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(54) **Liquid crystal display device and method for manufacturing the same**

Flüssigkristallanzeigevorrichtung und Herstellungsverfahren dafür

Dispositif d'affichage à cristaux liquides et procédé de fabrication de ce dernier

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EP 2 431 802 B1

Description

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of the Korean Patent Application No. 10-2010-0092392 filed on September 20, 2010.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates to a flat panel display device, and more particularly, a liquid crystal display device with a built-in touch screen, which facilitates to improve display quality and to reduce a manufacturing cost by a simplified manufacturing process, and a method for manufacturing the same.

Discussion of the Related Art

[0003] With the developments in various mobile electronic equipment, such as mobile terminals and notebook computers, there is the increasing demand for an applicable flat panel display device.

[0004] The flat panel display device may include a liquid crystal display device (LCD), a plasma display panel (PDP), a field emission display device (FED), a lightemitting diode display device (LED), etc.

[0005] Among the various flat panel display devices, the LCD device is widely used owing to various advantages. For example, technical developments have been made for the mass production of LCD devices, the driving means is easy, power consumption is low, and the LCD devices have high-quality resolution and large-sized screens.

[0006] Instead of using a related art mouse or keyboard as an input device of the flat panel display device, a touch screen is used as a new input device for the flat panel display device, wherein the touch screen enables a user to directly input information by the use of finger or pen.

[0007] The touch screen has been widely applied in various fields, for example, mobile terminals such as navigation, terminal for industrial use, notebook computer, automatic teller machine (ATM), mobile phone, MP3, PDA, PMP, PSP, mobile game machine, DMB receiver, and tablet PC; and electric appliances such as refrigerator, microwave oven, and washing machine. Furthermore, the easy operation of the touch screen rapidly enlarges the application field.

[0008] On application of touch screen to the LCD device, an LCD device with a built-in touch screen has been researched and developed to achieve a slim device.

[0009] FIG. 1 illustrates an LCD device with a built-in touch screen according to the related art, and a method for driving the same.

[0010] Referring to FIG. 1, the LCD device with a built-in touch screen according to the related art comprises lower and upper substrates 50 and 60 bonded to each other with a liquid crystal layer (not shown) interposed therebetween.

[0011] On the upper substrate 60, there are a black matrix 62; red, green, and blue color filters 64R, 64G, and 64B; and an overcoat layer 66. In this case, the black matrix 62 defines a pixel region corresponding to each of plural pixels. Also, the red, green, and blue color filters 64R, 64G, and 64B are respectively formed in the respective pixel regions defined by the black matrix 62. The overcoat layer 66 covers the red, green, and blue color filters 64R, 64G, and 64B and the black matrix 62, to thereby planarize the upper substrate 60.

[0012] On the lower substrate 50, there is a pixel array 40 including plural pixels to drive the liquid crystal layer and detect a touching point by finger or pen.

[0013] Each of the plural pixels is defined by gate and data lines crossing each other. At the crossing portion of the gate and data lines, there is a thin film transistor (hereinafter, referred to as 'TFT'). Each of the plural pixels includes a common electrode and a pixel electrode.

[0014] Recently, an in-cell touch type LCD device has been researched and developed, wherein the in-cell touch type LCD device refers to an LCD device that uses an element existing in the related art structure as a touch-sensing electrode (for example, a common electrode Vcom may be used as a touch-sensing electrode).

[0015] FIG. 2 is a cross section view illustrating a lower substrate in the LCD device with a built-in touch screen according to the related art. FIG. 2 shows a common electrode formed in the X-axis direction among all common electrodes of the LCD device.

[0016] In the LCD device with a built-in touch screen according to the related art, as shown in FIG. 2, a common electrode 75 of a lower substrate 50 not only supplies a common voltage (Vcom), but also functions as a sensing electrode for detection a user's touch.

[0017] For detection of the user's touch, the common electrodes (sensing electrode) 75 are formed in the X-axis and Y-axis directions. The common electrode 75 in the X-axis direction is brought into contact with a gate metal 73 at a lower portion of the lower substrate 50 through a contact structure, to be described.

[0018] In more detail, each pixel of the lower substrate 50 includes a buffer layer 51 on a glass substrate; a gate insulating layer 52; the gate metal 73; an interlayer dielectric (ILD) 53; a contact metal 74; a first passivation layer (PAS0) 54; a second passivation layer (PAS1) 55; the common electrode (Vcom) 75; a conductive line (3rd metal) 76; a third passivation layer (PAS2) 56; and a contact electrode 77.

[0019] The first to third passivation layers (PAS0 to PAS2) 54 to 56 are partially etched to thereby form a contact hole for exposing a predetermined portion of the contact metal 74.

[0020] In addition, the third passivation layer (PAS2) 56 is additionally etched to expose the conductive line 76.

[0021] The gate metal 73 is formed of metal used for

forming gate line.

[0022] The contact metal 74 is formed of metal used for forming source and drain electrodes of TFT.

[0023] The contact electrode 77 is formed of a transparent conductive material used for a pixel electrode (for example, ITO). Also, the contact electrode 77 is formed simultaneously with the pixel electrode.

[0024] According as the first, second, and third passivation layers 54, 55, and 56 are partially etched, the contact hole for exposing the contact metal 74 is formed in the contact electrode 77. Also, the conductive line 76 is exposed by etching the third passivation layer 56 thereabove.

[0025] The contact electrode 77 is formed inside the contact hole and simultaneously on the third passivation layer (PAS2) 56. Thus, the contact electrode 77 is electrically connected with the contact metal 74 and the conductive line 76.

[0026] Through the contact structure between the contact electrode 77 and the contact metal 74, among the entire common electrodes driven as the touch-sensing electrode, the common electrode 75 in the X-axis direction is brought into contact with the gate metal 73.

[0027] For bringing the common electrode 75 in the X-axis direction into contact with the gate metal 73 in the in-cell touch type LCD device according to the related art, the contact electrode 77 is formed simultaneously with the pixel electrode.

[0028] If the common electrode 75 is brought into contact with the gate metal 73 by the use of transparent metal for the pixel electrode, an aperture ratio of the corresponding pixel with the contact structure is relatively lower than that of the other pixels.

[0029] In order to connect the common electrodes of the neighboring pixels in the X-axis direction in the related art contact structure, the conductive line 76 is connected with the contact electrode 77, and the contact metal 74 connected with the gate metal 73 is connected with the contact electrode 77. This double contact structure may cause the structural problem of the increased size of the contact portion.

[0030] The aperture ratio in the pixel with the contact structure is lowered by the increased size of the contact portion. Especially, in case of the pixel structure with plural domains, the contact structure using the transparent metal of the pixel electrode is used so that an aperture ratio of the corresponding pixel is about 80% as compared to that of the neighboring pixels.

[0031] Accordingly, the pixel with the contact structure may be shown as a dark point when a viewer watches the corresponding pixel with the contact structure, to thereby lower visibility. As a result, a picture quality of the LCD device is deteriorated. The double contact structure may cause the complicated manufacturing process and low manufacturing efficiency.

EP 2 214 084 A1 discloses an integrated touch screen having a gate line and a data line crossing each other to define a pixel region, a xVcom line being in parallel with the gate line, an insulating layer formed on the xVcom line, a first contact hole disposed through the insulating layer to expose a predetermined portion of an upper surface of the xVcom line, and a yVcom line formed on the insulation layer and being in contact with the xVcom line through a conductive via provided in the contact hole. A dielectric layer is provided on the yVcom line and the insulating layer. The dielectric layer is provided with a contact hole so that a common electrode disposed on the dielectric layer is in contact with the conductive line by means of a conductive via. Another dielectric layer is formed on the resultant surface.

SUMMARY OF THE INVENTION

[0032] Accordingly, the present invention is directed to an LCD device and a method for manufacturing the same that substantially obviates one or more problems due to limitations and disadvantages of the related art.

[0033] It is an object of the present invention is to provide an LCD device and a method for manufacturing the same, which facilitates to realize high aperture ratio in a pixel with a contact structure between a gate metal and a conductive line for connection of a touch-sensing electrode (common electrode).

[0034] This object is achieved by the subject matter of the independent claims.

[0035] Owing to the simplified process of a lower substrate according to the invention, it is possible to facilitate improvement of manufacturing efficiency.

[0036] 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.

[0037] A liquid crystal display device with a built-in touch screen, which uses a common electrode as a touch-sensing electrode, comprises an intersection of a gate line and a data line to define a pixel region, a gate metal disposed in a central portion of the pixel, an insulating layer formed on the gate metal, a first contact hole disposed through the insulating layer to expose a predetermined portion of an upper surface of the gate metal, a contact metal on the insulating layer and inside the first contact hole, the contact metal electrically connected with the gate metal, a first passivation layer on the contact metal, a second contact hole disposed through the first passivation layer to expose a predetermined portion of an upper surface of the contact metal, a common electrode on the first passivation layer and inside the second contact hole, a conductive line electrically connected with the common electrode, and a second passivation layer on the first passivation layer and the conductive line, wherein the gate metal and the common electrode are

electrically connected via the contact metal.

