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(54) LIQUID CRYSTAL DISPLAY AND METHOD OF FABRICATING THE SAME

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(57) **ABSTRACT**

The present invention relates to an LCD that has a first panel, a second panel, a sealant, and a liquid crystal layer between the two panels. The first panel includes a pad provided in a first part of a non-display region and a dummy metal pattern provided in a second part of the non-display region along a circumference of a display region. The second panel is positioned opposite the first panel so that the two panels sandwich the liquid crystal layer. A sealant is formed on the pad and the dummy metal pattern and couples the first panel with the second panel. Thus, an LCD described herein has a uniform cell gap. A method of fabricating an LCD that has a uniform cell gap is also disclosed.

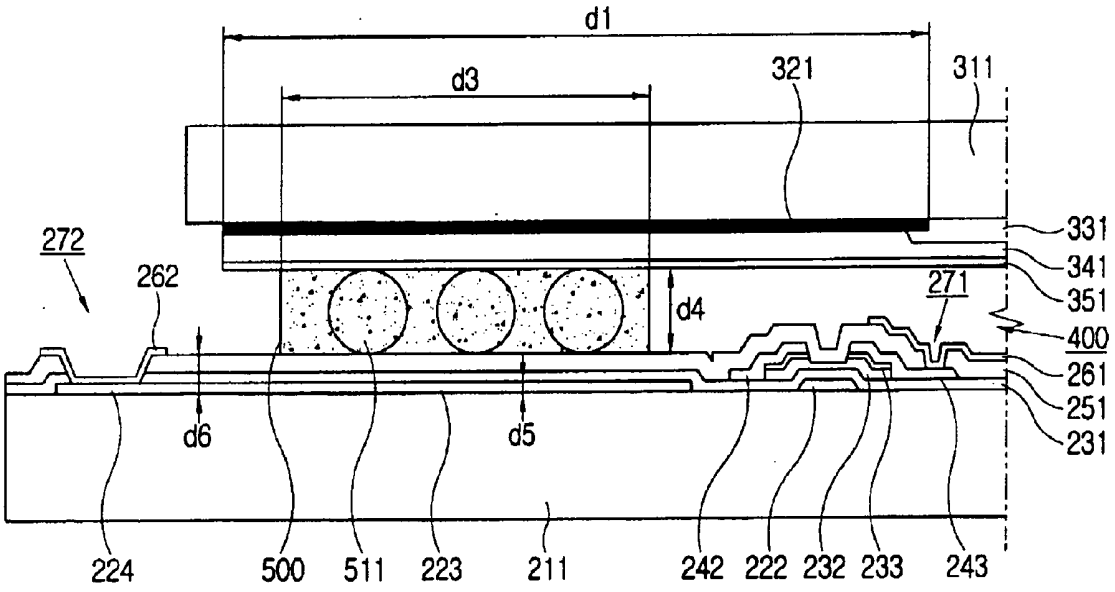


FIG. 1

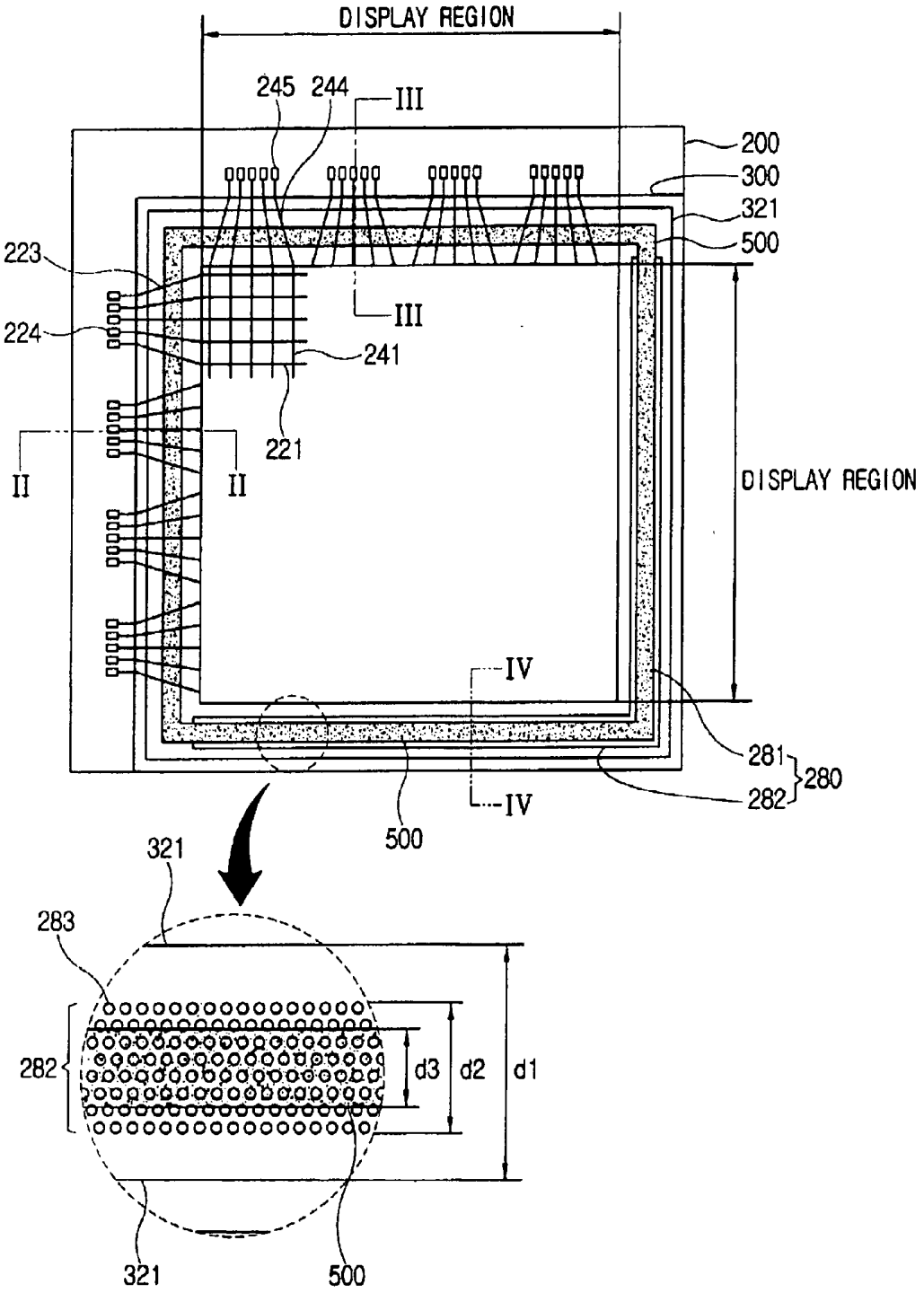

DISPLAY REGION
245
244
III
200
300
321
500
223
224
241
221
III
II
II
DISPLAY REGION
IV
281
280
282
IV
500
321
283
282
d3
d2
d1
321
500

FIG. 2

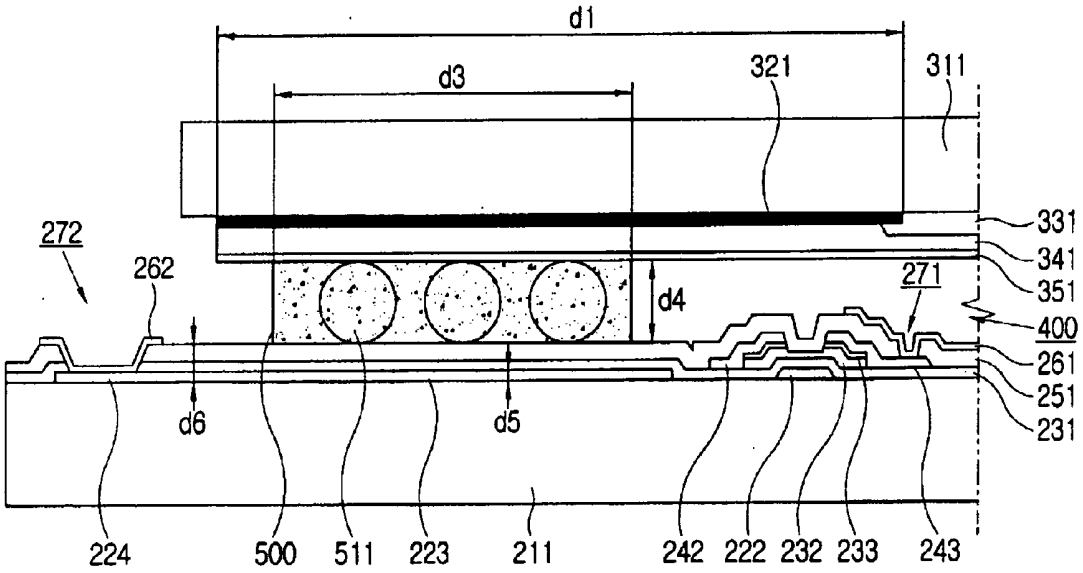

d1
d3
321
311
331
341
351
400
261
251
231
272
262
271
d4
d6
d5
224
500
511
223
211
242
222
232
233
243

FIG. 3

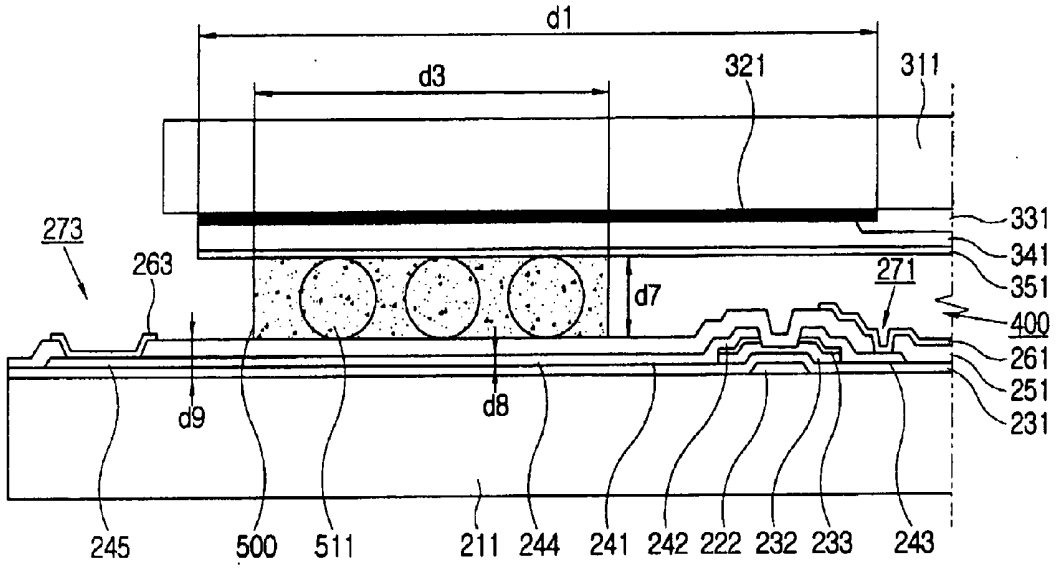

d1
d3
321
311
331
341
351
400
261
251
231
273
263
271
d7
d9
d8
245
500
511
211
244
241
242
222
232
233
243

