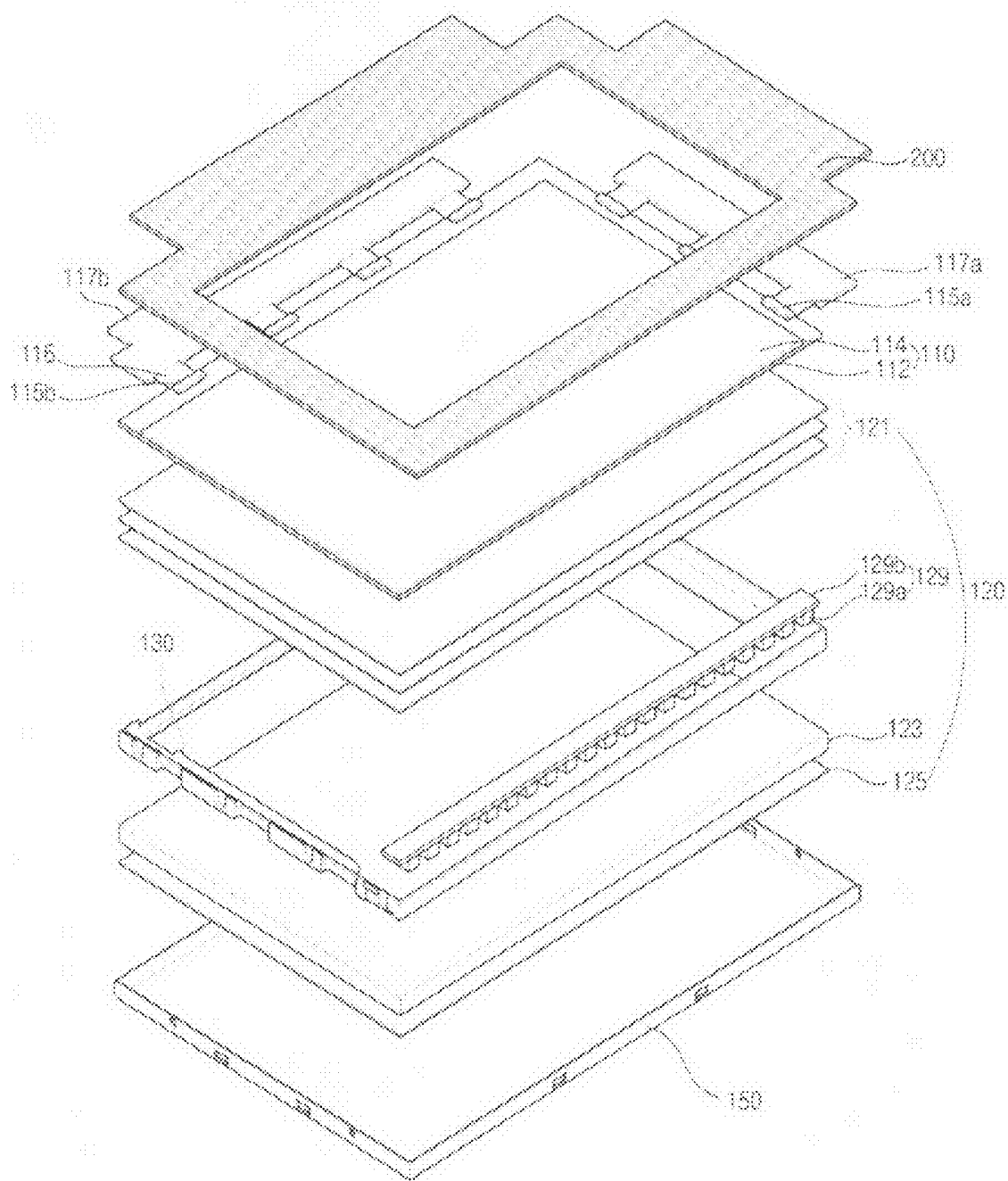


FIG. 2

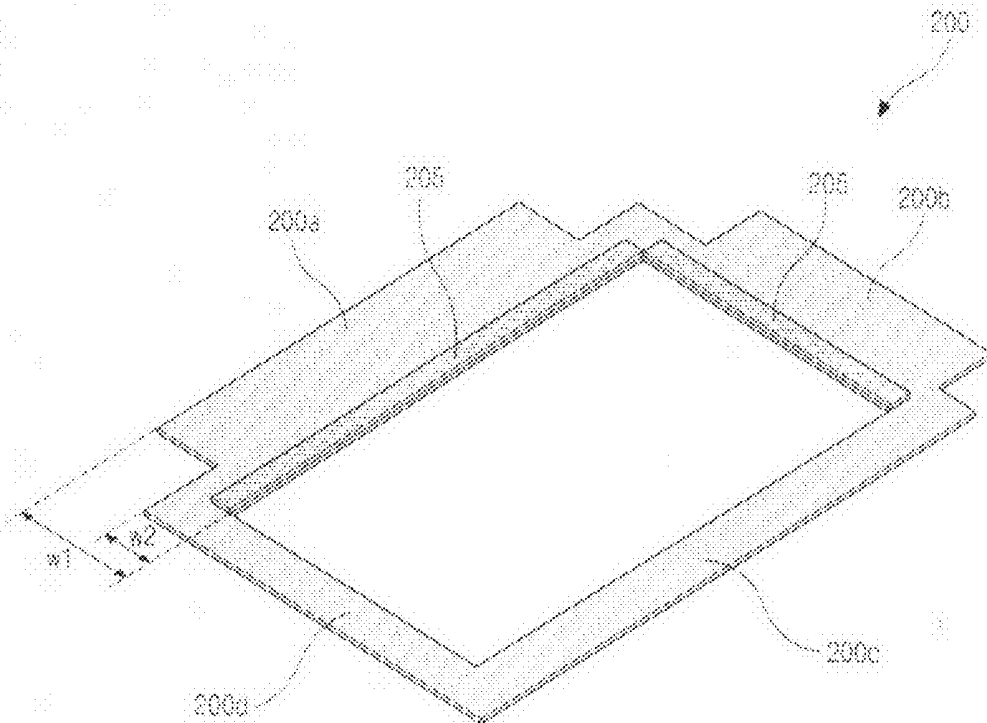


FIG. 3A

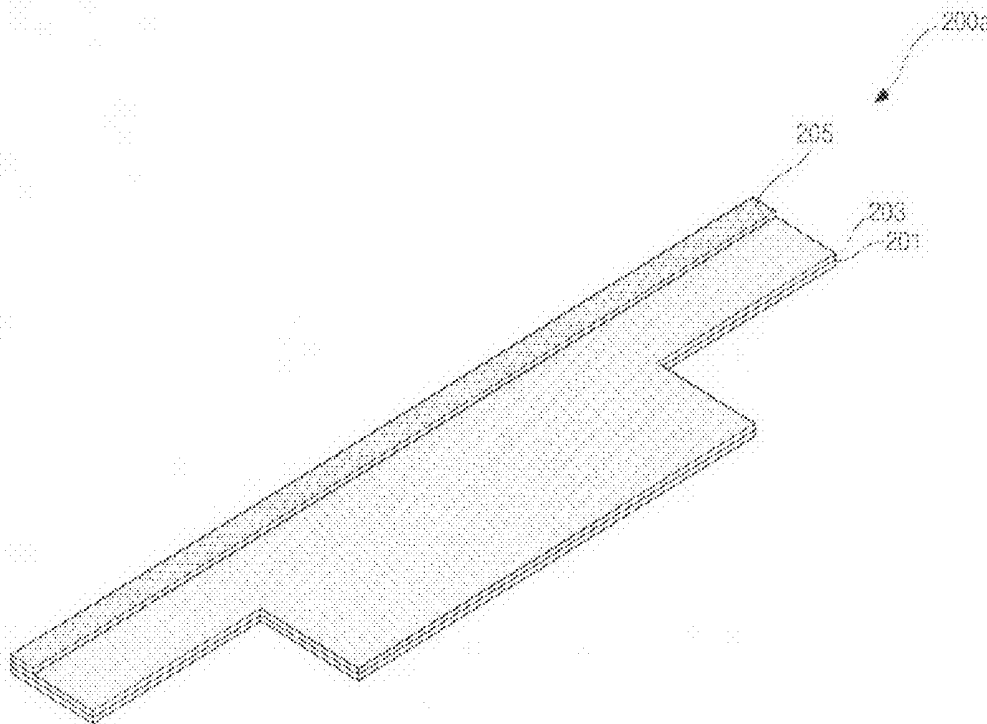


FIG. 3B

LIQUID CRYSTAL DISPLAY DEVICE

[0001] This application claims the benefit of Korean Patent Application No. 10-2008-0055535, filed in Korea on Jun. 13, 2008, 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 invention relates to a liquid crystal display device, and more particularly, to a liquid crystal display device having a thin thickness and light weight.

[0004] 2. Discussion of the Related Art

[0005] With the rapid development of information technology, flat panel display (FPD) devices, such as liquid crystal display (LCD) devices, plasma display panels (PDPs), electroluminescent display (ELD) devices and field emission display (FED) devices, have been developed and have replaced cathode ray tubes (CRTs) because of their thin thickness, light weight, and low power consumption.

