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Song

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(54) **LIQUID CRYSTAL DISPLAY DEVICE PROVIDED WITH A SENSING ELECTRODE FOR SENDING A TOUCH OF A USER**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 366 days.

This patent is subject to a terminal disclaimer.

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G06F 3/041 (2006.01)

(52) **U.S. Cl.**

CPC **G06F 3/0412** (2013.01)

USPC **345/173**; **345/104**

(58) **Field of Classification Search**

CPC G06F 3/0142; G06F 3/041; G06F 3/044; G06F 3/0416; G09G 3/36

See application file for complete search history.

(57) **ABSTRACT**

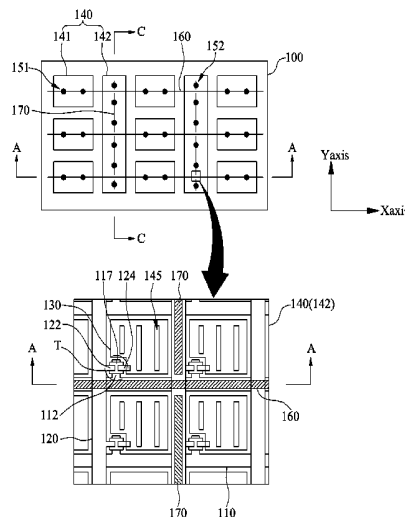
A liquid crystal display device is disclosed, which comprises gate and data lines arranged to cross each other on a substrate to define a pixel region; a pixel electrode formed in the pixel region; a common electrode forming an electric field together with the pixel electrode and sensing a touch of a user; and a sensing line electrically connected with the common electrode, wherein the common electrode includes a plurality of first common electrodes for sensing any one of a touch position of X axis and a touch position of Y axis and a plurality of second common electrodes for sensing the other one of the touch positions of X axis and Y axis, and the sensing line is not electrically connected with the plurality of second common electrodes but electrically connected with the plurality of first common electrodes.

