US 20090086113A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2009/0086113 A1**

(43) **Pub. Date: Apr. 2, 2009**

**Ko et al.**

(54) **TOUCH PANEL AND TOUCH LIQUID CRYSTAL DISPLAY USING THE SAME**

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(21) Appl. No.: **12/203,930**

(22) Filed: **Sep. 4, 2008**

(30) **Foreign Application Priority Data**

Sep. 29, 2007 (TW) ..... 96136575

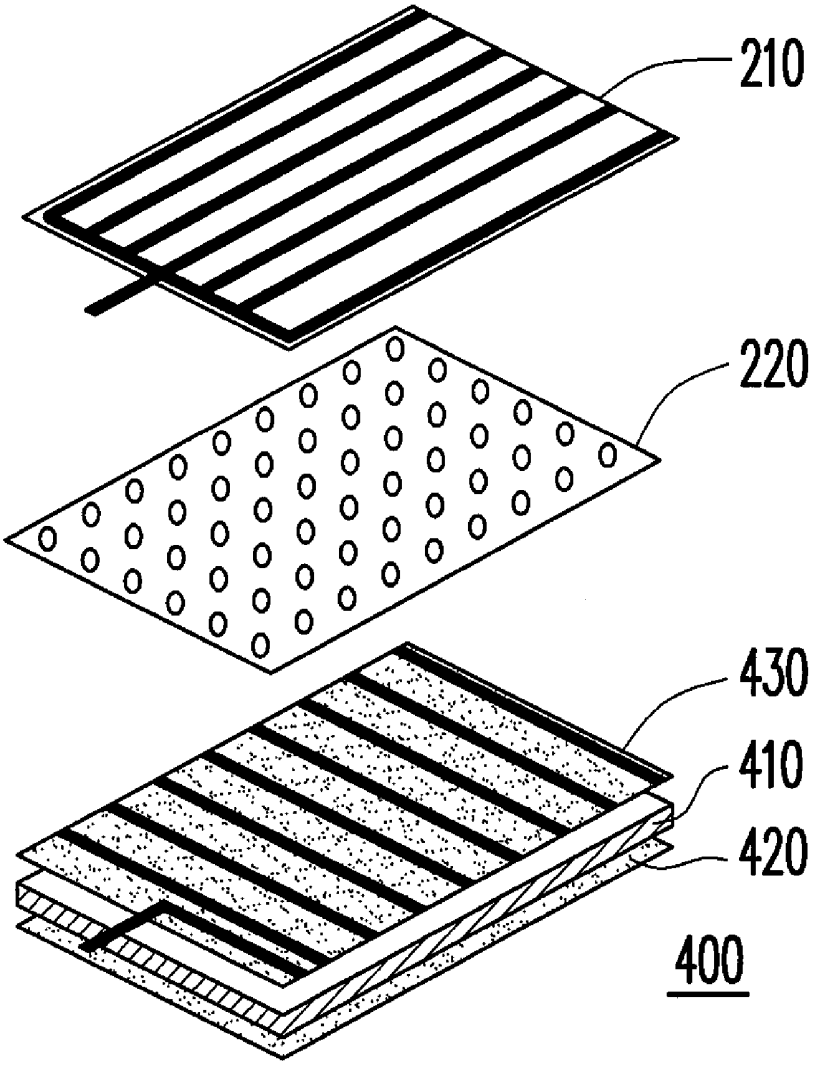
**Publication Classification**

(51) **Int. Cl.**
*G02F 1/1335* (2006.01)
*H03K 17/975* (2006.01)

(52) **U.S. Cl.** ..... **349/12**; 200/600

(57) **ABSTRACT**

A touch panel and a touch liquid crystal display (LCD) using the touch panel are provided. The structure of the touch panel is directly formed on an upper polarizer instead of a glass substrate. Thereby, the process of integrating the touch panel and an LCD panel is simplified and the glass substrate of the touch panel is eliminated. Thus, the cost, the thickness and the weight of the touch LCD are reduced.