[0006] Among these devices, liquid crystal display (LCD) devices widely used for monitors of notebook computers, monitors of personal computers and as displays for televisions because the LCD devices are excellent at displaying moving images and have a high contrast ratio.

[0007] LCD devices are not self-luminescent and require an additional light source. By disposing a backlight unit at the rear side of a liquid crystal panel to emit light into the liquid crystal panel, discernible images can be displayed. Backlight units may include cold cathode fluorescent lamps (CCFLs), external electrode fluorescent lamps (EEFLs) or light-emitting diodes (LEDs) as a light source.

[0008] Recently, the LEDs are widely used as a light source for a display device because of their small sizes, low power consumption and high reliability.

[0009] FIG. 1 is a cross-sectional view illustrating a liquid crystal display (LCD) module including LEDs as a light source according to the related art.

[0010] In FIG. 1, the related art LCD module includes a liquid crystal panel 10, a backlight unit 20, a support main 30, a top cover 40 and a cover bottom 50. The liquid crystal panel 10 displays images and includes first and second substrates 12 and 14 attached with a liquid crystal layer (not shown) interposed therebetween.

[0011] The backlight unit 20 is disposed at a rear side of the liquid crystal panel 10. The backlight unit 20 includes an LED assembly 29, a reflection sheet 25, a light guide plate 23 and a plurality of optical sheets 21. The LED assembly 29 is disposed at an edge of at least one side of the support main 30 along a length direction. The reflection sheet 25 is disposed over the cover bottom 50 and is white- or silver-colored. The light guide plate 23 is disposed over the reflection sheet 25. The plurality of optical sheets 21 are disposed over the light guide plate 23.

[0012] More particularly, the LED assembly 29 is disposed at a side of the light guide plate 23. The LED assembly 29 includes a plurality of LEDs 29a and a flexible printed circuit board (FPCB) 29b on which the LEDs 29a are planted.

[0013] Side surfaces of the liquid crystal panel 10 and the backlight unit 20 are surrounded by the support main 30 having a rectangular frame shape. The top cover 40 covers edges of a front surface of the liquid crystal panel 10, and the cover bottom 50 covers a rear surface of the backlight unit 20.

The top cover 40 and the cover bottom 50 are combined with the support main 30 to thereby constitute one-united body.

[0014] Lights emitted from the LEDs 29a are incident on the side surface of the light guide plate 23 and are refracted toward the liquid crystal panel 10. The lights are changed to have uniform brightness and high qualities through the plurality of optical sheets 21 and are provided to the liquid crystal panel 10. Accordingly, the liquid crystal panel 10 displays images.

[0015] Meanwhile, the LCD device is widely used for monitors of desktop computers or wall mounted televisions as well as portable computers. Studies for an LCD device with remarkably reduced weight and size while having a large display area have been actively made.

[0016] However, since the LCD device includes lots of elements, it is limited to reduce a thickness and a weight of an LCD device. In addition, it is easy that unnecessary electric charges such as static electricity flow into the LCD device, and this affects the arrangement of liquid crystal molecules (not shown) in the liquid crystal panel 10 and do damage to a normal operation. Accordingly, image qualities are lowered.

SUMMARY OF THE INVENTION

[0017] Accordingly, the present invention is directed to a liquid crystal display device that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

[0018] An advantage of the present invention is to provide a liquid crystal display device that has a thin thickness and light weight.

[0019] Another advantage of the present invention is to provide a liquid crystal display device that easily removes unnecessary charges.

[0020] 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. These 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.

[0021] To achieve these and other advantages and in accordance with the purpose of embodiments of the invention, as embodied and broadly described, a liquid crystal display device includes a cover bottom, a support main over the cover bottom, a backlight unit surrounded by the support main, a liquid crystal panel over the backlight unit and including first and second substrates with a liquid crystal layer interposed therebetween, a driving circuit on an edge portion of the first substrate, a printed circuit board connected to the driving circuit through a connection means and bent toward one of a side surface of the support main and a rear surface of the cover bottom, and an adhesive tape covering edges of a front surface of the liquid crystal panel and including a conductive layer contacting the liquid crystal panel and the driving circuit, wherein the conductive layer is electrically connected to one of the cover bottom and the printed circuit board.

[0022] 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 DRAWINGS

[0023] 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.

