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Chun et al.

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(54) **LIQUID CRYSTAL DISPLAY DEVICE FREE FROM CROSS TALK AND FABRICATION METHOD THEREOF**

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(51) **Int. Cl.**
G02F 1/1339 (2006.01)

(52) **U.S. Cl.** **349/156**; 349/155; 349/187

(58) **Field of Classification Search** 349/155–156, 349/153, 106, 56, 39, 110, 139, 187
See application file for complete search history.

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(57) **ABSTRACT**

A liquid crystal display device free from cross talk is disclosed. The device has a supporting column, a contact part and an electrically conductive layer. The supporting column is provided for an upper substrate and vertically extended therefrom to maintain a uniform cell gap. The contact part is provided for a common line disposed at a peripheral region outside an active area of a lower substrate. The contact part faces the supporting column at a corresponding place to guide a communication between the supporting column and the common line. And, the conductive layer is formed on surfaces of the supporting column and the upper substrate. A portion of the conductive layer on the supporting column is joined to the common line within the contact part to establish a signal interconnection between the lower substrate and the upper substrate. A related fabrication method is also disclosed.

5 Claims, 6 Drawing Sheets

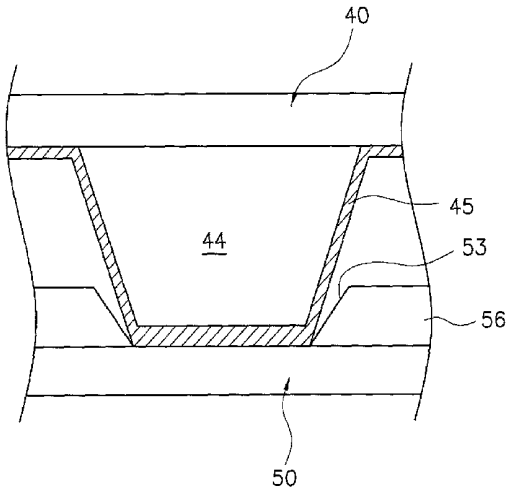

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FIG. 1
(PRIOR ART)

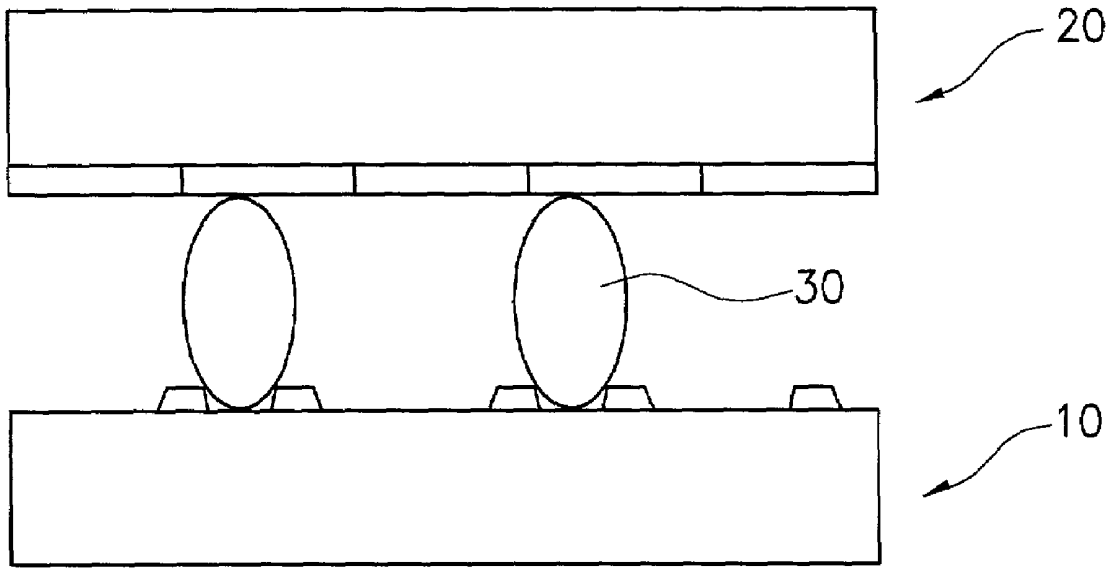


FIG.2

(PRIOR ART)