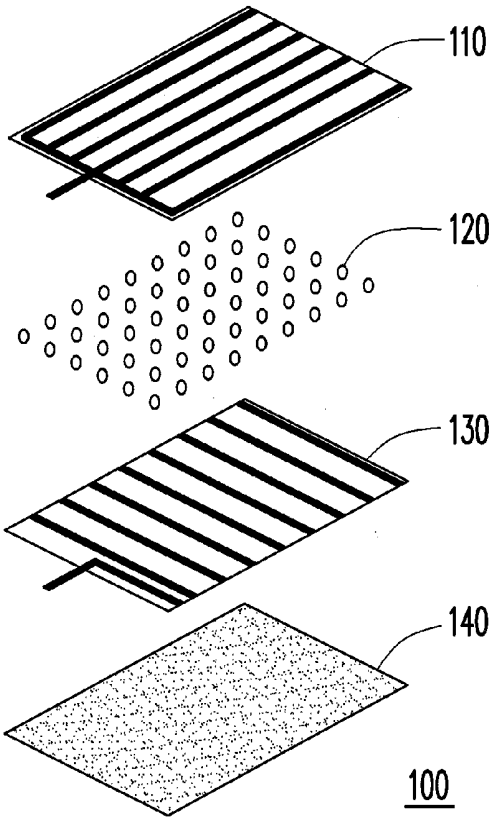



FIG. 1 (PRIOR ART)

