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Yeo et al.

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(54) **LIQUID CRYSTAL DISPLAY AND METHOD FOR FABRICATING THE SAME**

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Related U.S. Application Data

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G02F 1/136 (2006.01)

(52) **U.S. Cl.** **349/46; 349/43**

(58) **Field of Classification Search** 349/139,
349/43, 46, 38, 187; 257/59, 72
See application file for complete search history.

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(57) **ABSTRACT**

A liquid crystal display and a method for fabricating the same include a first substrate having an active layer with source/drain regions formed therein, a gate line and a data line extending in directions perpendicular to each other formed thereon, a dummy gate insulating film and a dummy gate electrode both formed on the first substrate in fixed patterns isolated from the gate line, an interlayer insulating film on the first substrate inclusive of the dummy gate electrode with a step, a drain electrode formed on the interlayer insulating film to overlap on upper regions of the dummy gate electrode so as to be in contact with the drain region and have a step to the data line, the data line formed on the interlayer insulating having a step to the drain electrode, a passivation film formed on the interlayer insulating film inclusive of the dummy gate electrode and the data line, a contact hole formed to expose the drain electrode overlapped with the dummy gate electrode, and a pixel electrode overlapping upper edges of the data line and in contact with the drain electrode through the contact hole, thereby reducing a vertical crosstalk while a large aperture is achieved, to improve the picture quality.

13 Claims, 8 Drawing Sheets

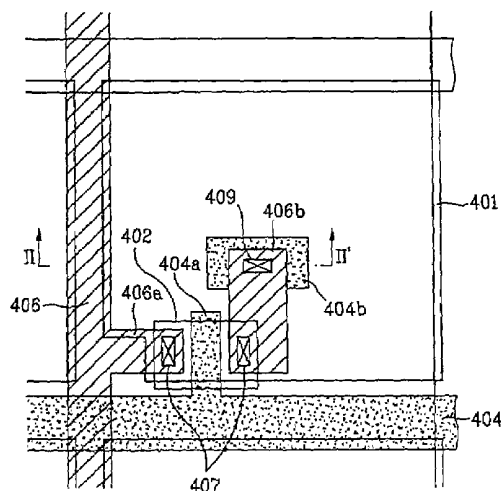
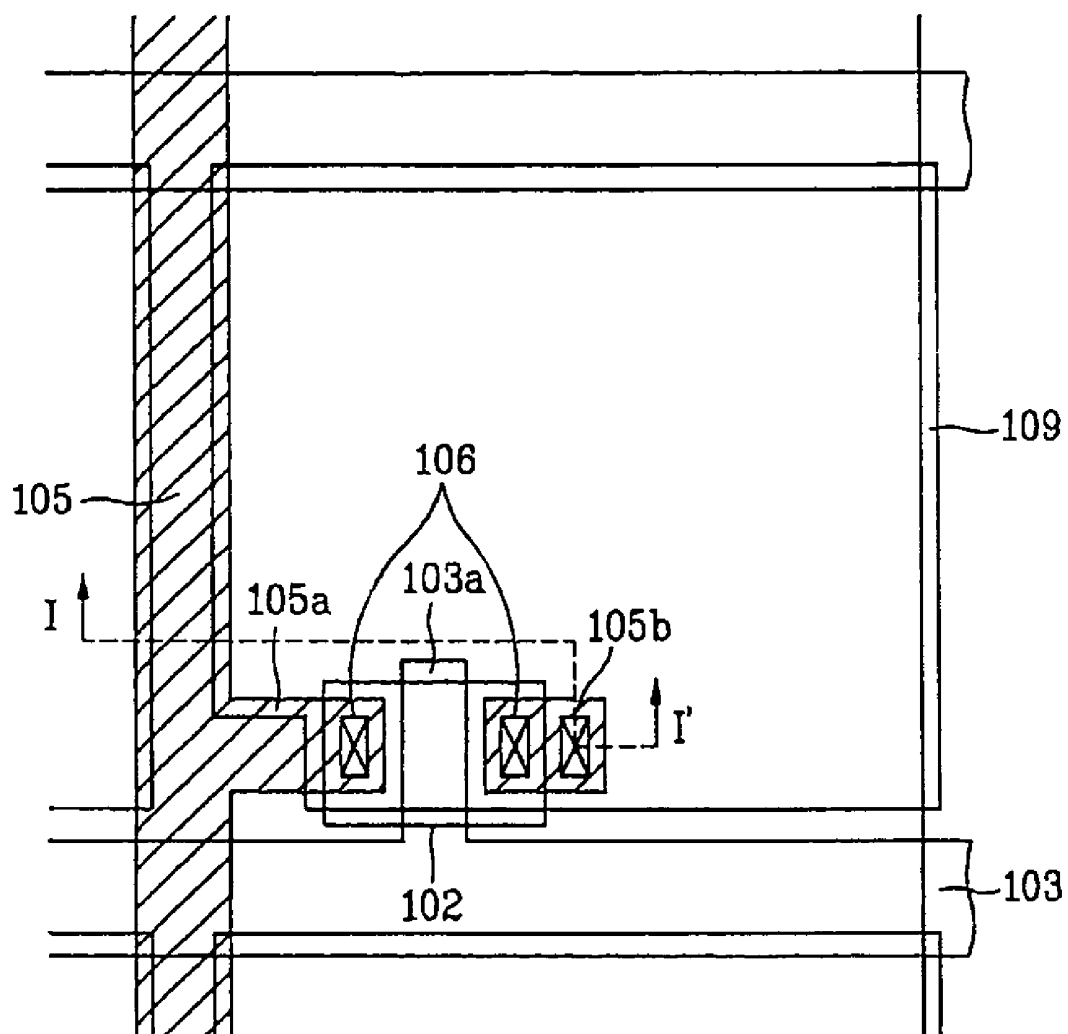