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9 Claims, 6 Drawing Sheets



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[Related Art]
FIG.1

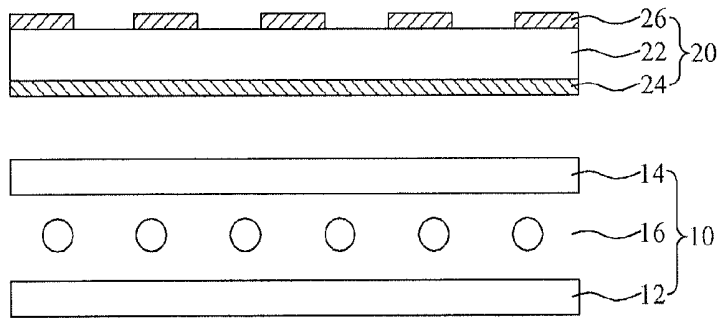


FIG.2A

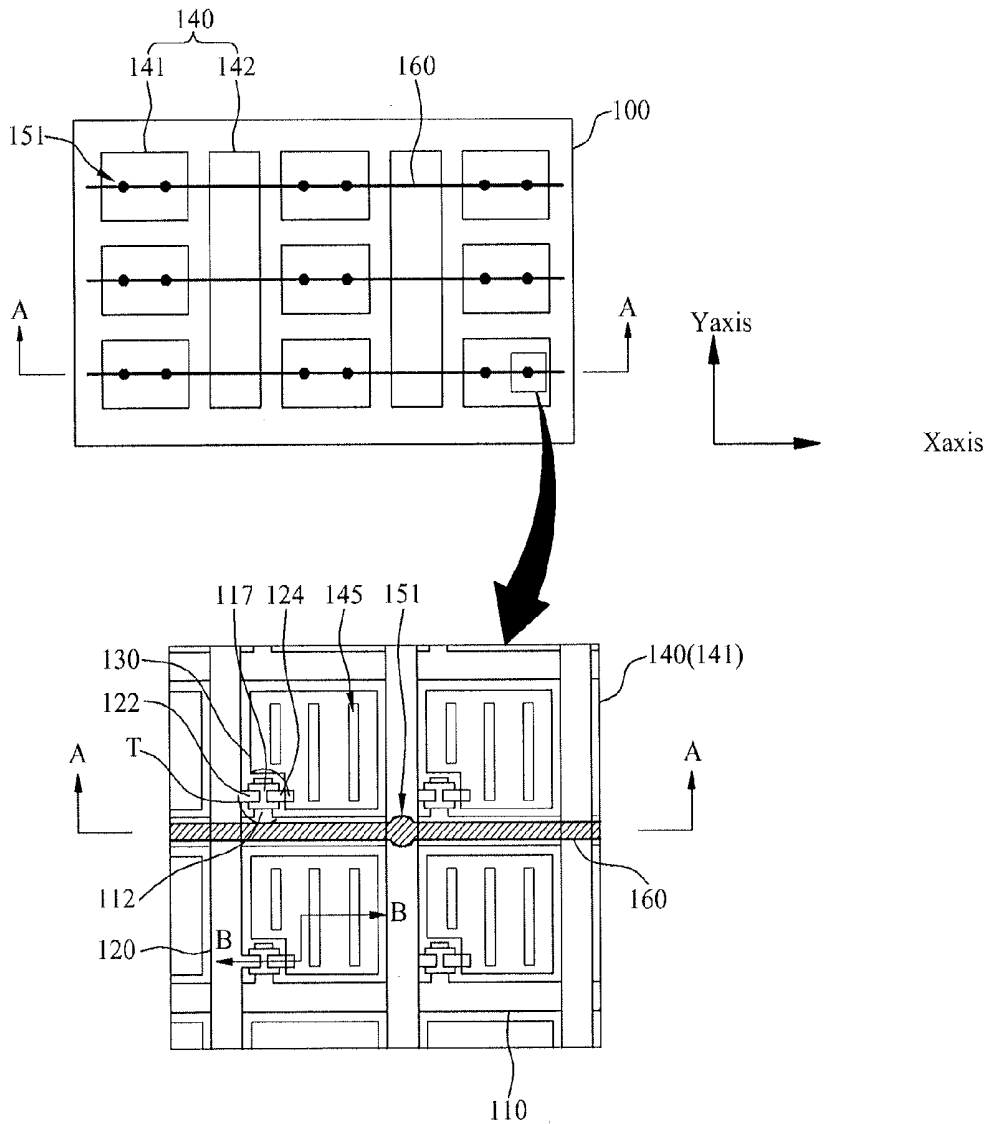


FIG.2B

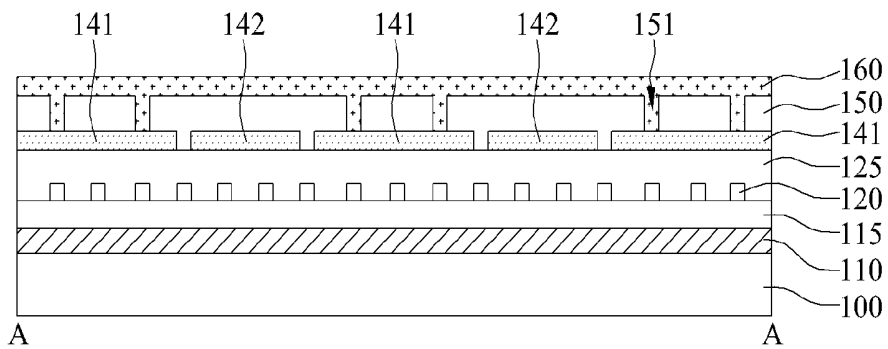


FIG.2C

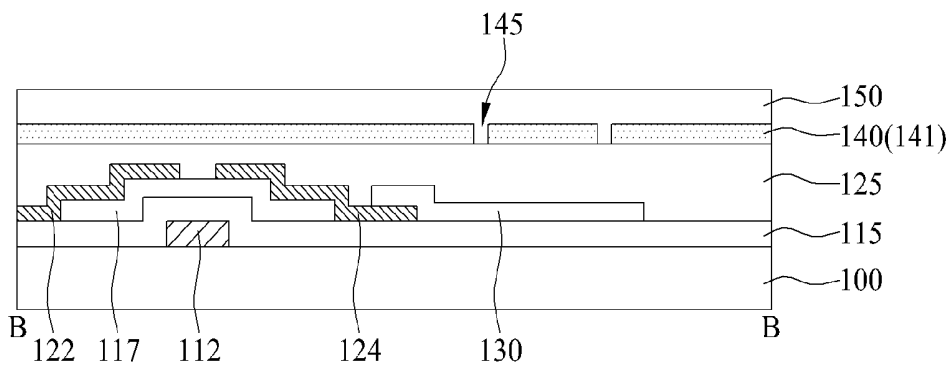


FIG. 3A

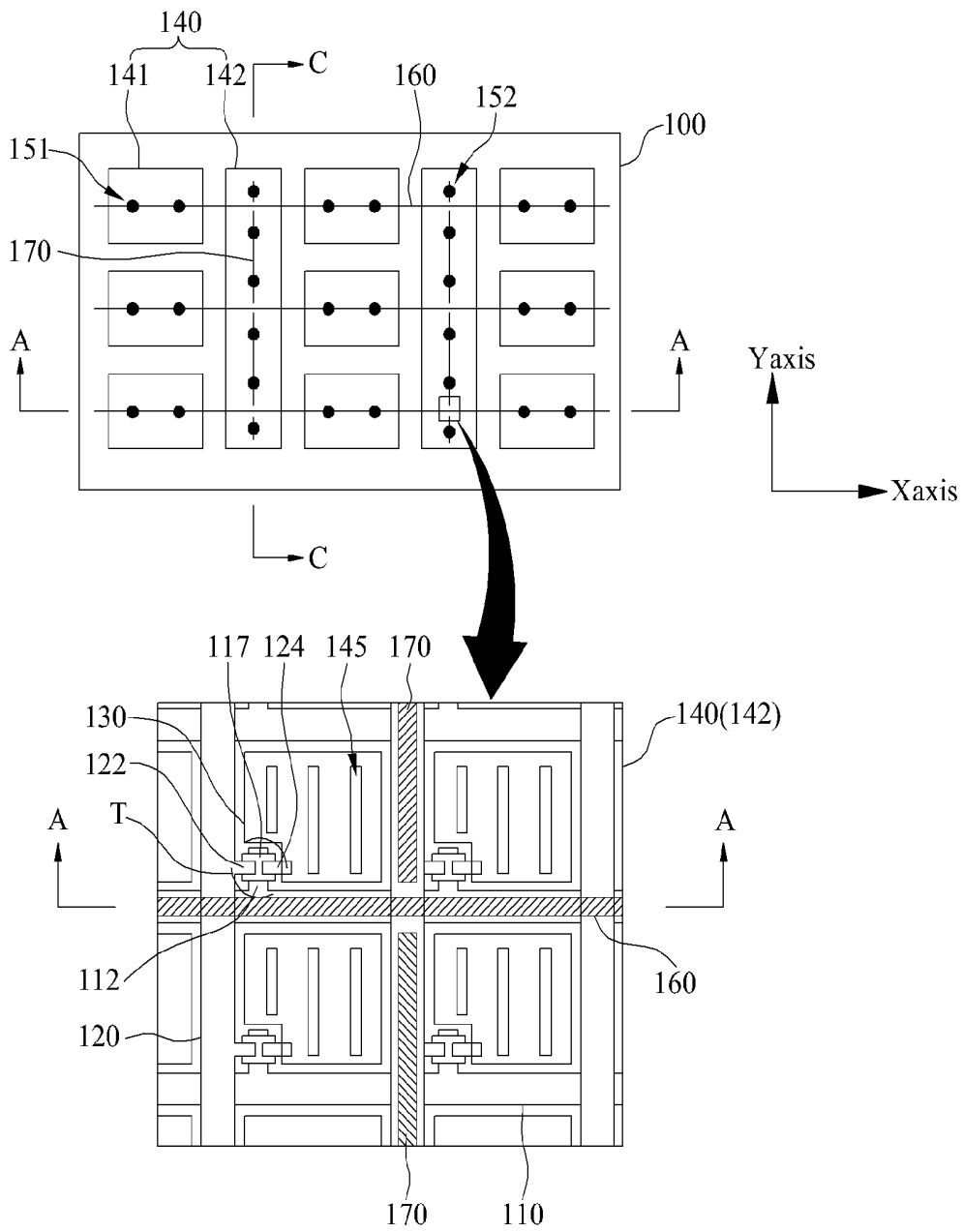


FIG. 3B

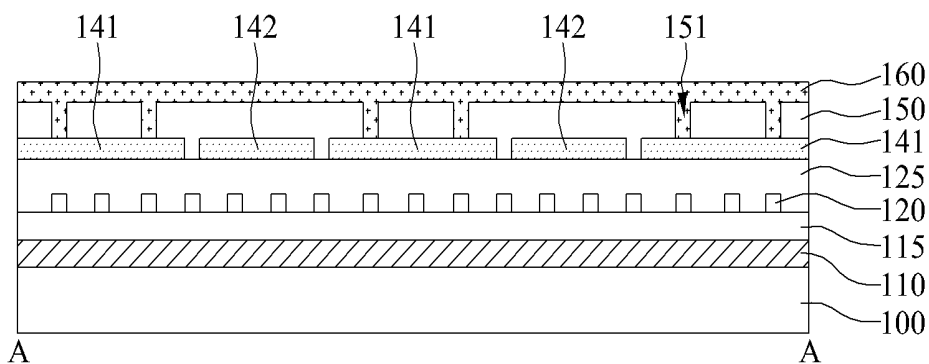


FIG. 3C

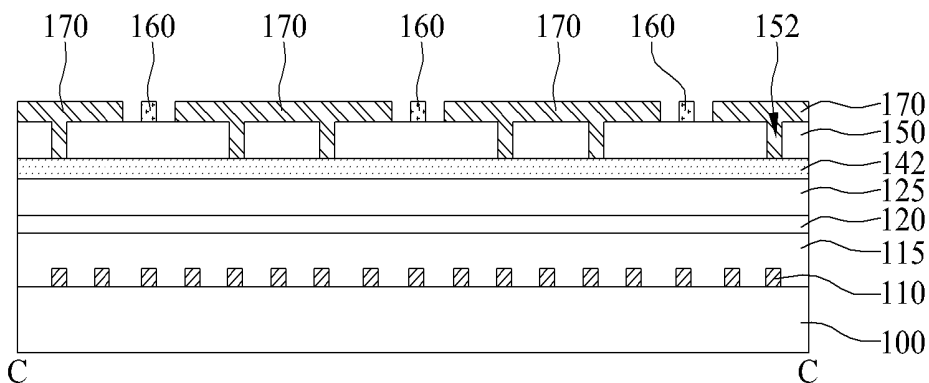


FIG. 4A

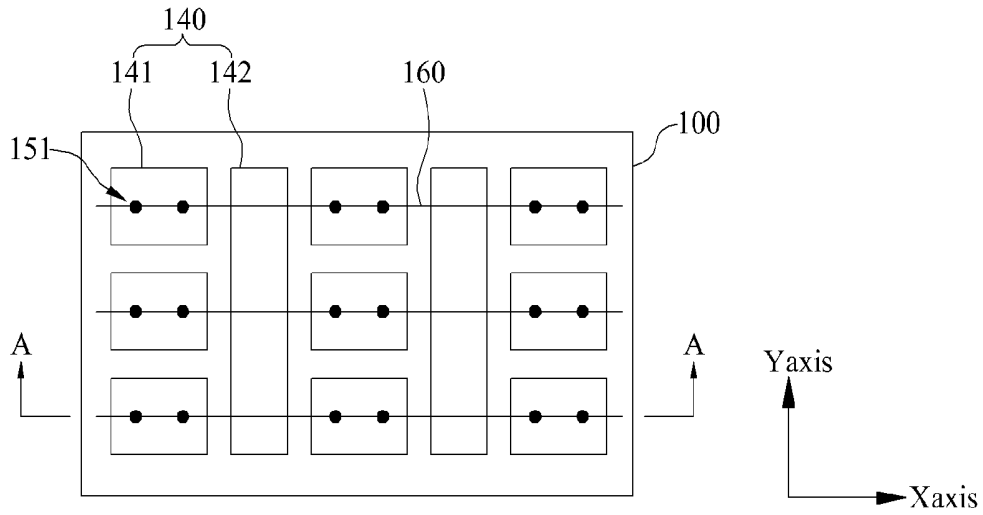


FIG. 4B

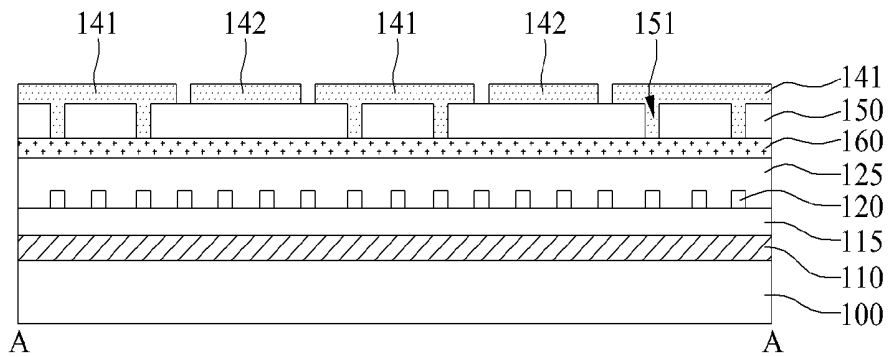


FIG. 5A

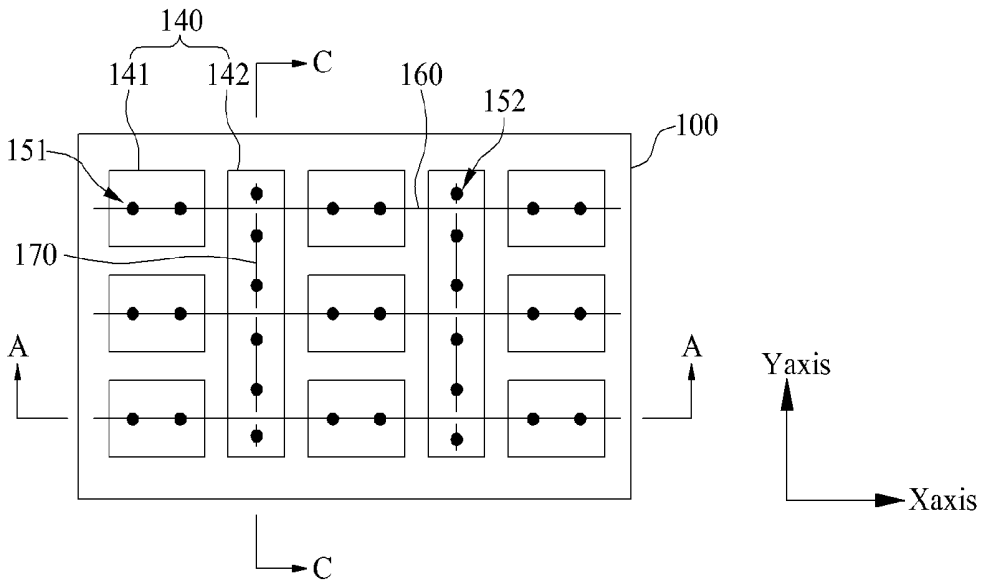


FIG. 5B

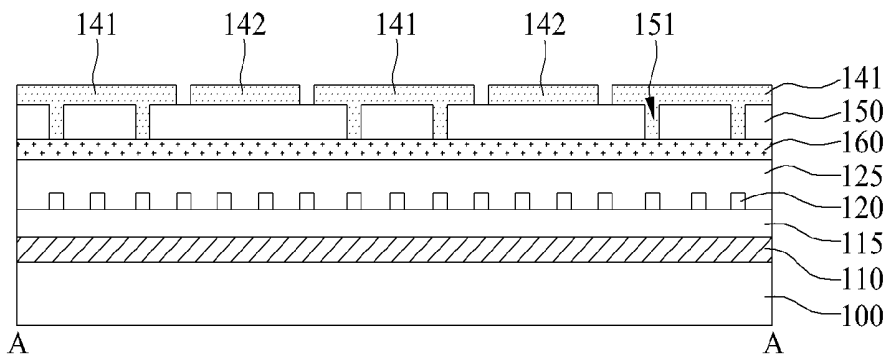
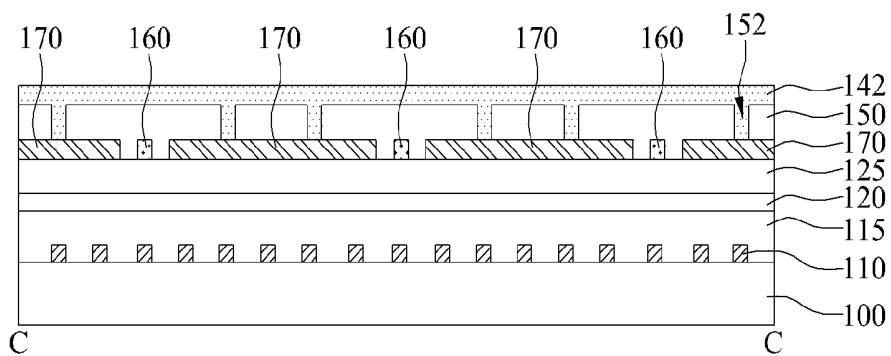


FIG. 5C



**LIQUID CRYSTAL DISPLAY DEVICE
PROVIDED WITH A SENSING ELECTRODE
FOR SENDING A TOUCH OF A USER**

CROSS REFERENCE TO RELATED
APPLICATIONS

This application claims the benefit of the Korean Patent Application No. 10-2010-0098253 filed on Oct. 8, 2010, which is hereby incorporated by reference for all purposes as if fully set forth herein.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a liquid crystal display device, and more particularly, to a liquid crystal display device provided with a sensing electrode for sensing a touch of a user.

2. Discussion of the Related Art