[0038] A method for manufacturing a liquid crystal display device with a built-in touch screen, which uses a common electrode as a touch-sensing electrode, comprises the steps of forming a pixel region defined by an intersection of a gate line and a data line, forming a gate metal disposed in a central portion of the pixel, forming an insulating layer on the gate metal, a first contact hole disposed through the insulating layer to expose a predetermined portion of an upper surface of the gate metal, forming a contact metal on the insulating layer and inside the first contact hole, the contact metal electrically connected with the gate metal, forming a first passivation layer on the contact metal, a second contact hole disposed through the first passivation layer to expose a predetermined portion of an upper surface of the contact metal, forming a common electrode on the first passivation layer and inside the second contact hole, forming a conductive line electrically connected with the common electrode, and forming a second passivation layer on the first passivation layer and the conductive line, wherein the gate metal and the common electrode are electrically connected via the contact metal.

[0039] Another method for manufacturing an liquid crystal display device with a built-in touch screen comprises forming a first contact hole by etching a predetermined portion of an insulating layer on a gate metal, wherein the first contact hole exposes a predetermined portion of an upper surface of the gate metal, forming a contact metal on the insulating layer and inside the first contact hole, wherein the contact metal is electrically connected with the gate metal, forming a first passivation layer on the contact metal, and forming a second contact hole by etching a predetermined portion of the first passivation layer, wherein the second contact hole exposes a predetermined portion of an upper surface of the contact metal, forming a common electrode on the first passivation layer and inside the second contact hole, forming a conductive line inside the second contact hole, wherein the conductive line is electrically connected with the common electrode, and forming a second passivation layer on the first passivation layer and the conductive line, wherein the gate metal and the common electrode are electrically connected with each other via the contact metal.

[0040] 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

[0041] 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 illustrates an LCD device with a built-in touch screen according to the related art, and a method for manufacturing the same;

FIG. 2 is a cross section view illustrating a lower substrate in an LCD device with a built-in touch screen according to the related art;

FIGs. 3 and 4 illustrate an LCD device with a built-in touch screen according to the first embodiment of the present invention;

FIGs. 5 and 6 illustrate an LCD device with a built-in touch screen according to the second embodiment of the present invention;

FIG. 7 illustrates an LCD device with a built-in touch screen according to the third embodiment of the present invention; and

FIGs. 8A-8D illustrate a method for manufacturing an LCD device with a built-in touch screen according to the embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0042] 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.

[0043] Hereinafter, an LCD device with a built-in touch screen according to the present invention and a method for manufacturing the same will be described with reference to the accompanying drawings.

[0044] For the following description of the embodiments of the present invention, if a first structure (for example, electrode, line, layer, contact, and etc.) is described as being formed "on" or "under" a second structure, the first and second structures may come in contact with each other, or there may be a third structure interposed between the first and second structures.

[0045] Depending on an alignment mode of liquid crystal layer, an LCD device may be classified into Twisted-Nematic (TN) mode, Vertical-Alignment (VA) mode, In-Plane Switching (IPS) mode, and Fringe Field Switching (FFS) mode.

[0046] In case of the IPS mode and the FFS mode, both a pixel electrode and a common electrode are formed on a lower substrate, whereby liquid crystal molecules of the liquid crystal layer are aligned depending on an electric field between the pixel electrode and the common electrode.

[0047] Especially, in case of the IPS mode, the pixel electrode and the common electrode are alternately arranged in parallel so that an In-Plane mode electric field occurs between the pixel electrode and the common electrode, thereby aligning the liquid crystal molecules of the liquid crystal layer. However, in case of the IPS mode, the liquid crystal molecules are not properly

aligned above the pixel electrode and the common electrode, whereby light transmittance is relatively deteriorated above the pixel electrode and the common electrode.

[0048] In order to overcome this problem of the IPS mode, the FFS mode has been proposed. In case of the FFS mode, an insulating layer is interposed between the pixel electrode and the common electrode, whereby the pixel electrode is formed at a predetermined interval from the common electrode by the interposed insulating layer.

[0049] In this case, any one of the pixel electrode and the common electrode is formed in a plate shape or pattern, and the other is formed in a finger shape, whereby a fringe field occurs between the pixel electrode and the common electrode. Thus, the liquid crystal molecules of the liquid crystal layer are aligned by the fringe field occurring between the pixel electrode and the common electrode.

[0050] The LCD device with a built-in touch screen according to the embodiment of the present invention is formed in the FFS mode.

[0051] The LCD device with a built-in touch screen according to the embodiment of the present invention comprises an in-cell touch type liquid crystal panel with a built-in touch screen for detection of a user's touch point; a backlight unit for supplying light to the liquid crystal panel; and a driving circuit.

[0052] Herein, a contact structure between a gate metal and a common electrode driven as a touch-sensing electrode is a main point in this present invention. Thus, a detailed explanation for the driving circuit and the backlight unit will be omitted.

[0053] For a display period, the LCD device with a built-in touch screen according to the embodiment of the present invention displays an image according to a video signal by controlling transmittance of light passing through a liquid crystal layer in each pixel.

[0054] Meanwhile, for a non-display period, the common electrode on the lower substrate is driven as the touch-sensing electrode so as to sense the change of capacitance depending on a user's touch, and to detect the user's touch.

[0055] On an upper substrate, there are a black matrix (BM); red, green, and blue color filters; and an overcoat layer.

[0056] On a lower substrate, there is a pixel array including plural pixels to drive the liquid crystal layer and detect the touching point by sensing the capacitance depending on the user's touch.

[0057] The pixel array includes gate and data lines crossing each other to define the pixel; a common electrode; and a conductive line for connection of the common electrodes of the neighboring pixels. Also, a thin film transistor (TFT) serving as a switching element is formed in each pixel, and is connected with a pixel electrode.

[0058] FIGs. 3 and 4 illustrate an LCD device with a built-in touch screen according to the first embodiment of the present invention. FIG. 4 is a cross section view along I-I' of FIG. 3.

[0059] FIGs. 3 and 4 show a contact portion between a gate metal and a common electrode in an entire pixel region of a lower substrate.

[0060] In the LCD with a built-in touch screen according to the first embodiment of the present invention, the contact structure between the gate metal and the common electrode has an overlap portion, to thereby realize high aperture ratio in the corresponding pixel with the contact structure of common electrode.

[0061] Referring to FIGs. 3 and 4, on the lower substrate 100, there are a buffer layer 110; a gate insulating layer (GI) 120; a gate metal 130; an interlayer dielectric (ILD) 140; a contact metal 150; a first passivation layer (PAS1) 160; a common electrode (Vcom) 170; a conductive line 180; and a second passivation layer (PAS2) 190.

[0062] The buffer layer 110 and the gate insulating layer 120 are sequentially formed on a glass substrate. Then, the gate metal 130 is formed on the gate insulating layer 120. The gate metal 130 is formed of metal used for forming the gate line, wherein the gate metal 130 is positioned in the central portion of the pixel.

[0063] Although not shown, an active layer (semiconductor layer) is formed below the gate insulating layer 120 of a TFT region. Also, a channel of the TFT is formed in an overlap region between the active layer and a gate electrode diverged from the gate line.

[0064] Then, TEOS (Tetra Ethyl Ortho Silicate) or MTO (Middle Temperature Oxide) may be deposited to cover the gate metal 130 by CVD (Chemical Vapor Deposition), thereby forming the interlayer dielectric 140.

[0065] A predetermined portion of an upper surface of the gate metal 130 is exposed by etching a predetermined portion of the interlayer dielectric 140. Also, predetermined portions of the contact metal 150, positioned on the interlayer dielectric 140, are overlapped with the gate metal 130.

[0066] In the exposed portion of the gate metal 130, the contact metal 150 is electrically connected with the gate metal 130.

[0067] At this time, the contact metal 150 is brought into contact with the central portion of the gate metal 130. That is, the gate metal 130 is overlapped with the contact metal 150.

[0068] The contact metal 150 may be formed of metal used for formation of source and drain electrodes of the TFT. Also, the contact metal 150 may be formed simultaneously with the source and drain electrodes of the TFT.

[0069] The first passivation layer (PAS1) 160 is formed on the interlayer dielectric 140 and the contact metal 150. A predetermined portion of an upper surface of the contact metal 150 is exposed by partially etching the first passivation layer (PAS1) 160 above the contact portion between the gate metal 130 and the contact metal 150.

[0070] The common electrode 170 is formed of a transparent conductive material such as ITO. The common electrode 170 is formed on the first passivation layer

(PAS1) 160, and simultaneously formed inside the contact hole obtained by partially etching the first passivation layer (PAS1) 160. Inside the contact hole, the contact metal 150 is electrically connected with the common electrode 170.

[0071] For a display period of one frame or plural frames, the common electrode 170 supplies the common voltage for controlling the transmittance of light passing through the liquid crystal layer to the pixel.

[0072] For a non-display period of one frame or plural frames, the common electrode 170 is driven as the touch-sensing electrode to detect the change of capacitance (Ctc) depending on the user's touch.

[0073] Generally, the common electrode of the LCD device according to the related art is formed in a plate shape to supply the same common voltage (Vcom) to the entire pixel region of the lower substrate.

[0074] The common electrode 170 of the LCD device according to the first embodiment of the present invention not only supplies the common voltage (Vcom), but also functions as the touch-sensing electrode for detection the user's touch.

[0075] Accordingly, the common electrode 170 is patterned every individual pixel. The common electrode 170 may be patterned every predetermined number of the pixels.