FIG. 1
Prior Art



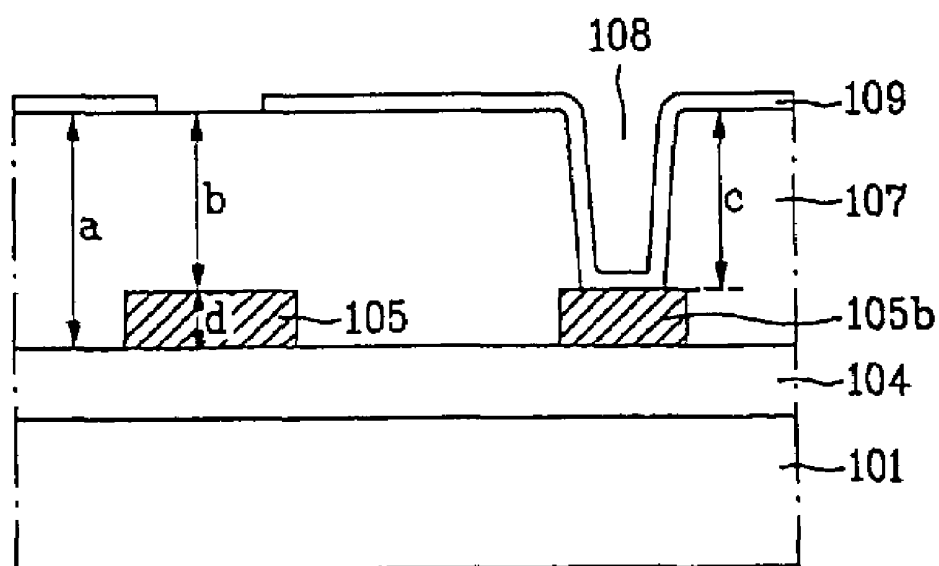


FIG. 3A
Prior Art



FIG. 3B
Prior Art

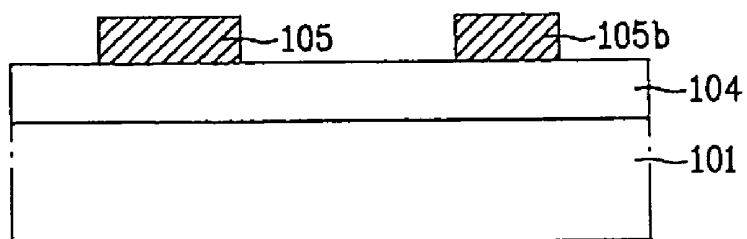


FIG. 3C
Prior Art

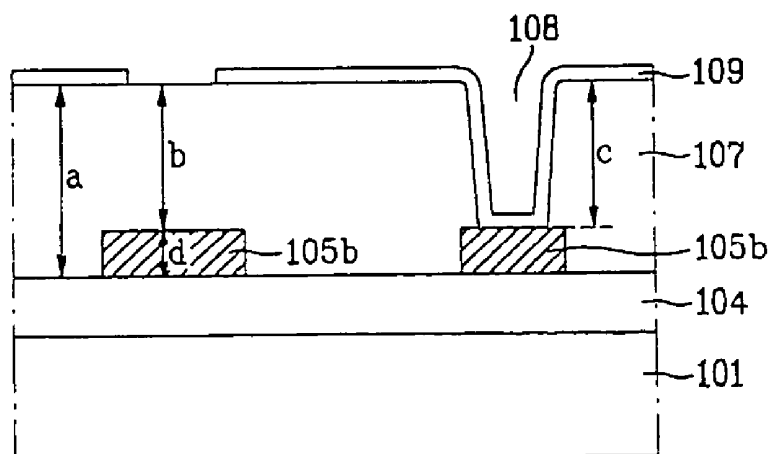


FIG. 4

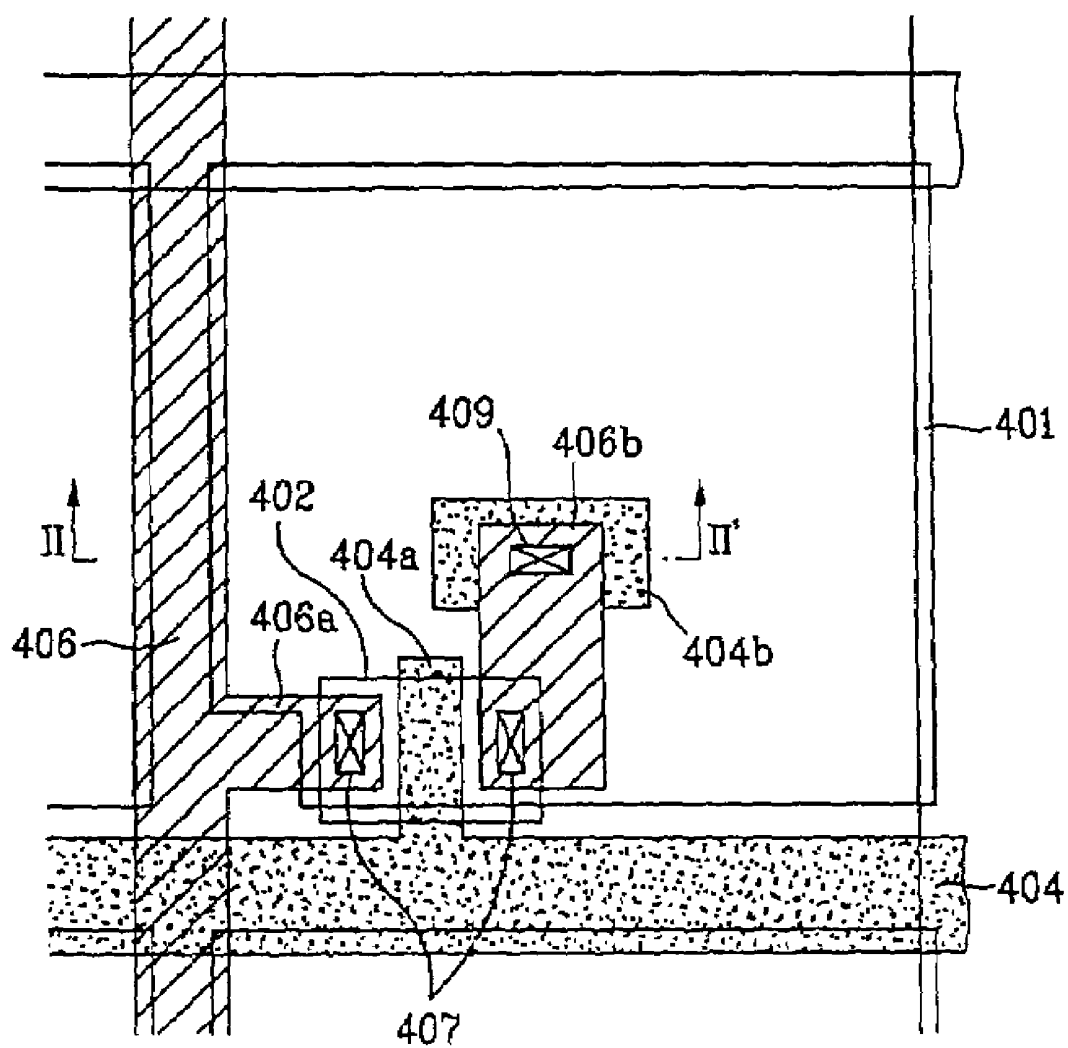


FIG. 5

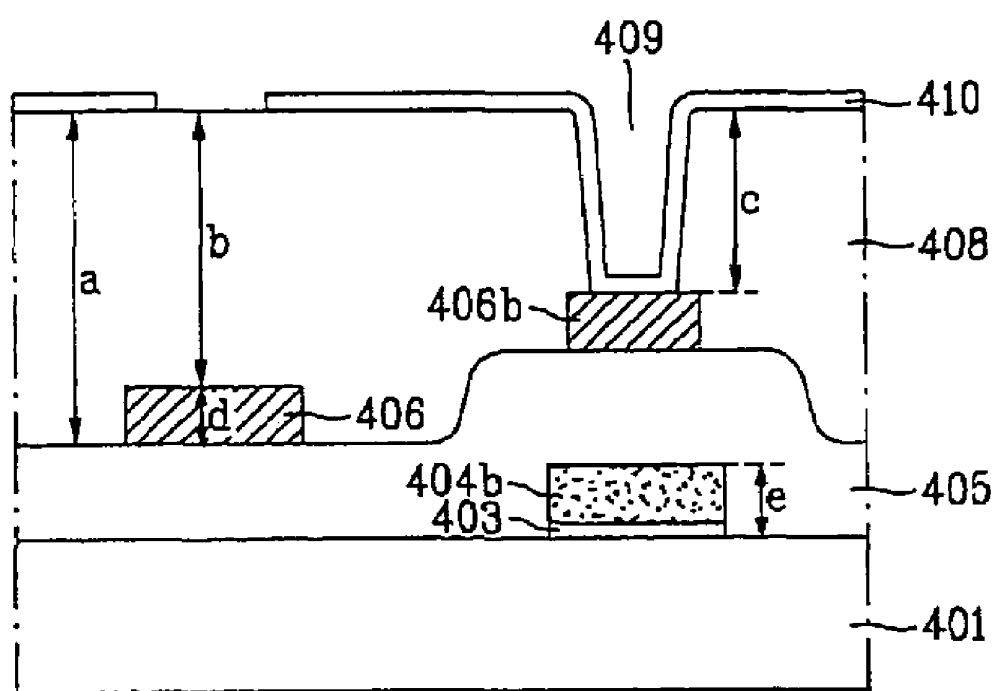


FIG. 6A

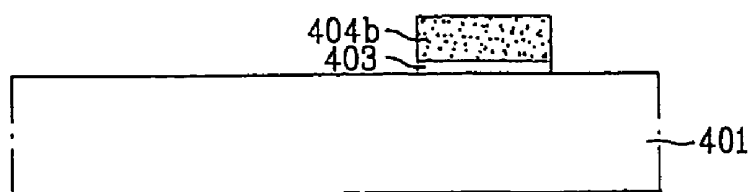


FIG. 6B

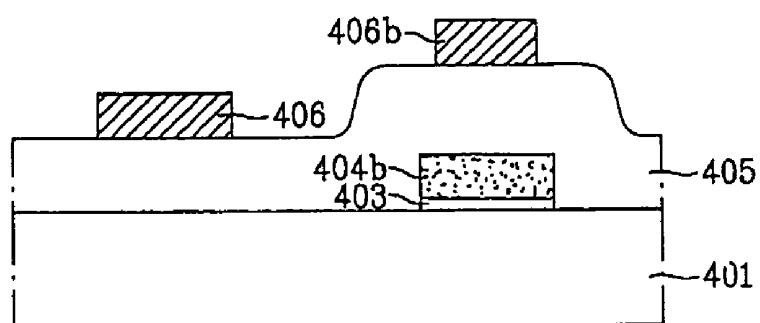


FIG. 6C

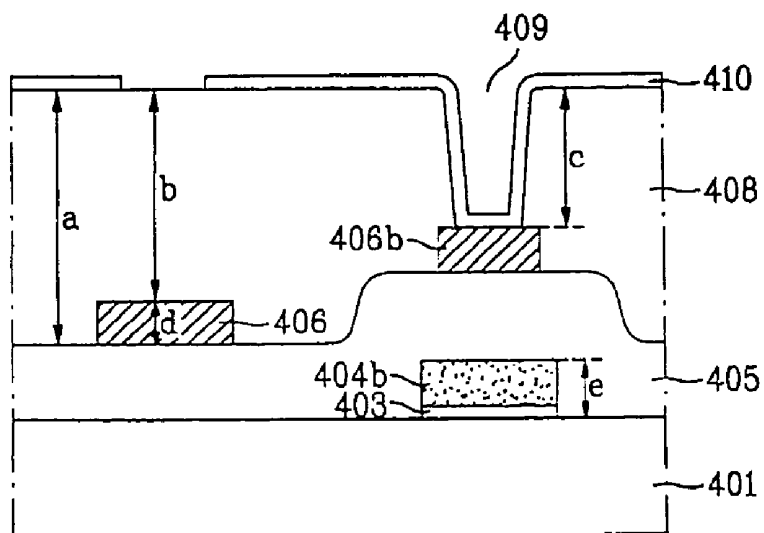


FIG. 7

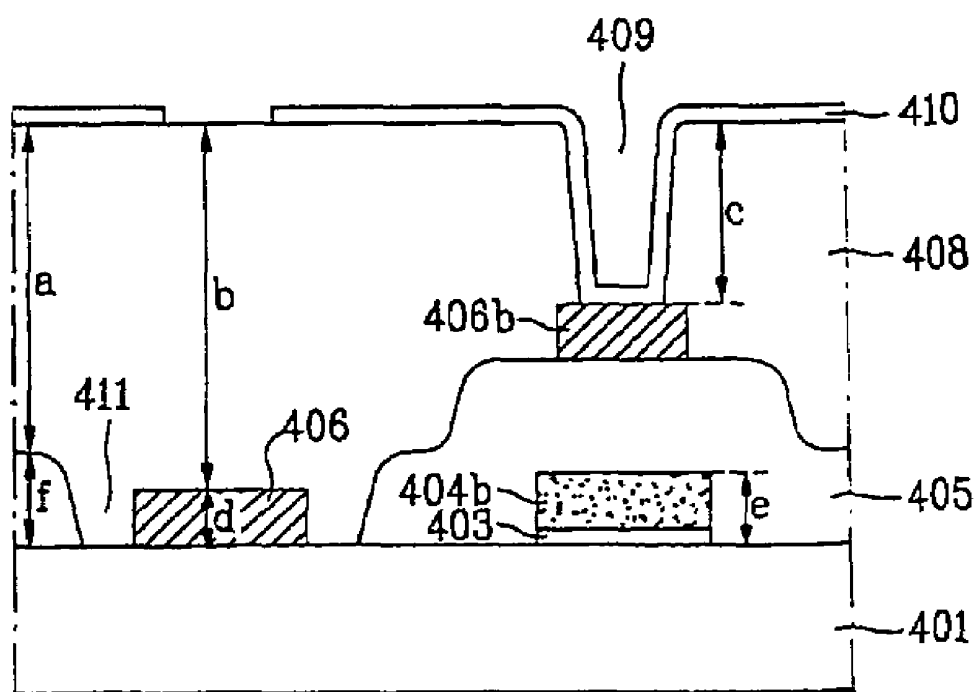


FIG. 8A

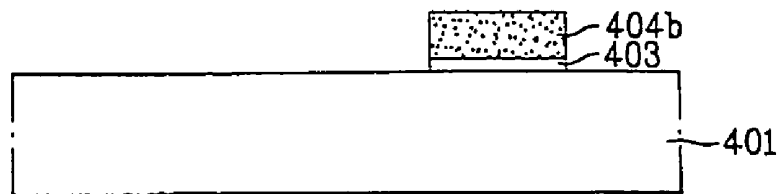


FIG. 8B

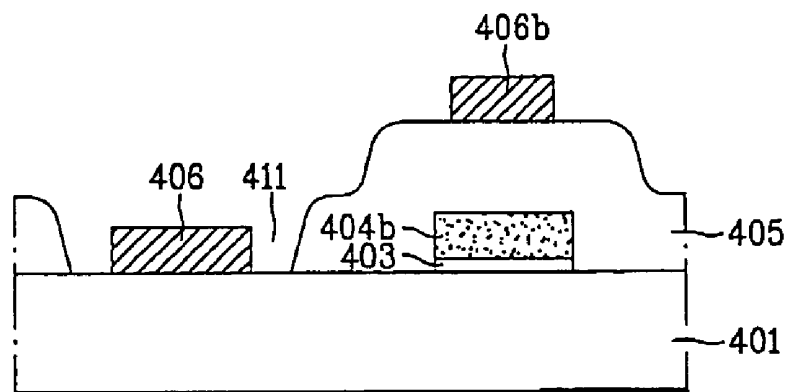
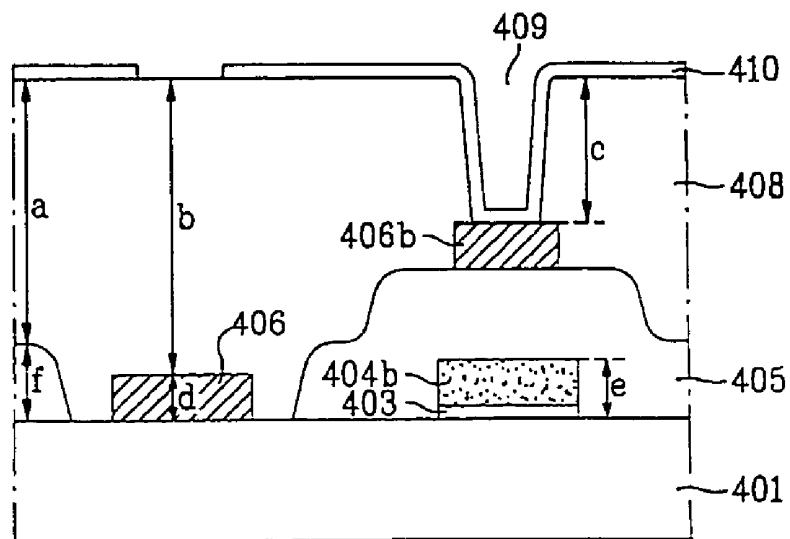


FIG. 8C



LIQUID CRYSTAL DISPLAY AND METHOD FOR FABRICATING THE SAME

This application is a divisional of U.S. patent application 09/892,648 filed Jun. 28, 2001 now U.S. Pat. No. 6,661,477.

CROSS REFERENCES TO RELATED APPLICATIONS

This application claims benefit of Korean Patent Application No. P2000-50429, filed on 29 Aug. 2000, the entirety of 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, and more