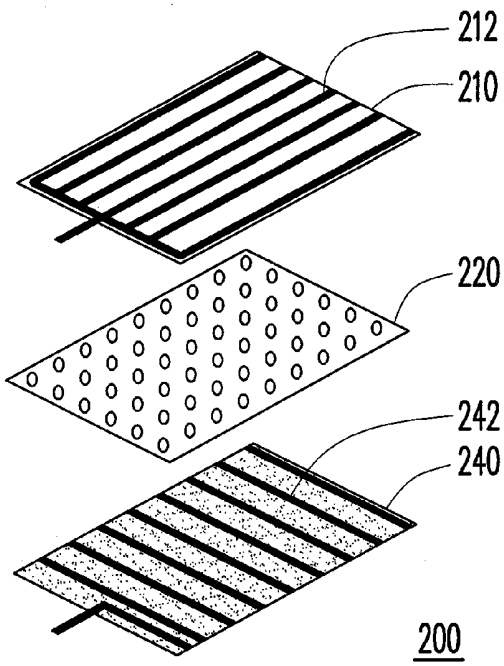



FIG. 2

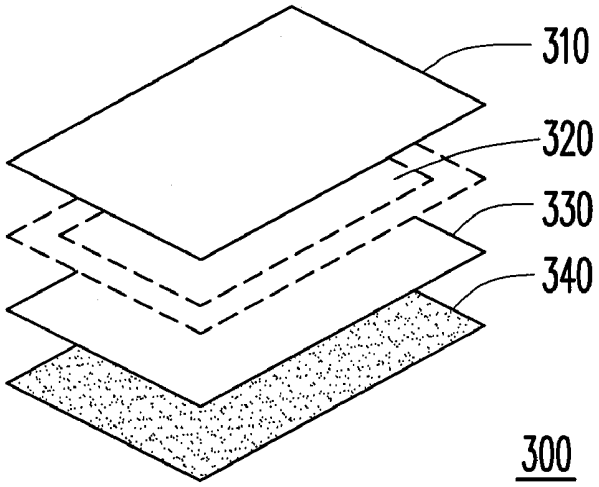



FIG. 3

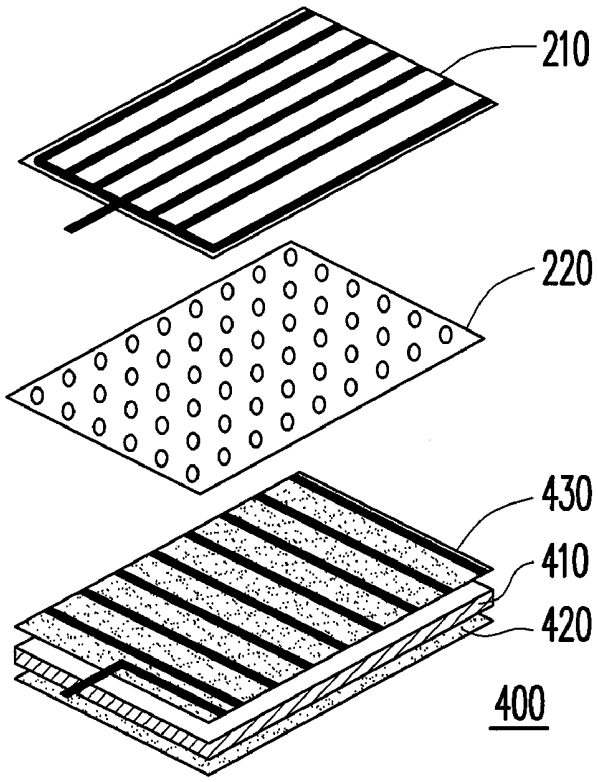



FIG. 4

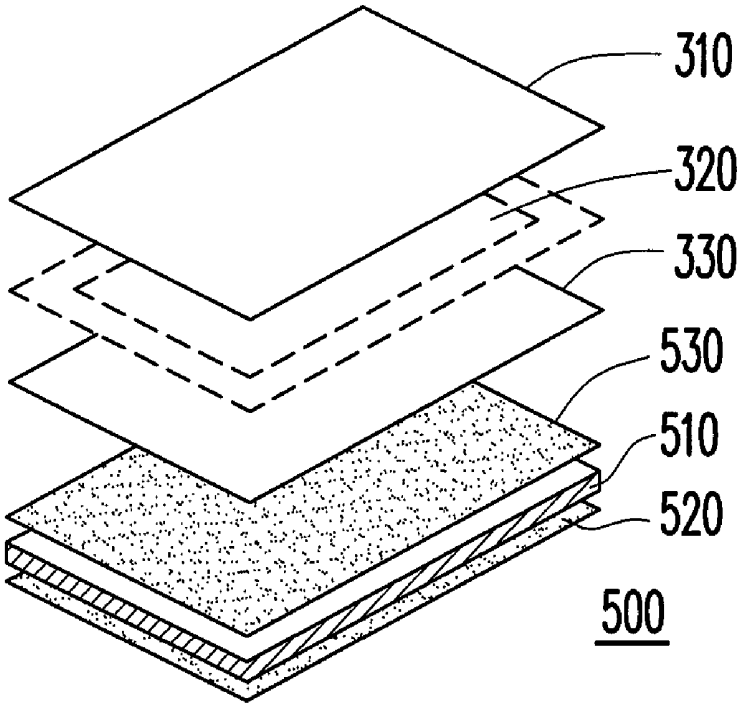



FIG. 5

# TOUCH PANEL AND TOUCH LIQUID CRYSTAL DISPLAY USING THE SAME

## CROSS-REFERENCE TO RELATED APPLICATION

**[0001]** This application claims the priority benefit of Taiwan application serial no. 96136575, filed on Sep. 29, 2007. The entirety of the above-mentioned patent application is hereby incorporated by reference herein and made a part of specification.

## BACKGROUND OF THE INVENTION

**[0002]** 1. Field of the Invention

**[0003]** The present invention relates to a touch panel. More particularly, the present invention relates to a touch panel using a polarizer instead of a glass substrate and a liquid crystal display (LCD) using the touch panel (abbreviated as a touch LCD).