[0076] The common electrodes of the neighboring pixels may be connected via the conductive line 180 by the X-axis direction or Y-axis direction. At this time, the common electrodes of the X-axis direction are brought into contact with the gate metal 130 through the aforementioned contact structure.

[0077] The conductive line 180 is formed by depositing (burying) a metal material on the first passivation layer (PAS1) 160 and inside the contact hole obtained by etching the first passivation layer (PAS1) 160. The conductive line 180 is brought into contact with the common electrode 170.

[0078] At this time, the conductive line 180 may be formed as the contact line to make the common electrode 170 driven as the touch-sensing electrode for detection of the user's touch.

[0079] The second passivation layer (PAS2) 190 is formed to cover the common electrode 170 and the conductive line 180.

[0080] The above LCD device with a built-in touch screen according to the first embodiment of the present invention has the contact structure where the gate metal 130, the contact metal 150, the common electrode 170, and the conductive line 180 are overlapped with one another in the same vertical line.

[0081] For the contact between the common electrode and the gate metal, in case of the related art of FIG. 2, the conductive line is firstly brought into contact with the pixel electrode by the use of pixel electrode, and then the pixel electrode is secondly brought into contact with the contact electrode, to thereby make the double contact structure. Owing to the double contact structure, the aperture ratio may be lowered in the corresponding pixel with the contact structure.

[0082] However, in case of the LCD device with a built-in touch screen according to the first embodiment of the present invention, the gate metal 130 is directly brought into contact with the common electrode 170 while being overlapped with the common electrode 170 in the same vertical line, to thereby realize the high aperture ratio.

[0083] Especially, as shown in FIG. 3, the above contact structure is formed in the central portion of disclination in the multi-domain pixel structure, whereby the aperture ratio of the corresponding pixel is increased to be about 90% as compared to that of the neighboring pixels (wherein, the neighboring pixel indicates the pixel without the contact structure).

[0084] FIGs. 5 and 6 illustrate an LCD device with a built-in touch screen according to the second embodiment of the present invention. FIG. 6 is a cross section view along II-II' of FIG. 5.

[0085] FIGs. 5 and 6 show a contact portion between a gate metal and a common electrode in an entire pixel region of a lower substrate.

[0086] Except for an overlap shape of a contact structure, and an element for reducing step coverage of overlap, the LCD device according to the second embodiment of the present invention is identical in structure to the LCD device according to the first embodiment of the present invention.

[0087] Thus, wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts, except parts of the contact structure. Also, a detailed explanation for the same parts as those of the first embodiment will be omitted.

[0088] In the LCD device with a built-in touch screen according to the second embodiment of the present invention, a contact structure between a gate metal and a common electrode has an overlap portion, thereby increasing aperture ratio of the pixel with the contact structure, and reducing step coverage by the overlap portion of the contact structure.

[0089] Referring to FIGs. 5 and 6, on a lower substrate 200, there are a buffer layer 110; a gate insulating layer (GI) 120; a gate metal 130; an interlayer dielectric (ILD) 240; a contact metal 250; a first passivation layer (PAS1) 260; a common electrode (Vcom) 270; a conductive line (3rd metal) 280; and a second passivation layer (PAS2) 290.

[0090] The interlayer dielectric (ILD) 240 is formed to cover the gate metal 130. A predetermined portion of an upper surface of the gate metal 130 is exposed by partially etching a predetermined portion of the interlayer dielectric 240.

[0091] The contact metal 250 is overlapped with the gate metal 130 above the interlayer dielectric 240. In the exposed portion of the gate metal 130, the contact metal 250 is electrically connected with the gate metal 130. At this time, the contact portion between the gate metal 130 and the contact metal 250 is provided at one side with

respect to the central portion of the gate metal 130.

[0092] At this time, the contact metal 250 may be formed of metal used for formation of source and drain electrodes of the TFT. Also, the contact metal 250 may be formed simultaneously with the source and drain electrodes of the TFT.

[0093] The gate metal 130 is overlapped with the contact metal 250.

[0094] The first passivation layer (PAS1) 260 is formed on the interlayer dielectric 240 and the contact metal 250.

[0095] A contact hole is formed by etching a predetermined portion of the first passivation layer 260. Via this contact hole, a predetermined portion of an upper surface of the contact metal 250 is exposed. In this case, the predetermined portion of the first passivation layer 260, which is not overlapped with the contact portion between the gate metal 130 and the contact metal 250, is etched.

[0096] The common electrode 270 is formed on the first passivation layer (PAS1) 260, and is also formed inside the contact hole realized by etching the first passivation layer (PAS1) 260. Inside the contact hole, the contact metal 250 is electrically connected with the common electrode 270.

[0097] The common electrodes of the neighboring pixels may be connected via the conductive line 280 by the X-axis direction or Y-axis direction. At this time, the common electrodes of the X-axis direction are brought into contact with the gate metal 130 through the aforementioned contact structure.

[0098] The conductive line 280 is formed by depositing (burying) a metal material on the first passivation layer (PAS1) 260 and inside the contact hole obtained by etching the first passivation layer (PAS1) 260. The conductive line 280 is brought into contact with the common electrode 270.

[0099] At this time, the conductive line 280 may be formed as the contact line to make the common electrode 270 driven as the touch-sensing electrode for detection of the user's touch.

[0100] The second passivation layer (PAS2) 290 is formed to cover the common electrode 270 and the conductive line 280.

[0101] In case of the LCD device according to the first embodiment of the present invention, the gate metal and the common electrode are brought into contact with each other via the contact metal, wherein the gate metal, the common electrode, and the contact metal are overlapped in the same vertical line.

[0102] In case of the LCD device according to the second embodiment of the present invention, the contact portion between the gate metal 130 and the contact metal 250, and the contact portion between the contact metal 250 and the common electrode 270 are provided at the different vertical lines.

[0103] Thus, the aperture ratio of the pixel may be increased owing to the contact between the gate metal 130 and the common electrode 270 via the contact metal 250. Also, it is possible to reduce the step coverage caused by the contact structure.

[0104] In case of the LCD device with a built-in touch screen according to the second embodiment of the present invention, as shown in FIG. 5, the contact structure is formed in the central portion of disclination in the multi-domain pixel structure, thereby realizing the high aperture ratio in the corresponding pixel.

[0105] FIG. 7 illustrates an LCD device with a built-in touch screen according to the third embodiment of the present invention. FIG. 7 shows a contact portion between a gate metal and a common electrode in an entire pixel region of a lower substrate.

[0106] Except for an overlap shape of a contact structure, and an element for reducing step coverage of overlap, the LCD device according to the third embodiment of the present invention is identical in structure to the LCD device according to the first embodiment of the present invention.

[0107] Thus, wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts, except parts of the contact structure. Also, a detailed explanation for the same parts as those of the first embodiment will be omitted.

[0108] In the LCD device with a built-in touch screen according to the third embodiment of the present invention, a contact structure between a gate metal and a common electrode has an overlap portion, thereby increasing aperture ratio of the pixel with the contact structure, and reducing step coverage by the overlap portion of the contact structure.

[0109] Referring to FIG. 7, on a lower substrate 300, there are a buffer layer 110; a gate insulating layer (GI) 120; a gate metal 130; an interlayer dielectric (ILD) 340; a contact metal 350; a first passivation layer (PAS1) 360; a common electrode (Vcom) 370; a conductive line 380; and a second passivation layer (PAS2) 390.

[0110] The interlayer dielectric (ILD) 340 is formed to cover the gate metal 130. A predetermined portion of an upper surface of the gate metal 130 is exposed by partially etching a predetermined portion of the interlayer dielectric 340.

[0111] The contact metal 350 is overlapped with the gate metal 130 above the interlayer dielectric 340. In the exposed portion of the gate metal 130, the contact metal 350 is electrically connected with the gate metal 130. At this time, the contact portion between the gate metal 130 and the contact metal 350 is positioned at one side with respect to the central portion of the gate metal 130.

[0112] At this time, the contact metal 350 may be formed of metal used for formation of source and drain electrodes of the TFT. The gate metal 130 is overlapped with the contact metal 350.

[0113] The first passivation layer (PAS1) 360 is formed on the interlayer dielectric 340 and the contact metal 350. A contact hole is formed by etching a predetermined portion of the first passivation layer 360. A predetermined portion of an upper surface of the contact metal 350 is exposed through the contact hole. At this time, the etched

portion of the first passivation layer (PAS1) 360 is partially overlapped with the contact portion between the gate metal 130 and the contact metal 350.

[0114] The common electrode 370 is formed on the first passivation layer (PAS1) 360, and is formed inside the contact hole obtained by etching the first passivation layer (PAS1) 360. Inside the contact hole, the contact metal 350 is electrically connected with the common electrode 370.

[0115] The common electrodes 370 of the neighboring pixels are connected via the conductive line 370 by the X-axis direction or Y-axis direction. The common electrodes 370 of the X-axis direction are brought into contact with the gate metal 130 through the above contact structure.

[0116] The conductive line 380 is formed by depositing (burying) a metal material on the first passivation layer (PAS1) 360 and inside the contact hole obtained by etching the first passivation layer (PAS1) 360. The conductive line 380 is brought into contact with the common electrode 370.

[0117] At this time, the conductive line 380 may be formed as the contact line to make the common electrode 370 driven as the touch-sensing electrode for detection of the user's touch.