A liquid crystal display device is widely used in various fields of notebook computers, monitors, spacecraft, aircraft, and etc. owing to advantages of low power consumption based on a low driving voltage and portability.

The liquid crystal display device includes a lower substrate, an upper substrate, and a liquid crystal layer formed between the lower and upper substrates. In the liquid crystal display device, an alignment state of liquid crystal molecules in the liquid crystal layer is controlled based on whether or not an electric field is applied thereto, and light transmittance is controlled according to the alignment state of liquid crystal molecules, whereby images are displayed thereon.

It is general that a mouse or key board is used as an input means of the liquid crystal display device. However, a touch screen, which can allow a user to directly input information using a finger or pen, is mainly applied to a navigation system, a portable terminal and electric home appliances.

Hereinafter, a related art liquid crystal display device provided with a touch screen will be described with reference to the accompanying drawings.

FIG. 1 is a cross-sectional view illustrating the related art liquid crystal display device.

As shown in FIG. 1, the related art liquid crystal display device includes a liquid crystal panel **10** and a touch screen **20**.

The liquid crystal panel **10** displays images, and includes a lower substrate **12**, an upper substrate **14**, and a liquid crystal layer **16** formed between these substrates **12** and **14**.

The touch screen **20** is formed on the liquid crystal panel **10** to sense a touch of a user, and includes a touch substrate **22**, a first sensing electrode **24** formed below the touch substrate **22**, and a second sensing electrode **26** formed on the touch substrate **22**.

The first sensing electrode **24** is arranged below the touch substrate **22** in a horizontal direction, and the second sensing electrode **26** is arranged on the touch substrate **22** in a vertical direction. Accordingly, if the user touches a predetermined position, capacitance between the first sensing electrode **24** and the second sensing electrode **26** is varied at the touched position. As a result, the position where capacitance is varied is sensed, whereby the touch position of the user can be sensed.

However, in the aforementioned related art liquid crystal display device, since the touch screen **20** is separately formed on the liquid crystal panel **10**, the overall thickness of the liquid crystal display device is increased by the touch screen

20. For this reason, problems occur in that fabricating process steps are complicated and the fabricating cost is increased.

