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(54) **DISPLAY DEVICE**

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(57) **ABSTRACT**

A display device has a first electrode provided corresponding to each of a plurality of pixels in a region in which the plurality of pixels is provided, a second electrode provided over the plurality of pixels and extending to a contact region provided outside the pixel region, a light emitting layer provided between the first electrode and the second electrode, a third electrode provided in the contact region, an organic insulating layer covering the third electrode and provided with a contact hole exposing the third electrode, and a connection portion between the second electrode and the third electrode in the contact hole, wherein the maximum distance between any two points on the outer periphery of the connection portion is 1 μm or more and 100 μm or less.

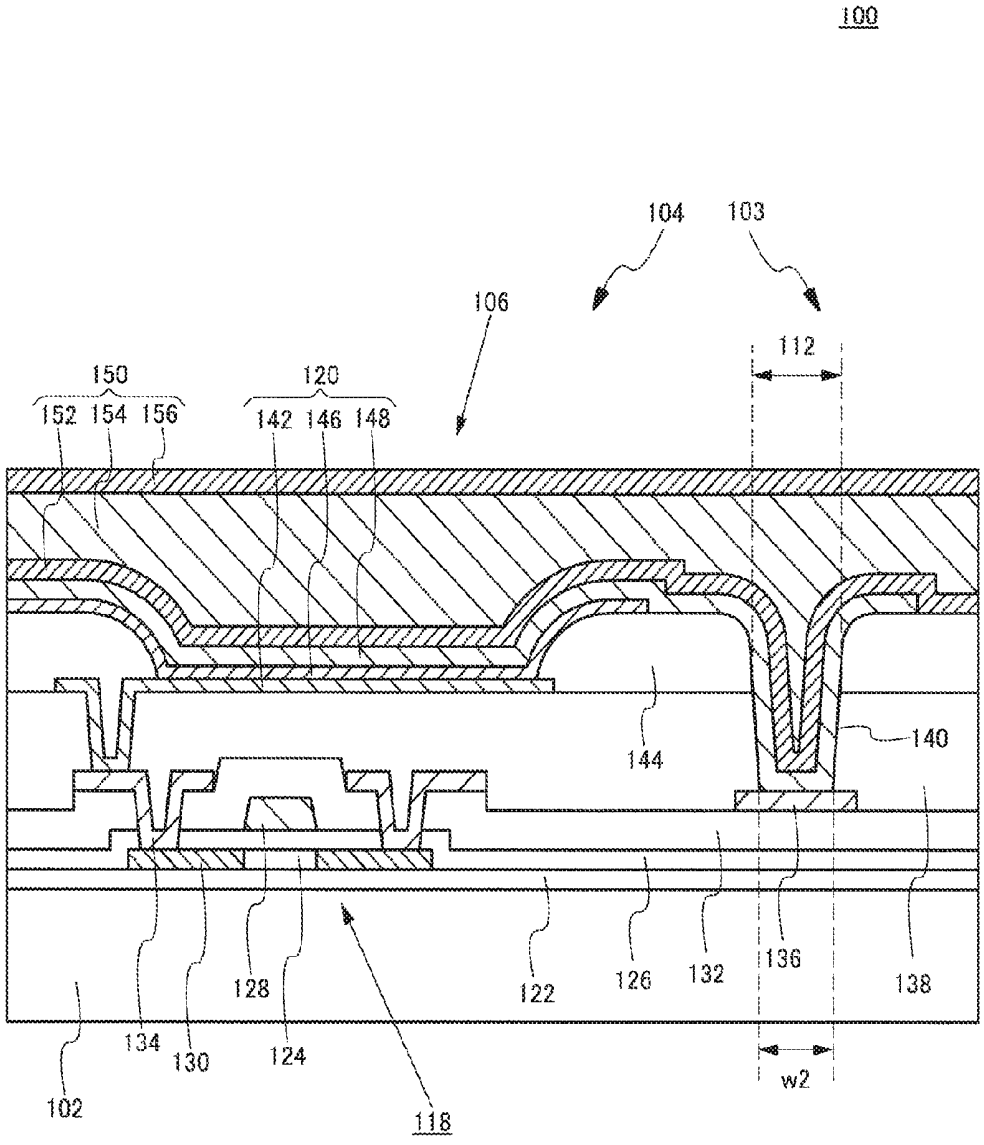


FIG. 1

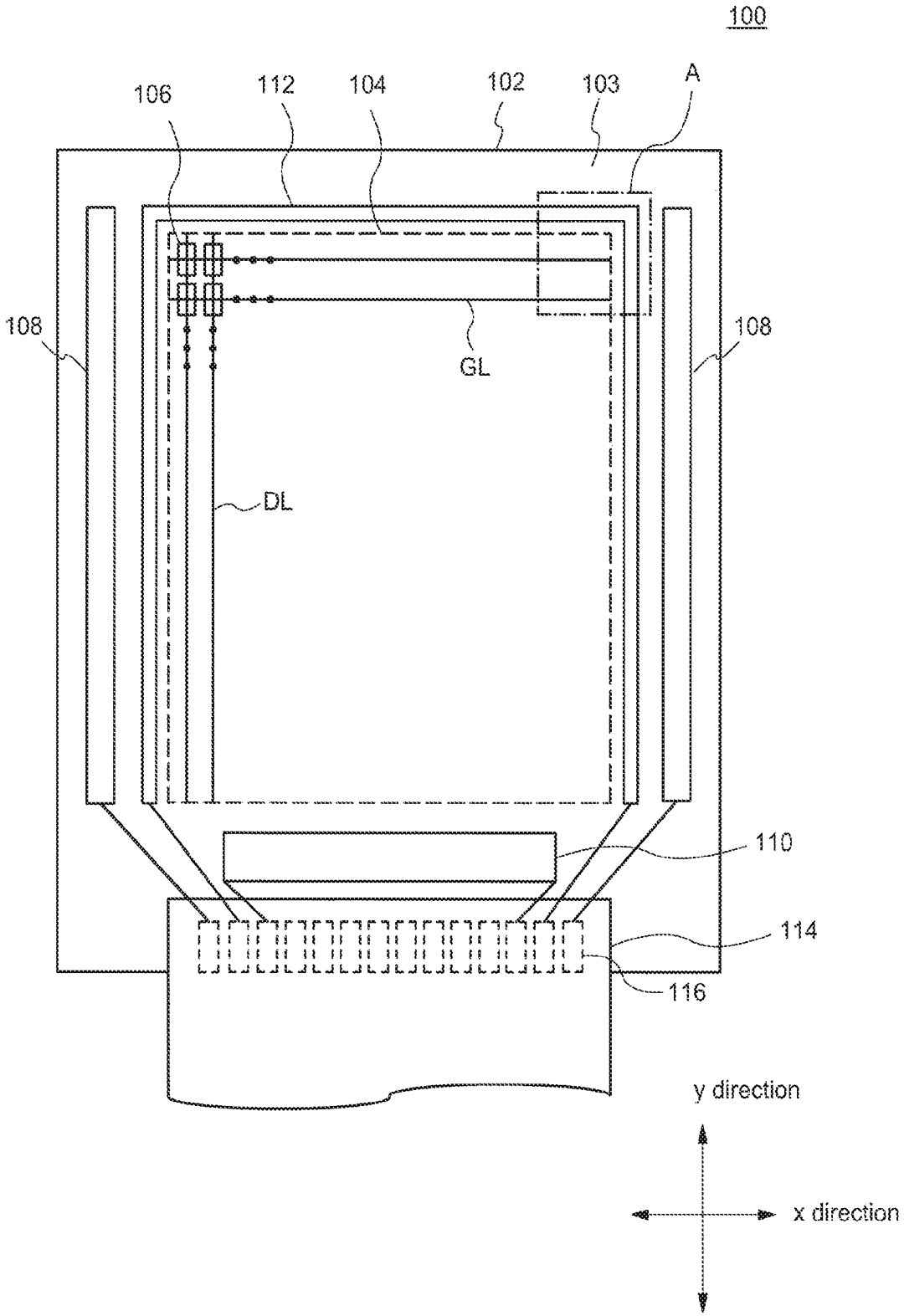

100
106
112
104
102
103
A
108
108
GL
DL
110
114
116
y direction