FIG. 4

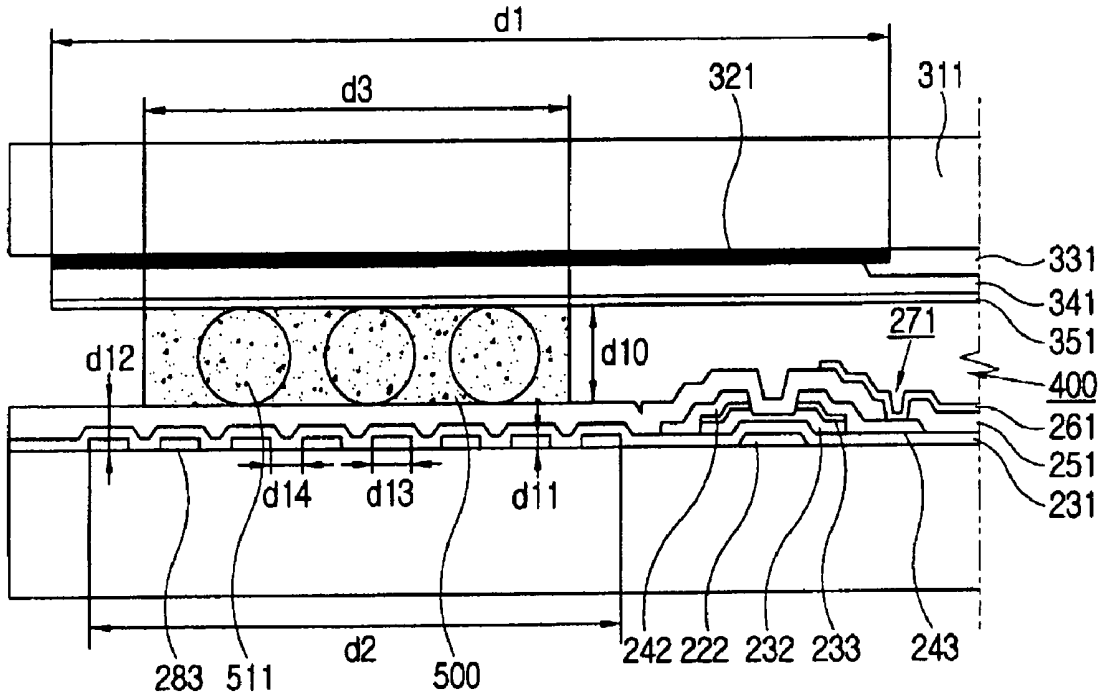

d1
d3
321
311
331
341
351
271
400
261
251
231
d12
d10
d14
d13
d11
d2
283
511
500
242
222
232
233
243

FIG. 5

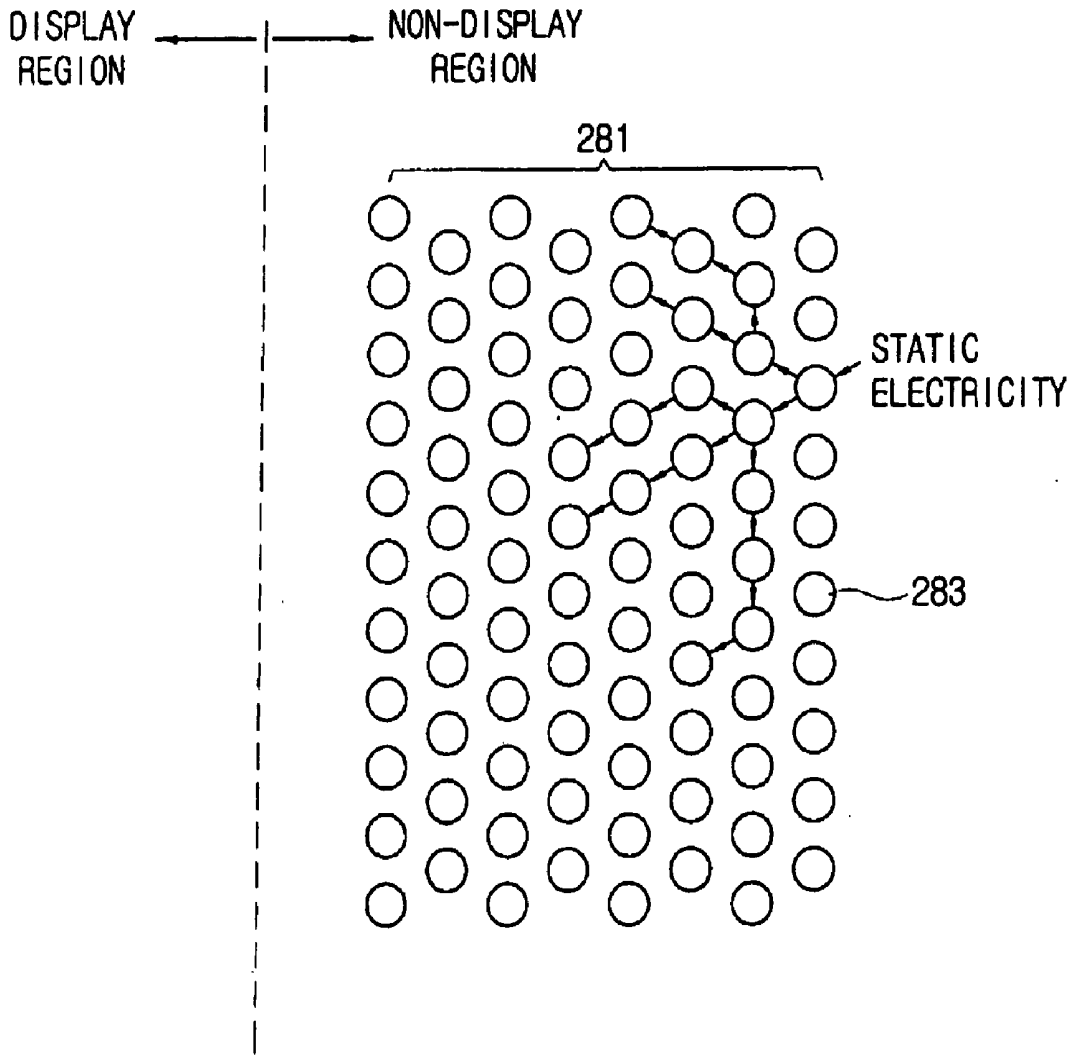

DISPLAY REGION
NON-DISPLAY REGION
281
STATIC ELECTRICITY
283

FIG. 6

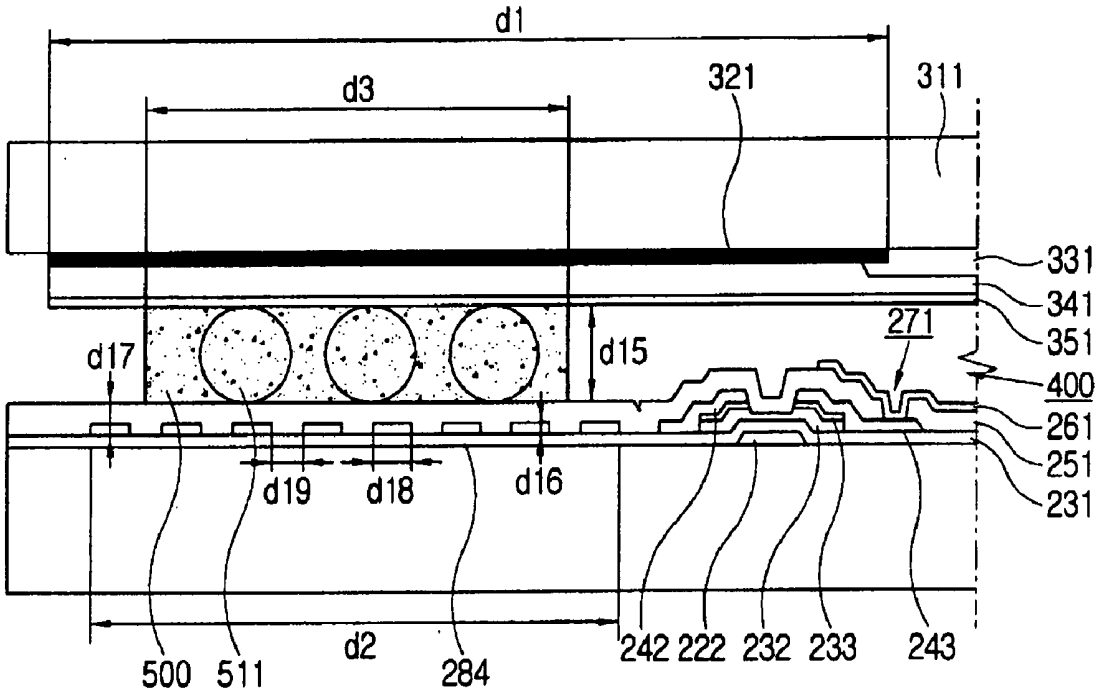

d1
d3
321
311
331
341
351
271
400
261
251
231
d17
d15
d19
d18
d16
d2
500
511
284
242
222
232
233
243