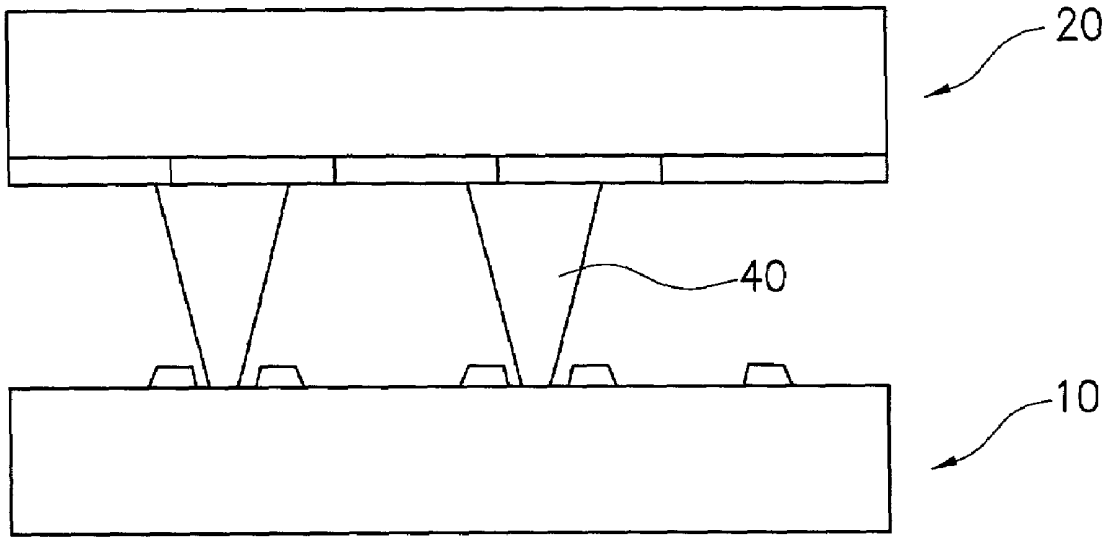


FIG.3
(PRIOR ART)