[0024] In the drawings:

[0025] FIG. 1 is a cross-sectional view illustrating a liquid crystal display (LCD) module including LEDs as a light source according to the related art;

[0026] FIG. 2 is an exploded perspective view of an LCD module according to an exemplary embodiment of the present invention;

[0027] FIGS. 3A and 3B are perspective views schematically illustrating a structure of an adhesive tape according to the exemplary embodiment of the present invention; and

[0028] FIG. 4A is a cross-sectional view of the LCD module of FIG. 2, and FIG. 4B is a view enlarging an area A of FIG. 4A.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

[0029] Reference will now be made in detail to an embodiment of the present invention, an example of which is illustrated in the accompanying drawings.

[0030] FIG. 2 is an exploded perspective view of an LCD module according to an exemplary embodiment of the present invention.

[0031] In FIG. 2, an LCD module includes a liquid crystal panel 110, a backlight unit 120, a support main 130, a cover bottom 150 and an adhesive tape 200.

[0032] More particularly, the liquid crystal panel 110 displays images. The liquid crystal panel 110 includes first and second substrates 112 and 114 facing and attached to each other with a liquid crystal layer interposed therebetween. In an active matrix-type, although shown in the figure, gate lines and data lines are formed on an inner surface of the first substrate 112, which may be referred to as a lower substrate or an array substrate. The gate lines and the data lines cross each other to define pixel regions. A thin film transistor (TFT) is formed at each crossing point of the gate and data lines, and a pixel electrode is connected to the thin film transistor at each pixel region. The pixel electrode may be formed of a transparent conductive material.

[0033] A black matrix and red, green and blue color filter patterns are formed on an inner surface of the second substrate 114, which may be referred to as an upper substrate or a color filter substrate. The color filter patterns corresponding to the pixel regions, respectively. The black matrix surrounds each of the color filter patterns and covers the gate lines, the data lines, and the thin film transistors. A transparent common electrode is formed over the color filter patterns and the black matrix.

[0034] The first substrate 112 has a larger size than the second substrate 114 because the first substrate 112 further includes pad areas as compared with the second substrate 114, and the pad areas, which are two edge portions of the first substrate 112 adjacent to each other, are exposed. Driving circuits 115a and 115b for providing signals to the gate lines and the data lines are disposed in the pad areas. The driving circuits 115a and 115b may have upper surfaces that are treated with synthetic pigments of copper or carbon and are used for screening static electricity.

[0035] The liquid crystal panel 110 having the above-stated structure may be referred to as a chip on glass (COG) type liquid crystal panel, in which the driving circuits 115a and 115b are directly attached on the first substrate 112 using an

anisotropic conductive film (ACF). The COG type liquid crystal panel increases an occupation ratio of the liquid crystal panel in the LCD device.

[0036] The driving circuits 115a and 115b are gate driving circuits and data driving circuits, respectively. The gate driving circuits 115a are connected to the gate lines on the first substrate 112, and the data circuits 116b are connected to the data lines on the first substrate 112.

[0037] The gate and data driving circuit 115a and 115b are connected to gate and data printed circuit boards 117a and 117b through connection means 116, respectively. The gate and data printed circuit boards 117a and 117b are electrically connected to each other. Here, the gate printed circuit board 117a may be omitted, and in this case, the gate driving circuits 115a may be directly connected to the data printed circuit board 117b.

[0038] The gate and data printed circuit boards 117a and 117b are bent toward a side surface of the support main 130 or a rear surface of the cover bottom 150 during a module process.

[0039] Although not shown in the figure, upper and lower alignment layers are interposed between the second substrate 114 and the liquid crystal layer and between the first substrate 112 and the liquid crystal layer, respectively. A seal pattern is formed along edge portions between the first and second substrates 112 and 114 to prevent liquid crystal materials of the liquid crystal layer from leaking.

[0040] Polarizers (not shown) are disposed at outer surfaces of the first and second substrates 112 and 114, respectively.

[0041] The thin film transistors are selected by each gate line and turn on according to scan signals transferred through the gate lines, and data signals are provided to the pixel electrodes through the data lines. According to this, an electric field is induced between the pixel electrodes and the common electrode, and the arrangement of the liquid crystal molecules is changed by the electric field to change transmittance. Therefore, the liquid crystal panel 110 displays variances in the transmittance as images.

[0042] The backlight unit 120 is disposed under and provides light to the liquid crystal panel 110 so that variances in transmittance of the liquid crystal panel 110 are shown to the outside.

[0043] The backlight unit 120 includes a light-emitting diode (LED) assembly 129, a reflection sheet 125 of a white or silver color, a light guide plate 123 over the reflection sheet 125, and optical sheets 121 over the light guide plate 123.