particularly, to a liquid crystal display and a method for fabricating the same, which has large aperture and can improve a poor picture quality caused by vertical cross talk.

2. Background of the Related Art

A related art liquid crystal display is provided with a liquid crystal panel, a light source, and a driving circuit. The liquid crystal panel has first and second substrates, and liquid crystal injected between the two substrates. The second substrate has a black matrix, a color filter layer, and a common electrode.

The first substrate has a plurality of gate lines running in one direction at fixed intervals, a plurality of data lines running in one direction perpendicular to the gate lines at fixed intervals, and an LCD array at crossing parts of the gate lines and the data lines.

In an LCD array region, a space region between the gate lines and data lines is a pixel region, in which a pixel electrode and a thin film transistor are provided. That is, the thin film transistor is provided with a gate electrode connected to the gate line, a source electrode connected to the data line, a data electrode connected to the pixel electrode, for being turned on selectively in response to a signal to the gate line to transfer a data signal from the data line to the pixel electrode. The gate lines and the data lines are electrically connected to driving circuits.

Vertical cross-talk in the liquid crystal display, caused by parasitic capacitance Cds between the source electrode and the drain electrode, degrades a picture quality as a source voltage (a data signal) to be provided to the pixels on a vertical (data) line influences the liquid crystal pixel voltage. The cross-talk mostly occurs as a static capacitance between the data line and the pixel electrode is increased. Research has been performed with a goal to reduce the vertical cross-talk in a liquid crystal display with a large aperture. In order to achieve the large aperture, an organic insulating film is used as a passivation film deposited between the data line and the pixel electrode, and the pixel electrode is overlapped with and edge of the data line.

