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(54) **LIQUID CRYSTAL DEVICE AND METHOD OF FABRICATING LIQUID CRYSTAL DISPLAY DEVICE MODULE INCLUDING THE SAME**

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(57) **ABSTRACT**

A liquid crystal display device includes a liquid crystal panel; a main frame surrounding sides of the liquid crystal panel; a backlight unit disposed under the liquid crystal panel and surrounded by the main frame, the backlight unit including a light guide plate, a lamp at a side of the light guide plate, a reflector under the light guide plate and an optical sheet on the light guide plate, wherein a rear surface of the reflector is exposed through an opening of the main frame; and a protection sheet attached to the rear surface of the reflector to protect the rear surface of the reflector and including a protruding part at a side of the protection sheet, the protection sheet has a rectangular shape.

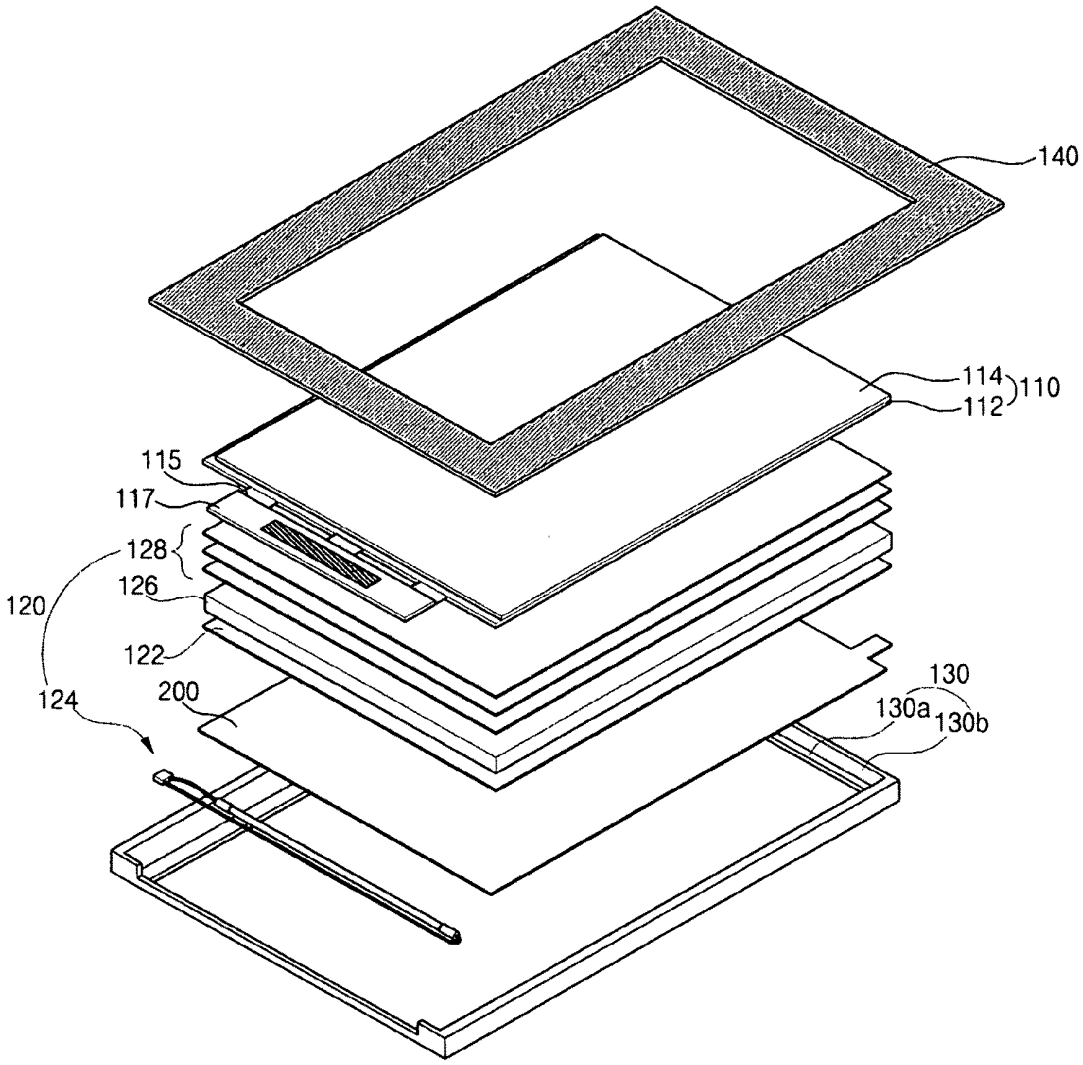


FIG. 1
RELATED ART

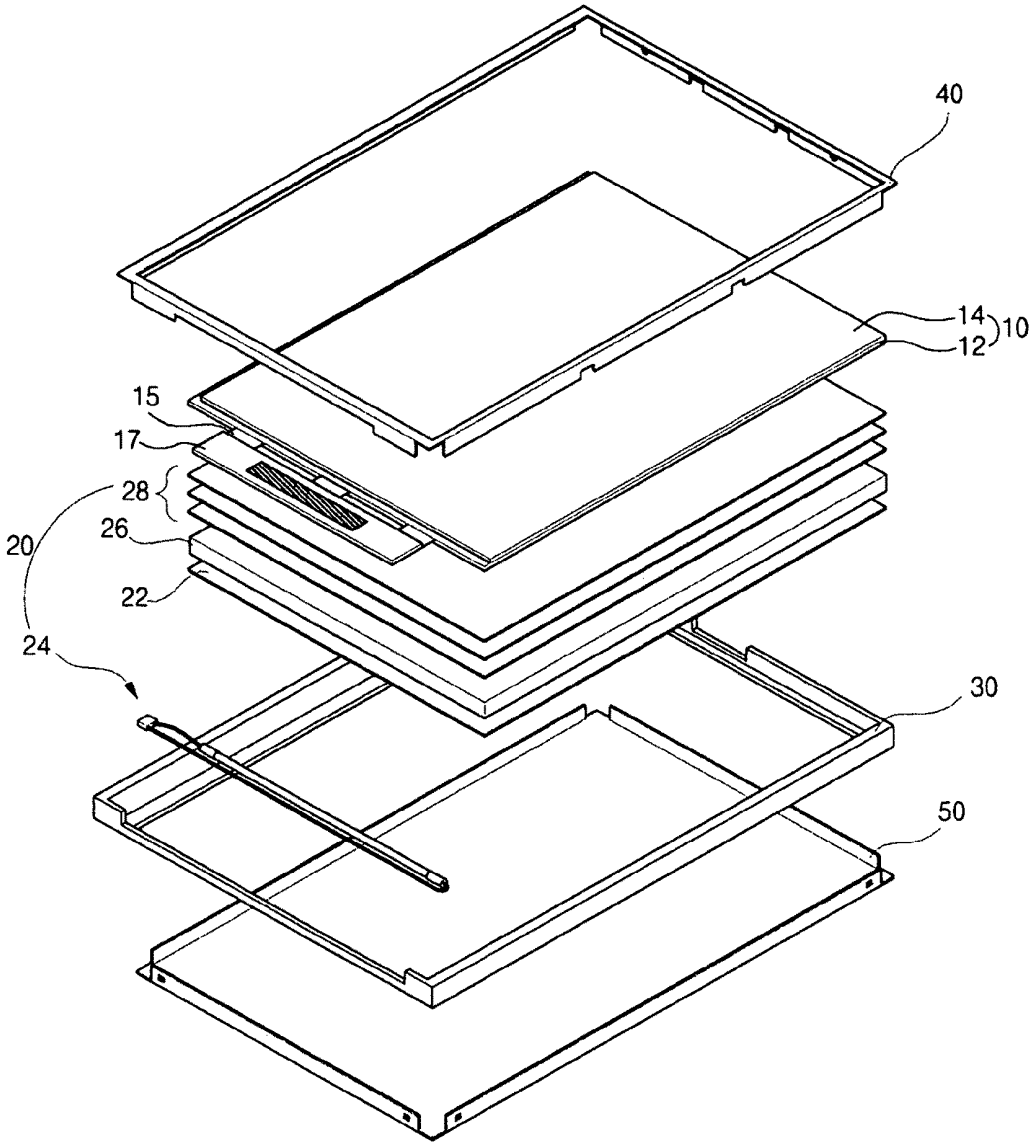


FIG. 2

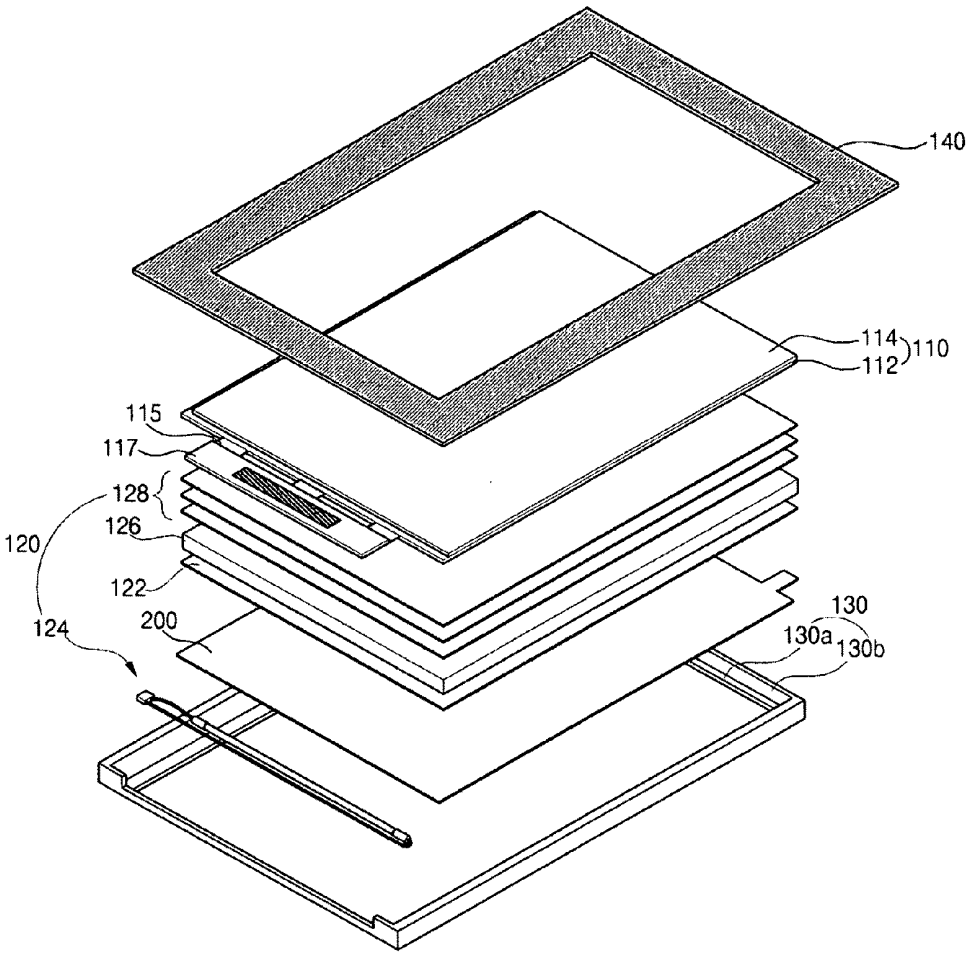


FIG. 3

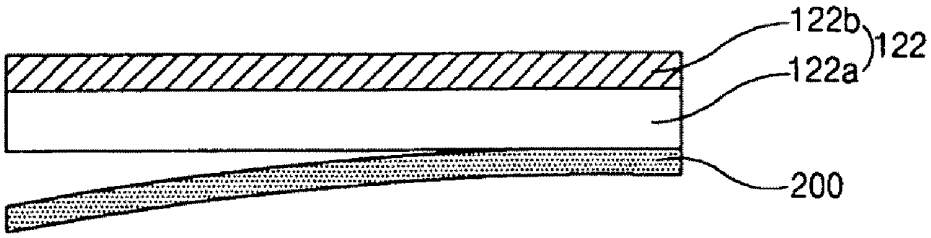


FIG. 4

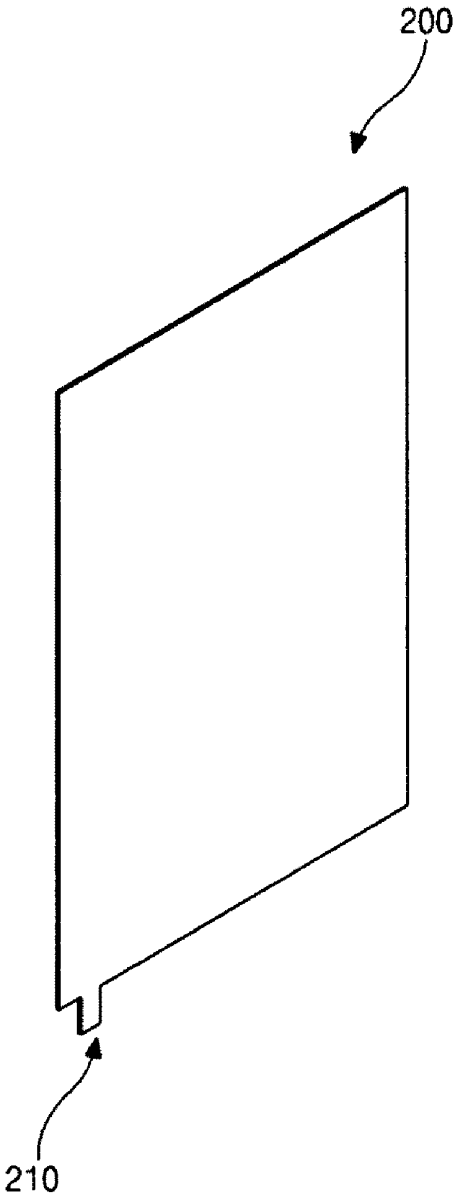


FIG. 5A

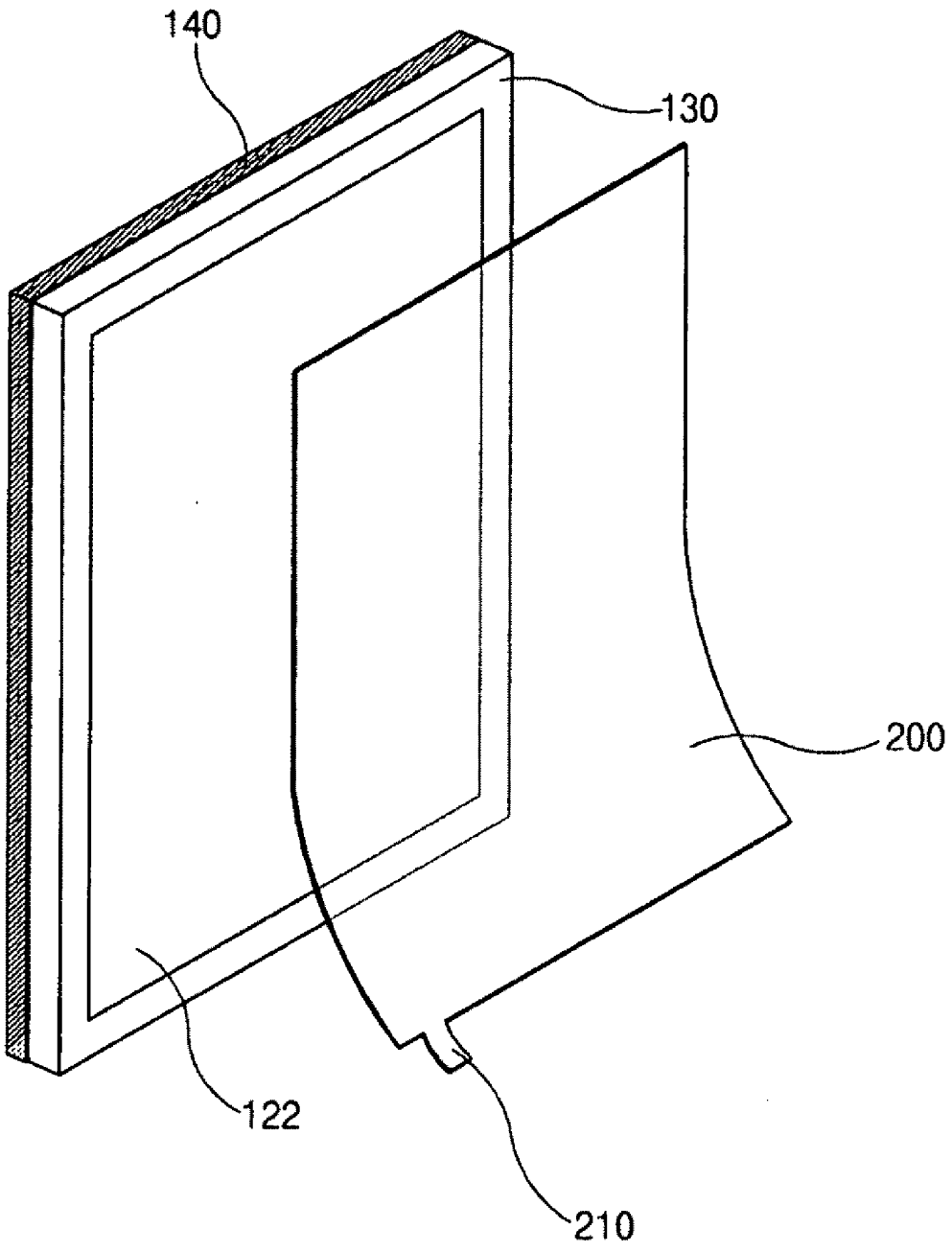
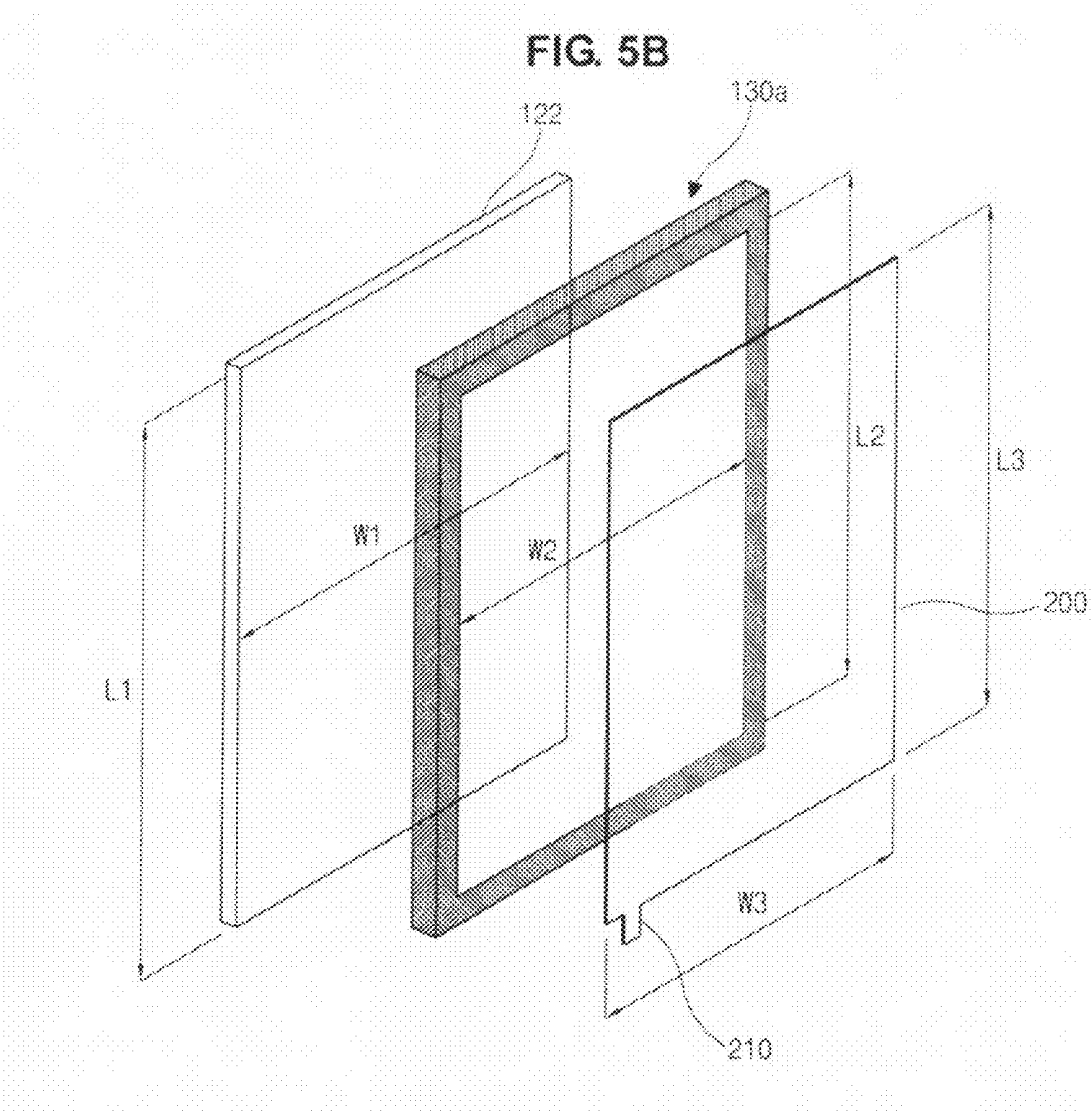


FIG. 5B



LIQUID CRYSTAL DEVICE AND METHOD OF FABRICATING LIQUID CRYSTAL DISPLAY DEVICE MODULE INCLUDING THE SAME

[0001] The present application claims the benefit of Korean Patent Application No. 10-2009-0040336 filed in Korea on May 8, 2009, 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 (LCD) device and more particularly to an LCD device having a thin profile and a light weight and a method of fabricating an LCD device module including the LCD device.