x direction

FIG. 2

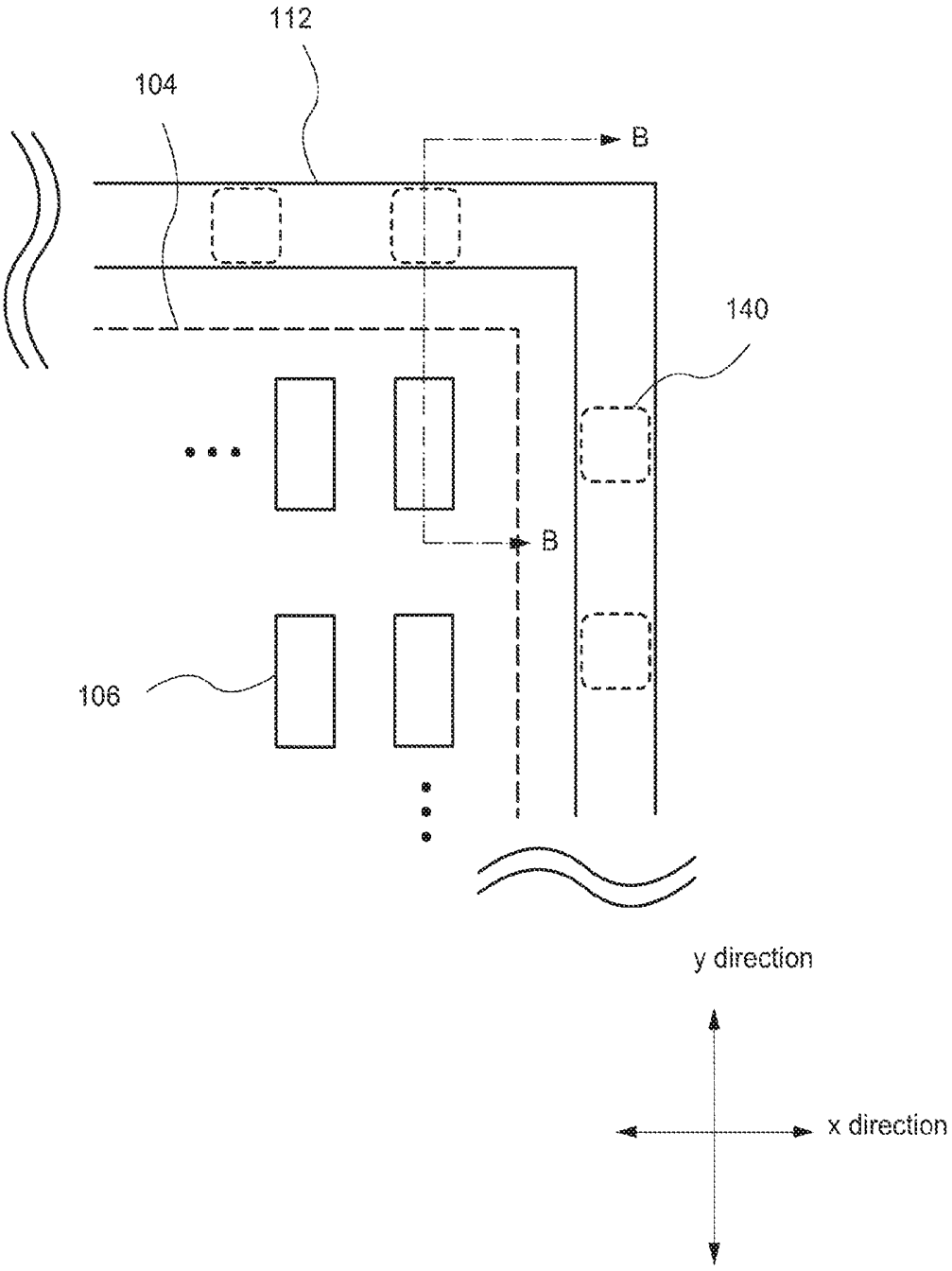


FIG. 3

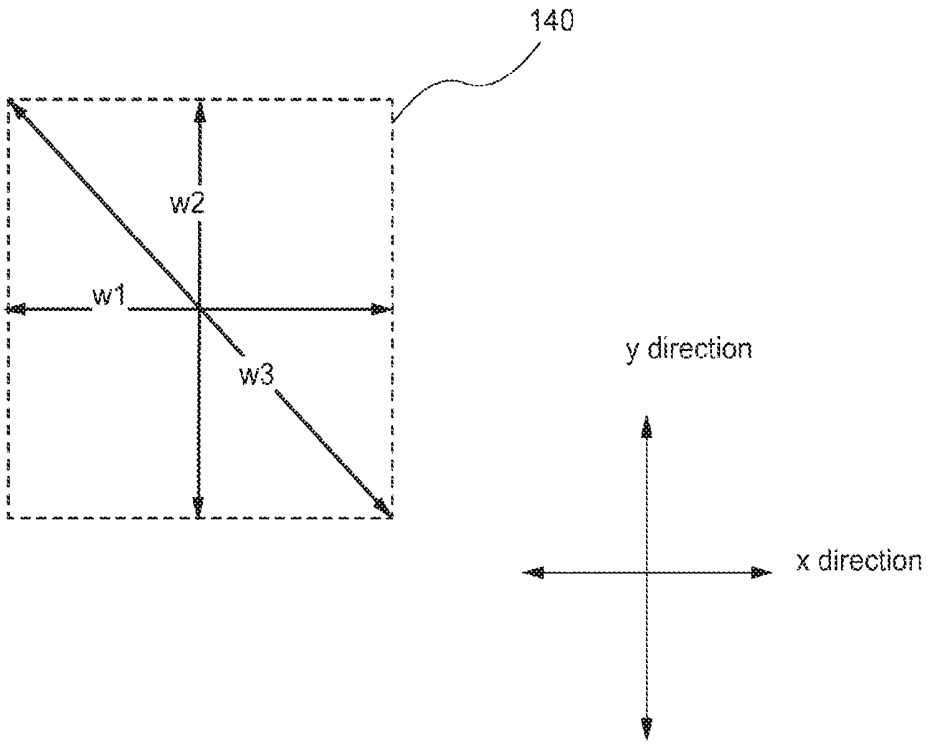


FIG. 4

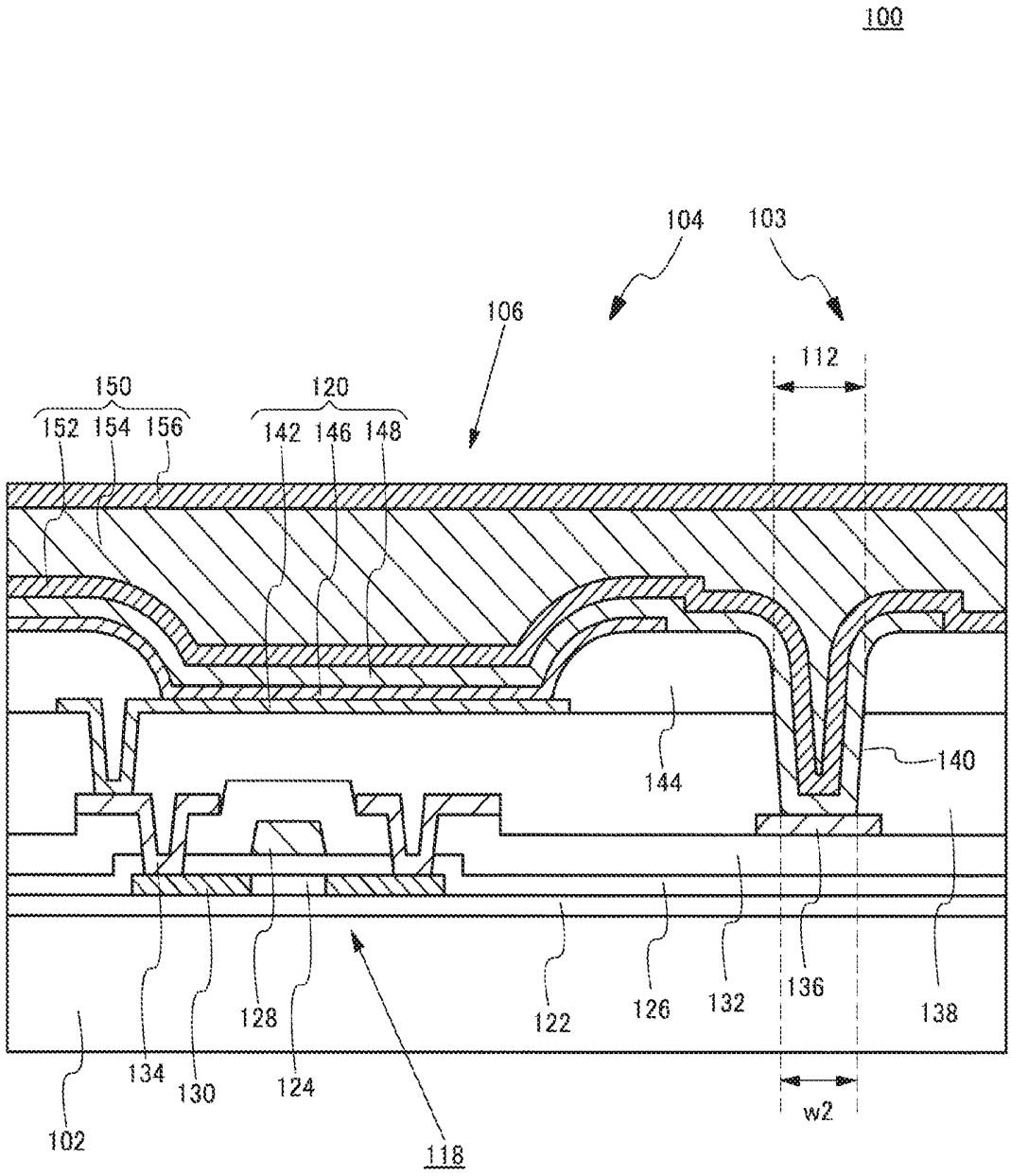

100
104
103
106
112
150
152 154 156
120
142 146 148
144
140
128
134
130
124
118
122
126
132
136
138
102
w2