[0044] The LED assembly 129 is disposed at a side of the light guide plate 123, on which light is incident, such that the LED assembly 129 faces the side of the light guide plate 123. The LED assembly 129 includes a plurality of LEDs 129a and a flexible printed circuit board (FPCB) 129b, on which the LEDs 129a are planted to be spaced apart from each other.

[0045] The LEDs 129a include red (R), green (G) and blue (B) LEDs respectively emitting red, green and blue lights toward the side of the light guide plate 123. A white light is produced by lighting the RGB LEDs 129a up at a time and by mixing the red, green and blue lights.

[0046] Each of the LEDs 129a may include an LED chip emitting red, green and blue lights, and each LED 129a may produce a white light. The LED 129a may include a chip emitting a white light and emit a full white light.

[0047] Meanwhile, the LEDs **129a** respectively emitting red, green and blue lights may be mounted as a cluster, and the plurality of LEDs **129a** may be arranged on the FPCB **129b** in a line or in several lines.

[0048] In addition to the LEDs **129a**, fluorescent lamps such as external electrode fluorescent lamps or cold cathode fluorescent lamps may be used as a light source of the backlight unit **120**.

[0049] The light guide plate **123** totally reflects lights emitted from the LEDs **129a** several times such that the lights move through the inside of the light guide plate **123** and are uniformly scattered. Accordingly, an initial flat light source is provided to the liquid crystal panel **110**. To provide a uniform flat light source, the light guide plate **123** may include predetermined patterns at its rear surface.

[0050] The reflection sheet **125** is disposed under the rear surface of the light guide plate **123**. The reflection sheet **125** reflects lights passing through the rear surface of the light guide plate **123** toward the liquid crystal panel **110** to increase the brightness.

[0051] The optical sheets **121** over the light guide plate **123** include a diffuser sheet and at least one light-concentrating sheet. The optical sheets **121** diffuse or concentrate lights passing through the light guide plate **123** such that more uniform flat light source is provided to the liquid crystal panel **110**.

[0052] The liquid crystal panel **110** and the backlight unit **120** may be combined together by the support main **130**, the cover bottom **150** and the adhesive tape **200** to constitute a liquid crystal display module. Here, the support main **130** has a rectangular frame shape surrounding edges of the liquid crystal panel **110** and the backlight unit **120**.

[0053] The cover bottom **150** combined with the support main **130** has a rectangular plate shape, and four edges of the cover bottom **150** are bent perpendicularly toward the liquid crystal panel **110** such that the liquid crystal panel **110** and the backlight unit **120** are disposed in and over cover bottom **150**.

[0054] The support main **130** may be referred to as a guide panel, a main support or a mold frame, and the cover bottom **150** may be referred to as a bottom cover or a lower cover.

[0055] The adhesive tape **200** covers four side surfaces and four edges of an upper surface of the liquid crystal panel **110** and exposes a front surface of the liquid crystal panel **110** such that images displayed by the liquid crystal panel **110** are shown.

[0056] The adhesive tape **200** extends to side surfaces of the support main **130**, and the liquid crystal panel **110**, the support main **130** and the cover bottom **150** are combined together by the adhesive tape **200** to constitute one-united module.

[0057] That is, the edges of the liquid crystal panel **110** and the backlight unit **120** are surrounded by the support main **130**, and the backlight unit **120** is prevented from being detached from the module by the cover bottom **150**.

[0058] In addition, the adhesive tape **200** covers the four side surfaces and the four edges of the upper surface of the liquid crystal panel **110** and prevents the liquid crystal panel **110** from being detached from the module.

[0059] The adhesive tape **200** functions as a top cover **40** of FIG. 1 of the related art. In the present invention, since the top cover is omitted, the liquid crystal display module can have a thin thickness. Additionally, the process is simplified, and it is

easy to reassemble the module. Moreover, since the top cover of a metallic material is eliminated, process costs can be reduced.

[0060] In the meantime, the liquid crystal panel **110** and the driving circuits **115a** and **115b** are grounded by the adhesive tape **200** that is attached to the two edge portions of the liquid crystal panel **110**, which are adjacent to each other and in which the driving circuits **115a** and **115b** are disposed, and thus the static electricity can be removed. This will be described in more detail with reference to accompanying drawings.

[0061] FIGS. 3A and 3B are perspective views schematically illustrating a structure of an adhesive tape according to the exemplary embodiment of the present invention.

[0062] In FIG. 3A, the adhesive tape **200** has a rectangular frame shape. The adhesive tape **200** includes first, second, third and fourth parts **200a**, **200b**, **200c** and **200d**. The first part **200a** corresponds to the data printed circuit board **117b** of FIG. 2, and the second part **200b** corresponds to the gate printed circuit board **117a** of FIG. 2. The third part **200c** is opposite to and faces the first part **200a**, and the fourth part **200d** is opposite to and faces the second part **200b**.