**[0004]** 2. Description of Related Art

**[0005]** Touch panel is an interface tool for information exchange and is widely accepted by the public. Currently, the widely employed touch panels are mainly classified into two types, i.e., resistive touch panels and capacitive touch panels. The structure of the touch panel is mostly formed by a polyethylene terephthalate (PET) film and a layer of glass, and then the touch panel is adhered onto a liquid crystal panel by glues. FIG. **1** is a structure diagram of a resistive touch panel in conventional art. A touch panel **100** is mainly contained a PET film **110**, spacer dots **120**, and a glass layer **130**, and the spacer dots **120** form an intermediate layer for spacing the PET film **110** from the glass layer **130**. Both surface of the PET film **110** and the glass layer **130** are developed by the transparent electrode wires using indium tin oxide (ITO), so as to transmit electrical signals. In the touch panel **100**, a glue is generally used to adhere the glass layer **130** and an upper polarizer **140** of the liquid crystal panel (other structures of the liquid crystal panel are not shown), and the arrangement structure is as shown in FIG. **1**.

**[0006]** As the glass layer **130** of the touch panel **100** is too heavy and thick, it is not suitable for being used in portable products such as notebooks. However, if the touch panel is formed by two PET films, the transmittance would be influenced. Furthermore, it is difficult to control the process quality due to poor adhesion of indium tin oxide (ITO) on the PET film.

**[0007]** Additionally, Taiwan Patent No. I223116 disclosed a liquid crystal display (LCD) device with a built-in touch panel and the manufacturing process thereof, in which the touch panel is formed between an upper polarizer and an upper glass substrate of an LCD display unit, while the polarizer is not designed for being pressed. Thus, the sensitivity of the contact points would be affected, and at the same time the polarizer would be damaged. Additionally, the upper polarizer is fully adhered on the PET film, while the PET is adhered on the color filter in the state of surrounding adhesion. Thus, edge mura or conner mura on polarizer is generated. Further, as the touch panel is formed between the upper polarizer and the upper glass substrate of the LCD display unit, the touch panel is difficult to maintain due to some damages. And the whole display panel might be discarded. Therefore, during the process conditions presently, if the touch panel is integrated into the liquid crystal panel, and the glass substrate is eliminated, the weight, the volume, and the cost of the touch panel would be effectively reduced.

## SUMMARY OF THE INVENTION

**[0008]** Accordingly, the present invention is directed to provide a touch panel, in which the touch panel is directly integrated in the structure of an LCD by using a polarizer instead of a glass substrate.

**[0009]** The present invention is further directed to provide a touch LCD, which can directly form a touch panel on a polarizer. As the result, it's making the touch LCD lighter and thinner, and reducing the cost of design.

**[0010]** The present invention provides a touch panel, which includes a polarizer, a contact layer, and an intermediate layer. The polarizer has a plurality of first electrodes, and the contact layer has a plurality of second electrodes. The intermediate layer is disposed between the polarizer and the contact layer for spacing the polarizer from the contact layer. The contact layer can be made of PET film, and the desired first electrodes and second electrodes can be respectively formed on the surface of the contact layer and the polarizer by using indium tin oxide (ITO). In an embodiment of the present invention, the intermediate layer includes a plurality of spacer dots for spacing the polarizer from the contact layer.

**[0011]** The present invention provides a touch panel, which includes a polarizer, a conductive layer, an electrode pattern layer, and a protective layer. The conductive layer is disposed on the polarizer, the electrode pattern layer has a plurality of first electrodes and second electrodes on upper and lower surfaces thereof respectively, the electrode pattern layer is disposed on the conductive layer, and the protective layer is disposed on the electrode pattern layer to protect the electrode pattern layer.

**[0012]** The present invention provides a touch LCD which includes a lower polarizer, an LCD display unit, an upper polarizer, a contact layer, and an intermediate layer. The upper polarizer and the lower polarizer are respectively disposed on the both sides of the LCD display unit, and the upper polarizer has a plurality of first electrodes which is opposite to the LCD display unit. The contact layer has a plurality of second electrodes, and is disposed on the upper polarizer. The intermediate layer is disposed between the upper polarizer and the contact layer for spacing the first electrodes from the second electrodes. The structure formed by the upper polarizer, the intermediate layer, and the contact layer has the functions of a touch panel.