FIG. 5

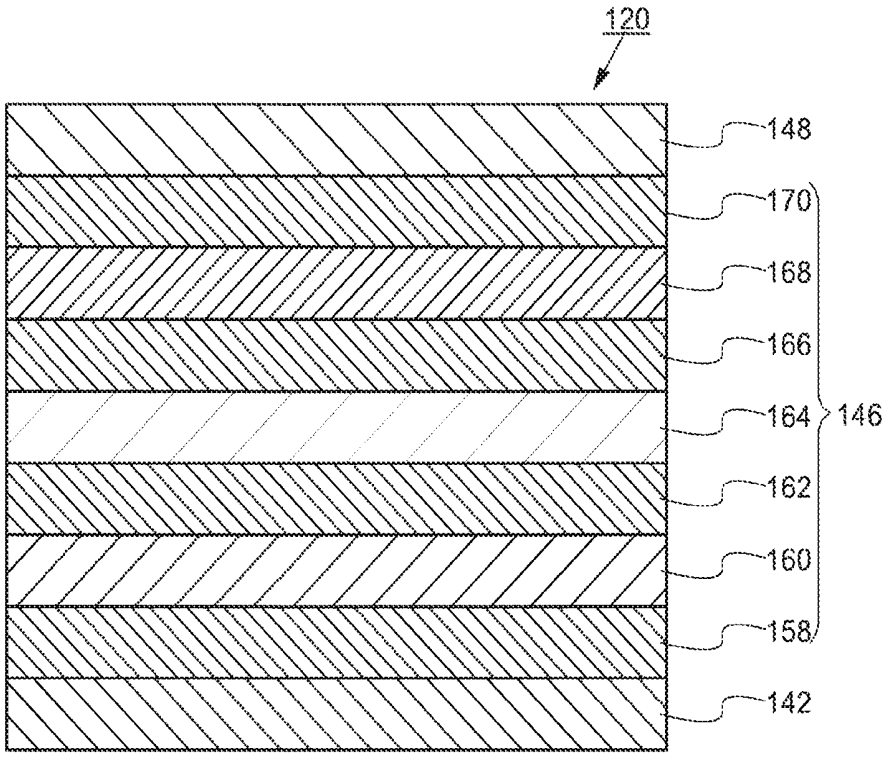


FIG. 6

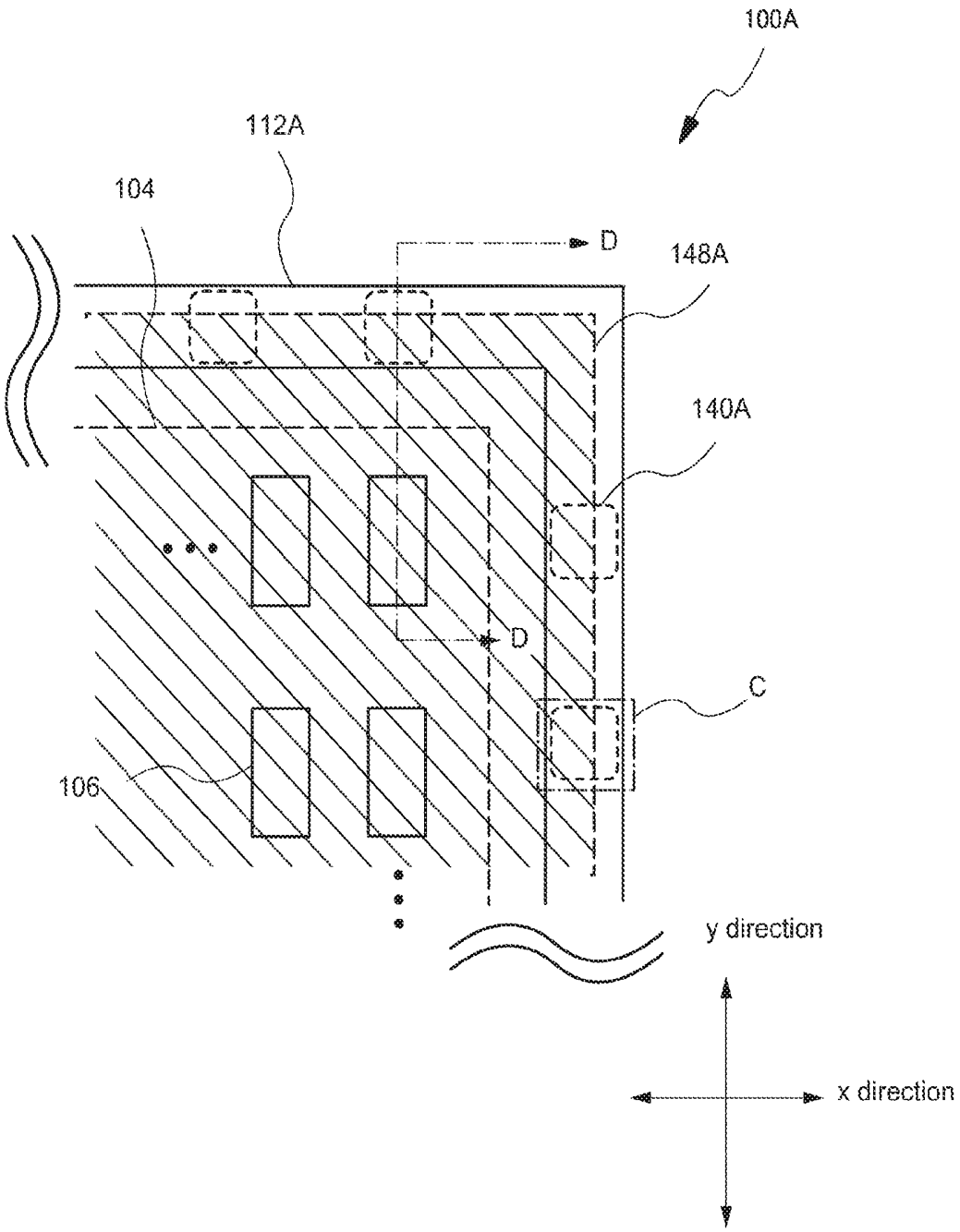