FIG. 7

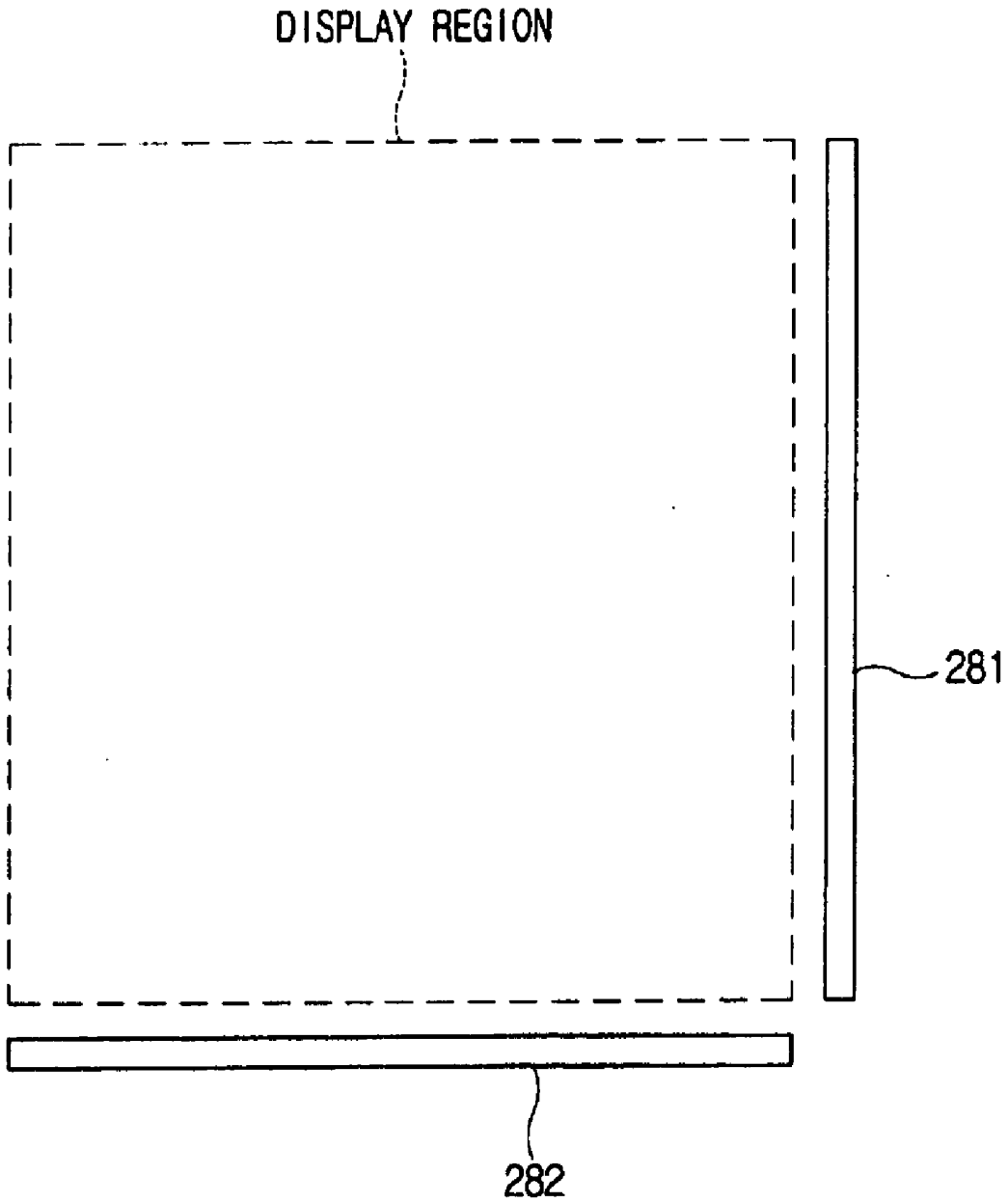


FIG. 8

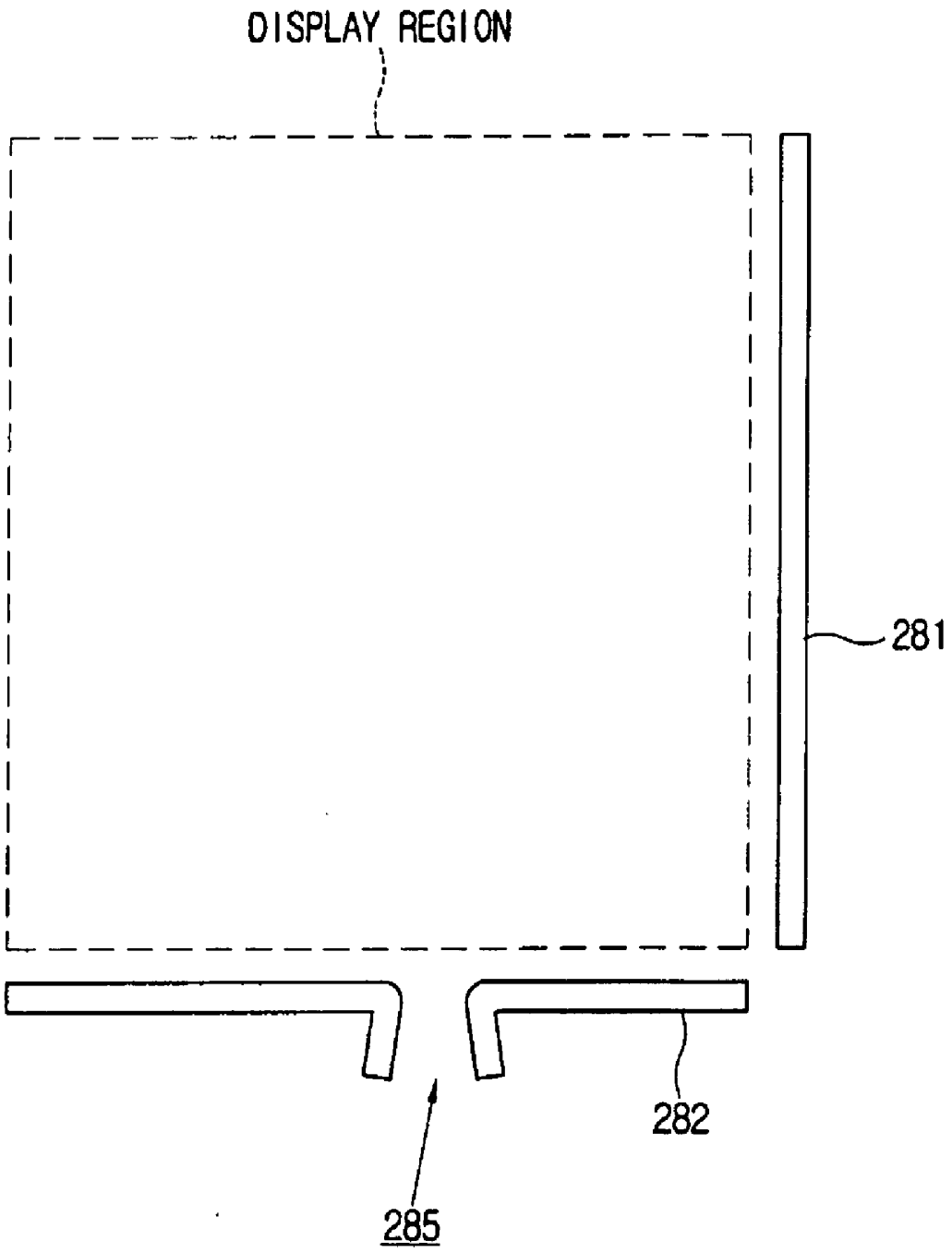


FIG. 9

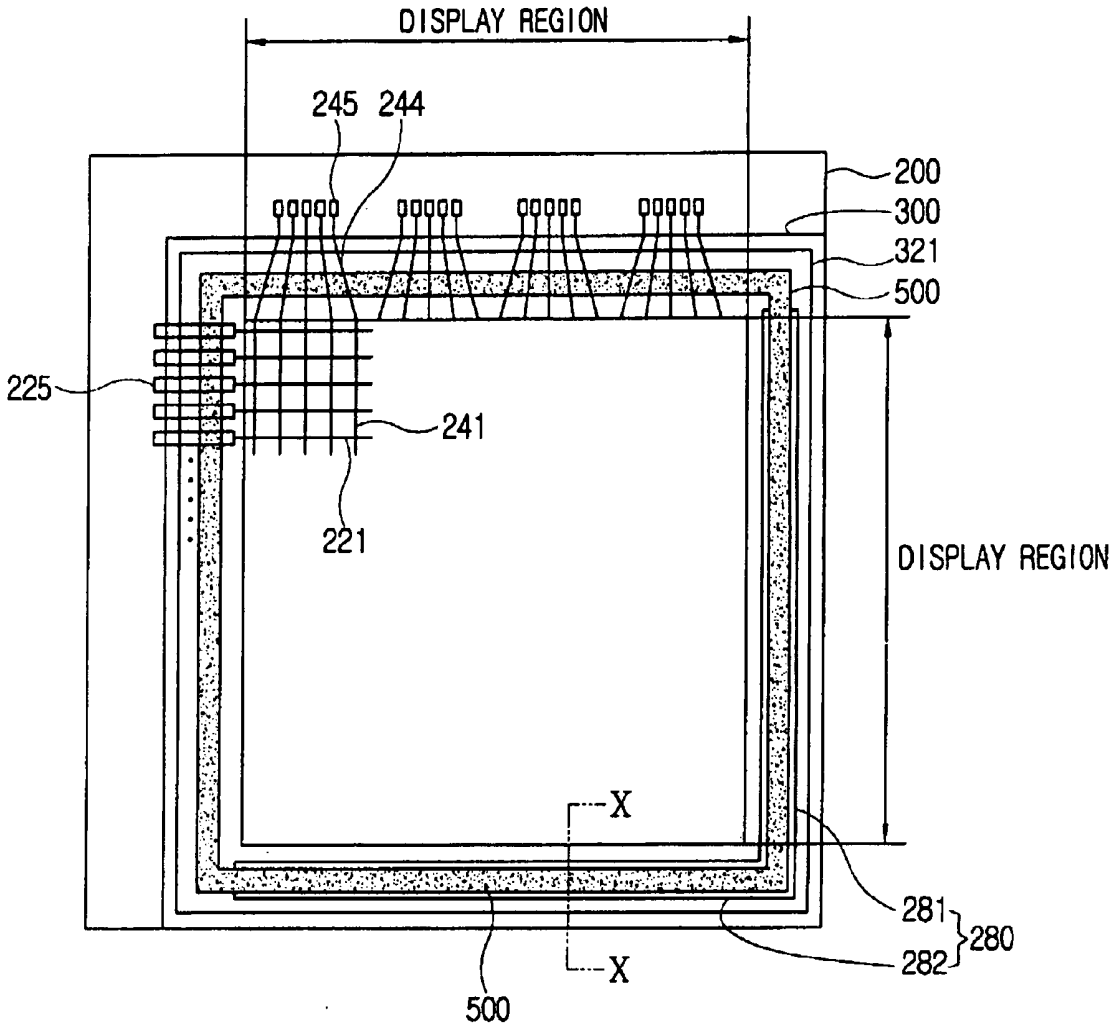

DISPLAY REGION
245
244
200
300
321
500
225
241
221
DISPLAY REGION
X
X
281
280
282
500

FIG. 10

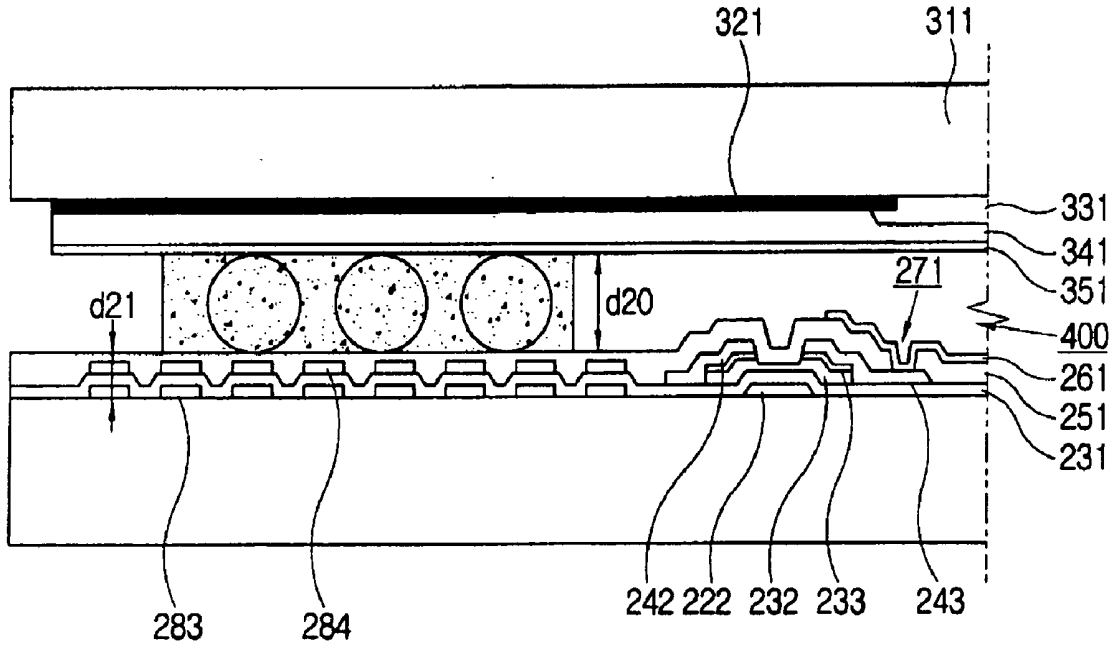

321
311