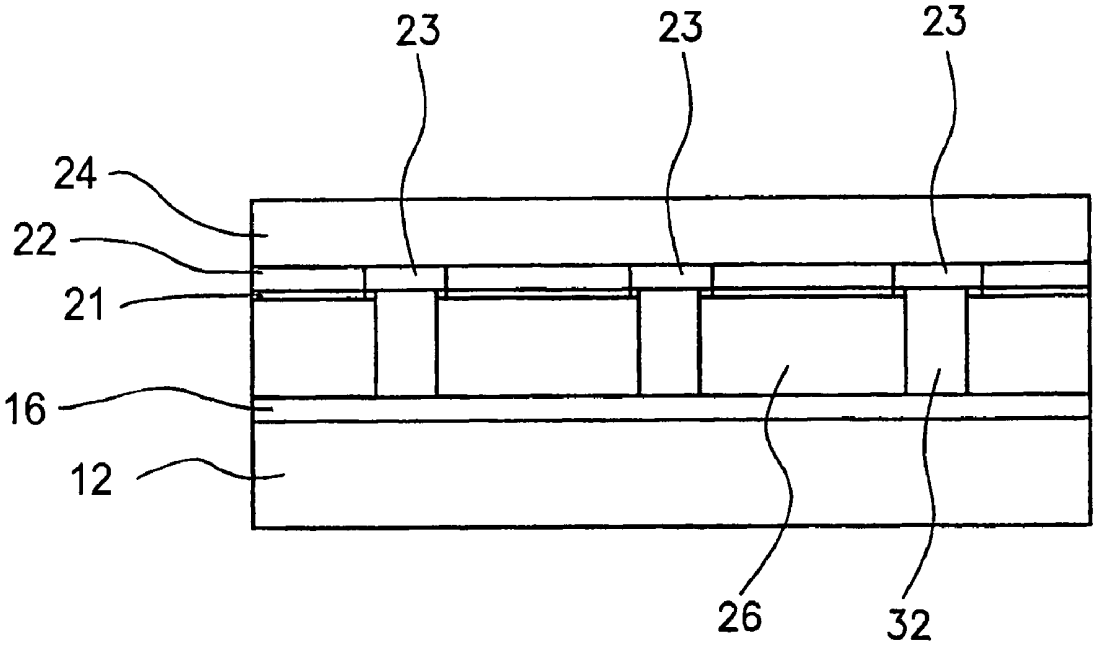


FIG.4

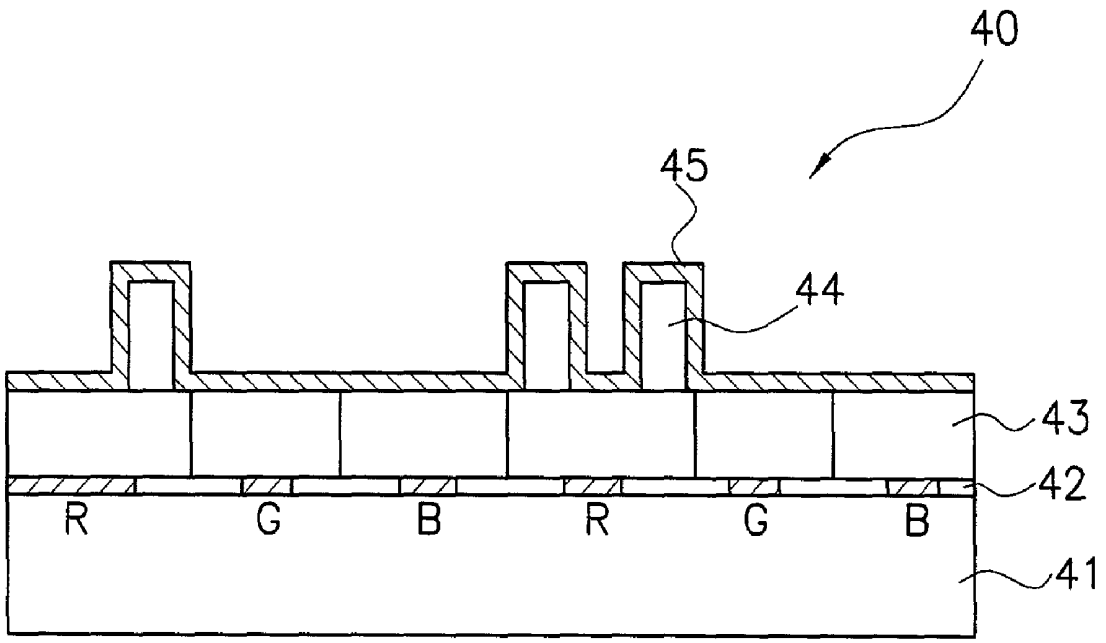