[0118] The second passivation layer (PAS2) 390 is formed to cover the common electrode 370 and the conductive line 380.

[0119] The above LCD device with a built-in touch screen according to the first embodiment of the present invention has the contact structure where the gate metal and the common electrode are overlapped with each other in the same vertical line.

[0120] Meanwhile, the LCD device with a built-in touch screen according to the third embodiment of the present invention has the contact structure where the contact portion between the gate metal 130 and the contact metal 350 is partially overlapped with the contact portion between the contact metal 350 and the common electrode 370 in the vertical line.

[0121] Thus, the aperture ratio of the pixel may be increased owing to the contact between the gate metal 130 and the common electrode 370 through the contact metal 350. Also, it is possible to reduce the step coverage caused by the contact structure.

[0122] In case of the LCD device with a built-in touch screen according to the third embodiment of the present invention, the contact structure is formed in the central portion of disclination in the multi-domain pixel structure, thereby realizing the high aperture ratio in the corresponding pixel.

[0123] The LCD devices according to the first to third embodiments of the present invention provides the good visibility of the pixel and good display quality by improving the contact structure between the gate metal and the common electrode.

[0124] Hereinafter, a method for manufacturing the LCD device with a built-in touch screen according to the embodiment of the present invention will be described with reference to FIG. 8.

[0125] FIG. 8 illustrates a method for manufacturing the LCD device according to the first embodiment of the present invention.

[0126] As shown in FIG. 8A, the buffer layer 110 is formed on the substrate. Then, TEOS (Tetra Ethyl Ortho Silicate) or MTO (Middle Temperature Oxide) may be deposited on an entire surface of the substrate, to thereby form the gate insulating layer 120.

[0127] Thereafter, a metal material is deposited on the gate insulating layer 120, and then photolithography and dry-etching process using a mask is applied to the deposited metal material, to thereby form the gate metal 130.

[0128] The substrate may be formed of glass or plastic material. FIGs. 8A-8D show the exemplary case using the glass substrate.

[0129] As shown in FIG. 8B, an insulating material is deposited on the substrate to cover the gate metal 130 and the gate insulating layer 120, thereby forming the interlayer dielectric (ILD) 140.

[0130] Then, photolithography and dry-etching process using a mask is carried out to etch a predetermined portion of the interlayer dielectric 140, thereby forming the first contact hole for exposing the upper surface of the central portion of the gate metal 130.

[0131] Then, a metal material is deposited to cover the interlayer dielectric 140, and photolithography and wet-etching process using a mask is applied to the deposited metal material, to thereby form the contact metal 150.

[0132] The contact metal 150 is formed by the process for forming the source and drain electrodes of the TFT, and is simultaneously with the source and drain electrodes of the TFT. The gate metal 130 and the contact metal 150 are electrically connected with each other inside the first contact hole obtained by etching the interlayer dielectric 140.

[0133] As shown in FIG. 8C, the first passivation layer (PAS1) 160 is formed to cover the interlayer dielectric 140 and the contact metal 150, and then photolithography and etching process is applied thereto, to thereby form the second contact hole.

[0134] The second contact hole is formed in the contact portion between the gate metal 130 and the contact metal 150.

[0135] After that, a transparent conductive material such as ITO is deposited on the first passivation layer (PAS1) 160, and is formed inside the second contact hole, to thereby form the common electrode (Vcom) 170. Thus, the gate metal 130 and the common electrode 170 are electrically connected with each other via the contact metal 150 inside the second contact hole.

[0136] As shown in FIG. 8D, a conductive metal material is deposited on the common electrode 170, and photolithography and etching process using a mask is applied to the deposited conductive metal material, to thereby form the conductive line 180 electrically connect-

ed with the common electrode 170.

[0137] The second passivation layer (PAS2) 190 is formed to cover the common electrode 170 and the conductive line 180.

[0138] In the method for manufacturing the LCD device with a built-in touch screen according to the embodiment of the present invention, the gate metal and the common electrode are overlapped in the same vertical line, to thereby realize the high aperture ratio in the pixel with the contact structure.

[0139] Also, the passivation layer PAS0, which has been applied to the related art structure, is omitted so that the contact structure and the manufacturing process are simplified, thereby improving the manufacturing efficiency and price competition of the LCD device with a built-in touch screen according to the present invention.

[0140] Although not shown, the method for manufacturing the LCD device with a built-in touch screen according to another embodiment of the present invention, the first contact hole and the second contact hole, which are formed by the processes of FIG. 8B and FIG. 8C, are not overlapped with each other, to thereby form the contact structure according to the second embodiment of the present invention, as shown in FIG. 6.

[0141] The contact structure according to the third embodiment of the present invention may be obtained by partially overlapping the first and second contact holes, as shown in FIG. 7.

[0142] The LCD device according to an embodiment of the present invention has the contact structure where the touch-sensing electrode (common electrode) is brought into contact with the gate metal, to thereby improve the display quality owing to the high aperture ratio of the pixel.

In case of the LCD device according to the second embodiment of the present invention, the contact structure between the common electrode and the gate metal is formed in the central portion of disclination in the multi-domain pixel structure, thereby realizing the high aperture ratio in the corresponding pixel.

[0143] Also, the simplified manufacturing process of the lower substrate in the LCD device according to the present invention enables to reduce the manufacturing cost of the LCD device, and to improve the manufacturing efficiency.

Claims

1. A FFS-type liquid crystal display device with a built-in touch screen, which is configured to use the common electrode (170) also as a touch-sensing electrode, comprising a substrate (100), the substrate comprising :

a plurality of intersecting gate lines and data lines to define an array of multi-domain pixels arranged in an X-and in a Y-direction, wherein each of the pixels comprises a disclination region in a central portion thereof;

a gate metal (130) disposed in the central portion of each of the pixels;

an insulating layer (140) formed on the gate metal (130), a first contact hole disposed through the insulating layer (140) to expose a predetermined portion of an upper surface of the gate metal (130);

a contact metal (150) on the insulating layer (140) and inside the first contact hole, the contact metal (150) electrically connected with the gate metal (130);

a first passivation layer (160) on the contact metal (150), a second contact hole disposed through the first passivation layer (160) to expose a predetermined portion of an upper surface of the contact metal (150);

a common electrode (170) on the first passivation layer (160) and inside the second contact hole;

a conductive line (180) electrically connected with the common electrode (170); and

a second passivation layer (190) on the first passivation layer (160), and the conductive line (180);

wherein the gate metal (130) and the common electrode (170) are electrically connected via the contact metal (150) and wherein the common electrodes (170) of neighboring pixels in the X-axis direction are connected through the gate metal (130).

2. The liquid crystal display device according to claim 1, wherein a first contact portion between the gate metal (130) and the contact metal (150, 350) is at least partially overlapped in a plan view with a second contact portion between the contact metal (150, 350) and the common electrode (170, 370).

3. The liquid crystal display device according to claim 2, wherein the first and second contact portions are overlapped with the gate metal (130).

4. The liquid crystal display device according to claim 1, wherein a first contact portion between the gate metal (130) and the contact metal (250) is overlapped in a plan view with a first portion of the gate metal (130), and a second contact portion between the contact metal (250) and the common electrode (270) is overlapped with a second portion of the gate metal (130), wherein the first portion is different from the second portion.

5. The liquid crystal display device according to claim 1, wherein a first contact portion between the gate metal (130) and the contact metal (250) is not overlapped in a plan view with a second contact portion

between the contact metal (250) and the common electrode (270).

6. A method for manufacturing a FFS-type liquid crystal display device with a built-in touch screen, which uses the common electrode (170) also as a touch-sensing electrode, comprising the steps of:

forming multi-domain pixel regions defined by intersections of gate lines and data lines wherein multi-domain pixels are arranged in an X-and in a Y-direction, wherein each of the pixels comprises a disclination region in a centrel portion thereof;
forming a gate metal (130) disposed in a central portion of the pixel;
forming an insulating layer (140) on the gate metal (130), a first contact hole disposed through the insulating layer to expose a predetermined portion of an upper surface of the gate metal (130);
forming a contact metal (150) on the insulating layer (140) and inside the first contact hole, the contact metal (150) electrically connected with the gate metal (130);
forming a first passivation layer (160) on the contact metal (150), a second contact hole disposed through the first passivation layer (160) to expose a predetermined portion of an upper surface of the contact metal (150);
forming a common electrode (170) on the first passivation layer (160) and inside the second contact hole;
forming a conductive line (180) electrically connected with the common electrode (170); and
forming a second passivation layer (190) on the first passivation layer and the conductive line (180),
wherein the gate metal (130) and the common electrode (170) are electrically connected via the contact metal (150), the common electrodes (170) of neighboring pixels in the X-axis direction are connected through the gate metal (130).

7. The method according to claim 6, wherein a first contact portion between the gate metal (130) and the contact metal (150, 350) is at least partially overlapped in a plan view with a second contact portion between the contact metal (150, 350) and the common electrode (170, 370).

8. The method according to claim 7, wherein the first and second contact portions are partially overlapped with the gate metal (130).

9. The method according to claim 7, wherein the first and second contact portions overlap the gate metal (130), wherein the first contact hole is formed corresponding to the predetermined portion of the upper surface of the gate metal (130), and the second contact hole is formed while being overlapped with the first contact hole.