**[0013]** The present invention further provides a touch LCD, which includes a lower polarizer, an LCD display unit, an upper polarizer, a conductive layer, an electrode pattern layer, and a protective layer. The upper polarizer and the lower polarizer are respectively disposed on the both sides of the LCD display unit, and the conductive layer is disposed on the upper polarizer. The electrode pattern layer has a plurality of first electrodes and second electrodes on upper and lower surfaces thereof respectively, the electrode pattern layer is disposed on the conductive layer, and the protective layer is disposed on the electrode pattern layer to protect the electrode pattern layer.

**[0014]** In another embodiment of the present invention, the LCD display unit at least includes a first substrate, a second substrate, and a lower polarizer. The upper polarizer is located on the surface of the first substrate, the lower polarizer is located on the surface of the second substrate, and the first

substrate and the second substrate are disposed in opposite directions and are sandwiched together with liquid crystal.

**[0015]** As the present invention adopts a polarizer to replace the glass substrate required by the touch panel, the touch panel can be directly integrated into a liquid crystal panel. Thus a structure of a touch panel is directly formed on the upper polarizer of the liquid crystal panel, and the glass substrate. The process of adhering the touch panel and panel module are eliminated, such that the touch panel and the panel module have better fixity and uniformity.

**[0016]** In order to make the aforementioned and other objects, features and advantages of the present invention comprehensible, preferred embodiments accompanied with figures are described in detail below.

**[0017]** It is to be understood that both the foregoing general description and the following detailed description are exemplary, and are intended to provide further explanation of the invention as claimed.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0018]** The accompanying drawings are included to provide a further understanding of the invention, and are incorporated in and constitute a part of this specification. The drawings illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

**[0019]** FIG. **1** is a structure diagram of a resistive touch panel in conventional art.

**[0020]** FIG. **2** is a structure diagram of a resistive touch panel according to a first embodiment of the present invention.

**[0021]** FIG. **3** is a structure diagram of a capacitive touch panel according to a second embodiment of the present invention.

**[0022]** FIG. **4** is a structure diagram of a touch LCD according to a third embodiment of the present invention.

**[0023]** FIG. **5** is a structure diagram of a touch LCD according to a fourth embodiment of the present invention.

## DESCRIPTION OF EMBODIMENTS

### First Embodiment

**[0024]** FIG. **2** is a structure diagram of a resistive touch panel according to a first embodiment of the present invention. A touch panel **200** includes a contact layer **210**, an intermediate layer **220**, and a polarizer **240**. The intermediate layer **220** is disposed between the contact layer **210** and the polarizer **240** for spacing the contact layer **210** from the polarizer **240**. The contact layer **210** can be formed by PET film, glass or polymer film, so as to serve as a region for the user to contact the touch panel. The intermediate layer **220** is formed by spacer dots for spacing the polarizer **240** from the contact layer **210** when no force is applied on the contact layer **210**. The polarizer **240** has a polarization function (i.e., limiting the angle of the passing light) and an electric signal transmitting function required by the touch panel.

**[0025]** The polarizer **240** has a plurality of first electrodes **242**, and the contact layer **210** has a plurality of second electrodes **212**. The first electrodes **242** and the second electrodes **212** can be replaced by transparent conductive electrodes formed by ITO, and the first electrodes **242** and the second electrodes **212** are disposed in opposite directions and are perpendicular to each other. When a force is applied to the contact layer **210** (for example, writing or pressing), the second electrodes **212** will contact with the first electrodes **242** to form channels, and the system can detect the pressing position through varies with current or voltage to, achieve the efficacy of the touch panel. Furthermore, the polarizer **240** in this embodiment can be directly replaced by the upper polarizer of LCD. That is to say, the first electrodes **242** are directly formed on the upper polarizer of the LCD. Accordingly, when the touch panel **200** and the LCD are integrated, a layer of glass substrate can be reduced compared to conventional touch LCD. Such that the touch LCD becomes lighter and thinner, and the cost of design is much lower.