SUMMARY OF THE INVENTION

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

An advantage of the present invention is to provide a liquid crystal display device in which a sensing electrode for sensing a touch of a user is built in a liquid crystal panel so as not to require a separate touch screen on the liquid crystal panel, whereby the overall thickness of the liquid crystal display device is reduced, fabricating process steps are simplified, and the fabricating cost is reduced.

Additional advantages and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, a liquid crystal display device comprises gate and data lines arranged to cross each other on a substrate to define a pixel region; a pixel electrode formed in the pixel region; a common electrode forming an electric field together with the pixel electrode and sensing a touch of a user; and a sensing line electrically connected with the common electrode, wherein the common electrode includes a plurality of first common electrodes for sensing any one of a touch position of X axis and a touch position of Y axis and a plurality of second common electrodes for sensing the other one of the touch positions of X axis and Y axis, and the sensing line is not electrically connected with the plurality of second common electrodes but electrically connected with the plurality of first common electrodes.

It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

FIG. 1 is a cross-sectional view illustrating the related art liquid crystal display device;

FIG. 2a is a plane view illustrating a lower substrate for a liquid crystal display device according to the first embodiment of the present invention, FIG. 2b is a cross-sectional view taken along line A-A of FIG. 2a, and FIG. 2c is a cross-sectional view taken along line B-B of FIG. 2a;

FIG. 3a is a plane view illustrating a lower substrate for a liquid crystal display device according to the second embodiment of the present invention, FIG. 3b is a cross-sectional view taken along line A-A of FIG. 3a, and FIG. 3c is a cross-sectional view taken along line C-C of FIG. 3a;

FIG. 4a is a plane view illustrating a lower substrate for a liquid crystal display device according to the third embodiment of the present invention, and FIG. 4b is a cross-sectional view taken along line A-A of FIG. 4a; and

FIG. 5a is a plane view illustrating a lower substrate for a liquid crystal display device according to the fourth embodiment of the present invention, FIG. 5b is a cross-sectional view taken along line A-A of FIG. 5a, and FIG. 5c is a cross-sectional view taken along line C-C of FIG. 5a.

DETAILED DESCRIPTION OF THE INVENTION

Reference will now be made in detail to the exemplary embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

FIG. 2a is a plane view illustrating a lower substrate for a liquid crystal display device according to the first embodiment of the present invention, FIG. 2b is a cross-sectional view taken along line A-A of FIG. 2a, and FIG. 2c is a cross-sectional view taken along line B-B of FIG. 2a.

Referring to FIG. 2a, especially a partially enlarged view marked with an arrow, the liquid crystal display device according to the first embodiment of the present invention includes a substrate 100, a gate line 110, a data line 120, a thin film transistor T, a pixel electrode 130, a common electrode 140, and a sensing line 160.

The gate line 110 is arranged on the substrate 100 in a first direction, for example, X axis direction, and the data line 120 is arranged on the substrate 100 in a second direction, for example, Y axis direction. In this way, the gate line 110 and the data line 120 cross each other to define a plurality of pixel regions. Although the gate line 110 and the data line 120 are arranged in a straight line as shown, they may be arranged in a bent line.

The thin film transistor T is a switching element, and is formed in a region where the gate line 110 and the data line 120 cross each other. The thin film transistor T includes a gate electrode 112, a semiconductor layer 117, a source electrode 122 and a drain electrode 124. The gate electrode 112 is extended from the gate line 110, the source electrode 122 is extended from the data line 120, and the drain electrode 124 faces the source electrode 122.

The aforementioned thin film transistor T may have various structures such as a bottom gate structure where the gate electrode 112 is arranged below the semiconductor layer 117 and a top gate structure where the gate electrode 112 is arranged over the semiconductor layer 117. Also, various modifications may be made in types of the respective electrodes.

The pixel electrode 130 is formed in each of the pixel regions, and is electrically connected with the drain electrode 124 of the thin film transistor T. Particularly, the pixel electrode 130 may directly be connected with the drain electrode 124. But, it is not limited to the above example.

The common electrode 140 serves to drive the liquid crystal layer by forming an electric field together with the pixel electrode 130. Particularly, the common electrode 140 includes one or more slits 145 in the pixel region. Accordingly, a fringe field is formed between the pixel electrode 130 and the common electrode 140 through the slits 145, and the liquid crystal may be driven by the fringe field.

Meanwhile, the common electrode 140 serves to drive the liquid crystal by forming the electric field together with the pixel electrode 130 as described above and also serves as a sensing electrode for sensing a touch position of a user. In

order to serve as the sensing electrode, the common electrode 140 is not formed on the entire surface of the substrate 100 but formed in a predetermined pattern.

In other words, as shown in FIG. 2a, the common electrode 140 includes a plurality of first common electrodes 141 and a plurality of second common electrodes 142. At this time, a position of Y axis touched by the user may be sensed by the first common electrodes 141, and a position of X axis touched by the user may be sensed by the second common electrodes 142.

The sizes of the first and second common electrodes 141 and 142 may be formed appropriately considering a touch surface of a finger or pen. For example, the first common electrode 141 may be formed to include several tens of pixels or several hundreds of pixels.

Hereinafter, the first and second common electrodes 141 and 142 serving as the sensing electrodes will be described in more detail.

First of all, in order to sense the position of the X axis touched by the user, the plurality of second common electrodes 142 are spaced apart from one another at predetermined intervals in X axis direction. Also, the second common electrodes 142 are longitudinally formed in a Y axis direction, and their end is connected with a sensing circuit although not shown.

Accordingly, if the user touches a predetermined position, the sensing circuit recognizes the second common electrode 142 of which capacitance is varied, among the plurality of second common electrodes 142. As a result, the position of the X axis touched by the user can be sensed.