[0004] 2. Discussion of the Related Art

[0005] Flat panel display devices, such as, liquid crystal display (LCD) devices, plasma display panels (PDPs), electroluminescent display (ELD) devices and field emission display (FED) devices, are widely used instead of a cathode ray tube (CRT) because of their advantages of a thin profile, a light weight, and a high efficiency.

[0006] Among these devices, the LCD devices are most widely used for a notebook computer, a monitor and a television because of their high contrast ratio and characteristics adequate to display moving images.

[0007] Generally, an additional light source is required because the LCD panel is a non-emissive-type display device. Accordingly, a backlight unit is disposed under the LCD panel. The LCD device displays images using light produced by the backlight unit and supplied to the LCD panel.

[0008] FIG. **1** is a schematic exploded perspective view of the related art LCD device. In FIG. **1**, the LCD device includes a liquid crystal panel **10**, a backlight unit **20**, a main frame **30**, a top frame **40** and a bottom frame **50**.

[0009] The liquid crystal panel **10** includes a first substrate **12**, a second substrate **14** and a liquid crystal layer (not shown). The first and second substrates **12** and **14** face each other, and the liquid crystal layer is interposed therebetween. A printed circuit board (PCB) **17** is connected to one side of the liquid crystal panel **10** via a connection member **15**.

[0010] The backlight unit **20** is disposed under the liquid crystal panel **10**. The backlight unit **20** includes a lamp **24** as a light source, a reflector **22**, a light guide plate **26** and an optical sheet **28**. The lamp **24** is arranged along at least one side of the main frame **30**. The reflector **22** is disposed on the bottom frame **50** and has a color of white or silver. The light guide plate **26** is disposed on the reflector **22**, and the optical sheet **28** is disposed on or over the light guide plate **26**.

[0011] The liquid crystal display panel **10** and the backlight unit **20** are combined using the main frame **30** that can prevent movement of the liquid crystal panel **10** and the backlight unit **20**. The top frame **40** cover edges of the liquid crystal panel **10** and sides of the main frame **30**, so the top frame **40** can support and protect of the edges of the liquid crystal panel **10** and sides of the main frame **30**. The bottom frame **50** covers back edges of the main frame **30**, so the bottom frame **50** is combined with the main frame **30** and the top frame **40** for modulation.

[0012] Light from the lamp **24** is illuminated onto the liquid crystal panel **10** through the light guide plate **26** and the optical sheet **28** such that the LCD can display images. The light is processed into a uniform plane light through the light guide plate **26** and the optical sheet **28**.

[0013] Recently, the LCD device is used for not only a portable computer but also a monitor of a desktop computer and a wall-mounted television. Accordingly, the LCD device having a large displaying area and a light weight and a small volume is required. Unfortunately, since the LCD device includes too many elements, it is very difficult to meet the above requirements. For example, if the bottom frame is eliminated to meet the requirements, there may be damage to the reflector because the reflector is exposed.

SUMMARY OF THE INVENTION

[0014] Accordingly, the present invention is directed to a liquid crystal display device and method of fabricating liquid crystal display device module including the same that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

[0015] An advantage of the present invention is to provide a LCD device having a light weight and a thin profile.

[0016] Another advantage of the present invention is to provide a LCD device being capable of efficiently protecting their elements.

[0017] 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.

[0018] To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, a liquid crystal display device includes a liquid crystal panel; a main frame surrounding sides of the liquid crystal panel; a backlight unit disposed under the liquid crystal panel and surrounded by the main frame, the backlight unit including a light guide plate, a lamp at a side of the light guide plate, a reflector under the light guide plate and an optical sheet on the light guide plate, wherein a rear surface of the reflector is exposed through an opening of the main frame; and a protection sheet attached to the rear surface of the reflector to protect the rear surface of the reflector and including a protruding part at a side of the protection sheet, the protection sheet has a rectangular shape.

[0019] In another aspect, a method of fabricating a liquid crystal display device module includes forming a liquid crystal display device including: a liquid crystal panel; a main frame surrounding sides of the liquid crystal panel; a backlight unit disposed under the liquid crystal panel and surrounded by the main frame, the backlight unit including a light guide plate, a lamp at a side of the light guide plate, a reflector under the light guide plate and an optical sheet on the light guide plate, wherein a rear surface of the reflector is exposed through an opening of the main frame; and a protection sheet attached to the rear surface of the reflector to protect the rear surface of the reflector and including a protruding part at a side of the protection sheet, the protection sheet has a rectangular shape; detaching the protection sheet from the reflective sheet using the protruding part; and modulating the liquid crystal display device with a case.

[0020] It is to be understood that both the foregoing general description and the following detailed description are exem-

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

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] 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.

[0022] FIG. **1** is a schematic exploded perspective view of the related art LCD device;

[0023] FIG. **2** is a schematic exploded perspective view of a LCD device according to the present invention;

[0024] FIG. **3** is a schematic cross-sectional view of a reflector for a LCD device according to the present invention;

[0025] FIG. **4** is a schematic cross-sectional view of a protection sheet for a LCD device according to the present invention; and

[0026] FIGS. **5**A and **5**B are a schematic view illustrating a figure of detaching a protection sheet from a reflector, respectively.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

[0027] Reference will now be made in detail to the preferred embodiments, examples of which are illustrated in the accompanying drawings.