### Second Embodiment

**[0026]** The technical method of the first embodiment can be applied in a capacitive touch panel. FIG. **3** is an architectural diagram of a capacitive touch panel according to a second embodiment of the present invention. The touch panel **300** includes a protective layer **310**, an electrode pattern layer **320**, a conductive layer **330**, and a polarizer **340**. The conductive layer **330** is disposed on the polarizer **340**, and can be formed on the surface of the polarizer **340** directly by ITO. Such that the polarizer **340** has electromagnetic shielding effects. The electrode pattern layer **320** is disposed between the protective layer **310** and the conductive layer **330**, and the electrode pattern layer **320** has a plurality of first electrodes and second electrodes on upper and lower surfaces thereof respectively, so as to form the desired electrode pattern. The protective layer **310** is disposed on the electrode pattern layer **320** to protect the electrode pattern layer **320**.

**[0027]** In another embodiment of the present invention, the electrode pattern layer **320** can be formed by a glass substrate. The first electrodes and the second electrodes can be formed by coating a layer of conductive material, for example, an ITO or antimony doped tin dioxide (ATO) film, on the upper and the lower surfaces of the glass substrate, and then a protective scratch-resistant paint, for example, the protective layer **310**, is coated thereon. As shown in FIG. **3**, the structure of the touch panel **300** includes the protective layer **310**, the electrode pattern layer **320**, the conductive layer **330**, and the polarizer **340** from top to bottom. The layers can be adhered together by conductive or nonconductive glues according to the design requirements, and the surrounding circuit wires can also be formed by silver paste film. The polarizer **340** in this embodiment can be directly replaced by the upper polarizer of LCD. That is to say, when integrating the touch panel and the LCD panel of this embodiment, the upper polarizer of the LCD panel can be directly used as the glass substrate of the touch panel. Compared with the conventional touch display panel, as a transmission layer is eliminated, the transmittance can be increased, and the weight is lighter and the thickness is thinner.

### Third Embodiment

**[0028]** FIG. **4** is a structure diagram of a touch LCD according to a third embodiment of the present invention. This embodiment further illustrates the structure relationship of a resistive touch panel integrated with an LCD panel. An LCD **400** includes a lower polarizer **420**, an LCD display unit **410**, an upper polarizer **430**, a contact layer **210**, and an intermediate layer **220**. The touch panel is formed by the upper polarizer **430**, the contact layer **210** and the intermediate layer **220**, and the structure thereof can be seen with reference to

FIG. **2**, which will not be repeated herein. In this embodiment, the polarizer **240** in FIG. **2** is directly used in the LCD **400** as the upper polarizer **430**.

**[0029]** The LCD display unit **410** at least includes a first substrate, a second substrate. The upper polarizer **430** is located on a surface of the first substrate, the lower polarizer **420** is located on a surface of the second substrate, and the first substrate and the second substrate are disposed in opposite directions and are sandwiched with the liquid crystal. The LCD display unit **410** displays images and forms a touch display with touch functions together with the upper polarizer **430**, the contact layer **210**, and the intermediate layer **220**.

**[0030]** During the process, the circuits required by the touch panel are directly formed on the upper polarizer **430**, the touch panel is then formed by adhering the upper polarizer **430**, the contact layer **210**, and the intermediate layer **220**, and the touch panel is directly adhered on the surface of the LCD display unit **410**. In such manner, the process of adhering the touch panel and the-upper polarizer can be omitted, and at the same time, the glass substrate of the conventional touch panel can be eliminated. Thus, the LCD **400** is lighter and thinner.

## Fourth Embodiment

**[0031]** FIG. **5** is a structure diagram of a touch LCD according to a fourth embodiment of the present invention. Referring to FIG. **3** together, this embodiment further illustrates the structure relationship between a capacitive touch panel and an LCD panel. An LCD **500** includes a lower polarizer **520**, an LCD display unit **510**, an upper polarizer **530**, a conductive layer **330**, an electrode pattern layer **320**, and a protective layer **310**, wherein the touch panel is formed by the upper polarizer **530**, the conductive layer **330**, the electrode pattern layer **320** and the protective layer **310**. And the structure thereof can be seen with reference to FIG. **2**, which will not be repeated herein. In this embodiment, the polarizer **340** in FIG. **3** is directly used in the LCD **500** as the upper polarizer **530**.