Next, in order to sense the position of the Y axis touched by the user, the plurality of first common electrodes 141 are spaced apart from one another at predetermined intervals in Y axis direction. However, if the first common electrodes 141 are longitudinally formed in X axis direction, the first common electrode 141 and the second common electrode 142 are electrically connected with each other, whereby the positions of the X axis and the Y axis touched by the user cannot be sensed. Accordingly, the first common electrodes 141 are not formed longitudinally in X axis direction but spaced apart from one another at predetermined intervals in X axis direction. In other words, as shown, the second common electrode 142 is formed between the first common electrodes 141 in X axis direction, whereas the second common electrode 142 is not formed between the first common electrodes 141 in Y axis direction.

Since the plurality of first common electrodes 141 are spaced apart from one another at predetermined intervals in X axis direction by interposing the second common electrode 142 therebetween as described above, it is required that the plurality of first common electrodes 141 are electrically connected with one another.

The sensing line 160 is extended in X axis direction as above to electrically connect the first common electrodes 141 with one another. Although not shown, the end of the sensing line 160 is connected with the sensing circuit.

Accordingly, if the user touches a predetermined position, the sensing circuit recognizes the first common electrode 141 of which capacitance is varied, among the plurality of first common electrodes 141. As a result, the position of the Y axis touched by the user can be sensed.

Meanwhile, although the sensing line 160 serves to electrically connect the first common electrodes 141 arranged in X axis direction with one another, the first common electrode 141 should not be connected with the second common electrode 142 electrically due to the sensing line 160. Accordingly, although the sensing line 160 is electrically connected

with the first common electrodes **141**, it is not connected with the second common electrodes **142** electrically.

Meanwhile, the sensing line **160** is connected with the common electrodes **140** through a predetermined first contact hole **151**. In this case, since the first contact hole **151** is formed only in a region for the first common electrodes **141**, the sensing line **160** is electrically connected with the first common electrode **141** through the first contact hole **151** but is not connected with the second common electrode **142** electrically.

Meanwhile, although one sensing line **160** is connected with the first common electrode **141** as shown, a plurality of sensing lines **160** may be connected with the first common electrode **141**. Particularly, since a transparent conductive oxide having high resistance such as ITO is generally used as the first common electrode **141**, the plurality of sensing lines **160** of metal having excellent electric conductivity are preferably connected with the first common electrode **141** to reduce resistance.

If the sensing line **160** is formed of opaque metal having excellent electric conductivity to reduce resistance, light transmittance may be reduced due to the sensing line **160**. Accordingly, the sensing line **160** is preferably formed in a non-transmissive region through which light is not transmitted, to prevent light transmittance from being reduced. Namely, as shown in the partially enlarged view of FIG. **2a**, the sensing line **160** is preferably formed in a region corresponding to the gate line **110**.

Also, although the first common electrode **141** is connected with the sensing line **160** through the two first contact holes **151** as shown, it may be connected with the sensing line **160** through one first contact hole **151** or three or more first contact holes **151**. However, in order to reduce resistance, it is preferable to increase the number of the first contact holes **151**. Also, as shown in the partially enlarged view of FIG. **2a**, the first contact hole **151** may be formed in the region where the gate line **110** and the data line **120** cross each other. However, the position of the first contact holes **151** is not limited to the example of FIG. **2a**.

It has been described that the second common electrodes **142** are longitudinally arranged in Y axis direction and the first common electrodes **141** are connected with the sensing line **160** in X axis direction. However, the second common electrodes **142** may longitudinally be arranged in X axis direction, and the first common electrodes **141** may be connected with the sensing line **160** in Y axis direction. If the sensing line **160** is extended in Y axis direction, it is preferably formed in a region corresponding to the data line **120** to prevent light transmittance from being reduced.

Hereinafter, a sectional structure of the liquid crystal display device according to the first embodiment of the present invention will be described with reference to FIG. **2b** and FIG. **2c**.

FIG. **2b** corresponds to a section of the gate line **110** taken in a vertical direction. As shown in FIG. **2b**, the gate line **110** is formed on the substrate **100**, and a gate insulating film **115** is formed on the gate line **110**. Also, the data line **120** is formed on the gate insulating film **115** at a predetermined interval, and a first passivation film **125** is formed on the data line **120**.

The first common electrode **141** and the second common electrode **142** are alternately formed on the first passivation film **125**, a second passivation film **150** is formed on the first common electrode **141** and the second common electrode **142**, and the sensing line **160** is formed on the second passivation film **150**.

At this time, since the first contact hole **151** is formed in the second passivation film **150**, the sensing line **160** is electrically connected with the first common electrode **141** through the first contact hole **151**. Particularly, since the first contact hole **151** is formed in the region corresponding to the first common electrode **141**, the sensing line **160** is electrically connected with the first common electrode **141** but is not electrically connected with the second common electrode **142**.

FIG. **2c** corresponds to a section of the pixel region taken in a vertical direction. As shown in FIG. **2c**, the gate electrode **112** is formed on the substrate **100**, and the gate insulating film **115** is formed on the gate electrode **112**. Also, the semiconductor layer **117** is formed on the gate insulating film **115**, and source and drain electrodes **122** and **124** are formed on the semiconductor layer **117** to face each other.

Since the pixel electrode **130** is formed on the drain electrode **124**, the drain electrode **124** is directly connected with the pixel electrode **130**. Meanwhile, although the pixel electrode **130** may be extended to the upper surface of the drain electrode **124** as shown, it may be extended to the lower surface of the drain electrode **124**.

The first passivation film **125** is formed on the pixel electrode **130**, the common electrode **140** is formed on the first passivation film **125**, and a second passivation film **150** is formed on the common electrode **140**.

Since the common electrode **140** includes one or more slits **145** above the pixel electrode **130**, a fringe field may be formed between the pixel electrode **130** and the common electrode **140**.

Meanwhile, the aforementioned liquid crystal display device according to the first embodiment of the present invention may be driven by a projected cap mode such as a self cap mode or a mutual cap mode.

The projected cap mode allows the user to sense the positions of the X axis and the Y axis by sensing capacitance varied between the first common electrode **141** and the second common electrode **142** if the user touches a predetermined position. The projected cap mode may be divided into a self cap mode and a mutual cap mode depending on a voltage mode applied to the electrodes **141** and **142**.

The self cap mode is to sense the positions of the X axis and the Y axis by sensing capacitance variation between the first common electrode **141** and the second common electrode **142** when the user touches a predetermined position after simultaneously applying a voltage to the sensing lines **160** connecting the first common electrodes **141**.