A related art liquid crystal display and method for fabricating the same will be explained, with reference to the attached drawings. FIG. 1 illustrates a layout of a first substrate of the related art liquid crystal display, and FIG. 2 illustrates a section of the related art liquid crystal display across line I-I' in FIG. 1, showing a pixel electrode, a data line, and a drain electrode.

Referring to FIGS. 1 and 2, the related art liquid crystal display is provided with an active layer 102, a channel layer of a thin film transistor in an active region defined on an

insulating substrate 101, a gate insulating film (not shown) on the active layer 102 to surround the active layer 102, and a gate electrode 103a crossing a central part of the active layer 102 on the gate insulating film. The gate electrode 103a is a projection from the gate line 103 running in one direction. There are source/drain regions in the active layer on both sides of the gate electrode 103a, an interlayer insulating film 104 on an entire surface inclusive of the gate electrode 103a, and first contact holes 106 to expose the source/drain regions in the active layer 102 by etching the interlayer insulating film 104 and the gate insulating film. The source electrode 105a, the drain electrode 105b, and the data line 105 are formed at each of the contact holes 106 and on the interlayer insulating film 104. The data line 105 and the gate line 103 cross each other. An organic insulating film 107 is formed on the interlayer insulating film 104 inclusive of the source electrode 105a, the drain electrode 105b, and the data line 105. The organic insulating film 107 has a flat surface. There is a second contact hole 108 in the organic insulating film 107 to expose the drain electrode 105b, and a pixel electrode 109 of ITO (Indium Thin Oxide) in the second contact hole 108 and on the organic insulating film 107. The pixel electrode 109 overlaps upper parts of edges of the data line 105, except the central part thereof.

Referring to FIG. 2, in a large aperture structure, a distance 'b' between the pixel electrode 109 and the data line 105 is the most important element in view of the vertical crosstalk. That is, the greater the distance 'b', the smaller the parasitic capacitance between the pixel electrode 109 and the data line 105, that improves the poor picture quality caused by the vertical crosstalk. However, the distance 'b' can not be made greater because an increased distance 'b' necessitates an increase of an etch depth 'c' of the second contact hole 108 provided for bringing the pixel electrode 109 into contact with the drain electrode 105. In conclusion, 'c' is fixed depending on a dry etching (anisotropic etching) capability, 'a' is fixed depending on 'c', and 'b' is fixed depending on 'c'. For an example, when 'c'=9500 Å, 'd'=3500 Å, 'a'=1.3 μm, and 'b'=0.95 μm. If 'b' is to be made thicker, then 'c' also has to be made thicker.

A method for fabricating the foregoing related art liquid crystal display will be explained. FIGS. 3A-3C illustrate sections showing the steps of a method for fabricating the related art liquid crystal display.

Referring to FIG. 3A, an active layer 102 (see FIG. 1) is formed on an active region defined on an insulating substrate 101, a gate insulating film (not shown) is formed on the active layer 102 to surround the active layer 102, and a gate line 103 (see FIG. 1) is formed on the gate insulating film to run in one direction, together with a gate electrode 103a (see FIG. 1) projected from the gate line 103 to cross a central part of the active layer 102. Source/drain regions are formed in the active layer on both sides of the gate electrode 103a.

Then, as shown in FIG. 3B, an interlayer insulating film 104 is deposited on an entire surface inclusive of the gate electrode 103a, and the interlayer insulating film 104 and the gate insulating film are etched to expose the source/drain regions in the active layer 102, to form a first contact hole 106 (see FIG. 1). A metal layer is formed in respective first contact holes 106 to the source and drain regions and on the interlayer insulating film 104, and subjected to anisotropic etching, to form a source electrode 105a (see FIG. 1) in contact with the source region, a drain electrode 105b in contact with the drain region, and a data line 105 extended from the source electrode to be in a perpendicular direction to the gate line 103.

As shown in FIG. 3C, an organic insulating film 107 is coated on an entire surface of the source electrode 105a, the data line 105, and the drain electrode 105b, and a second contact hole 108 is formed on the organic insulating film 107 to expose the drain electrode 105b. An ITO (Indium Tin Oxide) is deposited on an entire surface of the organic insulating film 107 inclusive of the second contact hole 108, and subjected to anisotropic etching to expose a central part of the data line 105, and overlaps upper part edges of the data line 105, to form a pixel electrode 109.

However, the foregoing related art liquid crystal display, and a method for fabricating the same, have the following problem.

The thicker organic insulating film formed between the data line and the pixel electrode for reduction of a parasitic capacitance between the data line and the pixel electrode requires a longer time period in etching a second contact hole to bring the drain electrode and the pixel electrode into contact. Accordingly, the related art has a limitation in providing a liquid crystal display, which reduces a vertical crosstalk while a large aperture is achieved, for improving a picture quality.

SUMMARY OF THE INVENTION

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

An object of the present invention is to provide a liquid crystal display and a method for fabricating the same, which can reduce a vertical crosstalk while a large aperture is achieved, for improving a picture quality.

Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described, the liquid crystal display includes a first substrate having an active layer with source/drain regions formed therein, a gate line and a data line formed thereon extending in directions perpendicular to each other, a dummy gate insulating film and a dummy gate electrode both formed on the first substrate in fixed patterns isolated from the gate line, an interlayer insulating film on the first substrate inclusive of the dummy gate electrode with a step, a drain electrode formed on the interlayer insulating film to overlap on upper regions of the dummy gate electrode so as to be in contact with the drain region and have a step to the data line, the data line formed on the interlayer insulating film having a step to the drain electrode, a passivation film formed on the interlayer insulating film inclusive of the dummy gate electrode and the data line, a contact hole formed to expose the drain electrode overlapping the dummy gate electrode, and a pixel electrode overlapping upper edges of the data line and in contact with the drain electrode through the contact hole, thereby reducing a vertical crosstalk while a large aperture is achieved, to improve a picture quality.

In the other aspect of the present invention, there is provided a method for fabricating a liquid crystal display including a first substrate having an active layer with source/drain regions formed therein, and a gate line and a data line

perpendicular to each other formed thereon, the method comprising the steps of (a) forming the gate line at the same time as forming a dummy gate insulating film and a dummy gate electrode both on the first substrate in fixed patterns isolated from the gate line, (b) forming an interlayer insulating film on the first substrate inclusive of the dummy gate electrode and the gate line so as to have a step, (c) forming the data line at the same time as forming a drain electrode on the interlayer insulating film to overlap on upper regions of the dummy gate electrode so as to be in contact with the drain region and have a step to the data line, (d) forming a passivation film on the interlayer insulating film inclusive of the dummy gate electrode and the data line, (e) forming a contact hole to expose the drain electrode overlapped with the dummy gate electrode, and (f) forming a pixel electrode on the passivation film to overlap upper edges of the data line and to be in contact with the drain electrode through the contact hole.