**[0032]** The LCD display unit **510** at least includes a first substrate, and a second substrate. The upper polarizer **530** is located on the first substrate, the lower polarizer **520** is located under the second substrate, and the first substrate and the second substrate are disposed in opposite directions and are sandwiched with the liquid crystal. The LCD display unit **510** can be used to display images and form a touch LCD with touch functions together with the upper polarizer **530**, the conductive layer **330**, the electrode pattern layer **320**, and the protective layer **310**.

**[0033]** During the process, the touch panel can be directly formed by adhering the upper polarizer **530**, the conductive layer **330**, the electrode pattern layer **320**, and the protective layer **310**, and the touch panel is then directly adhered onto the surface of the LCD display unit **5i 0**. In such manner, the process of adhering the touch panel and the upper polarizer can be omitted, and at the same time, the glass substrate of the conventional touch panel can be eliminated. Thus, the LCD **500** is lighter and thinner.

**[0034]** In view of above, a polarizer is used instead of a glass substrate of the touch panel in the embodiments. The structure of the touch panel is directly formed on the polarizer, so as to eliminate a layer of glass substrate and the conventional adhering process between the glass substrate of the touch panel and the upper polarizer. Thereby, the adhesion between the touch panel and the liquid crystal panel is improved, and the touch LCD is lighter and thinner.

**[0035]** It will be apparent to those skilled in the art that various modifications and variations can be made to the structure of the present invention without departing from the scope or spirit of the invention. In view of the foregoing, it is intended that the present invention cover modifications and variations of this invention provided they fall within the scope of the following claims and their equivalents.

What is claimed is:

**1**. A touch panel, comprising:
a polarizer, having a plurality of first electrodes;
a contact layer, having a plurality of second electrodes; and
an intermediate layer, disposed between the polarizer and the contact layer.

**2**. The touch panel as claimed in claim **1**, wherein the material of the contact layer comprises PET film, glass or polymer film, and the second electrodes are formed on a surface of the contact layer.

**3**. The touch panel as claimed in claim **1**, wherein the first electrodes are formed on a surface of the polarizer.

**4**. The touch panel as claimed in claim **1**, wherein the material of the first electrodes comprises indium tin oxide.

**5**. The touch panel as claimed in claim **1**, wherein the material of the second electrodes comprises indium tin oxide.

**6**. The touch panel as claimed in claim **1**, wherein the first electrodes and the second electrodes are disposed in opposite directions and are perpendicular to each other.

**7**. The touch panel as claimed in claim **1**, wherein the intermediate layer comprises a plurality of spacer dots for spacing the polarizer and the contact layer.

**8**. A touch panel, comprising:
a polarizer;
a conductive layer, disposed on a polarizer;
an electrode pattern layer, wherein the electrode pattern layer has a plurality of first electrodes and second electrodes on upper and lower surfaces thereof respectively, and the electrode pattern layer is disposed on the conductive layer; and
a protective layer, disposed on the electrode pattern layer, for protecting the electrode pattern layer.

**9**. The touch panel as claimed in claim **8**, wherein the material of the protective layer comprises PET film.

**10**. The touch panel as claimed in claim **8**, wherein the material of the electrode pattern layer comprises glass, and the first electrodes and the second electrodes are respectively formed on the upper and the lower surfaces of the electrode pattern layer.