[0063] The first, second, third and fourth parts **200a**, **200b**, **200c** and **200d** of the adhesive tape **200** have a width w_2 such that the first, second, third and fourth parts **200a**, **200b**, **200c** and **200d** cover the side surfaces and edges of the upper surface of the liquid crystal panel **110** of FIG. 2. The first and second parts **200a** and **200b** corresponding to the gate and data printed circuit boards **117a** and **117b** of FIG. 2 of the liquid crystal panel **110** of FIG. 2 partially have a width w_1 wider than the width w_2 . Accordingly, the first and second parts **200a** and **200b** are partially wider than the third and fourth parts **200c** and **200d**. This is to cover and protect the gate and data printed circuit boards **117a** and **117b** of FIG. 2, which are connected to the driving circuits **115a** and **115b** of FIG. 2 through the connection means **116** of FIG. 2 and are bent toward a side surface of the support main **130** of FIG. 2 or a rear surface of the cover bottom **150** of FIG. 2 during a module assembly process.

[0064] Accordingly, the third and fourth parts **200c** and **200d** have the width w_2 , which is able to cover some edges of the upper surface and some side surfaces of liquid crystal panel **110** of FIG. 2 and some side surfaces of the support main **130** of FIG. 2 in the module. The first and second parts **220a** and **220b** partially have the width w_1 , which extend onto the rear surface of the cover bottom **150** of FIG. 2 and is able to cover other edges of the upper surface and other side surfaces of liquid crystal panel **110** of FIG. 2 and other side surfaces of the support main **130** of FIG. 2 in the module and to cover the gate and data printed circuit boards **117a** and **117b** of FIG. 2 disposed on the rear surface of the cover bottom **150** of FIG. 2.

[0065] Here, the gate printed circuit board **117a** may be omitted, and at this time, the second part **200b** of the adhesive tape **200** may have the same width of the third and fourth parts **200c** and **200d**.

[0066] Meanwhile, a conductive metallic layer **205** is formed on each of the first and second parts **200a** and **200b**.

[0067] Referring to FIG. 3B showing the first part of the adhesive tape, the first part **200a** has substantially a bar shape. The first part **200a** includes a base film **201** of a polyethylene terephthalate (PET) resin and an adhesive material layer **203**. Further, a conductive metallic layer **205** is formed on the adhesive material layer **203** along a length direction of the

first part **200a**. The conductive metallic layer **205** is disposed on an inward edge of the first part **200a** and is formed of a conductive material such as aluminum (Al). The second part **200b** has the same structure as the first part **200a**.

[0068] The first and second parts **200a** and **200b** of the adhesive tape **200** are attached at two edge portions of the liquid crystal panel **110**, which are adjacent to each other and in which the driving circuits **115a** and **115b** are disposed. At this time, the conductive metallic layers **205** of the first and second parts **200a** and **200b** have a wider width than those of the driving circuits **115a** and **115b** of FIG. 2 disposed in the pad areas of the liquid crystal panel **110** of FIG. 2. The conductive metallic layers **205** of the first and second parts **200a** and **200b** completely cover the upper surfaces of the driving circuits **115a** and **115b** of FIG. 2 and partially contact the edge portions of the liquid crystal panel **110** of FIG. 2.

[0069] Accordingly, the conductive metallic layers **205** of the first and second parts **200a** and **200b** contact the liquid crystal panel **110** of FIG. 2 and also contact the upper surfaces of the driving circuits **115a** and **115b** of FIG. 2, and the liquid crystal panel **110** of FIG. 2 and the driving circuits **115a** and **115b** of FIG. 2 is grounded to the outside through the conductive metallic layer **205** of the adhesive tape **200** to remove the static electricity created in the liquid crystal panel **110** of FIG. 2 and the driving circuits **115a** and **115b** of FIG. 2.

[0070] Here, the outside may be the cover bottom **150** of FIG. 2 having a ground potential or the printed circuit boards **117a** and **117b** of FIG. 2 including ground pads (not shown). Unnecessary charges such as the static electricity created in the liquid crystal panel **110** of FIG. 2 and the driving circuits **115a** and **115b** of FIG. 2 are easily discharged and removed.

[0071] FIG. 4A is a cross-sectional view of the LCD module of FIG. 2, and FIG. 4B is a view enlarging an area A of FIG. 4A.