FIG.5

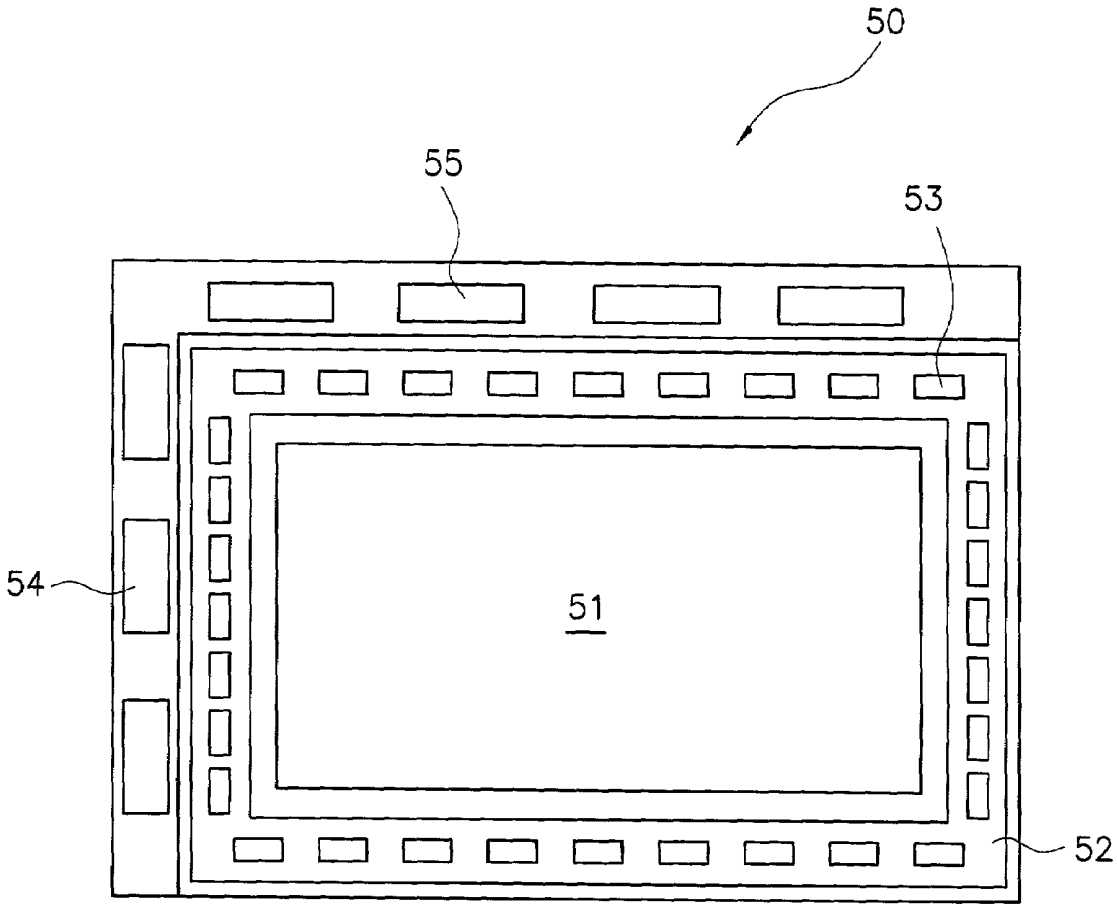
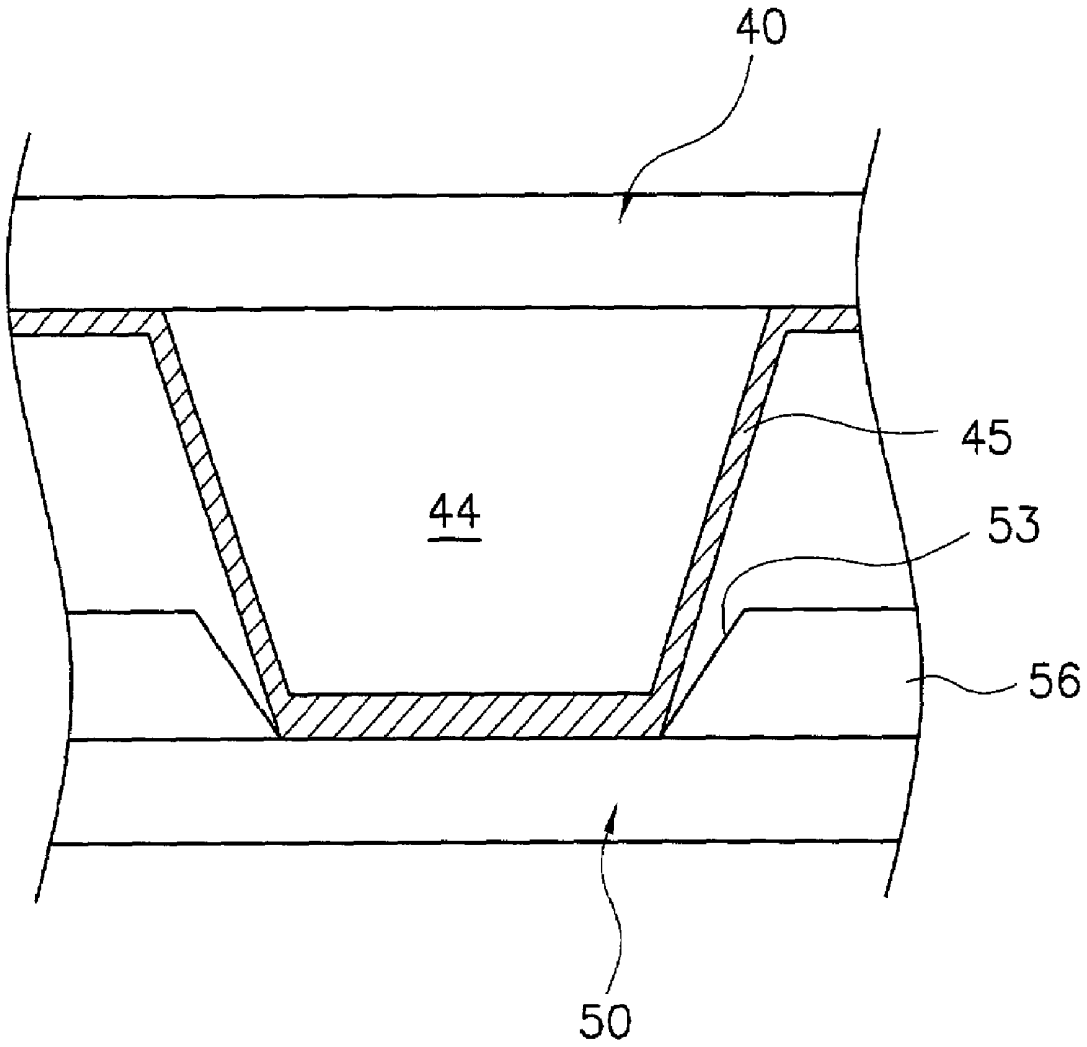