**11**. The touch panel as claimed in claim **8**, wherein the material of the first electrodes comprises ITO.

**12**. The touch panel as claimed in claim **8**, wherein the material of the second electrodes comprises ITO.

**13**. A touch liquid crystal display (LCD), comprising:
a lower polarizer;
an LCD display unit, disposed on the lower polarizer;
an upper polarizer, disposed on the LCD display unit, and the upper polarizer has a plurality of first electrodes on a surface opposite to the LCD display unit;
a contact layer, having a plurality of second electrodes, and disposed on the upper polarizer; and
an intermediate layer, disposed between the upper polarizer and the contact layer, for spacing the first electrodes and the second electrodes.

**14**. The touch LCD as claimed in claim **13**, wherein the LCD display unit at least comprises a first substrate and a second substrate, the upper polarizer is located on the first

substrate, the lower polarizer is located under the second substrate, and the first substrate and the second substrate are disposed in opposite directions and are sandwiched with the liquid crystal.

**15**. The touch LCD as claimed in claim **13**, wherein the material of the contact layer comprises PET film, glass or polymer film, and the second electrodes are formed on a surface of the contact layer.

**16**. The touch LCD as claimed in claim **13**, wherein the first electrodes are formed on a surface of the upper polarizer.

**17**. The touch LCD as claimed in claim **13**, wherein the material of the first electrodes comprises ITO.

**18**. The touch LCD as claimed in claim **13**, wherein the material of the second electrodes comprises ITO.

**19**. The touch LCD as claimed in claim **13**, wherein the first electrodes and the second electrodes are disposed in opposite directions and are perpendicular to each other.

**20**. The touch LCD as claimed in claim **13**, wherein the intermediate layer comprises a plurality of spacer dots, for spacing the polarizer and the contact layer.

**21**. A touch LCD, comprising:

a lower polarizer;

an LCD display unit, disposed on the lower polarizer;

an upper polarizer, disposed on the LCD display unit;

a conductive layer, disposed on the upper polarizer;

an electrode pattern layer, wherein the electrode pattern layer has a plurality of first electrodes and second electrodes on upper and lower surfaces thereof respectively, and the electrode pattern layer is disposed on the conductive layer; and

a protective layer, disposed on the electrode pattern layer, for protecting the electrode pattern layer.

**22**. The touch LCD as claimed in claim **21**, wherein the LCD display unit at least comprises a first substrate and a second substrate, the upper polarizer is located on the first substrate, the lower polarizer is located under the second substrate, and the first substrate and the second substrate are disposed in opposite directions and are sandwiched with the liquid crystal.

**23**. The touch LCD as claimed in claim **21**, wherein the material of the protective layer comprises PET film.

**24**. The touch LCD as claimed in claim **21**, wherein the material of the electrode pattern layer comprises glass, and the first electrodes and second electrodes are respectively formed on upper and lower surfaces of the electrode pattern layer.

**25**. The touch LCD as claimed in claim **21**, wherein the material of the first electrodes comprises ITO.

**26**. The touch LCD as claimed in claim **21**, wherein the material of the second electrodes comprises ITO.

**27**. The touch LCD as claimed in claim **21**, wherein the first electrodes and the second electrodes are disposed in opposite directions and are perpendicular to each other.

* * * * *

| | | | |
|---|---|---|---|
| 专利名称(译) | 触摸面板和使用它的触摸液晶显示器 | | |
| 公开(公告)号 | US20090086113A1 | 公开(公告)日 | 2009-04-02 |
| 申请号 | US12/203930 | 申请日 | 2008-09-04 |
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| 发明人 | KO, HAN-CHING<br>CHANG, MIN-HUNG | | |
| IPC分类号 | G02F1/1335 H03K17/975 | | |
| CPC分类号 | G02F1/13338 G06F3/045 G06F3/044 G06F3/0412 | | |
| 优先权 | 096136575 2007-09-29 TW | | |
| 外部链接 | Espacenet USPTO | | |


摘要(译)

提供一种触摸面板和使用该触摸面板的触摸液晶显示器（LCD）。触摸板的结构直接形成在上偏振器而不是玻璃基板上。由此，简化了集成触摸面板和LCD面板的过程，并且消除了触摸面板的玻璃基板。因此，降低了触摸LCD的成本，厚度和重量。