[0072] In FIG. 4A and FIG. 4B, the reflection sheet **125**, the light guide plate **123**, the LED assembly **129** at the side of the liquid guide plate **123**, and the plurality of optical sheets **121** over the light guide plate **123** are sequentially disposed to constitute the backlight unit **120**.

[0073] The liquid crystal panel **110** including the first and second substrates **112** and **114** and the liquid crystal layer (not shown) interposed therebetween is disposed over the backlight unit **120**. First and second polarizers **119a** and **119b** are disposed at outer surfaces of the first and second substrates **112** and **114**, respectively. The first and second polarizers **119a** and **119b** selectively transmit light polarized in a certain direction.

[0074] As stated above, the second substrate **114** has a smaller size than the first substrate **112** and exposes the edge portion of the first substrate **112**. Even though not shown in the figures, adjacent edges portions of the first substrate **112** are exposed. The driving circuit **115** is mounted in the edge portion of the first substrate **112** by the COG method. The upper surface of the driving circuit **115** is treated to block the static electricity.

[0075] The printed circuit board **117** is connected to the driving circuit **115** through the connection means **116** and is bent toward the side surface of the support main **130** or the rear surface of the cover bottom **150**.

[0076] The side surfaces of the backlight unit **120** and the liquid crystal panel **110** are surrounded by the support main **130**, and the cover bottom **150** is combined with the support main **130**.

[0077] The adhesive tape **200** covers the side surfaces and the edge portions of the upper surface of the liquid crystal panel **110** and the side surfaces of the support main **130**. The adhesive tape **200** extends onto the rear surface of the cover bottom **150**. The backlight unit **120**, the liquid crystal panel **110**, the support main **130** and the cover bottom **150** are combined together by the adhesive tape **200** to constitute one-united module.

[0078] Here, the adhesive tape **200** is attached and fixed to the upper surface and the side surface of the liquid crystal panel **110**, the side surface of the support main **130**, and the rear surface of the cover bottom **150** through the adhesive material layer **203** of FIG. 3.

[0079] Accordingly the adhesive tape **200** covers and protects the printed circuit board **117**, which is bent toward the side surface of the support main **130** or the rear surface of the cover bottom **150**, from the outside.

[0080] At this time, the adhesive tape **200** does not cover the second polarizer **119b**, and thus the thickness of the LCD module can be decreased by the thickness of the second polarizer **119b**.

[0081] Here, the conductive metallic layer **205**, which is formed on an inward edge of a lower surface of the adhesive tape **200**, partially contacts an edge portion of the outer surface of the second substrate **114** of the liquid crystal panel **110** and also contacts the upper surface of the driving circuit **115** on the first substrate **112** of the liquid crystal panel **110**.

[0082] According to this, the liquid crystal panel **110** and the driving circuit **115** are grounded to the outside through the conductive metallic layer **205** of the adhesive tape **200**, and the static electricity created in the liquid crystal panel **110** and the driving circuit **115** are removed. Therefore, various signals for operating the liquid crystal panel **110** and the driving circuit **115** are prevented from being interfered with the static electricity.

[0083] Meanwhile, a protection pad **118** may be further formed at a side of the driving circuit **115** on the first substrate **112** such that the conductive metallic layer **205** of the adhesive tape **200** does not directly contact the pad area of the first substrate **112**.

[0084] That is, copper patterns (not shown) for mounting the driving circuit **115** are formed in the pad area of the first substrate **112**. If the conductive metallic layer **205** contacts the patterns, there may occur electrical shocks, and this may cause abnormal operations. Therefore, the conductive metallic layer **205** is prevented from contacting the pad area of the first substrate **112**.

[0085] When adhesive tape **200** is attached to the liquid crystal panel **110** by hand of an operator, the conductive metallic layer **205** of the adhesive tape **200** may contact the pad area of the first substrate **112** of the liquid crystal panel **110**. To prevent this beforehand, the protection pad **118** is further formed at the side of the driving circuit **115**, that is, in the pad area of the first substrate **112**.

[0086] The protection pad **118** may include a PET resin layer and an adhesive material layer, and the protection pad **118** does not have a conductive property.

[0087] Table 1 shows operating properties of LCD modules with and without a static electricity-shielding structure according to the present invention and the related art. That is, the LCD module of the related art does not include the static electricity-shielding structure such as the conductive metallic layer **205** of the adhesive tape **200** of FIGS. 4A and 4B. The LCD module of the present invention includes the static electricity-shielding structure such as the conductive metallic layer **205** of the adhesive tape **200** of FIGS. 4A and 4B.