FIG.6



LIQUID CRYSTAL DISPLAY DEVICE FREE FROM CROSS TALK AND FABRICATION METHOD THEREOF

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to a liquid crystal display (LCD) device. More particularly, the present invention relates to a thin film transistor (TFT) LCD device and a fabrication method thereof, in which a cross talk caused by an alteration of an electric field is prevented.

2. Description of the Prior Art

As widely known in the art, the TFT LCD device is a typical electronic display device functioning by deformation of liquid crystal molecules according to the electric field between confronting electrodes on lower and upper substrates. In the TFT LCD device, the upper substrate usually referred as a color filter substrate maintains a uniform voltage by mostly receiving signals from the lower substrate usually referred as an array substrate.

To provide such signals to the upper substrate, a so-called transfer is currently used for interconnection between the lower and upper substrates. The interconnection transfer is generally located between outer lead bonding pads of an LCD panel or at a peripheral region outside an active area, and also penetrates a liquid crystal layer.

However, this may cause a difference in voltage between central and peripheral regions in the entire panel. That is, a common signal is differently provided to each color filter region, so that undesirable cross talk is generated while degrading the quality of a screen of the LCD panel.

On the other hand, as another factor in good quality of the screen, the liquid crystal layer should have a uniform cell gap between the lower and upper substrates. One of conventional solutions to satisfy this requisite is to use a spacer ball **30** shown in FIG. **1**. Referring to FIG. **1**, the spacer ball **30** is interposed between the lower and upper substrates **10** and **20**, thus uniformly maintaining the gap therebetween.