331
341
351
271
400
261
251
231
d21
d20
283
284
242
222
232
233
243

FIG. 11

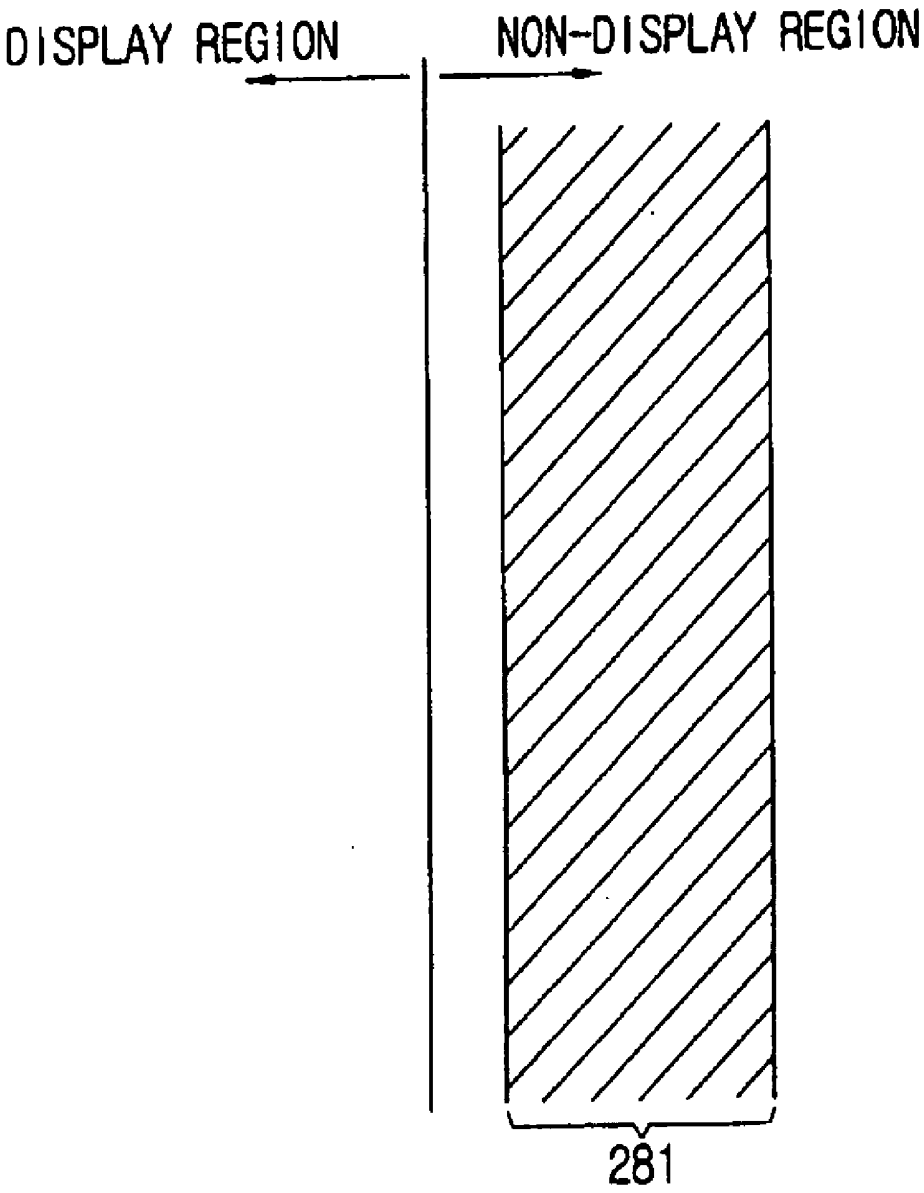


FIG. 12

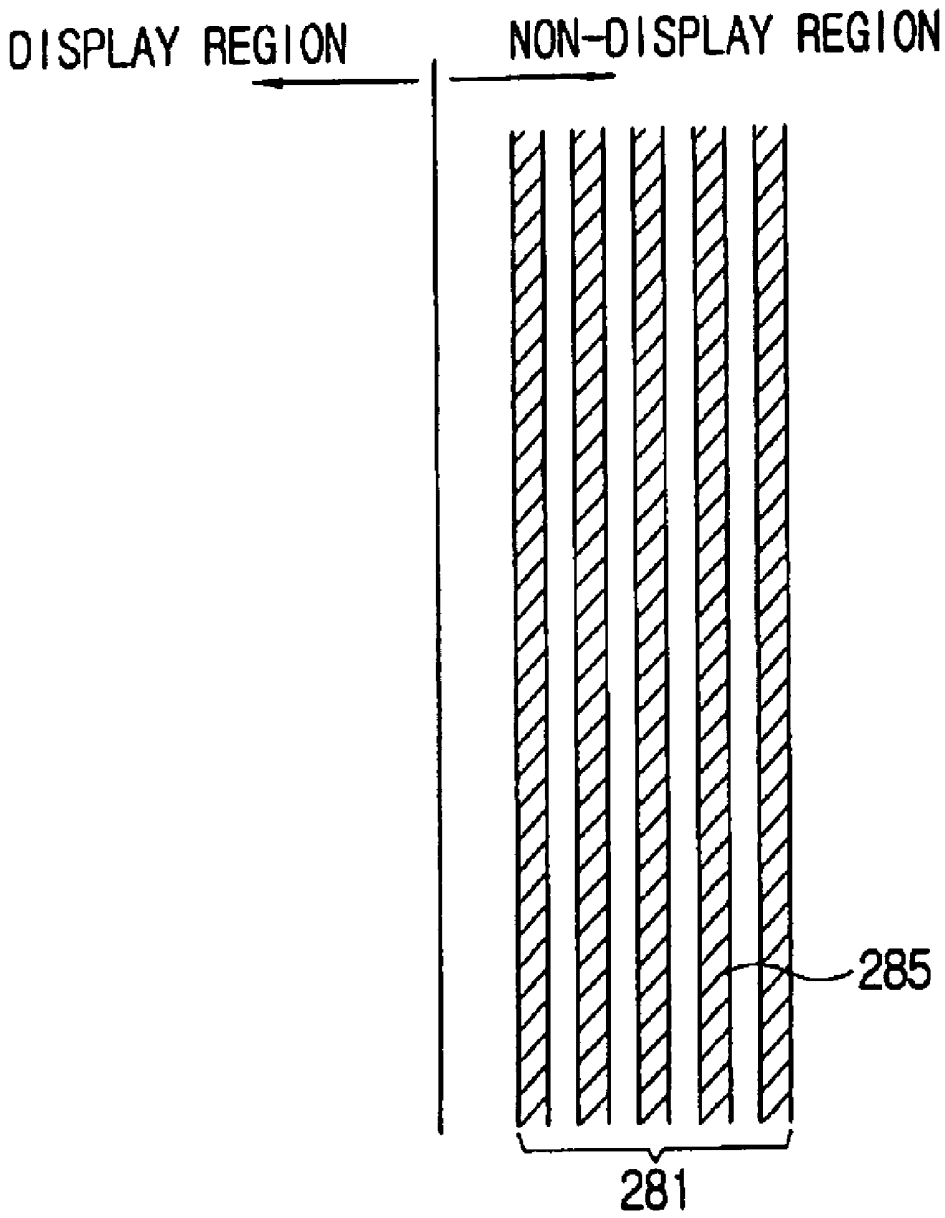


FIG. 13

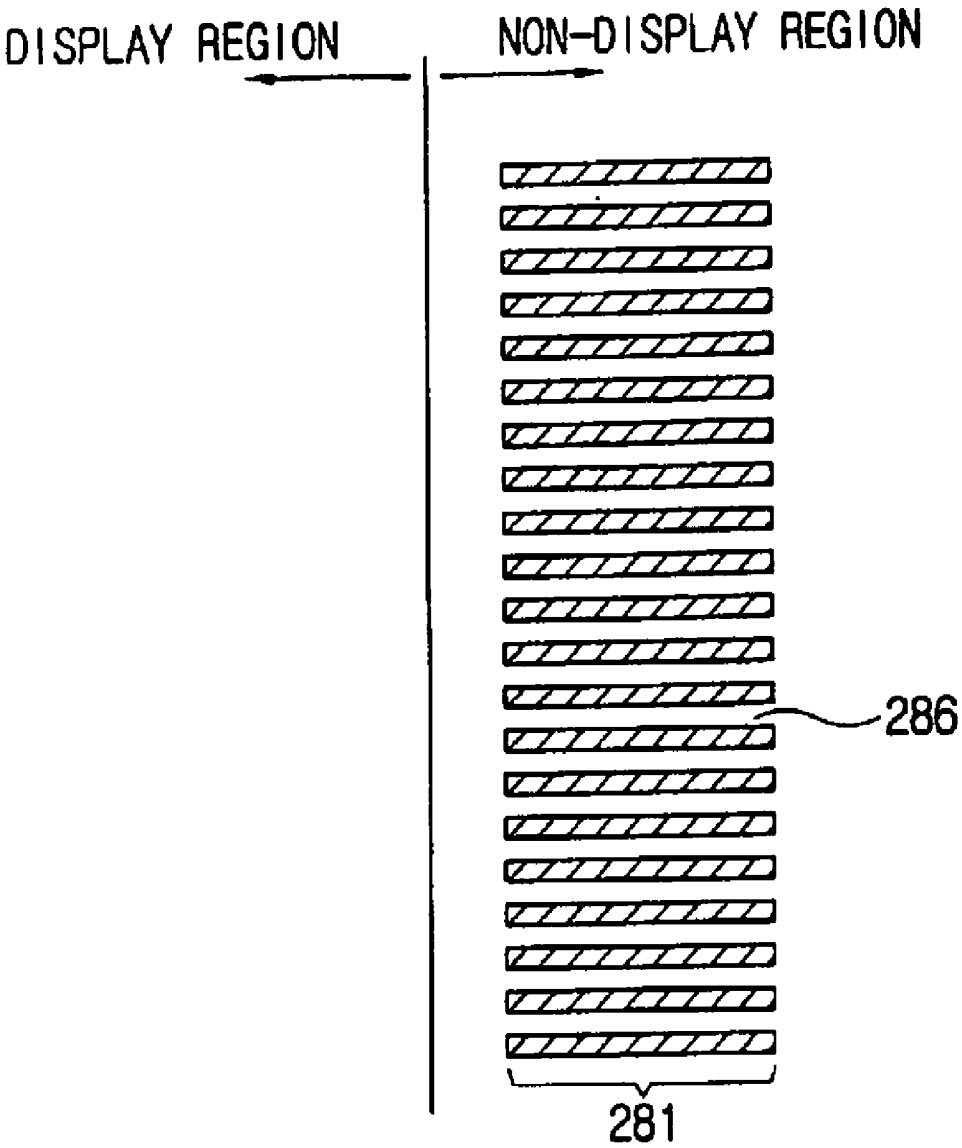


FIG. 14

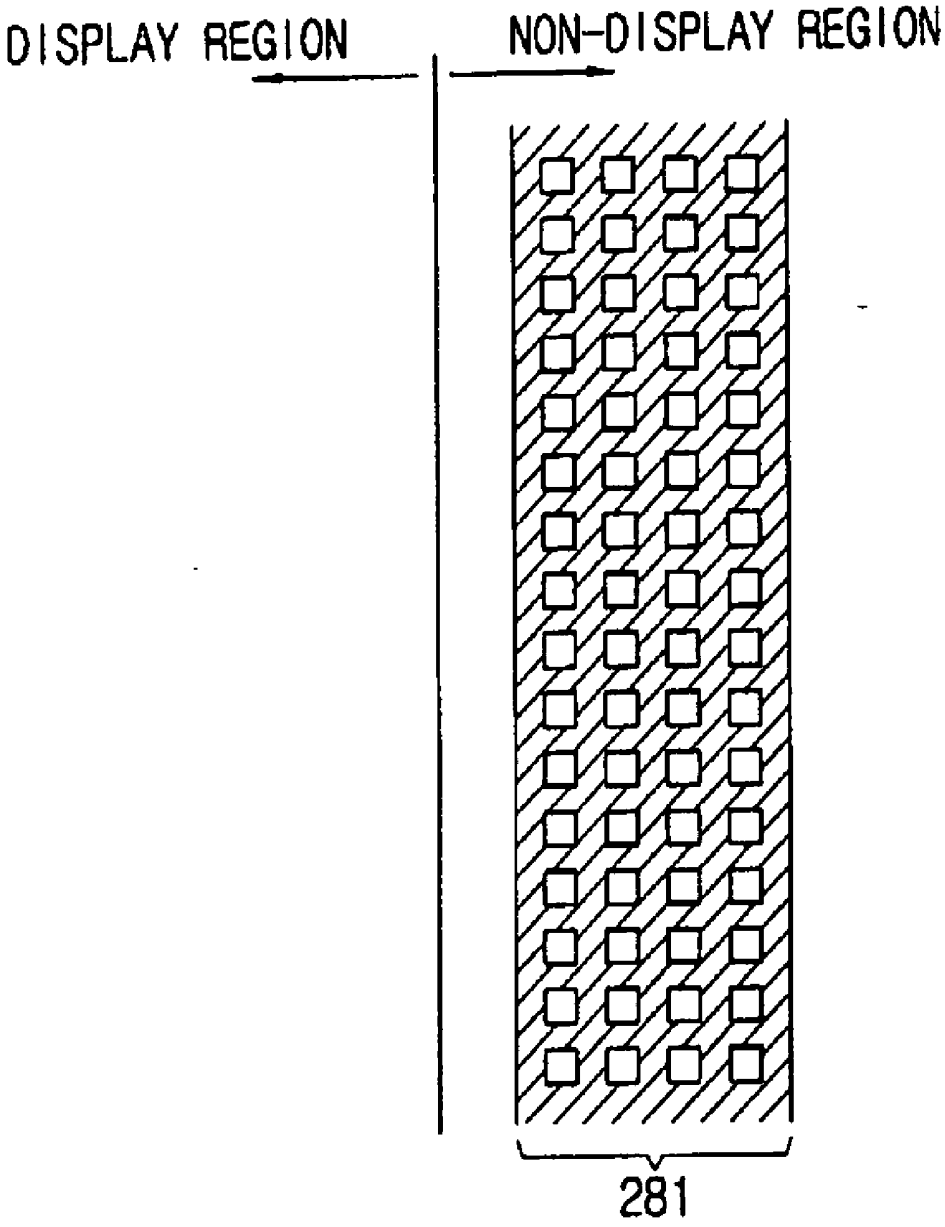


FIG. 15