The present invention reduces a capacitance between the pixel electrode and the data line for reducing a vertical crosstalk, by forming an organic insulating film between the pixel electrode and the data line while a contact hole forming time period for providing a contact between the pixel electrode and the drain electrode is not increased because the thickness of the insulating film where the contact hole is formed is not increased.

It is to be understood that both the foregoing general description and the following detailed description 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 specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention:

In the drawings:

FIG. 1 illustrates a layout of a first substrate of a related art liquid crystal display;

FIG. 2 illustrates a section of the related art liquid crystal display across line I-I' in FIG. 1, showing a pixel electrode, a data line, and a drain electrode;

FIGS. 3A~3C illustrate sections showing the steps of a method for fabricating the related art liquid crystal display of FIG. 2;

FIG. 4 illustrates a layout of a first substrate of a liquid crystal display in accordance with a preferred embodiment of the present invention;

FIG. 5 illustrates a section of the liquid crystal display across line II-II' in FIG. 4, showing a pixel electrode, a data line, and a drain electrode in accordance with a first preferred embodiment of the present invention;

FIGS. 6A~6C illustrate sections showing the steps of a method for fabricating a liquid crystal display in accordance with a first preferred embodiment of the invention;

FIG. 7 illustrates a section of the liquid crystal display across line II-II' in FIG. 4, showing a pixel electrode, a data line, and a drain electrode in accordance with a second preferred embodiment of the present invention; and,

FIGS. 8A~8C illustrate sections showing the steps of a method for fabricating a liquid crystal display in accordance with a second preferred embodiment of the invention.

DETAILED DESCRIPTION OF THE
PREFERRED EMBODIMENTS

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. FIG. 4 illustrates a layout of a first substrate of a liquid crystal display in accordance with a first preferred embodiment of the present invention, and FIG. 5 illustrates a section of the liquid crystal display across line II-II' in FIG. 4, showing a pixel electrode, a data line, and a drain electrode in accordance with a first preferred embodiment of the present invention.

Referring to FIGS. 4-5, the first embodiment liquid crystal display of the present invention includes an active layer 402 formed on an active region defined on an insulating film 402, a gate insulating film (not shown) on the active layer 402 to surround the active layer 402, and a gate electrode 404a to cross a central part of the active layer 402 on the gate insulating film. There are source/drain regions in the active layer on both sides of the gate electrode 404a. The gate electrode 404a is projected from the gate line 404 running in one direction. When the gate insulating film and the gate electrode 404a are formed thus, there are a dummy gate insulating film 403 and a dummy gate electrode 404b on a region of the insulating substrate 401 to overlap with one side of a lower part of the drain electrode 406b to be formed later. The dummy gate electrode 404b has a width greater than the drain electrode 406b. There is an interlayer insulating film 405 deposited on an entire surface inclusive of the gate electrode 404a and the dummy gate electrode 404b, and first contact holes 407 in the interlayer insulating film 405 and the gate insulating film to expose the source/drain regions in the active layer 402, respectively. There are a source electrode 406a, a drain electrode 406b, and a data line 406 in the first contact holes 407 to respective source region and drain region and on the interlayer insulating film 405. The data line 406 and the drain electrode 406b form a step owing to the dummy gate insulating film 403 and the dummy gate electrode 404b. There is an organic insulating film 408 on the interlayer insulating film 405 inclusive of the source electrode 406a and the drain electrode 406b. The organic insulating film 408 has a flat surface. There is a second contact hole 409 in the organic insulating film 408 to expose a top of the drain electrode 406b overlapped with the dummy gate electrode 404a, and a pixel electrode 410 of a transparent conductive material (e.g., ITO) in the second contact hole 409 and on the organic insulating film 408. The pixel electrode 410 is overlapped with the data line 406 at upper edges except a central part thereof.

As shown in FIG. 5, in the large aperture structure, a distance 'b' between the pixel electrode 410 and the data line 406 is the most important parameter in view of a picture quality. That is, the thicker the 'b', the smaller the capacitance between the pixel electrode 410 and the data line 406, to reduce deterioration of picture quality caused by vertical crosstalk.

Thus, in the first embodiment of the present invention, because the dummy gate insulating film 403 and the dummy gate electrode 404a are overlapped with one side of the drain electrode 406b, and the second contact hole 409 is to be formed thereto, the thickness of the organic insulating film 408 over the data line 406 overlapped with the pixel electrode 410 at an edge thereof is formed thicker than the related art, while the thickness of the part of the organic insulating film 408 to be etched for forming the second contact hole 409 is maintained. For an example, when 'c' is

9500 Å, and 'd' is 3500 Å, if 'e', a total thickness of the dummy gate insulating film 403 and the dummy gate electrode 404b, is 4800 Å, 'a' becomes 1.78 μm, and 'b' becomes 1.43 μm, which is approx. 50.5% increase of thickness compared to the 'b'=0.95 μm in the related art.

Next, a liquid crystal display in accordance with a second preferred embodiment of the present invention will be explained. FIG. 7 illustrates a section of the liquid crystal display across line II-II' in FIG. 4, showing a pixel electrode, a data line, and a drain electrode in accordance with a second preferred embodiment of the present invention.