[0028] FIG. **2** is a schematic exploded perspective view of a LCD device according to the present invention. In FIG. **2**, an LCD device includes a liquid crystal panel **110**, a backlight unit **120**, a main frame **130** and adhesive tape **140**.

[0029] The liquid crystal panel **110** includes a first substrate **112**, a second substrate **114** and a liquid crystal layer (not shown). The first and second substrates **112** and **114** face each other, and the liquid crystal layer is interposed therebetween. Assuming the liquid crystal panel **110** is driven by an active matrix type, a gate line (not shown) and a data line (not shown) are formed on the first substrate **112**. The gate and data lines cross each other to define a pixel. A thin film transistor (TFT) (not shown) is also formed on the first substrate **112** and positioned at a crossing portion of the gate and data lines. In addition, a pixel electrode (not shown) is positioned in each pixel and connected to the pixel electrode. The first substrate **112** may be called as an array substrate. On the other hand, red, green and blue color filters (not shown) are formed on the second substrate **114**. In addition, a black matrix (not shown) for shielding the gate and data lines and the TFT and a common electrode for generating an electric field with the pixel electrode is formed on the second substrate **114**. The second substrate **114** may be called a color filter substrate. A printed circuit board (PCB) **117** is connected to one side of the liquid crystal panel **110** via a connection member **115**. The PCB **117** is bent along a side surface of the main frame **130** or a rear surface of the backlight unit **120** during a modulation process of the LCD device.

[0030] Although not shown, orientation layers for controlling an initial arrangement of liquid crystal molecules in the liquid crystal layer are formed on each of the first and second substrates **112** and **114** to face the liquid crystal layer. A seal pattern is formed along edges of the first and second substrates **112** and **114** to prevent leakage of the liquid crystal layer. A polarizing plate is formed on an outer surface of each of the first and second substrates **112** and **114**.

[0031] The backlight unit **120** is disposed under the liquid crystal panel **110** such that light is illuminated onto the liquid crystal panel **110**. The backlight unit **120** includes a lamp **124** as a light source, a reflector **122**, a light guide plate **126** and an optical sheet **128**. The lamp **124** is arranged along at least one side of the main frame **130**. The reflector **122** is disposed under the light guide plate **126** and has a color of white or silver. The light guide plate **126** is disposed on the reflector **122**, and the optical sheet **128** is disposed on or over the light guide plate **126**. Although not shown, a light shielding tape may be formed between the liquid crystal panel **110** and the optical sheet **128** to prevent for the light from passing through a non-display region of the liquid crystal panel **110**. In addition, a lamp guide for guiding the lamp **124** may be formed. A side of the lamp guide facing the light guide plate **126** is opened, and other portions of the lamp guide covering the lamp **124**. The lamp guide protects the lamp **124**, and light from the lamp **124** is concentrated to the light guide plate **126** due to the lamp guide. One of a cold cathode fluorescent lamp (CCFL), an external electrode fluorescent lamp, and an LED is used as a lamp **124**. The lamp guide may be not required for the LED.

[0032] The light from the lamp **124** is diffused and processed to a plane light source by a total reflection through the light guide plate **126**. The light guide plate **126** may include a pattern on a rear surface of the light guide plate **126** to improve uniformity of the light. The pattern of the light guide plate **126** may be one of an elliptical shape, a polygonal shape and a hologram shape. The pattern is formed by a printing method or an injection molding method.

[0033] The reflector **122** is disposed at a rear side of the light guide plate **126** and reflects the light to provide the liquid crystal panel **110** such that light brightness is improved. The optical sheet **128** on the light guide plate **126** includes one diffusion sheet and at least one light concentration sheet. The diffusion sheet is disposed directly on the light guide plate **126**. The diffusion sheet diffuses the light through the light guide plate **126** and controls light direction such that the light is illuminated to the concentration sheet. The diffused light by the diffusion sheet is concentrated by the light concentration sheet to have a substantially vertical direction related to the liquid crystal display panel **110**.

[0034] The above backlight unit **120** may be called as a side light type. Namely, the lamp **124** is arranged along one side of the main frame **130**. The lamp **124** may be further arranged along any side of the main frame **130**.

[0035] The liquid crystal panel **110** and the backlight unit **120** are mounted with the main frame **130** using the adhesive tape **140**. The main frame **130** has a rectangular frame shape. The main frame **130** includes a horizontal portion **130***a* and a vertical portion **130***b* perpendicular to the horizontal portion **130***a*. The horizontal portion **130***a* covers rear edges of the backlight unit **120**, and the vertical portion **130***b* covers a side of each of the liquid crystal panel **110** and the backlight unit **120**. In other words, the rear edges of the backlight unit **120** are supported by the horizontal portion **130***a* of the main frame **130**, and the sides of the liquid crystal panel **110** and the backlight unit **120** are supported by the vertical portion **130***b* of the main frame **130**. The main frame **130** may be called as a guide panel, a main supporter, or a mold frame. The adhesive tape **140** covers edges of the liquid crystal panel **110** and an opening corresponding to a center of the liquid crystal panel **110** such that images can display through the opening. Edges of the adhesive tape **140** extend along an outer surface

of the vertical portion **130***b* of the main frame **130** such that the liquid crystal panel **110** is mounted with the main frame **130**. Namely, the liquid crystal panel **110** and the backlight unit **120** are combined using the main frame **130** that can prevent movement of the liquid crystal panel **110** and the backlight unit **120**. In addition, the liquid crystal panel **110** and the main frame **130** are combined using the adhesive tape **140** that can further prevent movement of the liquid crystal panel **110**.