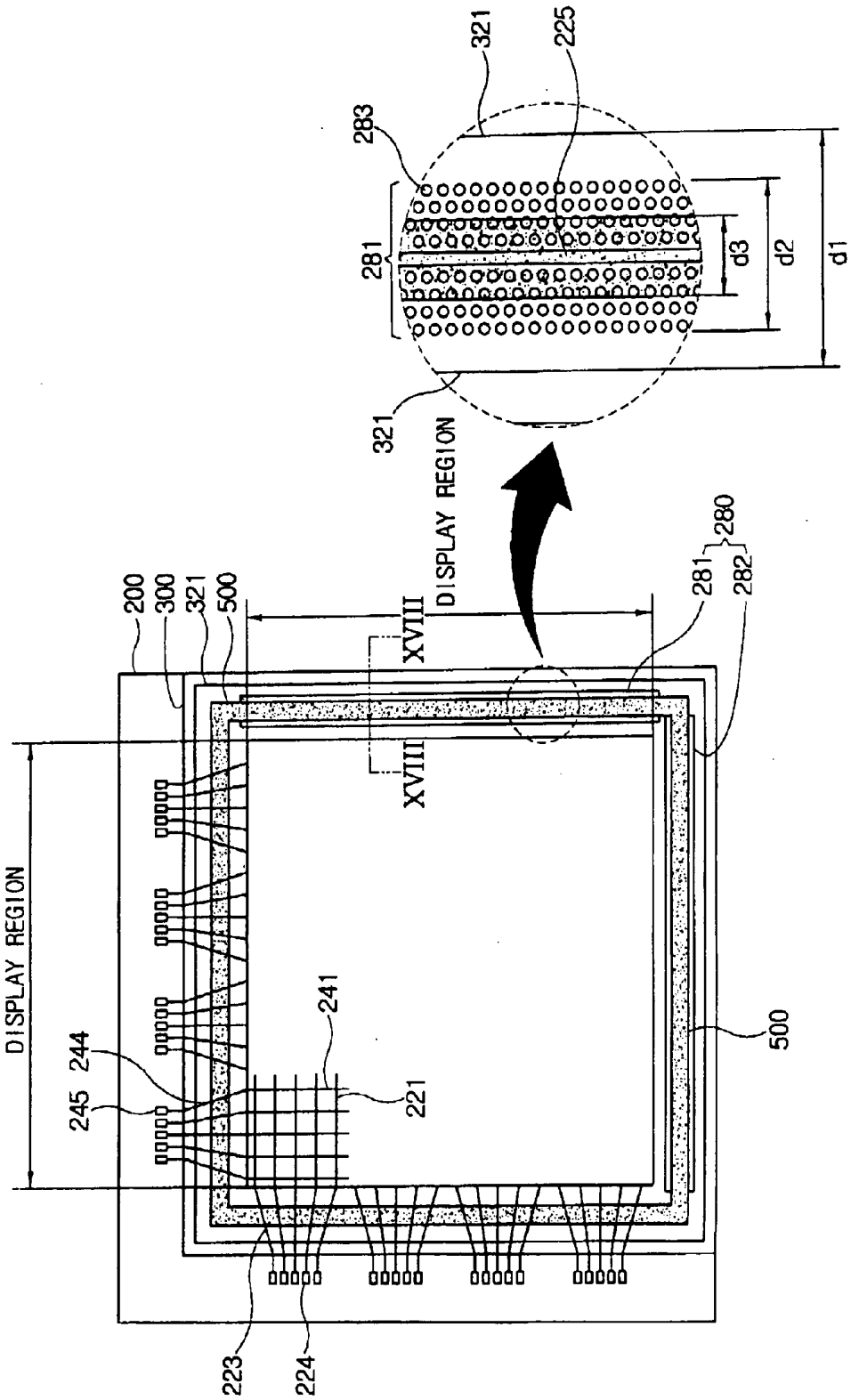

321
225
283
281
d3
d2
d1
321
DISPLAY REGION
280
281
282
200
300
321
500
XVIII
XVIII
DISPLAY REGION
241
244
245
221
500
223
224

FIG. 16

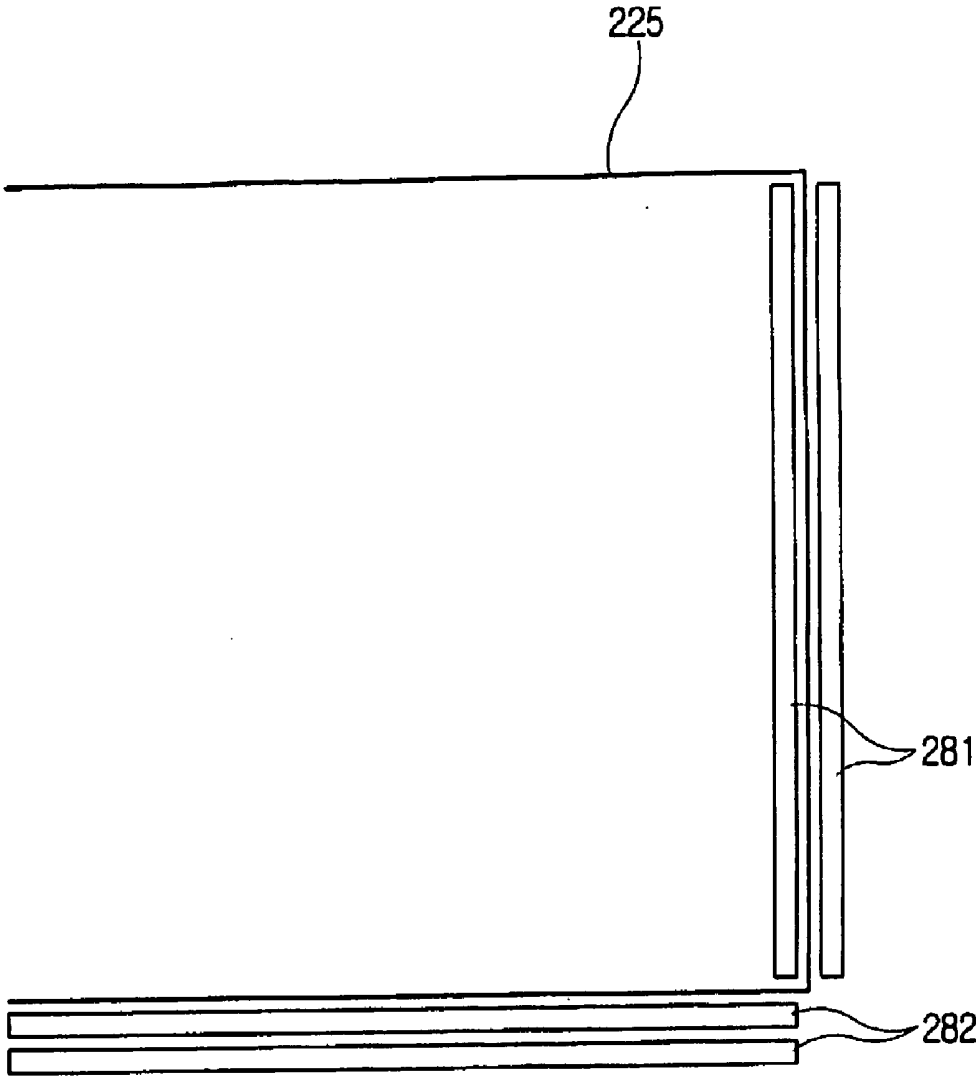


FIG. 17

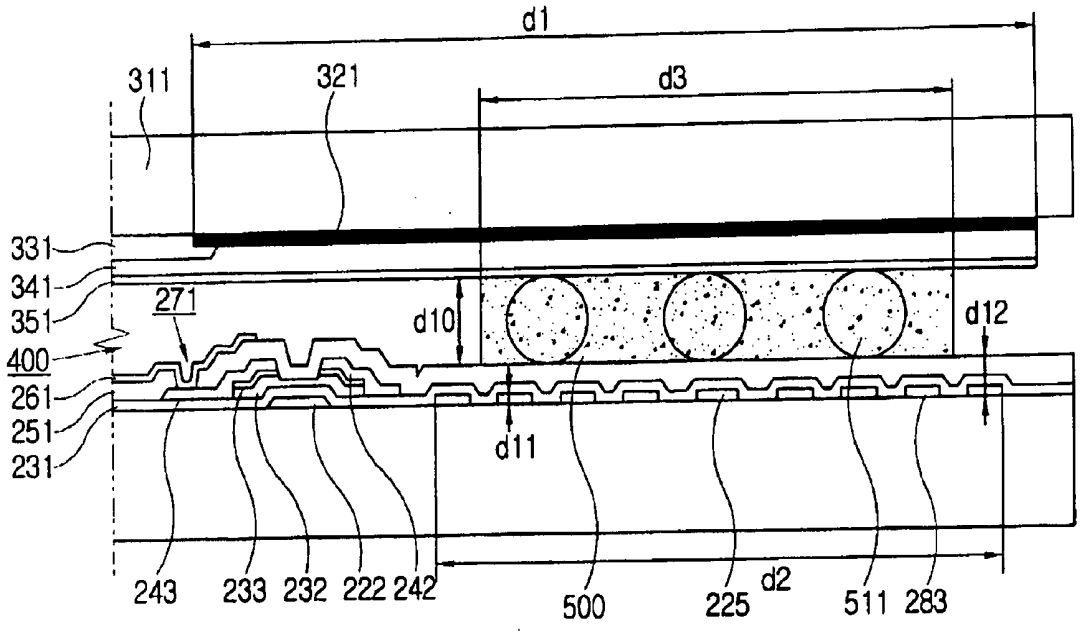
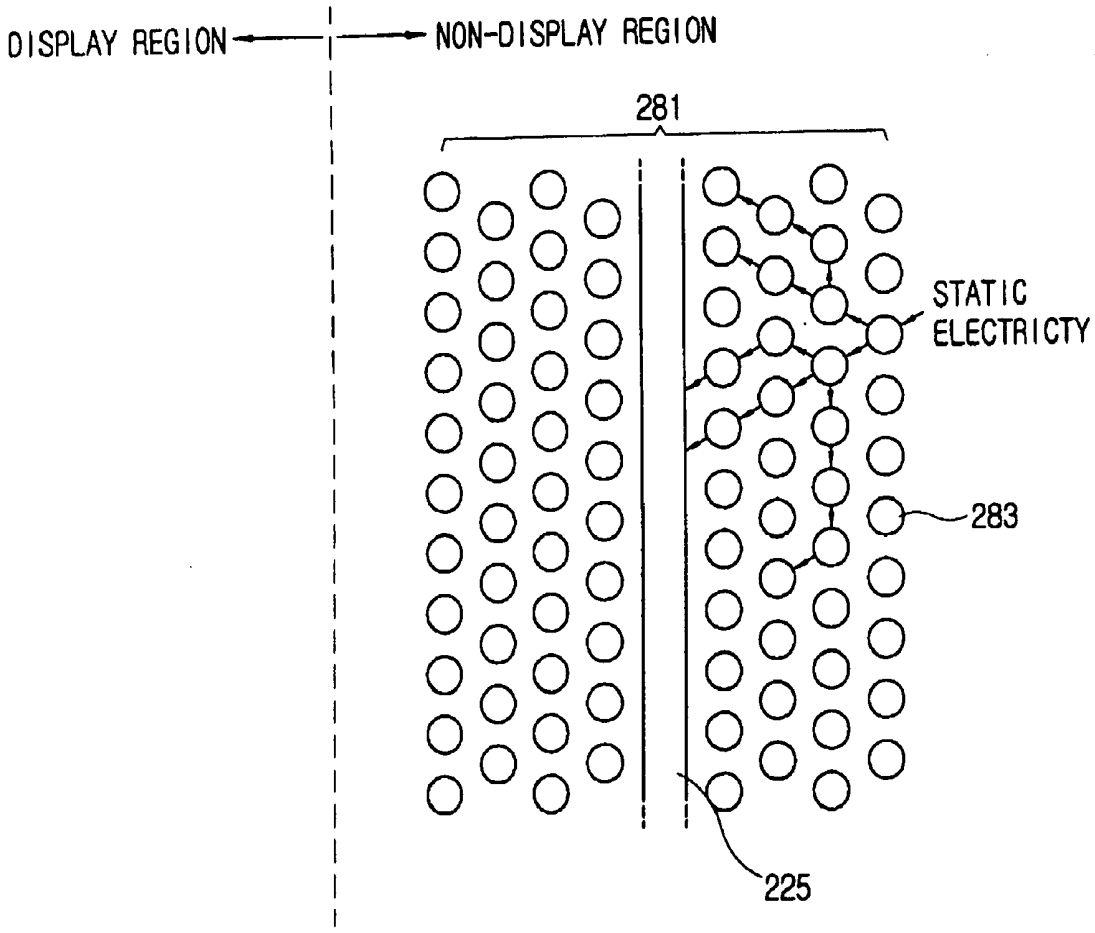