Referring to FIGS. 4 and 7, the liquid crystal display in accordance with a second preferred embodiment of the present invention includes an active layer 402 in an active region defined on an insulating substrate 401, a gate insulating film (not shown) on the active layer 402 to surround the active layer 402, and a gate electrode 404a (see FIG. 4) to cross a central part of the active layer 402 on the gate insulating film. There are source/drain regions in the active layer 402 on both sides of the gate electrode 404a. The gate electrode 404a is projected from the gate line 404 (see FIG. 4) running in one direction. There are a dummy gate insulating film 403 and a dummy gate electrode 404b on a region of the insulating substrate 401 beneath one side of the drain electrode 406b. The dummy gate electrode 404b has a width larger than a width of the drain electrode 406. There are an interlayer insulating film 405 on an entire surface inclusive of the gate electrode 404 and the dummy gate electrode 404b, and contact holes 407 in the interlayer insulating film 405 and the gate insulating film (not shown) to expose the source/drain regions in the active layer 402. When the first contact hole 407 is etched, the interlayer insulating film 405 is also etched to form a channel or hole 411 exposing the insulating substrate 401 where the data line 406 is to be formed. The channel 411 of the interlayer insulating film 405 is etched to a width larger than a width of the data line 406. The source electrode 406a, the drain electrode 406b, and the data line 406 are formed in the contact holes 407 to the source region and the drain region, and the channel 411 of the interlayer insulating film 405, respectively. The data line 406 is formed on the insulating substrate 401 in the channel 411 having the interlayer insulating film 405 removed therefrom. The data line 406 and the drain electrode 406b form a step owing to the interlayer insulating film 405 etched at the time of formation of the dummy gate insulating film 403, the dummy gate electrode 404b, and the first contact hole 407. There is an organic insulating film 408 deposited on the interlayer insulating film 405 inclusive of the source electrode 406a, the drain electrode 406b, and the data line 406. In this instance, the organic insulating film 408 has a flat surface, the second contact hole 409 is formed in the organic insulating film to expose the drain electrode 406b, and there is the pixel electrode 410 of a transparent conductive material (e.g., ITO) in the second contact hole 409 and on the organic insulating film 408. The pixel electrode 410 is overlapped on an upper part of edges of the data line 406 except a central portion thereof.

Thus, in the second embodiment of the present invention, for formation of a thicker organic insulating film 408 between the pixel electrode 410 and the data line 406, the dummy gate insulating film 403 and the dummy gate electrode 404b are formed under a region the second contact hole 409 is formed thereto, and the data line 406 is buried in a channel 411 in the interlayer insulating film 405 etched during formation of the first contact hole 407. The thickness of the organic insulating film 408 over an upper part of the

data line **406** is increased, while the thickness of the second contact hole **409** to be etched is not increased, thus reducing the capacitance Cdp between the data line **406** and the pixel electrode **410**. For an example, in similarity to the related art example, if 'c' is 9500 Å, and 'd' is 3500 Å, a total thickness of the dummy gate insulating film **403** and the dummy gate electrode **404b** 'e' is 4800 Å, and a thickness 'f' of the interlayer insulating film **405** is 6000 Å, 'a' is 1.78 μm, and 'b' is 2.03 μm. The 2.03 μm thickness of 'b' is an increase of 114% in thickness compared to the 0.95 μm thickness of 'b' in the related art.

A method for fabricating a foregoing liquid crystal display of the present invention will be explained. FIGS. 6A–6C illustrate sections showing the steps of a method for fabricating a liquid crystal display in accordance with a first preferred embodiment of the invention, and FIGS. 8A–8C illustrate sections showing the steps of a method for fabricating a liquid crystal display in accordance with a second preferred embodiment of the invention.

In the method for fabricating a liquid crystal display in accordance with a first preferred embodiment of the invention, though not shown in the drawings, an amorphous silicon layer (not shown) is deposited on an insulating substrate **401** having an active region defined thereon, and etched by photo etching to form an active layer **402** on the active region. A gate insulating film (not shown) is formed to surround the active layer **402**. Next, a conductive material (e.g., a metal) is deposited (e.g., sputtered) on the gate insulating film, and patterned, to form a gate electrode **404a** and the gate line **404**. In the formation of the gate insulating film, the gate electrode, and the gate line, as shown in FIG. 6A, a dummy gate insulating film **403** and a dummy gate electrode **404b** are also formed on the insulating substrate **401** beneath an area where one side of a drain electrode (see FIG. 6B) will be formed later. Then, though not shown, impurity ions are injected into the active layer **402** on both sides of the gate electrode **404a** by using the gate electrode **404a** as a mask, to form source/drain regions.

Next, as shown in FIG. 6B, an interlayer insulating film **405** is deposited on an entire surface of the insulating substrate **401** inclusive of the gate electrode **404a** and the dummy gate electrode **404b**. Then, though not shown, the interlayer insulating film **405** and the gate insulating film (not shown) are subjected to anisotropic etching until the source/drain regions are exposed, to form first contact holes **407** in the source/drain regions. A conductive material (e.g., metal) layer is deposited on the interlayer insulating film **405**, and subjected to anisotropic etching, to form a source electrode (not shown) in the first contact hole **407** in the source region, and a data line **406** on the interlayer insulating film **405** adjacent to the source electrode perpendicular to the gate line **404**. There is a drain electrode **406b** formed in the drain region spaced from the source electrode.

Next, as shown in FIG. 6C, an organic insulating film **408** is coated on an entire surface of the interlayer insulating film **405** inclusive of the source electrode, drain electrode **406b**, and the data line **406**, and subjected to anisotropic etching until a top of the drain electrode **406b** overlapped with the dummy gate electrode **404b** is exposed, to form a second contact hole **409**. Then, a transparent conductive (e.g., ITO) film is deposited on an entire surface of the organic insulating film inclusive of the second contact hole **409**, and subjected to anisotropic etching to overlap with upper edges of the data line **406** except a central part, to form a pixel electrode **410**. Thus, by forming the dummy gate insulating film **403** and the dummy gate electrode **404b** under the second contact hole **409** to be formed, a thickness of the

organic insulating film **408** between the data line **406** and the pixel electrode **410** is increased while a thickness of the organic insulating film **408** where the second contact hole **409** is to be formed is not increased.

A method for fabricating a liquid crystal display in accordance with a second preferred embodiment of the present invention will be explained. Since the second embodiment method is the same with the first embodiment method up to formation of the dummy gate insulating film and the dummy gate electrode **404b** in FIG. 6A of the first embodiment, the second embodiment method will be explained from deposition of an interlayer insulating film **405**.

As shown in FIG. 8B, an interlayer insulating film **405** is deposited on an entire surface of the insulating substrate **401** inclusive of the gate electrode **404a** and the dummy gate electrode **404b**. Though not shown, the interlayer insulating film **405** and the gate insulating film are subjected to anisotropic etching until the source/drain regions are exposed, to form first contact holes in the source/drain regions. When the first contact holes are thus formed, a part of the interlayer insulating film **405** is etched in one direction at a time until a channel **411** is formed in the insulating film **405** and a portion of the insulating substrate **401** is exposed where a data line **406** is to be formed. The insulating substrate **401** is etched to a width larger than a width of the data line **406** to be formed, later. Then, a conductive material (e.g., metal) layer is deposited on the interlayer insulating film **405**, inclusive of the exposed insulating substrate **401**, and subjected to anisotropic etching to form a source electrode (FIG. 4) in the first contact hole in the source region, and the data line **406** on the part of the insulating substrate **401** exposed as the interlayer insulating film **405** is etched to be in contact with the source electrode and perpendicular to the direction of the gate line. There is a drain electrode **406b** in the drain region spaced apart from the source electrode.