[0036] In the present invention, since the adhesive tape **140** has a function of the top frame **40** (of FIG. **1**) in the related art LCD device and the main frame **130** has a function of the bottom frame **50** (of FIG. **1**) in the related art LCD device, the LCD device according to the present invention has a thin profile by eliminating the top and bottom frames. Namely, the LCD device according to the present invention has decreased thickness and width. In addition, the mounting process is simplified. Furthermore, without the top and bottom frame of a metallic material, the LCD device according to the present invention has lighter weight and reduced production costs.

[0037] A protection sheet **200** is attached on a rear surface of the reflector **122**. Since there is no bottom frame in the present invention, the rear surface of the reflector **122** is exposed through an opening of the main frame **130**. The protection sheet **200** protects the exposed rear surface of the reflector **122**. Referring to FIG. **3**, which is a schematic cross-sectional view of a reflector for an LCD device according to the present invention, the reflector with the protection sheet is explained in more detail.

[0038] In FIG. **3**, the reflector **122** includes a base film **122***a* and a reflective film **122***b* on the base film **122***a*. The base film **122***a* is formed of a polyethylene-based material, for example, terephthahlic acid, and has good size stability. Silver (Ag), which has a reflectivity of about 90% for visible light, is deposited on the reflective film **122***b* by a vacuum deposition process or a sputtering process. Alternatively, one of copper (Cu), aluminum (Al), tin (Sn), gold (Au), and a stainless-steel (SUS) may be used for the reflective film **122***b*. There is no limitation in thickness of the reflective film **122***b*. For example, the reflective film **122***b* has a thickness of 50 to 2000 angstroms. It is preferable to have a thickness of 500 to 1000 angstroms. If the reflector **122***b* has a thickness below 50 angstroms, light reflection is too weak. In addition, since there are many voids on a surface of the reflective film **122***b*, it is very difficult to obtain a uniform film. On the other hand, if the reflector **122***b* has a thickness over 2000 angstroms, processing time of deposition or sputtering is increased such that production throughput is decreased. Although not shown, an anchor coat layer may be further formed between the base film **122***a* and the reflective film **122***b* to improve their adhesive strength. Alternatively, one of a corona process, a plasma process, a glow discharge process, and a reverse sputter process is processed to one surface of the base film **122***a* or the reflective film **122***b* to improve adhesive strength between the base film **122***a* and the reflective film **122***b*. For example, the anchor coat layer may be formed of one of polyester resin, alkyd resin being capable of being denaturalized to oil, alkyd resin being capable of denaturalized to urethane, alky resin being capable of being denaturalized to melamine, acrylic resin being capable of being hardened by epoxy, and epoxy-based resin or a their mixture. Alternatively, the anchor coat layer may be formed of an inorganic coating agent, for example, silane as a coupling agent. The anchor coat layer may have a thickness of about 0.01 to 10 micrometers. It is preferable to have about 0.02 to 5 micrometers. If the thickness of the anchor coat layer is below 0.01 micrometer, adhesive strength is too weak. On the other hand, if the thickness of the anchor coat layer is over 10 micrometers, the adhesive strength is no longer improved.

[0039] In addition, a top coat layer (not shown) having a thickness of about 1 to 2 micrometers may be formed on the reflective film **122***b* to prevent oxidization of the reflective film **122***b* and to maintain the reflectivity. The top coat layer may be formed of acrylic resin including functional additives such as anti-oxidizing agent and ultraviolet shielding agent. The reflector **122** has reflectivity of about 98% and transmissivity of about 2% such that light through the rear surface of the light guide plate **126** (of FIG. **2**) is reflected on the reflector **122** to illuminate the liquid crystal panel **110** (of FIG. **2**). The above reflector **122** may be called as an enhanced specular reflector.

[0040] The protection sheet **200** is attached on the rear surface of the base film **122***a* of the reflector **122** to protect the reflector **122**. Since the bottom frame **50** (of FIG. **1**) is eliminated in the LCD device of the present invention and the reflector **122** is exposed through the opening of the main frame **130**, the protection sheet **200** prevents for the reflector **122** from being exposed. The protection sheet **200** is removed during an assembling process of the LCD device with a case (not shown) to obtain an LCD device module as an end product. The case may cover a rear surface, side surfaces and edges of a front surface of the liquid crystal display device. Since a dummy sheet attached to the reflector **122** to protect damage to the reflector **122** during the fabricating process of the reflector **122** is used for the protection sheet **200**, additional processes or elements for the reflection sheet **200** are not required.

[0041] FIG. **4** is a schematic cross-sectional view of a protection sheet for an LCD device according to the present invention. The protection sheet **200** may be formed of synthetic resin, for example, polyethylene terephthalate (PET), polyethylene or polyamide. The protection sheet **200** has substantially the same shape as the reflector **122**. For example, the protection sheet **200** may have a rectangular shape. A protruding part **210** is formed at one side of the protection sheet **200**. Generally, the protection sheet **200** is detached from the reflector **122** by hand. It is easier to remove the protection sheet **200** due to the protrusion part **210**.