d1
311
321
d3
331
341
351
271
d10
d12
400
261
251
231
d11
243
233
232
222
242
500
225
d2
511
283

FIG. 18


DISPLAY REGION
NON-DISPLAY REGION
281
STATIC ELECTRICTY
283
225

LIQUID CRYSTAL DISPLAY AND METHOD OF FABRICATING THE SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of Korean Patent Application No. 2005-0008994 filed on Feb. 1, 2005 and Korean Patent Application No. 2005-0043492 filed on May 24, 2005 in the Korean Intellectual Property Office, the disclosures of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a liquid crystal display (LCD) and a method of fabricating the same.

[0004] 2. Description of the Related Art

[0005] A liquid crystal display (LCD), which has been widely used as a display, includes an LCD panel. The LCD panel controls the light transmissivity of individual liquid crystal cells based on a video signal. As the liquid crystal cells are arranged in a matrix configuration, the desired image is displayed by controlling the liquid crystal cells' light transmissivities.

[0006] The LCD panel comprises a thin film transistor (TFT) array panel, a color filter array panel coupled to the TFT array panel, and a liquid crystal layer sandwiched between the TFT array panel and the color filter array panel. Further, polarizing plates are attached to the outsides of the TFT array panel and the color filter array panel.

[0007] The TFT array panel and the color filter array panel are usually coupled by a sealant applied along the circumference of a display region. The sealant not only couples the TFT array panel with the color filter array panel but also forms a cell gap for the LCD. However, the circumferential thickness of the display region formed in the TFT array panel, to which the sealant is applied, varies according to the presence or absence of a pad for connecting the TFT array panel to a driving circuit. Thus, the thickness of the sealant is not uniform, and the cell gap of the LCD is irregular.

[0008] The optical properties of the LCD is closely related with the cell gap for the liquid crystal layer sandwiched between the TFT array panel and the color filter array panel. Particularly, the optical properties such as a contrast and a view angle of the LCD are varied depending on the product of the double refraction Δn of the liquid crystal layer and the distance of the cell gap. Therefore, when the cell gap of the LCD is not uniform, the optical properties of the LCD are also not uniform.

SUMMARY OF THE INVENTION

[0009] An aspect of the present invention is an LCD that has a uniform cell gap.

[0010] Another aspect of the present invention is a method of fabricating an LCD that has a uniform cell gap.

[0011] Additional aspects and/or advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

[0012] The foregoing and/or other aspects of the present invention can be achieved by providing an LCD including a first panel and a second panel that are coupled with a sealant and a liquid crystal layer between the two panels. The first panel includes a pad provided in a first part of a non-display region and a dummy metal pattern provided in a second part of the non-display region along a circumference of a display region. The sealant is formed on the pad and the dummy metal pattern.

[0013] The sealant may include a spacer including plastics. For example, the sealant may include a spacer that is deformed by 5% or more in a direction of a force when the force of about 500 kg/mm^2 is applied to the spacer at a room temperature.

[0014] The dummy metal pattern may have a width wider than the width of the sealant.

[0015] The dummy metal pattern may include a plurality of dots, which may be arranged in five or more rows. The distance between the dots may range from about 5 μm to about 15 μm.

[0016] Some of the dots may have either a circular cross-section or a polygonal cross-section.

[0017] Some of the dots may have a diameter ranging from about 15 μm to about 40 μm.

[0018] The dots may be arranged to have a density ranging from 40% to 60%.

[0019] The second panel may include an outer black matrix arranged along the sealant.

[0020] The dummy metal pattern may be a line pattern arranged parallel to the circumference of the display region. Alternatively, the dummy metal pattern may include a line pattern arranged at a predetermined angle to the circumference of the display region.

[0021] The pad may include a gate pad and a data pad, and the dummy metal pattern may be formed of the same layer as either the gate pad or the data pad.

[0022] The LCD panel may also include a signal line that is at least partially placed inside the dummy metal pattern.

[0023] The pad may include a gate pad and a data pad, the dummy metal pattern may include a first dummy metal pattern across the display region from the gate pad, and a second dummy metal pattern across the display region from the data pad, and the signal line may be partially placed inside the first dummy metal pattern.

[0024] The first panel may include a gate line and a data line arranged at an angle relative to each other and insulated from each other, and the signal line is insulated from and positioned at an angle with respect to the data line.

[0025] The signal line may include a repair line.

[0026] In another aspect, the invention includes an LCD panel including a first panel that has a display region defined by a gate line and a data line; a second panel opposite the first panel; a sealant formed along a circumference of the display region and coupling the first panel with the second panel; a liquid crystal layer provided between the first panel

and the second panel; and a dummy metal pattern provided on either the first panel or the second panel and uniformizing the height of the sealant.

[0027] In yet another aspect, the invention is a method of fabricating an LCD panel, comprising providing a first panel comprising a pad provided in a first part of a non-display region and a dummy metal pattern provided in a second part of the non-display region along a circumference of a display region; providing a second panel; forming a sealant on either the first panel or the second panel along the pad and the dummy metal pattern; and filling liquid crystal between the first panel and the second panel and coupling the first panel with the second panel.

[0028] The pad may include a gate pad, and the dummy metal pattern may be formed in the same process step as the gate pad.

[0029] The pad may include a data pad, and the dummy metal pattern is formed at the same time when the data pad is formed.

[0030] The dummy metal pattern may include dots.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] The above and/or other aspects and advantages of the present invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

[0032] **FIG. 1** is a configuration of an LCD according to a first embodiment of the present invention;

[0033] **FIG. 2** is a sectional view of the LCD, taken along the line II-II of **FIG. 1**;

[0034] **FIG. 3** is a sectional view of the LCD, taken along the line III-III of **FIG. 1**;

[0035] **FIG. 4** is a sectional view of the LCD, taken along the line IV-IV of **FIG. 1**;

[0036] **FIG. 5** is a view illustrating an electrostatic phenomenon arising in a dummy metal pattern;

[0037] **FIG. 6** is a sectional view of an LCD according to a second embodiment of the present invention;

[0038] **FIG. 7** is a configuration of an LCD according to a third embodiment of the present invention;

[0039] **FIG. 8** is a configuration of an LCD according to a fourth embodiment of the present invention;

[0040] **FIG. 9** is a configuration of an LCD according to a fifth embodiment of the present invention;

[0041] **FIG. 10** is a sectional view of the LCD, taken along the line X-X of **FIG. 9**;

[0042] **FIG. 11** is a view of a dummy metal pattern according to a sixth embodiment of the present invention;

[0043] **FIG. 12** is a view of a dummy metal pattern according to a seventh embodiment of the present invention;

[0044] **FIG. 13** is a view of a dummy metal pattern according to an eighth embodiment of the present invention;

[0045] **FIG. 14** is a view of a dummy metal pattern according to a ninth embodiment of the present invention;

[0046] **FIG. 15** is a configuration of an LCD according to a tenth embodiment of the present invention;

[0047] **FIG. 16** is a configuration showing the relationship between a dummy metal pattern and a repair line in the LCD according to the tenth embodiment of the present invention;

[0048] **FIG. 17** is a sectional view of the LCD, taken along the line XVII-XVII of **FIG. 15**; and

[0049] **FIG. 18** is a view illustrating an electrostatic phenomenon arising in the dummy metal pattern in the LCD according to the tenth embodiment of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS

[0050] Reference will now be made to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings in which like reference numerals refer to like elements throughout. The embodiments are described below by referring to the figures.

[0051] Hereinbelow, an LCD according to a first embodiment of the present invention will be described with references to **FIGS. 1 through 4**.

[0052] **FIG. 1** is a configuration of an LCD according to the first embodiment of the present invention; **FIG. 2** is a sectional view of the LCD taken along the line II-II of **FIG. 1**; **FIG. 3** is a sectional view of the LCD taken along the line III-III of **FIG. 1**; and **FIG. 4** is a sectional view of the LCD taken along the line IV-IV of **FIG. 1**.

[0053] The LCD includes a first panel **200** formed with a plurality of TFTs, a second panel **300** opposite to the first panel **200**, a sealant **500** coupling the first panel **200** with the second panel **300**, and a liquid crystal layer **400** sandwiched between the first and second panels **200** and **300**.

[0054] The first panel **200** is as follows.

[0055] A first insulating plate **211** is made of an insulating material such as glass, quartz, plastic or the like. On the first insulating plate **211** are formed a gate line **221**, a gate electrode **222**, a gate fan out **223**, and a gate pad **224**, which are herein collectively referred to as "gate wiring lines." A plurality of gate lines **221** are arranged parallel to each other to extend in a first direction; the gate electrode **222** is connected to the gate line **221**; the gate fan out **223** extends from the gate line **221**; and the gate pad **224** is connected to the gate fan out **223** and receives a driving signal from a driving circuit (not shown). In the embodiment shown, the gate fan out **223** and the gate pad **224** are placed in a non-display region outside a display region.

[0056] On the first insulating plate **211** and the gate wiring lines **221**, **222**, **223**, **224** is formed a gate insulating layer **231** made of silicon nitride SiNx or the like. On the gate insulating layer **231** deposited in the region corresponding to the gate electrode **222** are formed a semiconductor layer **232** made of amorphous silicon and a resistive contact layer **233** made of n+ amorphous silicon hydride that is highly doped with n-type impurities. The resistive contact layer **233** is bifurcated with respect to the gate electrode **222**.

[0057] On the resistive contact layer **233** and the gate insulating layer **231** are formed data lines **241**, a source electrode **242**, a drain electrode **243**, a data fan out **244**, and a data pad **245**, which are herein collectively referred to as "data wiring lines." The data lines **241** are arranged in a

second direction that is substantially perpendicular to the first direction and define a pixel by intersecting the gate lines **221**; the source electrode **242** partially branch from the data line **241** and extend to a top portion of the resistive contact layer **233**; the drain electrode **243** is separated from the source electrode **242** and formed opposite to the source electrode **242** with respect to the gate electrode **222**; the data fan out **244** extend from the data line **241**; and a data pad **245** is connected with the data fan out **244**. In the embodiment shown, the data pad part **244**, **245** is placed in the non-display region outside the display region.