Such a conventional solution using the spacer ball has, however, some drawbacks. For example, since the spacer ball is only several microns in diameter, variations of diameter may often happen. In addition, due to the movement of grains in the spacer ball, a photoalignment layer may be destroyed or the grains may be agglomerated. Besides, the use of the spacer ball may cause the leakage of light. Unfortunately, these drawbacks may result in bad problems such as poor display and low contrast ratio. To solve these problems, various approaches such as the coloring of the spacer ball, the development of a fixed spacer, or the increase in hardness of the ball have been made, but satisfactory results have been not given.

Recently, one way has been proposed to overcome the drawbacks of the conventional spacer ball. The way is, as shown in FIG. **2**, to form a supporting column **40** under the upper substrate **20**. The supporting column **40** is made of photosensitive polyimide, photosensitive acrylic acid resin, photosensitive coloring resin, or photoresist by using a photolithography process. Generally, the supporting column has a trapezoid body shape and a round tip.

FIG. **3** illustrates a conventional LCD device employing a supporting column **32**. As depicted in FIG. **3**, a color filter layer **22** and a black matrix **23** are formed under a glass board **24** for the upper substrate. Next, indium tin oxide (ITO) layers **16** and **21** are formed respectively on a glass board **12** for the lower substrate and under the upper glass board **24**. The supporting column **32** is then formed through

the liquid crystal layer **26** by using the above-mentioned material and process. The supporting column **32** is placed at every pixel, and preferably disposed at a red or blue region.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a liquid crystal display device and a fabrication method thereof, which, without employing a conventional spacer ball as well as a conventional interconnection transfer, can maintain a uniform cell gap and also realize a signal interconnection between lower and upper substrates.

Another object of the present invention is to provide a liquid crystal display device and a fabrication method thereof in which a cross talk is prevented by entirely applying an electric field to an upper substrate.

Still another object of the present invention is to provide a liquid crystal display device and a fabrication method thereof without requiring a conventional dotting process for forming an interconnection transfer, thereby reducing fabrication cost.

To achieve these and other objects in accordance with the present invention, a liquid crystal display device that comprises a supporting column, a contact part and an electrically conductive layer is provided. The supporting column is provided for an upper substrate and vertically extended from the upper substrate so as to maintain a uniform cell gap. The contact part is provided for a common line disposed at a peripheral region outside an active area of a lower substrate confronting the upper substrate. The contact part faces the supporting column at a corresponding position so as to guide a communication between the supporting column and the common line. And, the electrically conductive layer is formed on surfaces of the supporting column and the upper substrate. A portion of the electrically conductive layer on the supporting column is joined to the common line within the contact part so as to establish a signal interconnection between the lower substrate and the upper substrate.

Preferably, an insulating layer may be further provided for the common line, and the contact part may be a contact hole formed in the insulating layer so as to expose a portion of the common line.

According to another aspect of the present invention, a method for fabricating a liquid crystal display device is provided. In the method, a supporting column is provided for an upper substrate, wherein the supporting column is vertically extended from the upper substrate so as to maintain a uniform cell gap. Then an electrically conductive layer is formed on surfaces of the supporting column and the upper substrate. In addition, a contact part is provided for a common line disposed at a peripheral region outside an active area of a lower substrate confronting the upper substrate, wherein the contact part faces the supporting column at a corresponding position. Finally, the lower substrate and the upper substrate are united so that a portion of the electrically conductive layer on the supporting column is joined to the common line within the contact part. Accordingly, a signal interconnection is established between the lower substrate and the upper substrate.

Preferably, the providing of the contact part may include providing an insulating layer for the common line and forming a contact hole in the insulating layer so as to expose a portion of the common line. Furthermore, the electrically conductive layer may include an indium tin oxide (ITO) layer.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a cross-sectional view showing a conjunctional structure of lower and upper substrates in a conventional liquid crystal display device.

FIG. **2** is a cross-sectional view showing another conjunctional structure of lower and upper substrates in a conventional liquid crystal display device.