10. The method according to claim 6, wherein a first contact portion between the gate metal (130) and the contact metal (250) is overlapped in a plan view with a first portion of the gate metal (130), and a second contact portion between the contact metal (250) and the common electrode (270) is overlapped in a plan view with a second portion of the gate metal (130), wherein the first portion is different from the second portion.

11. The method according to claim 6, wherein a first contact portion between the gate metal (130) and the contact metal (250) does not overlap a second contact portion between the contact metal (250) and the common electrode (270), wherein the first and second contact portion are not overlapped with each other.

12. The method according to claim 9, wherein the first contact portion and the second contact portion are formed in the central portion of disclination of the multi-domain pixel region.

13. The method according to claim 6, wherein the first contact hole is formed by etching a predetermined portion of the insulating layer (140) corresponding to the gate metal (130), and the second contact hole is formed by etching a predetermined portion of the first passivation layer (160) corresponding to the contact metal (150).

Patentansprüche

1. Flüssigkristallanzeigevorrichtung vom FFS-Typ mit einem eingebauten Berührungsbildschirm, der konfiguriert ist, die gemeinsame Elektrode (170) auch als eine berührungserfassende Elektrode zu verwenden, die umfasst:

ein Substrat (100), wobei das Substrat umfasst:

mehrere sich überschneidende Gate-Leitungen und Datenleitungen, um eine Anordnung von Mehrdomänenpixeln zu definieren, die in einer X- und in einer Y-Richtung angeordnet sind, wobei jedes der Pixel in seinem mittleren Teil einen Disklinationsbereich umfasst;
ein Gate-Metall (130), das in dem mittleren Teil jedes der Pixel angeordnet ist;
eine Isolierschicht (140), die auf dem Gate-Metall (130) gebildet ist, wobei ein erstes

Kontaktloch durch die Isolierschicht (140) angeordnet ist, um einen vorgegebenen Teil einer oberen Fläche des Gate-Metalls (130) freizulegen;
ein Kontaktmetall (150) auf der Isolierschicht (140) und innerhalb des ersten Kontaktlochs, wobei das Kontaktmetall (150) mit dem Gate-Metall (130) elektrisch verbunden ist;
eine erste Passivierungsschicht (160) auf dem Kontaktmetall (150), wobei ein zweites Kontaktloch durch die erste Passivierungsschicht (160) angeordnet ist, um einen vorgegebenen Teil einer oberen Fläche des Kontaktmetalls (150) freizulegen;
eine gemeinsame Elektrode (170) auf der ersten Passivierungsschicht (160) und innerhalb des zweiten Kontaktlochs;
eine leitende Leitung (180), die mit der gemeinsamen Elektrode (170) elektrisch verbunden ist; und
eine zweite Passivierungsschicht (190) auf der ersten Passivierungsschicht (160) und der leitenden Leitung (180);

wobei das Gate-Metall (130) und die gemeinsame Elektrode (170) über das Kontaktmetall (150) elektrisch verbunden sind und wobei die gemeinsamen Elektroden (170) von benachbarten Pixeln in der Richtung der X-Achse durch das Gate-Metall (130) verbunden sind.

2. Flüssigkristallanzeigevorrichtung nach Anspruch 1, wobei ein erster Kontaktteil zwischen dem Gate-Metall (130) und dem Kontaktmetall (150, 350) sich in einer Draufsicht zumindest teilweise mit einem zweiten Kontaktteil zwischen dem Kontaktmetall (150, 350) und der gemeinsamen Elektrode (170, 370) überschneidet.

3. Flüssigkristallanzeigevorrichtung nach Anspruch 2, wobei sich der erste und der zweite Kontaktteil mit dem Gate-Metall (130) überschneiden.

4. Flüssigkristallanzeigevorrichtung nach Anspruch 1, wobei sich ein erster Kontaktteil zwischen dem Gate-Metall (130) und dem Kontaktmetall (250) in einer Draufsicht mit einem ersten Teil des Gate-Metalls (130) überschneidet und sich ein zweiter Kontaktteil zwischen dem Kontaktmetall (250) und der gemeinsamen Elektrode (270) mit einem zweiten Teil des Gate-Metalls (130) überschneidet, wobei der erste Teil von dem zweiten Teil verschieden ist.

5. Flüssigkristallanzeigevorrichtung nach Anspruch 1, wobei sich ein erster Kontaktteil zwischen dem Gate-Metall (130) und dem Kontaktmetall (250) in einer Draufsicht nicht mit einem zweiten Kontaktteil zwischen dem Kontaktmetall (250) und der gemeinsamen Elektrode (270) überschneidet.

6. Verfahren zum Herstellen einer Flüssigkristallanzeigevorrichtung vom FFS-Typ mit einem eingebauten Berührungsbildschirm, der die gemeinsame Elektrode (170) auch als eine berührungserfassende Elektrode verwendet, das die Schritte umfasst:

Bilden von Mehrdomänenpixelbereichen, die durch Überschneidungen von Gate-Leitungen und Datenleitungen definiert werden, wobei Mehrdomänenpixel in einer X- und in einer Y-Richtung angeordnet werden, wobei jedes der Pixel einen Disklinationsbereich in seinem mittleren Teil umfasst;
Bilden eines Gate-Metalls (130), das in einem mittleren Teil des Pixels angeordnet ist;
Bilden einer Isolierschicht (140) auf dem Gate-Metall (130), wobei ein erstes Kontaktloch durch die Isolierschicht angeordnet ist, um einen vorgegebenen Teil einer oberen Fläche des Gate-Metalls (130) freizulegen;
Bilden eines Kontaktmetalls (150) auf der Isolierschicht (140) und innerhalb des ersten Kontaktlochs, wobei das Kontaktmetall (150) mit dem Gate-Metall (130) elektrisch verbunden ist;
Bilden einer ersten Passivierungsschicht (160) auf dem Kontaktmetall (150), wobei ein zweites Kontaktloch durch die erste Passivierungsschicht (160) angeordnet ist, um einen vorgegebenen Teil einer oberen Fläche des Kontaktmetalls (150) freizulegen;
Bilden einer gemeinsamen Elektrode (170) auf der ersten Passivierungsschicht (160) und innerhalb des zweiten Kontaktlochs;
Bilden einer leitenden Leitung (180), die mit der gemeinsamen Elektrode (170) elektrisch verbunden ist; und
Bilden einer zweiten Passivierungsschicht (190) auf der ersten Passivierungsschicht (160) und der leitenden Leitung (180);
wobei das Gate-Metall (130) und die gemeinsame Elektrode (170) über das Kontaktmetall (150) elektrisch verbunden sind, wobei die gemeinsamen Elektroden (170) von benachbarten Pixeln in der Richtung der X-Achse durch das Gate-Metall (130) verbunden sind.

7. Verfahren nach Anspruch 6, wobei sich ein erster Kontaktteil zwischen dem Gate-Metall (130) und dem Kontaktmetall (150, 350) in einer Draufsicht zumindest teilweise mit einem zweiten Kontaktteil zwischen dem Kontaktmetall (150, 350) und der gemeinsamen Elektrode (170, 370) überschneidet.

8. Verfahren nach Anspruch 7, wobei sich der erste und der zweite Kontaktteil mit dem Gate-Metall (130)

überschneiden.

9. Verfahren nach Anspruch 7, wobei sich der erste und der zweite Kontaktteil mit dem Gate-Metall (130) überschneiden, wobei das erste Kontaktloch entsprechend dem vorgegebenen Teil der oberen Fläche des Gate-Metalls (130) gebildet wird und das zweite Kontaktloch gebildet wird, während es sich mit dem ersten Kontaktloch überschneidet.

10. Verfahren nach Anspruch 6, wobei sich ein erster Kontaktteil zwischen dem Gate-Metall (130) und dem Kontaktmetall (250) in einer Draufsicht mit einem ersten Teil des Gate-Metalls (130) überschneidet und sich ein zweiter Kontaktteil zwischen dem Kontaktmetall (250) und der gemeinsamen Elektrode (270) in einer Draufsicht mit einem zweiten Teil des Gate-Metalls (130) überschneidet, wobei der erste Teil von dem zweiten Teil verschiedenen ist.

11. Verfahren nach Anspruch 6, wobei sich ein erster Kontaktteil zwischen dem Gate-Metall (130) und dem Kontaktmetall (250) nicht mit einem zweiten Kontaktteil zwischen dem Kontaktmetall (250) und der gemeinsamen Elektrode (270) überschneidet, wobei sich der erste und der zweite Kontaktteil nicht miteinander überschneiden.

12. Verfahren nach Anspruch 9, wobei der erste Kontaktteil und der zweite Kontaktteil in dem mittleren Teil der Disklination des Mehrdomänenpixelbereichs gebildet werden.

13. Verfahren nach Anspruch 6, wobei das erste Kontaktloch durch Ätzen eines vorgegebenen Teils der Isolierschicht (140), der dem Gate-Metall (130) entspricht, gebildet wird, und das zweite Kontaktloch durch Ätzen eines vorgegebenen Teils der erste Passivierungsschicht (160), der dem Kontaktmetall (150) entspricht, gebildet wird.