By contrast, the mutual cap mode is to sense the positions of the X axis and the Y axis by sensing capacitance variation between the first common electrode **141** and the second common electrode **142** when the user touches a predetermined position after applying a voltage to the sensing lines **160**, which connects the first common electrodes **141**, in accordance with a time gap. In other words, the mutual cap mode means that the sensing line **160** serves as a transmission line and the common electrode **142** serves as a reception line, and has recently received more attention than the self cap mode.

FIG. **3a** is a plane view illustrating a lower substrate for a liquid crystal display device according to the second embodiment of the present invention, FIG. **3b** is a cross-sectional view taken along line A-A of FIG. **3a**, and FIG. **3c** is a cross-sectional view taken along line C-C of FIG. **3a**.

The lower substrate for the liquid crystal display device according to the second embodiment of the present invention as shown in FIG. **3a** to FIG. **3c** is the same as that for the liquid crystal display device according to the first embodiment of the present invention except that a conductive line **170** is

additionally connected with a plurality of second common electrodes **142**. Accordingly, the same reference numbers will be used throughout the drawings to refer to the same or like parts, and detailed description of the same or like parts will be omitted.

As shown in FIG. **3a**, according to the second embodiment of the present invention, the conductive line **170** is connected with the plurality of second common electrodes **142**.

A transparent conductive oxide such as ITO is generally used as the second common electrode **142**. The transparent conductive oxide has a problem in that resistance is high. Accordingly, in the second embodiment of the present invention, the conductive line **170** of a metal having excellent electric conductivity is connected with the second common electrode **142** to reduce resistance of the second common electrode **142**.

The conductive line **170** is connected with the second common electrode **142** through a second contact hole **152**. In this case, it is preferable that more second contact holes **152** are provided to reduce resistance.

It is preferable that the conductive line **170** is extended in a length direction of the second common electrode **142**, i.e., Y axis direction. However, in this case, the conductive line **170** is cross-connected with the sensing line **160**, whereby short occurs. Accordingly, the conductive line **170** is formed as a discontinuous line such that it is not connected with the sensing line **160**.

The conductive line **170** may be formed of the same opaque metal as that of the sensing line **160** by the same process as that of the sensing line **160**. If the conductive line **170** is formed of the opaque metal, light transmittance may be reduced due to the conductive line **170**. Accordingly, the conductive line **170** is preferably formed in a non-transmissive region through which light is not transmitted, to prevent light transmittance from being reduced. Namely, as shown in the partially enlarged view of FIG. **3a**, the conductive line **170** is preferably formed in a region corresponding to the data line **120**.

Although one discontinuous conductive line **170** is connected with the second common electrode **142** as shown, it is preferable that a plurality of conductive lines **170** are connected with the second common electrode **142** to minimize resistance of the second common electrode **142**. Also, it is preferable that each of the plurality of conductive lines **170** is formed in the region corresponding to the data line **120** to prevent light transmittance from being reduced. The conductive line **170** may be formed in a region corresponding to the gate line **110** as the case may be.

FIG. **3b** corresponds to a section of line A-A of FIG. **3a**, and is the same as FIG. **2b** of the first embodiment. Accordingly, the repeated description will be omitted.

FIG. **3c** corresponds to a section of the data line **120** taken along line C-C of FIG. **3a** in a vertical direction. In more detail, gate lines **110** are formed on the substrate **100** at predetermined intervals, and a gate insulating film **115** is formed on the gate lines **110**. Also, a data line **120** is formed on the gate insulating film **115**, and a first passivation film **125** is formed on the data line **120**.

A second common electrode **142** is formed on the first passivation film **125**, and a second passivation film **150** is formed on the second common electrode **142**.

A sensing line **160** and a conductive line **170** are alternately formed on the second passivation film **150**. At this time, since a second contact hole **152** is formed in the second passivation film **150**, the conductive line **170** is electrically connected with the second common electrode **142** through the second contact hole **152**.

FIG. **4a** is a plane view illustrating a lower substrate for a liquid crystal display device according to the third embodiment of the present invention, and FIG. **4b** is a cross-sectional view taken along line A-A of FIG. **4a**.

The lower substrate for the liquid crystal display device according to the third embodiment of the present invention as shown in FIG. **4a** and FIG. **4b** is the same as that for the liquid crystal display device according to the first embodiment of the present invention except for a layer formed between the common electrodes **141** and **142** and the sensing line **160**. Accordingly, the same reference numbers will be used throughout the drawings to refer to the same or like parts, and repeated description of the same or like parts will be omitted.

In the first embodiment of the present invention as described above, the common electrodes **141** and **142** and the sensing line **160** are formed by interposing the second passivation film **150** therebetween, wherein the common electrodes **141** and **142** are formed below the second passivation film **150** and the sensing line **160** is formed over the second passivation film **150**.

However, in the third embodiment of the present invention, although the common electrodes **141** and **142** and the sensing line **160** are formed by interposing the second passivation film **150**, the first common electrodes **141** and **142** are formed over the second passivation film **150** and the sensing line **160** is formed below the second passivation film **150**.

Referring to FIG. **4b**, a gate line **110** is formed on a substrate **100**, a gate insulating film **115** is formed on the gate line **110**, a data line **120** is formed on the gate insulating film **115**, and a first passivation film **125** is formed on the data line **120**.

The sensing line **160** is formed on the first passivation film **125**, and the second passivation film **150** is formed on the sensing line **160**. Also, the first common electrode **141** and the second common electrode **142** are alternately formed on the second passivation film **150**.

At this time, since the first contact hole **151** is formed in the second passivation film **150**, the sensing line **160** is electrically connected with the first common electrode **141** through the first contact hole **151**. Particularly, since the first contact hole **151** is formed in the region corresponding to the first common electrode **141**, the sensing line **160** is electrically connected with the first common electrode **141** but is not electrically connected with the second common electrode **142**.