[**0058**] Thus, the gate pad part **223**, **244** and the data pad part **244**, **245** are placed in a first part of the non-display region. No gate pad part **223**, **224** or data pad part **244**, **245** is placed in a second part of the non-display region. In the second part of the non-display region, a dummy metal pattern **281**, **282** is formed along the circumference of the display region. The dummy metal pattern **281**, **282** includes a first dummy metal pattern **281** that is across the display region from the gate pad part **223**, **224** and a second dummy metal pattern **282** that is across the display region from the data pad part **224**, **245**. According to the first embodiment of the present invention, the dummy metal pattern **281**, **282** is made of the same material as the gate wiring lines **221**, **222**, **223**, **224**. That is, the dummy metal pattern **281**, **282** and the gate wiring lines **221**, **222**, **223**, **224** are formed in a single step in a fabricating process. Here, the dummy metal pattern **281**, **282** is formed to match the height of the gate pad part **223**, **224** and the data pad part **244**, **245**.

[**0059**] The dummy metal pattern **281**, **282** includes a plurality of dots **283**. The dots **283** are arranged to form a plurality of lines. Preferably, the dots **283** are arranged in five or more rows in order to prevent static electricity from being introduced in the display region, as will be described in more detail. Although the dot **283** is shown to have a circular-shaped cross-section in the embodiment, this is not a limitation of the invention. For example, the dot **283** may have a polygonal-shaped cross-section such as an octagonal shaped section or the like in another embodiment. In one embodiment, the distance d**14** (See **FIG. 4**) between the dots **283** ranges from 5 μm to 15 μm, and the diameter of the dot **283** ranges from 5 μm to 40 μm. Additionally, the dots **283** are arranged such that the dots **283** in the neighboring rows are staggered, thus increasing the overall dot density. Preferably, the density of the dots **283** is similar to those of the gate fan out **223** and the data fan out **244**. The dots **283** may have a density of 40% through 60%.

[**0060**] A passivation layer **251** is formed on the data wiring lines **241**, **242**, **243**, **244**, **245** and the semiconductor layer **232**, which are not covered with the data wiring lines **241**, **242**, **243**, **244**, **245**. The passivation layer **251** may be made of silicon nitride. In the embodiment shown, the passivation layer **251** may be made of silicon nitride or an organic layer. The passivation layer **251** is formed with contact holes **271**, **272**, **273** through which the drain electrode **243**, the gate pad **224** and the drain pad **245**, respectively, are exposed. Further, the gate insulating layer **231** is removed corresponding to the contact hole **271** to expose the gate pad **224** therethrough.

[**0061**] On the passivation layer **251** are formed transparent electrodes **261**, **262**, **263**. The transparent electrodes **261**, **262**, **263** are made of a transparent conductive material such as indium tin oxide, indium zinc oxide or the like. Here, the transparent electrodes **261**, **262**, **263** comprise a pixel electrode **261** electrically contacting the drain electrode **243** through the contact hole **271**, and the contact member **262**, **263** contacting the gate and drain pads **224** and **245** via the contact holes **272**, **273**, respectively. Further, the pixel electrode **261** applies voltage from the drain electrode **243** to the liquid crystal layer, thereby adjusting the arrangement of liquid crystals.

[**0062**] Now, the second panel will be described.

[**0063**] The second panel **300** includes a second insulating plate **311** made of an insulating material such as glass, quartz, ceramic, plastic, etc. like the first insulating plate, an outer black matrix **321** formed along the circumference of the second insulating plate **311**, a trichromatic color filter **331** having a set of red, green and blue or a set of cyan, magenta and yellow, an overcoat layer **341** formed on the color filter **331**, and a common electrode **351** formed on the overcoat layer **341**.

[**0064**] The outer black matrix **321** distinguishes the display region from the non-display region. Here, the outer black matrix **321** can be made of chrome, chrome oxide, chrome nitride or a multi-layered metal including a combination thereof. Further, the outer black matrix **321** can be made of a photosensitive organic material including a black color pigment to intercept light, wherein the black color pigment includes carbon black, titanium oxide or the like.

[**0065**] The color filter **331** is formed by repeating the sets of red, green and blue or the sets of cyan, magenta and yellow. The color filter **331** colors the light that passes through the liquid crystal layer **400**. The color filter **231** can be made of a colored photosensitive organic material by a well-known pigment dispersion method.

[**0066**] The overcoat layer **341**, which is used to protect the color filter **331**, is made of an acrylic epoxy material.

[**0067**] The common electrode **351** is made of a transparent conductive material such as indium tin oxide (ITO), indium zinc oxide (IZO) or the like. Here, the common electrode **351**, together with the pixel electrode **261** of the first panel **200**, directly applies a signal voltage to the liquid crystal layer **400**.

[**0068**] Under the outer black matrix **321** is provided the sealant **500** coupling the first panel **200** with the second panel **300**. The sealant **500** includes an acrylic resin, an epoxy resin or the like, and is hardened by ultraviolet rays and/or heat. Further, the sealant **500** additionally includes an amic hardener, a filler such as alumina powder, etc. Inside the sealant **500** is provided a spacer **511** made of plastic such as the acrylic resin. The spacer **511** may be made of a plastic coated with silica. When a force of about 500 kg/mm^2 is applied to the spacer **511** at a room temperature, the "soft" characteristic of the plastic allows the length of the spacer **511** to be preferably deformed by 5% or more in a direction of the force. The spacer **511** is employed for maintaining the cell gap between the first and second panels **200** and **300**. Further, when the sealant **500** is formed on a circuit fabricated on the first panel **200**, the spacer **511** prevents the circuit from being damaged. In some embodiments, the sealant **500** may be provided with a "hard" spacer made of glass fiber or silica to maintain the cell gap between the first

and second panels **200** and **300**. A "hard" spacer does not deform under pressure like the "soft" spacer made of plastic.

[**0069**] The sealant **500** is placed within a region corresponding to the outer black matrix **321**. In general, the outer black matrix **321** has a width d**1** ranging from about 3 mm to 5 mm, and the sealant **500** has a width d**3** that is about 0.7 mm to 2 mm narrower than the width d**1** of the outer black matrix **321**. Referring to **FIG. 1**, the sealant **500** placed to the left side of the display region is formed on the gate fan out **223**, and the sealant **500** placed at the top side of the display region is formed on the data fan out **244**. Further, the sealant **500** placed to the right and bottom sides of the display region are formed on the dummy metal patterns **281** and **282**, respectively.

[**0070**] The sealant **500** formed on the gate fan out **223** will be described with reference to **FIG. 2**. In a region corresponding to the sealant **500**, the gate fan out **223**, the gate insulating layer **231** and the passivation layer **251** are layered on the first panel **200** in sequence to a predetermined thickness d**6**. Further, in the region corresponding to the sealant **500**, the outer black matrix **321**, the overcoat layer **341** and the common electrode **351** are layered on the second panel **300** in sequence. Thus, the sealant **500** is placed between the passivation layer **251** and the common electrode **351**. Alternatively, the common electrode **351** may be not be placed in the region corresponding to the sealant **500**.

[**0071**] The sealant **500** formed on the data fan out **244** will be described with reference to **FIG. 3**. In a region corresponding to the sealant **500**, the gate insulating layer **231**, the data fan out **244** and the passivation layer **251** are layered on the first panel **200** in sequence to a predetermined thickness d**9**. Further, in the region corresponding to the sealant **500**, the outer black matrix **321**, the overcoat layer **341** and the common electrode **351** are layered on the second panel **300** in sequence. Thus, the sealant **500** is placed between the passivation layer **251** and the common electrode **351**. In some alternate embodiments, the common electrode **351** may be placed outside the region corresponding to the sealant **500**.

[**0072**] The sealant **500** formed on the second dummy metal pattern **282** will be described with reference to **FIG. 4**. Likewise, the sealant **500** formed on the first dummy metal pattern **282** has the same structure as that of **FIG. 4**, and therefore repetitive descriptions will be avoided. In a region corresponding to the sealant **500**, the dots **283** of the second dummy metal pattern **282**, the gate insulating layer **231** and the passivation layer **251** are layered on the first panel **200** in sequence to a predetermined thickness d**12**. Further, in the region corresponding to the sealant **500**, the outer black matrix **321**, the overcoat layer **341** and the common electrode **351** are layered on the second panel **300** in sequence. Thus, the sealant **500** is placed between the passivation layer **251** and the common electrode **351**. Alternatively, the common electrode **351** may be placed in a region other than the region corresponding to the sealant **500**. Here, each width d**2** of the dummy metal patterns **281** and **282** is narrower than the width d**1** of the outer black matrix **321** and wider than the width d**3** of the sealant **400**. Thus, the sealant **400** is formed within the region corresponding to the dummy metal pattern **281**, **282**.

[**0073**] Thus, the cell gaps d**4**, d**7** and d**10** are substantially equal to each other according to the arrangement of the sealant **500**. For example, the cell gaps d**4**, d**7** and d**10** range between 4.5 μm and 5 μm. Therefore, the distances d**6**, d**9** and d**12** between the sealant **500** and the first insulating plate **211** should be substantially equal to each other. Referring to **FIGS. 2 through 4**, the distances between the sealant **500** and the second insulating plate **311** are also substantially equal to each other. Further, the gate insulating layer **231** and the passivation layer **251** are commonly provided between the sealant **500** and the first insulating plate **211**. Therefore, the gate fan out **223**, the data fan out **244** and the dots **283** should be equal to each other in the thickness d**5**, d**8**, d**11**. Here, the gate fan out **223** and the dots **283** are made as the same layer, so that they are equal to each other in the thickness d**5**, d**11**. Further, the thickness d**5** of the gate fan out **223** is similar to the thickness d**8** of the data fan out **244**. For example, the thickness d**5**, d**8** ranges from 2,000 Å to 2,500 Å. The cell gaps d**4**, d**7** and d**10** are substantially equal to each other regardless of their positions.

[**0074**] **FIG. 5** is a view illustrating an electrostatic phenomenon arising in a dummy metal pattern. External static electricity may be applied to the dots **283** of the dummy metal pattern **281**, **282**. The static electricity is transferred to the neighboring dots **283**. Thus, the static electricity is dispersed through many dots **283** and dissipates, so that it is not transferred to the display region. Typically, it takes about five rows of the dots **283** for the static electricity to dissipate. Thus, it is preferable to arrange the dots **283** in five or more lines. Further, the distance d**14** between the dots **283** is set to allow the the electrons to hop therebetween. Thus, the dummy metal pattern **281**, **282** is formed in a dot shape, thereby preventing the external static electricity from intruding into the display region.

[**0075**] Hereinbelow, a method of fabricating the LCD according to the first embodiment of the present invention will be described.

[**0076**] In the first panel **200**, a gate wiring material is deposited and patterned on the first insulating plate **211**, thereby forming the gate wiring lines **221**, **222**, **223**, **224** and the dummy metal pattern **281**, **282**. The following process is the same as a process of fabricating a well-known TFT array panel. Further, the second panel **200** can be fabricated by a well-known method.

[**0077**] Thereafter, the sealant **500** including the spacer **511** is applied to the second panel **300**. The sealant **500** can be applied with a dispenser method or a printer (screen printing) method. The sealants **500** are formed to locate on the gate fan out **223**, the data fan out **244**, the first dummy metal pattern **281**, and the second dummy metal pattern **282**, respectively, when they adhere to the first panel **200**. Then, liquid crystal is filled between the second panel **300** and the sealant **500** by a dropping method. Thereafter, the first panel **200** and the second panel **300** are coupled, and the sealant **500** is hardened by heat and/or ultraviolet rays.

[**0078**] **FIG. 6** is a sectional view of an LCD according to a second embodiment of the present invention.