Revendications

1. Dispositif d'affichage à cristaux liquides de type FFS avec un écran tactile intégré, qui est configuré pour utiliser l'électrode commune (170) également en tant qu'électrode de détection de toucher, comprenant un substrat (100), le substrat comprenant :

une pluralité de lignes de grille et de lignes de données en intersection pour définir un réseau de pixels multi-domaines agencés dans un sens d'axe X et dans un sens d'axe Y, dans lequel chacun des pixels comprend une région de déclination dans une portion centrale de celui-ci ;
un métal de grille (130) disposé dans la portion centrale de chacun des pixels ;
une couche isolante (140) constituée sur le métal de grille (130), un premier trou de contact disposé à travers la couche isolante (140) pour exposer une portion prédéterminée d'une surface supérieure du métal de grille (130) ;
un métal de contact (150) sur la couche isolante (140) et à l'intérieur du premier trou de contact, le métal de contact (150) étant électriquement relié au métal de grille (130) ;
une première couche de passivation (160) sur le métal de contact (150), un deuxième trou de contact disposé à travers la première couche de passivation (160) pour exposer une portion prédéterminée d'une surface supérieure du métal de contact (150) ;
une électrode commune (170) sur la première couche de passivation (160) et à l'intérieur du deuxième trou de contact ;
une ligne conductrice (180) reliée électriquement à l'électrode commune (170) ; et
une deuxième couche de passivation (190) sur la première couche de passivation (160), et la ligne conductrice (180) ;
dans lequel le métal de grille (130) et l'électrode commune (170) sont reliés électriquement par l'intermédiaire du métal de contact (150) et dans lequel les électrodes communes (170) de pixels voisins dans le sens d'axe X sont reliées par l'intermédiaire du métal de grille (130).

2. Dispositif d'affichage à cristaux liquides selon la revendication 1, dans lequel une première portion de contact entre le métal de grille (130) et le métal de contact (150, 350) est au moins partiellement chevauchée dans une vue en plan par une deuxième portion de contact entre le métal de contact (150, 350) et l'électrode commune (170, 370).

3. Dispositif d'affichage à cristaux liquides selon la revendication 2, dans lequel les première et deuxième portions de contact sont chevauchées par le métal de grille (130).

4. Dispositif d'affichage à cristaux liquides selon la revendication 1, dans lequel une première portion de contact entre le métal de grille (130) et le métal de contact (250) est chevauchée dans une vue en plan par une première portion du métal de grille (130), et une deuxième portion de contact entre le métal de contact (250) et l'électrode commune (270) est chevauchée par une deuxième portion du métal de grille (130), dans lequel la première portion est différente de la deuxième portion.

5. Dispositif d'affichage à cristaux liquides selon la revendication 1, dans lequel une première portion de contact entre le métal de grille (130) et le métal de contact (250) n'est pas chevauchée dans une vue

en plan par une deuxième portion de contact entre le métal de contact (250) et l'électrode commune (270).

6. Procédé de fabrication d'un dispositif d'affichage à cristaux liquides de type FFS avec un écran tactile intégré, qui utilise l'électrode commune (170) également en tant qu'électrode de détection de toucher, comprenant les étapes de :

la constitution de régions de pixels multi-domaines définies par des intersections de lignes de grille et de lignes de données, dans lequel les pixels multi-domaines sont agencés dans un sens d'axe X et dans un sens d'axe Y, dans lequel chacun des pixels comprend une région de déclination dans une portion centrale de celui-ci ;
la constitution d'un métal de grille (130) disposé dans la portion centrale du pixel ;
la constitution d'une couche isolante (140) sur le métal de grille (130), un premier trou de contact étant disposé à travers la couche isolante pour exposer une portion prédéterminée d'une surface supérieure du métal de grille (130) ;
la constitution d'un métal de contact (150) sur la couche isolante (140) et à l'intérieur du premier trou de contact, le métal de contact (150) étant électriquement relié au métal de grille (130) ;
la constitution d'une première couche de passivation (160) sur le métal de contact (150), un deuxième trou de contact étant disposé à travers la première couche de passivation (160) pour exposer une portion prédéterminée d'une surface supérieure du métal de contact (150) ;
la constitution d'une électrode commune (170) sur la première couche de passivation (160) et à l'intérieur du deuxième trou de contact ;
la constitution d'une ligne conductrice (180) reliée électriquement à l'électrode commune (170) ; et
la constitution d'une deuxième couche de passivation (190) sur la première couche de passivation et la ligne conductrice (180),
dans lequel le métal de grille (130) et l'électrode commune (170) sont reliés électriquement par l'intermédiaire du métal de contact (150) et dans lequel les électrodes communes (170) de pixels voisins dans le sens d'axe X sont reliées par l'intermédiaire du métal de grille (130).

7. Procédé selon la revendication 6, dans lequel une première portion de contact entre le métal de grille (130) et le métal de contact (150, 350) est au moins partiellement chevauchée dans une vue en plan par une deuxième portion de contact entre le métal de contact (150, 350) et l'électrode commune (170, 370).

8. Procédé selon la revendication 7, dans lequel les première et deuxième portions de contact sont chevauchées par le métal de grille (130).

9. Procédé selon la revendication 7, dans lequel les première et deuxième portions de contact chevauchent le métal de grille (130), dans lequel le premier trou de contact est constitué en correspondance avec la portion prédéterminée de la surface supérieure du métal de grille (130), et le deuxième trou de contact est constitué en étant chevauché par le premier trou de contact.

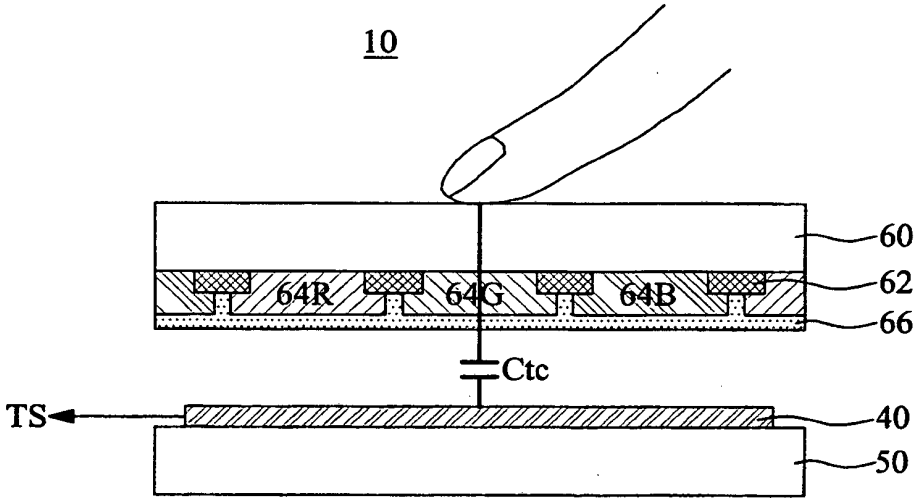
10. Procédé selon la revendication 6, dans lequel une première portion de contact entre le métal de grille (130) et le métal de contact (250) est chevauchée dans une vue en plan par une première portion du métal de grille (130), et une deuxième portion de contact entre le métal de contact (250) et l'électrode commune (270) est chevauchée dans une vue en plan par une deuxième portion du métal de grille (130), dans lequel la première portion est différente de la deuxième portion.

11. Procédé selon la revendication 6, dans lequel une première portion de contact entre le métal de grille (130) et le métal de contact (250) n'est pas chevauchée par une deuxième portion de contact entre le métal de contact (250) et l'électrode commune (270), dans lequel les première et deuxième portions de contact ne sont pas chevauchées l'une sur l'autre.

12. Procédé selon la revendication 9, dans lequel la première portion de contact et la deuxième portion de contact sont constituées dans la portion centrale de déclination de la région de pixels multi-domaines.

13. Procédé selon la revendication 6, dans lequel le premier trou de contact est constitué par mordançage d'une portion prédéterminée de la couche isolante (140) correspondant au métal de grille (130), et le deuxième trou de contact est constitué par mordançage d'une portion prédéterminée de la première couche de passivation (160) correspondant au métal de contact (150) .