FIG. **5a** is a plane view illustrating a lower substrate for a liquid crystal display device according to the fourth embodiment of the present invention, FIG. **5b** is a cross-sectional view taken along line A-A of FIG. **5a**, and FIG. **5c** is a cross-sectional view taken along line C-C of FIG. **5a**.

The lower substrate for the liquid crystal display device according to the fourth embodiment of the present invention as shown in FIG. **5a** to FIG. **5c** is the same as that for the liquid crystal display device according to the third embodiment of the present invention except that a conductive line **170** is additionally connected with a plurality of second common electrodes **142**. Accordingly, the same reference numbers will be used throughout the drawings to refer to the same or like parts, and detailed description of the same or like parts will be omitted.

As shown in FIG. **5a**, according to the fourth embodiment of the present invention, since the conductive line **170** of a metal having excellent electric conductivity is connected with a plurality of second common electrodes **142**, resistance of the second common electrodes **142** may be reduced.

The conductive line 170 is connected with the second common electrode 142 through a second contact hole 152. In this case, it is preferable that more second contact holes 152 are provided to reduce resistance.

The conductive line 170 is formed as a discontinuous line such that it is not connected with the sensing line 160.

It is preferable that the conductive line 170 is formed in a non-transmissive region through which light is not transmitted, i.e., a region corresponding to the data line, to prevent light transmittance from being reduced. It is also preferable that a plurality of conductive lines 170 are connected with the second common electrode 142 to minimize resistance of the second common electrode 142.

FIG. 5b corresponds to a section of line A-A of FIG. 5a, and is the same as FIG. 4b of the third embodiment. Accordingly, the repeated description will be omitted.

FIG. 5c corresponds to a section of the data line 120 taken along line C-C of FIG. 5a in a vertical direction. In more detail, gate lines 110 are formed on the substrate 100 at predetermined intervals, and a gate insulating film 115 is formed on the gate lines 110. Also, a data line 120 is formed on the gate insulating film 115, and a first passivation film 125 is formed on the data line 120.

A sensing line 160 and a conductive line 170 are alternately formed on the first passivation film 125.

A second passivation film 150 is formed on the conductive line 170 and the sensing line 160, and a second common electrode 142 is formed on the second passivation film 150. At this time, since a second contact hole 152 is formed in the second passivation film 150, the conductive line 170 is electrically connected with the second common electrode 142 through the second contact hole 152.

The lower substrate constituting the liquid crystal display device according to the present invention has been described in detail as above. Accordingly, the liquid crystal display device according to the present invention includes the lower substrate, an upper substrate provided with a color filter, and a liquid crystal layer formed between both substrates.

The upper substrate may include light shielding layers for shielding light from leaking to a region other than the pixel region, color filter layers of red R, green G and blue B formed between the light shielding layers, and an overcoat layer formed on the color filter layers. Various modifications known in the art may be made in the above structure of the upper substrate.

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 inventions. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

As described above, the liquid crystal display device according to the present invention has the following advantages.

Since the common electrode used to form an electric field for driving a liquid crystal is used as a sensing electrode for sensing a touch of a user, a separate touch screen on the liquid crystal panel is not required unlike the related art, whereby the overall thickness of the liquid crystal display device is reduced, fabricating process steps are simplified, and the fabricating cost is reduced.

What is claimed is:

1. A liquid crystal display device comprising:
 - gate and data lines arranged to cross each other on a substrate to define a pixel region;
 - a pixel electrode formed in the pixel region;
 - a common electrode forming an electric field together with the pixel electrode and sensing a touch of a user; and
 - a sensing line electrically connected with the common electrode, wherein the common electrode includes a plurality of first common electrodes for sensing any one of a touch position of X axis and a touch position of Y axis and a plurality of second common electrodes for sensing the other one of the touch positions of X axis and Y axis, and the sensing line is not electrically connected with the plurality of second common electrodes but electrically connected with the plurality of first common electrodes, wherein the common electrode and the sensing line are formed on the same substrate, and
 - wherein the plurality of second common electrodes are continuously extended from one end portion of the substrate to the other portion of the substrate; and
 - a conductive line electrically connected with the second common electrodes to reduce resistance of the second common electrodes.
2. The liquid crystal display device of claim 1, wherein the pixel electrode is formed below a first passivation film, and the common electrode is formed over the first passivation film and includes one or more slits in the pixel region.
3. The liquid crystal display device of claim 1, wherein the sensing line and the common electrode are spaced apart from each other by interposing a second passivation film therebetween, and the sensing line is electrically connected with the first common electrodes through a first contact hole provided in the second passivation film.
4. The liquid crystal display device of claim 1, wherein the sensing line is formed in a region corresponding to the gate line or the data line.
5. The liquid crystal display device of claim 1, wherein each of the second common electrodes is longitudinally extended in X axis direction or Y axis direction, and the respective first common electrodes are spaced apart from each other by interposing the second common electrodes therebetween.
6. The liquid crystal display device of claim 5, wherein the sensing line is extended in a direction crossing the extended direction of the second common electrodes.
7. The liquid crystal display device of claim 1, wherein the conductive line is spaced apart from the common electrode by interposing the second passivation film therebetween, and is electrically connected with the second common electrode through a second contact hole provided in the second passivation film.
8. The liquid crystal display device of claim 1, wherein the conductive line is formed in a region corresponding to the gate line or the data line.
9. The liquid crystal display device of claim 1, wherein the conductive line is not electrically connected with the sensing line.

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专利名称(译)	液晶显示装置，具有用于发送用户触摸的感应电极		
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申请(专利权)人(译)	宋INHYUK		
当前申请(专利权)人(译)	LG DISPLAY CO. , LTD.		
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摘要(译)

本发明公开了一种液晶显示装置，包括栅极和数据线，所述栅极和数据线设置在基板上彼此交叉以限定像素区域；形成在像素区域中的像素电极；公共电极与像素电极一起形成电场并感测用户的触摸；以及与公共电极电连接的感测线，其中公共电极包括多个第一公共电极，用于感测X轴的触摸位置和Y轴的触摸位置中的任何一个，以及多个第二公共电极，用于感测X轴和Y轴的触摸位置中的另一个，并且感测线不与多个第二公共电极电连接，而是与多个第一公共电极电连接。