FIG. **3** is a cross-sectional view showing a constitution of a conventional liquid crystal display device.

FIG. **4** is a cross-sectional view showing a structure of an upper substrate in a liquid crystal display device according to an embodiment of the present invention.

FIG. **5** is a plan view showing a structure of a lower substrate in a liquid crystal display device according to an embodiment of the present invention.

FIG. **6** is a cross-sectional view partially showing a vertical structure after a conjunction of lower and upper substrates in a liquid crystal display device according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention will be now described more fully hereinafter with reference to accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

FIG. **4** is a cross-sectional view showing a structure of an upper substrate in a liquid crystal display device according to an embodiment of the present invention. Referring to FIG. **4**, the upper substrate **40** usually referred as a color filter substrate is composed of a black matrix **42** formed on a glass board **41**, a color filter layer **43** formed on the black matrix, a supporting column **44** formed on a portion of the color filter layer **43**, and an electrically conductive layer **45** formed on surfaces of the supporting column **44** and the color filter layer **43**. The conductive layer **45** is preferably formed of indium tin oxide.

The supporting column **44** is vertically extended from the upper substrate **40**, thereby enabling to maintain a uniform cell gap. In addition, the conductive layer **45** covering the supporting column **44** acts as a substitute for a conventional interconnection transfer, as will be described later.

FIG. **5** is a plan view showing a structure of a lower substrate in a liquid crystal display device according to an embodiment of the present invention. As shown in FIG. **5**, the lower substrate **50** usually referred as an array substrate has an active area **51** where pixels are formed, a common line **52** disposed at a peripheral region outside the active area **51**, and a contact hole **53** formed on the common line **52**. The lower substrate **50** confronts the upper substrate (**40** in FIG. **4**), while the contact hole **53** of the lower substrate **50** faces the supporting column (**44** in FIG. **4**) of the upper substrate.

That is, the contact hole **53** is placed at a corresponding position to the supporting column. The contact hole **53** can therefore serve as a contact part for guiding a communication between the supporting column of the upper substrate and the common line **52** of the lower substrate **50** when both substrates are joined together. The contact hole **53** is actually formed in an insulating layer **56**, shown in FIG. **6**, covering the common line **52**. The lower substrate **50** further has a gate outer lead bonding pad **54** and a data outer lead bonding pad **55**, both pads being well known in the art.

FIG. **6** is a cross-sectional view partially showing a vertical structure after a conjunction of lower and upper substrates in a liquid crystal display device according to an embodiment of the present invention. As depicted in FIG. **6**, the insulating layer **56** is formed on the lower substrate **50** and has the contact hole **53** selectively exposing the lower substrate **50**. Particularly, as stated above, the contact hole **53** is located on the common line (**52** in FIG. **5**) of the lower substrate **50**. When the upper and lower substrates **40** and **50** are united, the supporting column **44** covered with the conductive layer **45** is partially inserted into the contact hole **53**. Therefore, a portion of the conductive layer **45** on the surface of the supporting column **44** is joined to the common line of the lower substrate **50** within the contact hole **53**, thus enabling to establish a signal interconnection between the upper and lower substrates **40** and **50**.

As fully described hereinbefore, the liquid crystal display device according to the present invention does not employ a conventional spacer ball nor a conventional interconnection transfer, but the device maintains a uniform cell gap and also realize a signal interconnection between the lower and upper substrates. As a substitute for the conventional interconnection transfer, the electrically conductive layer covering the supporting column is used. Additionally, the conductive layer covers the entire upper substrate as well as the supporting column, while uniformly existing over the peripheral region outside the active area in the LCD panel. Accordingly, the common signal is uniformly provided to each color filter region, so that undesirable cross talk is effectively prevented and the quality of the LCD screen is also improved. Furthermore, since the method of the present invention does not require a conventional dotting process for the interconnection transfer, the fabrication cost is considerably reduced.

In the drawings and specification, there have been disclosed typical preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being set forth in the following claims.