Related Art
FIG.1



Related Art
FIG.2

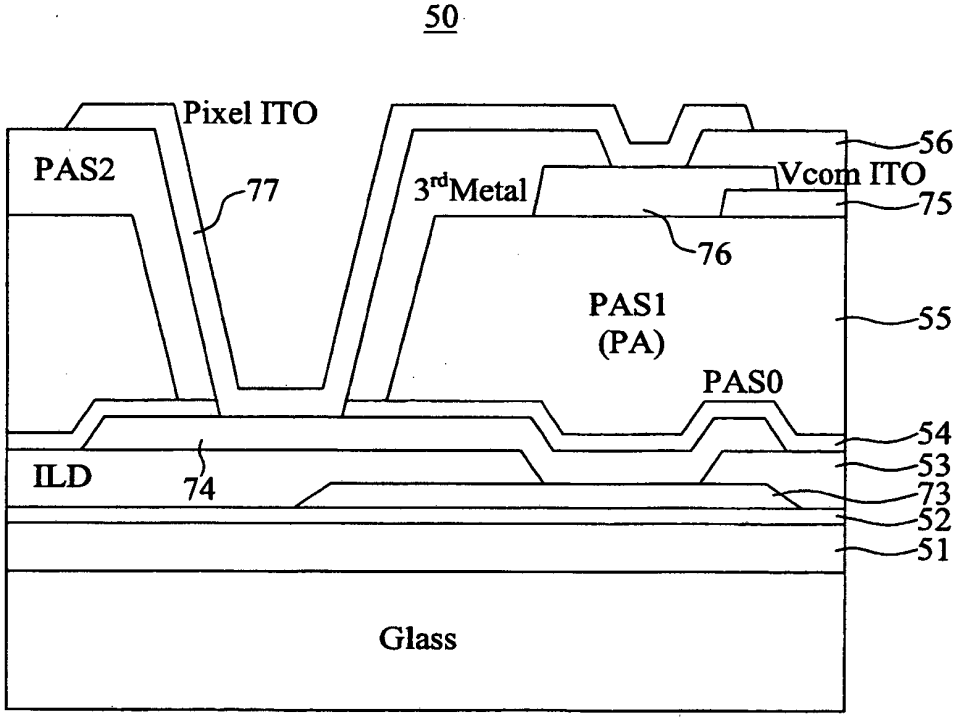


FIG.3

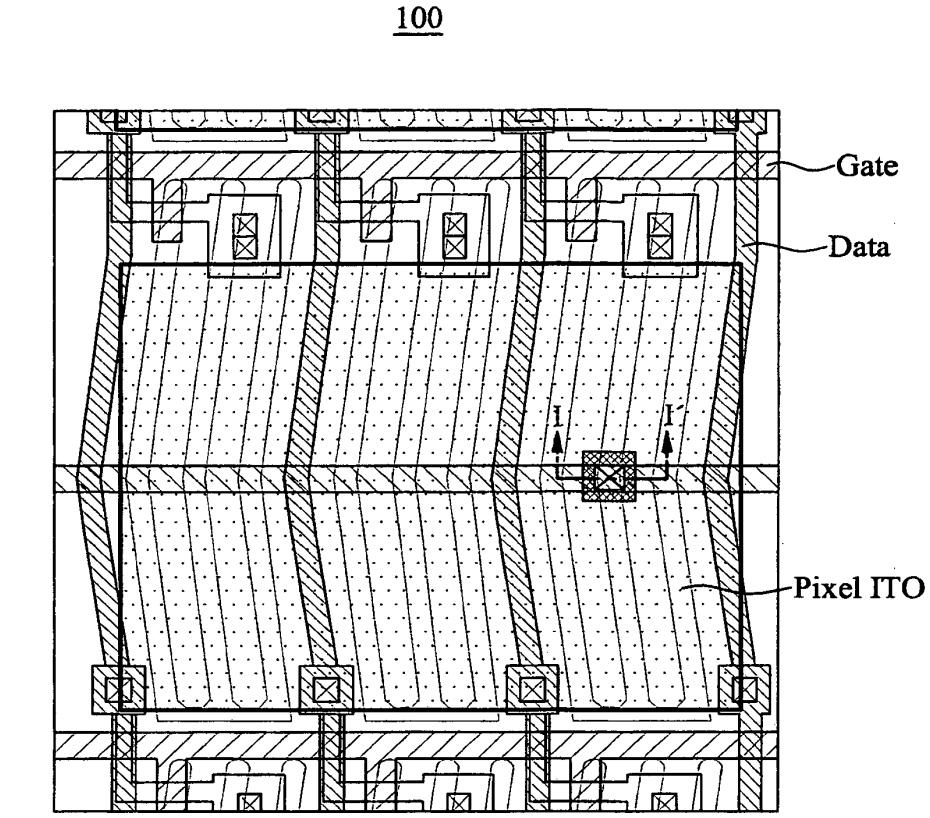

100
Gate
Data
I
I'
Pixel ITO

FIG.4

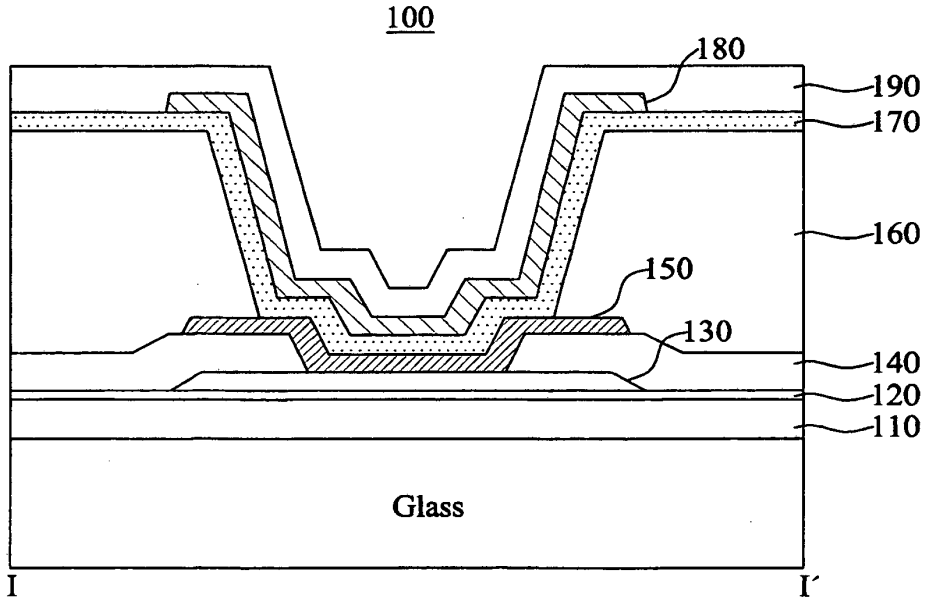

100
180
190
170
160
150
130
140
120
110
Glass
I
I'