TABLE 1

classification		data						
related art	voltage	8 kV	9 kV	17 kV	18 kV	19 kV	25 kV	
	grade	B	D	—	—	—	—	
present invention	module 1	B	D	—	—	—	—	
	module 2	B	D	—	—	—	—	
	voltage	15 kV	16 kV	17 kV	18 kV	19 kV	25 kV	
	grade	B	B	B	B	B	B	
	module 1	B	B	B	B	B	B	
	module 2	B	B	B	B	B	C	

[0088] Here, grade B means the state of the LCD module that instantly abnormally operates and normally operates at once. Grade C means the state of the LCD module that abnormally operates for a considerable time and then normally operates. Grade D means the state of the LCD module that completely abnormally operates.

[0089] From Table 1, the LCD module of the related art abnormally operates when a static electricity testing voltage of 9 kV is applied to the module. More particularly, when the static electricity of more than 9 kV occurs in the LCD module, the static electricity affects the arrangement of the liquid crystal molecules in the liquid crystal panel and impedes a normal operation, and the driving circuits are damaged.

[0090] On the other hand, in the present invention, since the static electricity of the liquid crystal panel 110 and the driving circuit 115 is removed through the adhesive tape 200, the LCD module of the present invention normally operates even if the static electricity of more than 19 kV is applied to the module.

[0091] As mentioned above, the adhesive tape 200 covers the side surfaces and the edge portions of the upper surface of the liquid crystal panel 110 and extends to the side portions of the support main 130. The adhesive tape 200 enables the liquid crystal panel 110, the support main 130 and the cover bottom 150 to be one-united module. Accordingly, the related art top cover can be omitted, and the LCD module can have a thin thickness. In addition, the process is simplified, and it is easy to reassemble the module.

[0092] At this time, in the LCD module including the liquid crystal panel 110 on which the driving circuits 115 are mounted by the COG method, the adhesive tape 200 further includes the conductive metallic layer 205 contacting the liquid crystal panel 110 and the driving circuit 115. Therefore, the static electricity created in the liquid crystal panel 110 and the driving circuit 115 is grounded to the outside through the conductive metallic layer 205 of the adhesive tape 200 and is removed.

[0093] The above-mentioned backlight unit 120 has the LED assembly 129 at a side of the light guide plate 123, which may be referred to as a side light type, and the LED assembly 129 may be disposed at each of opposite sides of the light guide plate 123 inside of both sides of the support main 130 facing each other along a length direction.

[0094] 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 liquid crystal display device, comprising:

- a cover bottom;
 - a support main over the cover bottom;
 - a backlight unit surrounded by the support main;
 - a liquid crystal panel over the backlight unit and including first and second substrates with a liquid crystal layer interposed therebetween;
 - a driving circuit on an edge portion of the first substrate;
 - a printed circuit board connected to the driving circuit through a connection means and bent toward one of a side surface of the support main and a rear surface of the cover bottom; and
 - an adhesive tape covering edges of a front surface of the liquid crystal panel and including a conductive layer contacting the liquid crystal panel and the driving circuit,
- wherein the conductive layer is electrically connected to one of the cover bottom and the printed circuit board.

2. The device according to claim 1, further comprising a protection pad at a side of the driving circuit.

3. The device according to claim 1, wherein the adhesive tape includes first, second, third and fourth parts and has a rectangular frame shape.

4. The device according to claim 3, wherein the conductive layer is formed on an inward portion of the first part along a length direction of the first part and has a wider width than the driving circuit.

5. The device according to claim 4, wherein the first part of the adhesive tape is partially wider than the third and fourth parts of the adhesive tape.

6. The device according to claim 4, wherein the first part of the adhesive tape extends onto the rear surface of the cover bottom.

7. The device according to claim 6, wherein the first part of the adhesive tape covers the printed circuit board.

8. The device according to claim 1, wherein the conductive layer corresponds to a side of the liquid crystal panel connected to the printed circuit board.

9. The device according to claim 1, wherein the conductive layer includes aluminum.

10. The device according to claim 1, wherein the adhesive tape includes a base film of a polyethylene terephthalate (PET) resin and an adhesive material layer.

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专利名称(译)	液晶显示装置		
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摘要(译)

一种液晶显示装置，包括盖底，盖底上方的支撑主体，由支撑主体围绕的背光单元，位于背光单元上方的液晶面板，并包括其间插入有液晶层的第一和第二基板，在第一基板的边缘部分上的驱动电路，通过连接装置连接到驱动电路并朝向支撑主体的侧表面和盖底的后表面中的一个弯曲的印刷电路板，以及胶带覆盖物所述液晶面板的前表面的边缘包括与所述液晶面板和所述驱动电路接触的导电层，其中所述导电层电连接到所述盖底和所述印刷电路板中的一个。