[0042] FIGS. **5**A and **5**B are a schematic view illustrating a figure of detaching a protection sheet from a reflector. In FIGS. **5**A and **5**B, the liquid crystal panel **110** (of FIG. **2**) and the backlight unit **120** (of FIG. **2**) are modulated using the main frame **130** and the adhesive tape **140**. Since the bottom frame is omitted in the present invention, the rear surface of the reflector **122** as a lowest element of the backlight unit **120** is exposed through the opening of the main frame **130**. To protect the exposed rear surface of the reflector **122**, the protection sheet **200** is attached to the reflector **122**. After a driving circuit (not shown) is connected to the LCD device, the LCD device module as an end product is obtained by combining the LCD device and a case (not shown). The protection sheet **200** should be detached from the reflector **122** before the combining process of the LCD device and the case. The reflective sheet **122** has a first width W**1** and a first length L**1**. Since the main frame **130** covers edges of the reflective sheet **122** and exposes a center of the reflective sheet **122**, the opening **130***a* of the main frame **130** has a second width W**2** smaller than the first width W**1** and a second

length L2 smaller than the first length L1. In addition, since the protection sheet **200** covers the exposed reflective sheet **122** and includes the protruding part **210** for detaching the protection sheet **200**, the protection sheet **200** has a third width W3, which is substantially equal to the second width W2, and a third length L3 smaller than the second length L2. The protruding part **210** is not covered with the main frame **130**. As mentioned above, the detaching process of the protection sheet **200** is performed by hand. It is easier to detach the protection sheet **200** due to the protrusion part **210**.

[0043] In the present invention, since the LCD device does not require the top frame and the bottom frame, the LCD device according to the present invention has a thin profile by eliminating the top and bottom frames. In addition, there is no damage to the reflector, which is exposed because the bottom frame is eliminated, due to the protection sheet. Furthermore, it is easier to detach the protection sheet from the reflector due to the protrusion part of the protection sheet.

[0044] It will be apparent to those skilled in the art that various modifications and variations 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 liquid crystal panel;
a main frame surrounding sides of the liquid crystal panel;
a backlight unit disposed under the liquid crystal panel and surrounded by the main frame, the backlight unit including a light guide plate, a lamp at a side of the light guide plate, a reflector under the light guide plate and an optical sheet on the light guide plate, wherein a rear surface of the reflector is exposed through an opening of the main frame; and
a protection sheet attached to the rear surface of the reflector to protect the rear surface of the reflector and includes a protruding part at a side of the protection sheet, the protection sheet has a rectangular shape.

2. The device according to claim **1**, wherein the reflective sheet has a first width larger than a second width of the opening of the main frame and a first length larger than a second length of the opening of the main frame, and wherein the rectangular shape of the protection sheet has a third width being substantially equal to the second width and a third length smaller than the second length.

3. The device according to claim **1**, wherein the protrusion is disposed in the opening of the main frame.

4. The device according to claim **1**, wherein the reflector is an enhanced specular reflector.

5. The device according to claim **1**, further comprising adhesive tape covering front edges of the liquid crystal panel and combined with the main frame.

6. A method of fabricating a liquid crystal display device module, comprising:
forming a liquid crystal display device including:
a liquid crystal panel;
a main frame surrounding sides of the liquid crystal panel;
a backlight unit disposed under the liquid crystal panel and surrounded by the main frame, the backlight unit including a light guide plate, a lamp at a side of the light guide plate, a reflector under the light guide plate and an optical sheet on the light guide plate, wherein a rear surface of the reflector is exposed through an opening of the main frame; and
a protection sheet attached to the rear surface of the reflector to protect the rear surface of the reflector and includes a protruding part at a side of the protection sheet, the protection sheet has a rectangular shape;
detaching the protection sheet from the reflective sheet using the protruding part; and
mounting the liquid crystal display device with a case.

7. The method according to claim **6**, wherein the reflective sheet has a first width larger than a second width of the opening of the main frame and a first length larger than a second length of the opening of the main frame, and wherein the rectangular shape of the protection sheet has a third width being substantially equal to the second width and a third length smaller than the second length.

8. The method according to claim **6**, wherein the protrusion is disposed in the opening of the main frame.

9. The method according to claim **6**, wherein the reflector is an enhanced specular reflector.

10. The method according to claim **6**, wherein the liquid crystal display device further includes adhesive tape covering front edges of the liquid crystal panel and combined with the main frame.

* * * * *

专利名称(译)	液晶装置和制造包括其的液晶显示装置模块的方法		
公开(公告)号	US20100283935A1	公开(公告)日	2010-11-11
申请号	US12/588299	申请日	2009-10-09
[标]申请(专利权)人(译)	朴宰SUNG 李正HUN		
申请(专利权)人(译)	朴晟 李政勋		
当前申请(专利权)人(译)	朴晟 李政勋		
[标]发明人	PARK JAE SUNG LEE JUNG HUN		
发明人	PARK, JAE-SUNG LEE, JUNG-HUN		
IPC分类号	G02F1/1333 H01J9/20		
CPC分类号	G02B6/0081 G02F1/133308 G02F2001/133314 G02F1/133608 G02F2201/50 G02F2202/28 G02F2001/13332		
优先权	1020090040336 2009-05-08 KR		
其他公开文献	US8542332		
外部链接	Espacenet USPTO		

摘要(译)

液晶显示装置包括液晶面板;围绕液晶面板侧面的主框架;背光单元，设置在液晶面板下方并被主框架包围，该背光单元包括导光板，导光板一侧的灯，导光板下方的反射器和灯上的光学片导板，其中反射器的后表面通过主框架的开口露出;保护片附接到反射器的后表面以保护反射器的后表面并且包括在保护片的侧面处的突出部分，保护片具有矩形形状。