What is claimed is:

1. A liquid crystal display device having upper and lower substrates and an active area having pixels for displaying an image, the display device comprising:

a supporting column extending from the upper substrate to the lower substrate so as to maintain a uniform cell gap therebetween, said supporting column having an outer surface inclined relative to the lower substrate at a first angle, relative to the lower substrate;

a contact part having an interior surface that is inclined with respect to the lower substrate at a second angle, relative to the lower substrate, the second angle being different than the first angle, said contact part being provided for a common line disposed at a peripheral region outside the active area of the lower substrate opposite to the upper substrate, wherein the contact part faces the supporting column at a corresponding position so as to guide electrical communication between the supporting column and the common line; and

an electrically conductive layer formed on the outer surfaces of the supporting column and on a corresponding outer surface of the upper substrate, wherein a portion of the electrically conductive layer on the supporting column is joined to the common line within

the contact part so as to establish a signal interconnection between the lower substrate and the upper substrate.

2. The liquid crystal display device of claim **1**, wherein an insulating layer is further provided for the common line, and the contact part is a contact hole formed in the insulating layer so as to expose a portion of the common line.

3. A method for fabricating a liquid crystal display device upper and lower substrates and having an active area having pixels for displaying an image, the method, comprising the steps of:

providing a supporting column extending from the upper substrate to a lower substrate so as to maintain a uniform cell gap between the upper substrate and the lower substrate, said supporting column having an outer surface inclined with respect to the lower substrate to form a first angle between the outer surface of the supporting column and the lower substrate;

forming an electrically conductive layer on the outer surface of the supporting column and on the upper substrate;

providing a contact part for a common line disposed at a peripheral region outside the active area of the lower substrate confronting the upper substrate, wherein the contact part faces the supporting column at a corresponding position and having an interior surface that is inclined with respect to the lower substrate to form a second angle between said interior surface and the lower substrate, said second angle being at different than the first angle; and

uniting the lower substrate and the upper substrate so that a portion of the electrically conductive layer on the supporting column is joined to the common line within the contact part, thereby establishing a signal interconnection between the lower substrate and the upper substrate.

4. The method of claim **3**, wherein the providing of the contact part includes providing an insulating layer for the common line and forming a contact hole in the insulating layer so as to expose a portion of the common line.

5. The method of claim **3**, wherein the electrically conductive layer includes an indium tin oxide (ITO) layer.

* * * * *

专利名称(译)	无串扰的液晶显示装置及其制造方法		
公开(公告)号	US7215404	公开(公告)日	2007-05-08
申请号	US09/994283	申请日	2001-11-26
[标]申请(专利权)人(译)	CHUN JIN YOUNG LEE SEOK LYUL		
申请(专利权)人(译)	CHUN JIN YOUNG LEE SEOK LYUL		
当前申请(专利权)人(译)	BOE-HYDIS TECHNOLOGY CO.，LTD.		
[标]发明人	CHUN JIN YOUNG LEE SEOK LYUL		
发明人	CHUN, JIN YOUNG LEE, SEOK LYUL		
IPC分类号	G02F1/1339 G02F1/136 G02F1/1343 G02F1/1345 G09F9/30 G09F9/35		
CPC分类号	G02F1/13394		
代理机构(译)	LADAS & PARRY LLP		
优先权	1020000070707 2000-11-25 KR		
其他公开文献	US20020063840A1		
外部链接	Espacenet USPTO		

摘要(译)

公开了一种没有串扰的液晶显示装置。该装置具有支撑柱，接触部分和导电层。支撑柱设置用于上基板并从其垂直延伸以保持均匀的单元间隙。接触部分被设置用于设置在下基板的有源区域外部的外围区域处的公共线。接触部分在相应的位置面向支撑柱，以引导支撑柱和公共线之间的连通。并且，导电层形成在支撑柱和上基板的表面上。支撑柱上的导电层的一部分连接到接触部分内的公共线，以在下基板和上基板之间建立信号互连。还公开了一种相关的制造方法。