[**0079**] In a region corresponding to a sealant **500**, a gate insulating layer **231**, a dot **284** of a second dummy metal pattern **282** and a passivation layer **251** are layered on a first panel **200** in sequence to a predetermined thickness d**17**. Further, in a region corresponding to the sealant **500**, an outer black matrix **321**, an overcoat layer **341** and a common

electrode **351** are layered on a second panel **300** in sequence. Thus, the sealant **500** is placed between the passivation layer **251** and the common electrode **351**. In some alternative embodiments, the common electrode **351** may be placed in an area other than the region corresponding to the sealant **500**. Here, the dot **284** is made of the same material as the data fan out **244**, wherein the thickness d**16** of the dot **284** is equal to the thickness of the data fan out **244**. Therefore, the cell gap d**15** corresponding to the second dummy metal pattern **282** is substantially equal to the other cell gaps d**4**, d**7**. Further, the diameter d**18** of the dot **284** and the distance d**19** between the dots **284** are the same as those of the dot **283** according to the first embodiment.

[**0080**] **FIG. 7** is a configuration of an LCD according to a third embodiment of the present invention. According to the third embodiment of the present invention, a first dummy metal pattern **281** and a second dummy metal pattern **282** are separated from each other.

[**0081**] **FIG. 8** is a configuration of an LCD according to a fourth embodiment of the present invention. According to the fourth embodiment of the present invention, a second dummy metal pattern **282** is formed with an inlet **285**. Similar to the first embodiment, a sealant **500** is formed on a second panel **300**. The sealants **500** are formed to locate on a gate fan out **223**, a data fan out **244**, a first dummy metal pattern **281**, and a second dummy metal pattern **282**, respectively, when they adhere to the first panel **200**. Therefore, the sealant **500** is shaped corresponding to the second dummy metal pattern **282** formed with the inlet **285**. Thereafter, the first panel **200** and the second panel **300** are aligned and adhered to each other, and the sealant **500** is hardened by heat and/or ultraviolet rays. In this state, liquid crystal is filled between the first and second panels **200** and **300** through the inlet **285** by a vacuum filling method. After the liquid crystal is completely filled between the panels **200** and **300**, the inlet **285** is sealed by a sealant to be hardened by violet rays.

[**0082**] **FIG. 9** is a configuration of an LCD according to a fifth embodiment of the present invention, and **FIG. 10** is a sectional view of the LCD, taken along line X-X of **FIG. 9**.

[**0083**] According to the fifth embodiment contrary to the first embodiment, there is no gate pad part, and a gate line **221** is connected to a shift register **225** provided in the outside of the display region. That is, a driving circuit for driving the gate line **22** is directly provided in a first panel **200**. The sealant **500** placed in the left side of the display region is formed on the shift register **225**, wherein the shift register **225** includes a plurality of thin film transistors, so that the shift register **225** is thicker than the gate fan out **223** of the first embodiment.

[**0084**] Referring to **FIG. 10**, a dot **283**, a gate insulating layer **231**, a dot **284** and a passivation layer **251** are sequentially layered between the sealant **500** and a first insulating plate **211**, thereby forming a predetermined thickness d**21**. Here, the lower dot **283** is made of the same material as a gate wiring material, and the upper dot **284** is made of the same material as a data wiring material. Because of the lower and upper dots **283** and **284**, the distance between the sealant **500** and the first insulating plate **211** is larger than the distances d**6**, d**9** and d**12** of the first embodiment to account for the thickness difference between the shift register **225** and the gate fan out **223**. Thus, the cell gap d**20** in this position is smaller than the cell gaps d**4**, d**7** and d**10** according to the first embodiment.

[**0085**] According to an embodiment of the present invention, the dummy metal patterns **281** and **282** are not limited to the dot shape and may have various shapes, which will be described later with reference to the first dummy metal pattern by way of example.

[**0086**] **FIGS. 11 through 14** are views of the dummy metal patterns according to sixth through ninth embodiment of the present invention. Referring to **FIG. 11**, the first dummy metal pattern **281** according to the sixth embodiment has a single solid shape. Referring to **FIG. 12**, the first dummy metal pattern **281** according to the seventh embodiment is shaped into a plurality of lines **285** arranged parallel to the circumference of a display region. Referring to **FIG. 13**, a first dummy metal pattern **281** according to the eighth embodiment has a plurality of lines **286** arranged perpendicularly to the circumference of the display region. Referring to **FIG. 14**, a first dummy metal pattern **281** according to the ninth embodiment has a lattice shape as a combination of the parallel lines **285** and the perpendicular lines **286**.

[**0087**] Alternatively, the line patterns **285** and **286** may be arranged at various angles to the circumference of the display region.

[**0088**] Below, an LCD according to a tenth embodiment of the present invention will be described with reference to **FIGS. 15 through 18**.

[**0089**] Sometimes, a signal line such as a repair line can be formed along the circumference of the display region if desired. As the density of panel configuration has recently become high, the signal line approaches a corner of a substrate. Therefore, a problem arises in that the signal line is opened by static electricity. In the LCD according to the tenth embodiment of the present invention, the foregoing problem of the signal line being opened is diminished. Below, the repair line will be described as an example of the signal line according to the tenth embodiment of the present invention. However, it should be understood that the embodiment is not limited to being used for a repair line.

[**0090**] Along the circumference of the display region, the repair line **225** is formed on the same layer as the gate wiring lines **221**, **222**, **223**, **224**. The repair line **225** is provided between the display region and the data pad **245**, a side opposite to the gate pad **224**, and a side opposite to the data pad **225**. Here, the repair line **225** is insulated from and intersects the data line **241** connected to the data pad **245**, leaving the gate insulating layer **231** therebetween.

[**0091**] The repair line **225** passes through the inside of the first dummy metal patterns **281**. For this, the first dummy metal pattern **281** is divided into two sections by the repair line **225**. Likewise, the second dummy metal pattern **282** is also divided into two sections but the repair line **225** passes between the second dummy metal pattern **282** and the display region. In some alternative embodiments, the second dummy metal pattern **282** may not be divided into two sections.

[**0092**] The sealant **500** instead of the liquid crystal layer **400** is provided between the repair line **225** placed inside the first dummy metal pattern **281** and the common electrode

351. If the liquid crystal layer **400** is placed between the repair line **225** and the common electrode **351**, there is a resistance and capacitance (RC) delay due to a high dielectric constant, thereby causing a defect in driving the LCD.

[**0093**] **FIG. 18** is a view illustrating an electrostatic phenomenon arising in the dummy metal pattern **281** in the LCD in the case where the repair line **225** according to the tenth embodiment of the present invention is provided. External static electricity may be applied to the dots **283** of the dummy metal pattern **281**. In this case, the static electricity is transferred to the neighboring dots **283**. Thus, the static electricity is dispersed through many dots **283** and prevented from reaching the display region. Even in cases where some electricity reaches the display region, the amount that reaches the display region is very weak. Therefore, the repair line **225** is protected from the external static electricity. Also, the dots **283** are provided between the repair line **225** and the display region, thereby preventing the static electricity from being applied to the display region.

[**0094**] The foregoing embodiments may vary. For example, the first dummy metal pattern **281** may be asymmetrically divided into two sections. Further, the first dummy metal pattern **281** may be provided as a data metal layer, or may be provided as a double layer of a gate metal layer and the data metal layer.

[**0095**] Further, the foregoing embodiments can be used in various combinations. For example, the first dummy metal pattern **281** may have the dot shape **283**, **284** in one region (e.g., a region near the display region) and have the line shape **285**, **286** in another region (e.g., a region distant from the display region). Further, the first dummy metal pattern **281** and the second dummy metal pattern **282** can be shaped differently from each other. Also, in some embodiments, only one of the first dummy metal pattern **281** and the second dummy metal pattern **282** may be provided.

[**0096**] As described above, the present invention provides an LCD comprising a uniform cell gap and a method of fabricating the same.

[**0097**] Although a few embodiments of the present invention have been shown and described, it will be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the appended claims and their equivalents.

What is claimed is:

1. An LCD comprising:

a first panel comprising a pad provided in a first part of a non-display region and a dummy metal pattern provided in a second part of the non-display region, wherein the first part and the second part lie along a circumference of a display region;

a second panel;

a sealant formed on the pad and the dummy metal pattern and coupling the first panel with the second panel; and

a liquid crystal layer provided between the first panel and the second panel.

2. The LCD according to claim 1, wherein the sealant comprises a spacer including plastics.

3. The LCD according to claim 1, wherein the sealant comprises a spacer that is deformed by 5% or more in a direction of a force when the force of about 500 kg/mm^2 is applied to the spacer at a room temperature.

4. The LCD according to claim 1, wherein the dummy metal pattern has a width wider than a width of the sealant.

5. The LCD according to claim 1, wherein the dummy metal pattern includes a plurality of dots.

6. The LCD according to claim 5, wherein the dots are arranged in five or more rows.

7. The LCD according to claim 5, wherein a distance between the dots ranges from about 5 μm to about 15 μm.

8. The LCD according to claim 5, wherein at least some of the dots have either a circular cross-section or a polygonal cross-section.

9. The LCD according to claim 5, wherein at least some of the dots have a diameter ranging from about 15 μm to about 40 μm.

10. The LCD according to claim 5, wherein the dots are arranged to have a density ranging from 40% to 60%.

11. The LCD according to claim 1, wherein the second panel comprises an outer black matrix arranged along the sealant.

12. The LCD according to claim 1, wherein the dummy metal pattern comprises a line pattern arranged parallel to the circumference of the display region.

13. The LCD according to claim 1, wherein the dummy metal pattern comprises a line pattern arranged at a predetermined angle to the circumference of the display region.

14. The LCD according to claim 1, wherein the pad comprises a gate pad and a data pad, and

the dummy metal pattern is formed of the same layer as either the gate pad or the data pad.

15. The LCD according to claim 1, further comprising a signal line at least partially placed inside the dummy metal pattern.

16. The LCD according to claim 15, wherein the pad comprises a gate pad and a data pad,

the dummy metal pattern comprises a first dummy metal pattern across the display region from the gate pad, and a second dummy metal pattern across the display region from the data pad, and

the signal line is partially placed inside the first dummy metal pattern.

17. The LCD according to claim 15, wherein the first panel comprises a gate line and a data line arranged at an angle relative to each other and insulated from each other, and

the signal line is insulated from and positioned at an angle with respect to the data line.

18. The LCD according to claim 15, wherein the signal line comprises a repair line.

19. An LCD comprising:

a first panel comprising a display region defined by a gate line and a data line;

a second panel opposite the first panel;

a sealant formed along a circumference of the display region and coupling the first panel with the second panel;

a liquid crystal layer provided between the first panel and the second panel; and

a dummy metal pattern provided on either the first panel or the second panel and uniformizing the height of the sealant.

20. A method of fabricating an LCD, comprising:

providing a first panel comprising a pad provided in a first part of a non-display region and a dummy metal pattern provided in a second part of the non-display region along a circumference of a display region;

providing a second panel;

forming a sealant on either the first panel or the second panel along the pad and the dummy metal pattern; and

filling liquid crystal between the first panel and the second panel and coupling the first panel with the second panel.

21. The method according to claim 20, wherein the pad comprises a gate pad, and the dummy metal pattern is formed in the same process step as the gate pad.

22. The method according to claim 20, wherein the pad comprises a data pad, and the dummy metal pattern is formed in the same process step as the data pad.

23. The method according to claim 20, wherein the dummy metal pattern includes dots.

* * * * *

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摘要(译)

LCD技术领域本发明涉及一种LCD，其具有第一面板，第二面板，密封剂和位于两个面板之间的液晶层。第一面板包括设置在非显示区域的第一部分中的焊盘和设置在非显示区域的第二部分中的沿显示区域的圆周的虚设金属图案。第二面板与第一面板相对设置，使得两个面板将液晶层夹在中间。在垫和虚设金属图案上形成密封剂，并将第一面板与第二面板连接。因此，这里描述的LCD具有均匀的单元间隙。还公开了一种制造具有均匀单元间隙的LCD的方法。