FIG.5

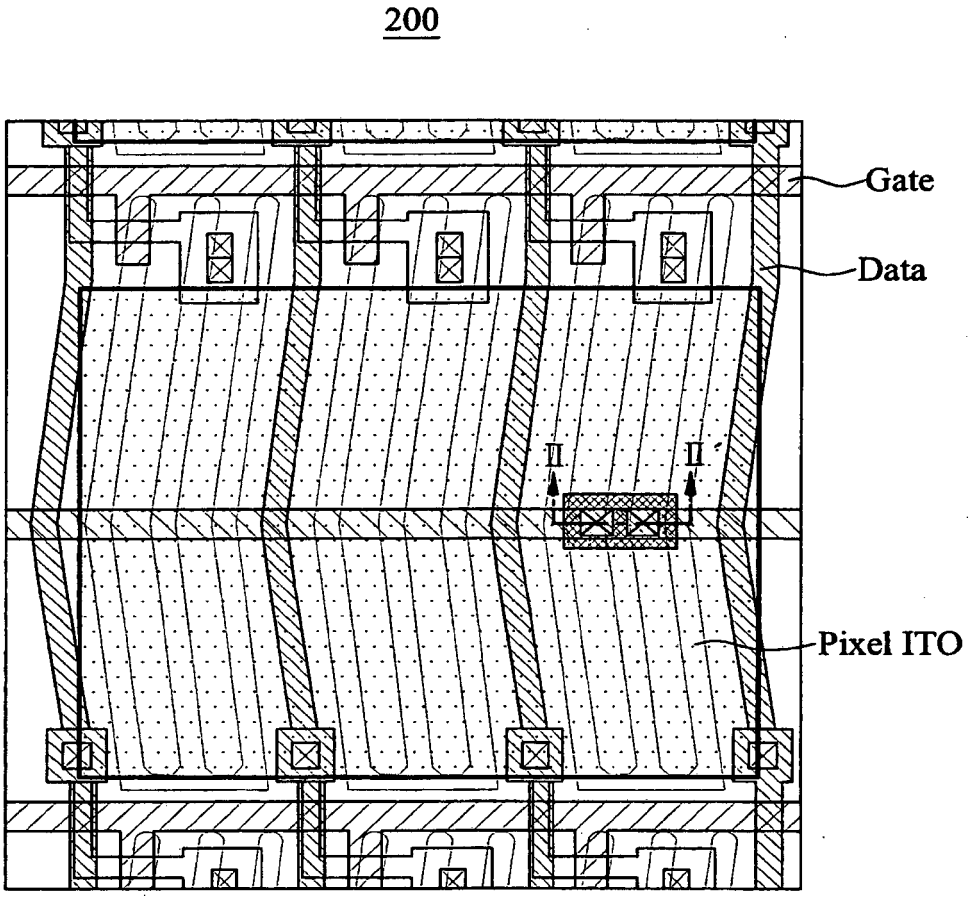


FIG.6

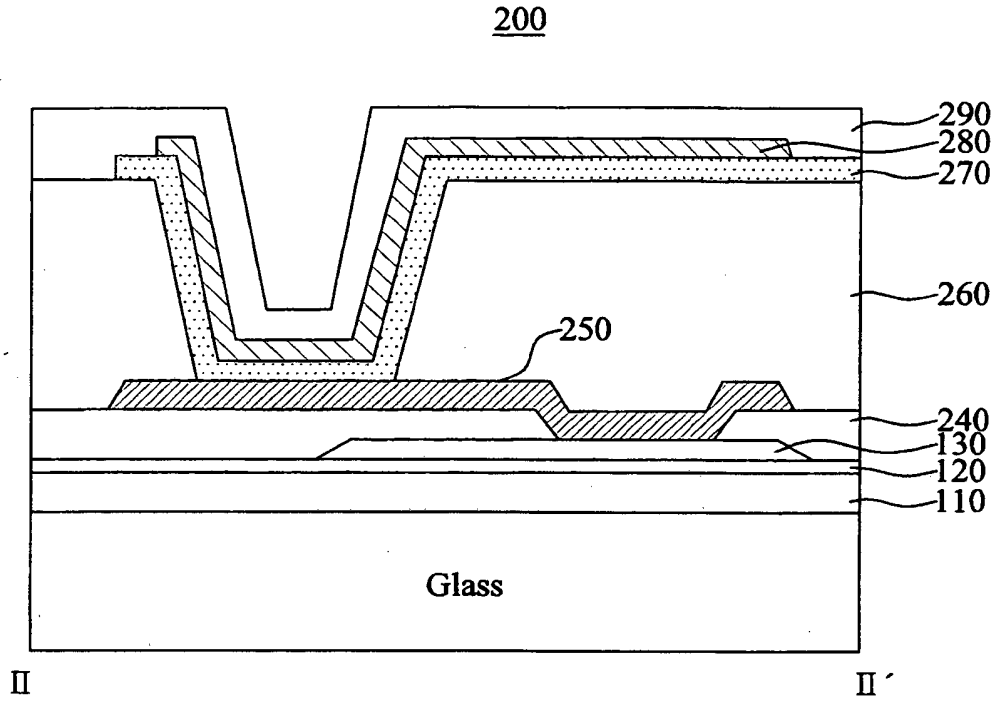

200
290
280
270
260
250
240
130
120
110
Glass
II
II'

FIG.7

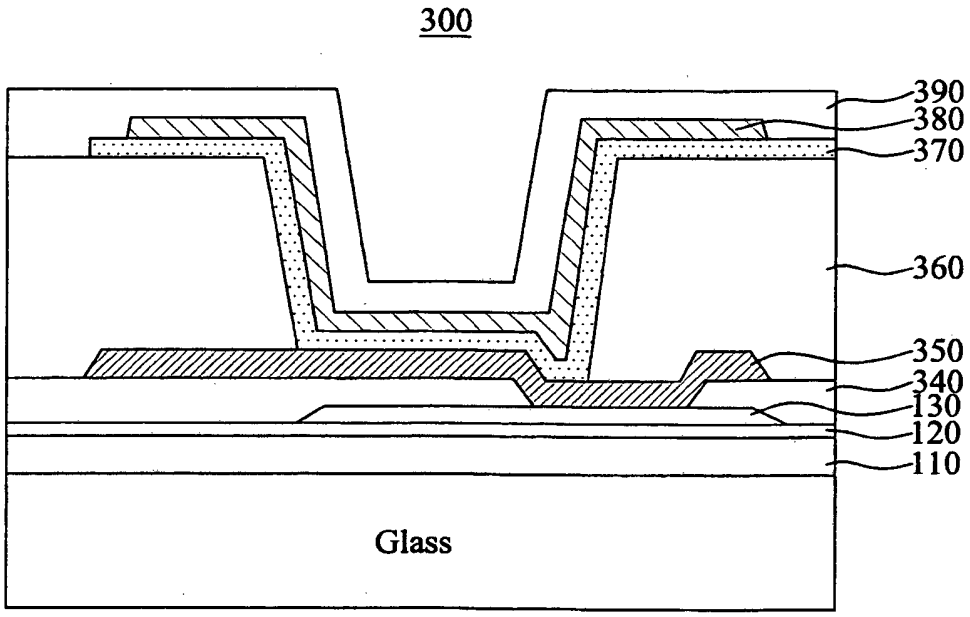
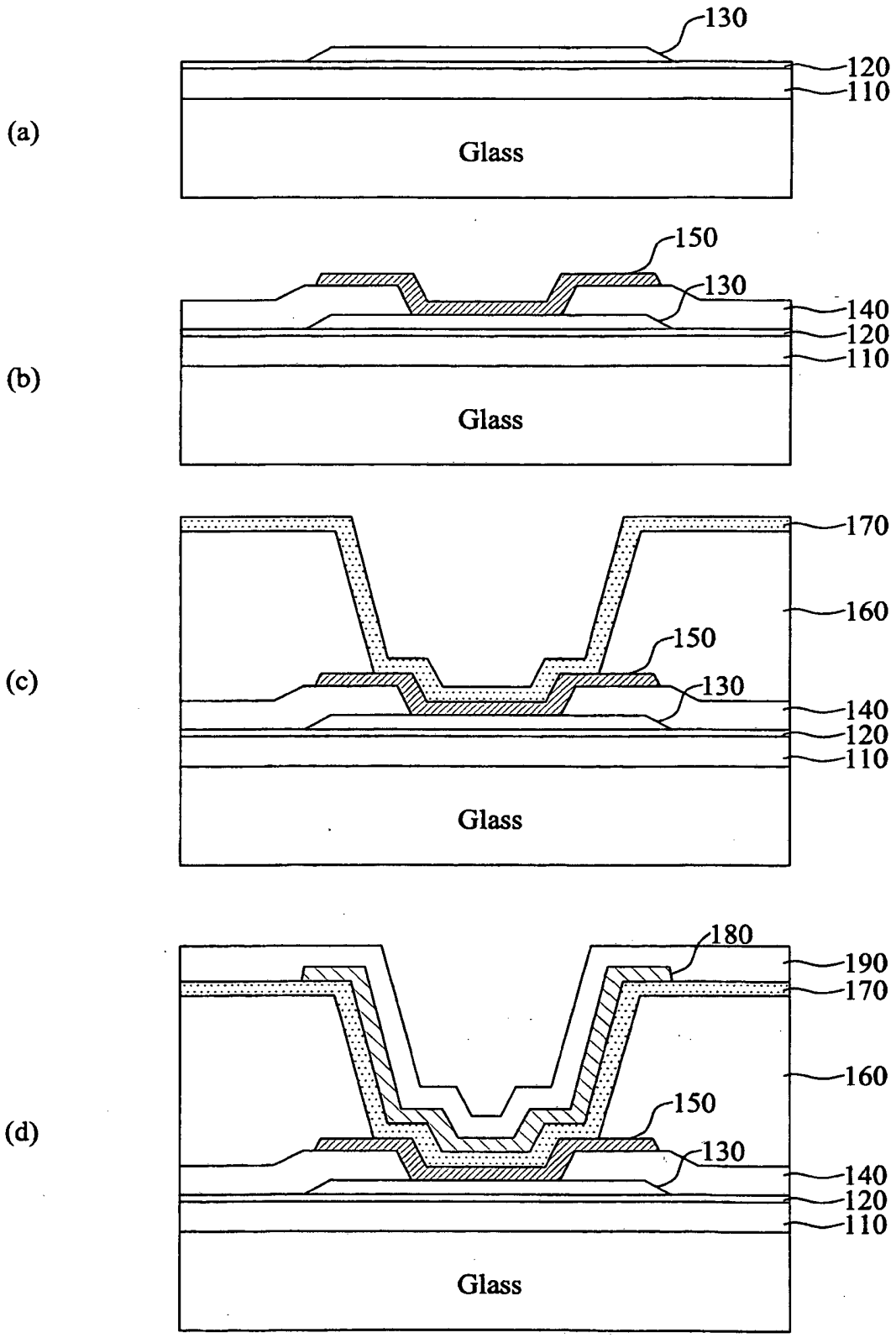

300
390
380
370
360
350
340
130
120
110
Glass

FIG.8


(a)
130
120
110
Glass
(b)
150
130
140
120
110
Glass
(c)
170
160
150
130
140
120
110
Glass
(d)
180
190
170
160
150
130
140
120
110
Glass

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- KR 1020100092392 **[0001]**
- EP 2214084 A1 **[0031]**

专利名称(译)	液晶显示装置及其制造方法		
公开(公告)号	EP2431802B1	公开(公告)日	2017-12-06
申请号	EP2011007618	申请日	2011-09-19
[标]申请(专利权)人(译)	乐金显示有限公司		
申请(专利权)人(译)	LG DISPLAY CO. , LTD.		
当前申请(专利权)人(译)	LG DISPLAY CO. , LTD.		
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IPC分类号	G02F1/1362 G06F3/041		
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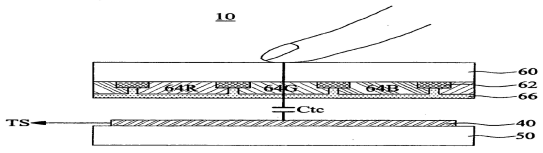
优先权	1020100092392 2010-09-20 KR		
其他公开文献	EP2431802A1		
外部链接	Espacenet		

摘要(译)

一种具有内置触摸屏的液晶显示装置，其使用公共电极作为触摸感应电极，包括栅极线和数据线的交叉点以限定像素区域，栅极金属设置在中央部分中。所述像素，形成在所述栅极金属上的绝缘层，穿过所述绝缘层设置以暴露所述栅极金属的上表面的预定部分的第一接触孔，所述绝缘层上的接触金属和所述第一接触孔内部，接触金属与栅极金属电连接，接触金属上的第一钝化层，穿过第一钝化层设置的第二接触孔以暴露接触金属的上表面的预定部分，第一钝化层上的公共电极在第二接触孔内，与公共电极电连接的导线，以及在第一钝化层和导电层上的第二钝化层e线，其中栅极金属和公共电极通过接触金属电连接。

Related Art
FIG.1



Related Art
FIG.2