Next, as shown in FIG. 8C, an organic insulating film **408** is coated on an entire surface of the interlayer insulating film **405** inclusive of the source electrode and the drain electrode **406b**, and the data line **406**. The organic insulating film **408** over the drain electrode **406b** is subjected to anisotropic etching until a top of the drain electrode **406b** over the dummy gate electrode **404b** is exposed, to form a second contact hole **409**. A transparent conductive (e.g., ITO) film is deposited on an entire surface of the organic insulating film **408** inclusive of the second contact hole **409**, and subjected to anisotropic etching to overlap with upper edges of the data line **406** except a central part of the data line **406**, to form a pixel electrode **410**. Thus, by stacking the dummy gate insulating film **403** and the dummy gate electrode **404b** beneath the drain electrode **406b**, the second contact hole is to be formed thereto at one side of a lower part thereof, and forming the data line on the insulating substrate **401** to be buried in a hole in the interlayer insulating film **405**, a thickness of the organic insulating film **408** between the data line **406** and the pixel electrode **410** is increased.

As has been explained, the liquid crystal display and the method for fabricating the same have the following advantages.

In the formation of the pixel electrode to overlap with edge parts of the data line for providing a large aperture, by increasing the thickness of the organic insulating film between the data line and the pixel electrode the parasitic capacitance between the data line and the pixel electrode can be reduced, which in turn reduces vertical crosstalk, preventing a picture quality from becoming poor.

It will be apparent to those skilled in the art that various modifications and variations can be made in the liquid crystal display and the method for fabricating the same of the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A liquid crystal display (LCD) device having a first substrate having an active layer with source/drain regions formed therein, the LCD device comprising:

a gate line formed on the substrate extending in a first direction;

a dummy gate electrode formed on the substrate;

a data line formed on the substrate extending in a second direction substantially perpendicular to the first direction;

a first insulating layer formed on the substrate and covering the gate line and the dummy gate electrode;

a drain electrode having a first portion connected to the drain region and a second portion extending above the dummy gate electrode;

a second insulating layer formed on the first insulating layer and covering the data line, the second insulating layer having a contact hole defined therein exposing the second portion of the drain electrode; and

a transparent conductive layer formed above the second insulating layer, overlapping at least a portion of the data line, and contacting the drain electrode through the contact hole defined in the second insulating layer.

2. The LCD device of claim 1, further comprising a dummy gate insulating film formed between the dummy gate electrode and the substrate.

3. The LCD device of claim 1, wherein the second portion of the drain electrode is located a greater distance above the substrate than the data line.

4. The LCD device of claim 1, wherein the data line is formed on the first insulating layer.

5. The LCD device of claim 1, wherein the first insulating layer includes a channel and wherein the data line is formed in the channel.

6. The LCD device of claim 5, wherein the channel exposes a portion of the substrate.

7. The LCD device of claim 1, wherein a first thickness of the second insulating layer over the second portion of the drain electrode where the contact hole is formed is less than a second thickness of the second insulating layer over the data line.

8. A method of fabricating a liquid crystal display (LCD) device including a first substrate having an active layer with source/drain regions formed therein, the LCD device comprising:

forming at a same time on the substrate a dummy gate electrode and a gate line extending in a first direction;

forming a first insulating layer formed on the substrate covering the gate line and the dummy gate electrode;

forming at a same time on the substrate a data line extending in a second direction substantially perpendicular to the first direction and a drain electrode having a first portion connected to the drain region and a second portion extending above the dummy gate electrode;

forming a second insulating layer on the first insulating layer covering the dummy gate electrode, the second insulating layer having a contact hole defined therein exposing the second portion of the drain electrode; and forming a transparent conductive layer formed above the second insulating layer, overlapping at least a portion of the data line, and contacting the drain electrode through the contact hole defined in the second insulating layer.

9. The method of claim 8, further comprising forming a dummy gate insulating film prior to forming the dummy gate electrode and the gate line.

10. The method of claim 8, wherein the second portion of the drain electrode is formed a greater distance above the substrate than the data line.

11. The method of claim 8, wherein the data line is formed on the first insulating layer.

12. The method of claim 8, further comprising forming a channel in the first insulating layer prior to forming the data line, wherein the data line is formed in the channel.

13. The method of claim 8, wherein the channel exposes a portion of the substrate.

* * * * *

专利名称(译)	液晶显示器及其制造方法		
公开(公告)号	US6982771	公开(公告)日	2006-01-03
申请号	US10/683666	申请日	2003-10-14
[标]申请(专利权)人(译)	YEO JU CHEON HA YONG MIN 朴宰DEOK		
申请(专利权)人(译)	YEO JU CHEON HA YONG MIN 朴宰DEOK		
当前申请(专利权)人(译)	LG DISPLAY CO. , LTD.		
[标]发明人	YEO JU CHEON HA YONG MIN PARK JAE DEOK		
发明人	YEO, JU CHEON HA, YONG MIN PARK, JAE DEOK		
IPC分类号	G02F1/136 G02F1/1362 G02F1/1368		
CPC分类号	G02F1/136227 G02F1/1368		
优先权	1020000050429 2000-08-29 KR		
其他公开文献	US20040075784A1		
外部链接	Espacenet USPTO		

摘要(译)

液晶显示器及其制造方法包括：第一基板，具有形成有源/漏区的有源层；栅线 and 数据线，其在彼此垂直的方向上延伸；伪栅极绝缘膜和虚设栅极电极，均以与栅极线隔离的固定图案形成在第一基板上，第一基板上的层间绝缘膜包括具有台阶的虚设栅极电极，漏极电极形成在层间绝缘膜上以重叠在上部伪栅极电极的区域与漏区接触并具有到数据线的台阶，形成在层间绝缘层上的数据线具有到漏电极的台阶，在层间绝缘膜上形成的钝化膜包括虚设栅极电极和数据线，形成用于暴露与虚设栅极电极重叠的漏极电极的接触孔，以及像素ele ctrode重叠数据线的上边缘并通过接触孔与漏电极接触，从而在实现大孔径时减小垂直串扰，以改善图像质量。