FIG. 7

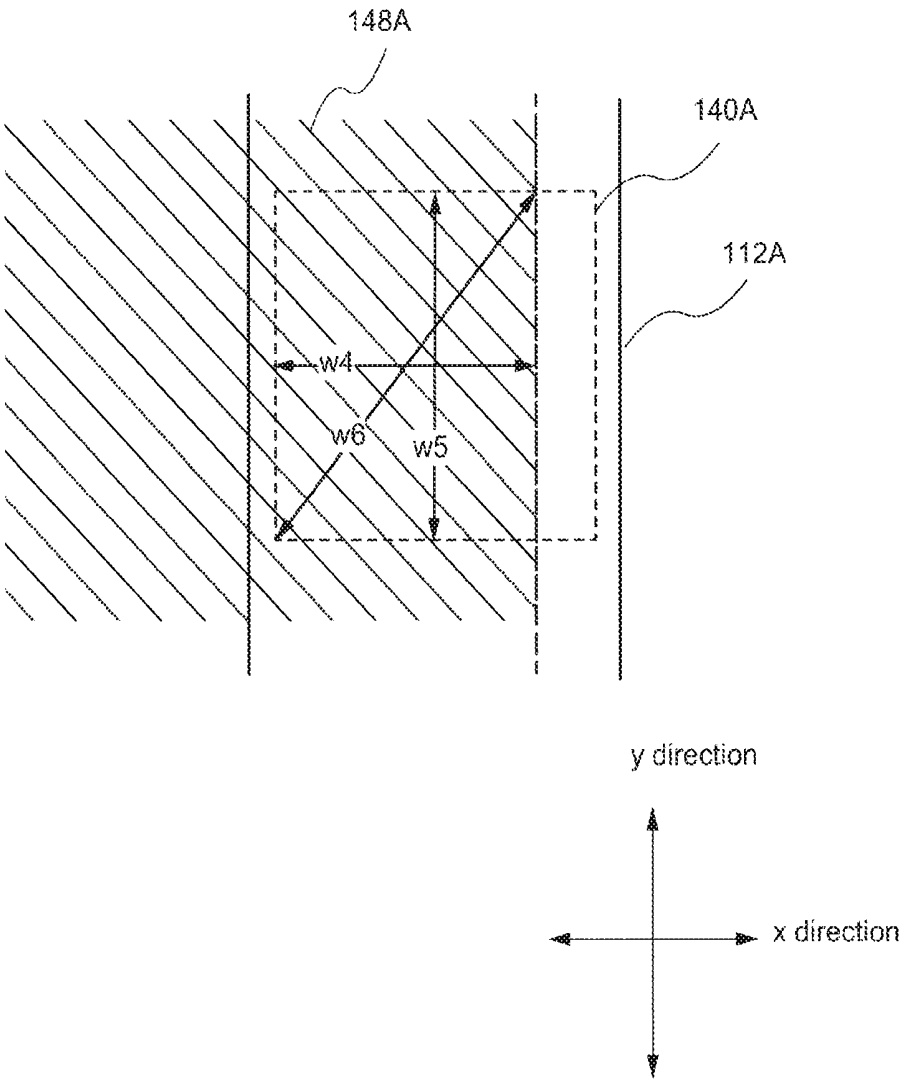


FIG. 8

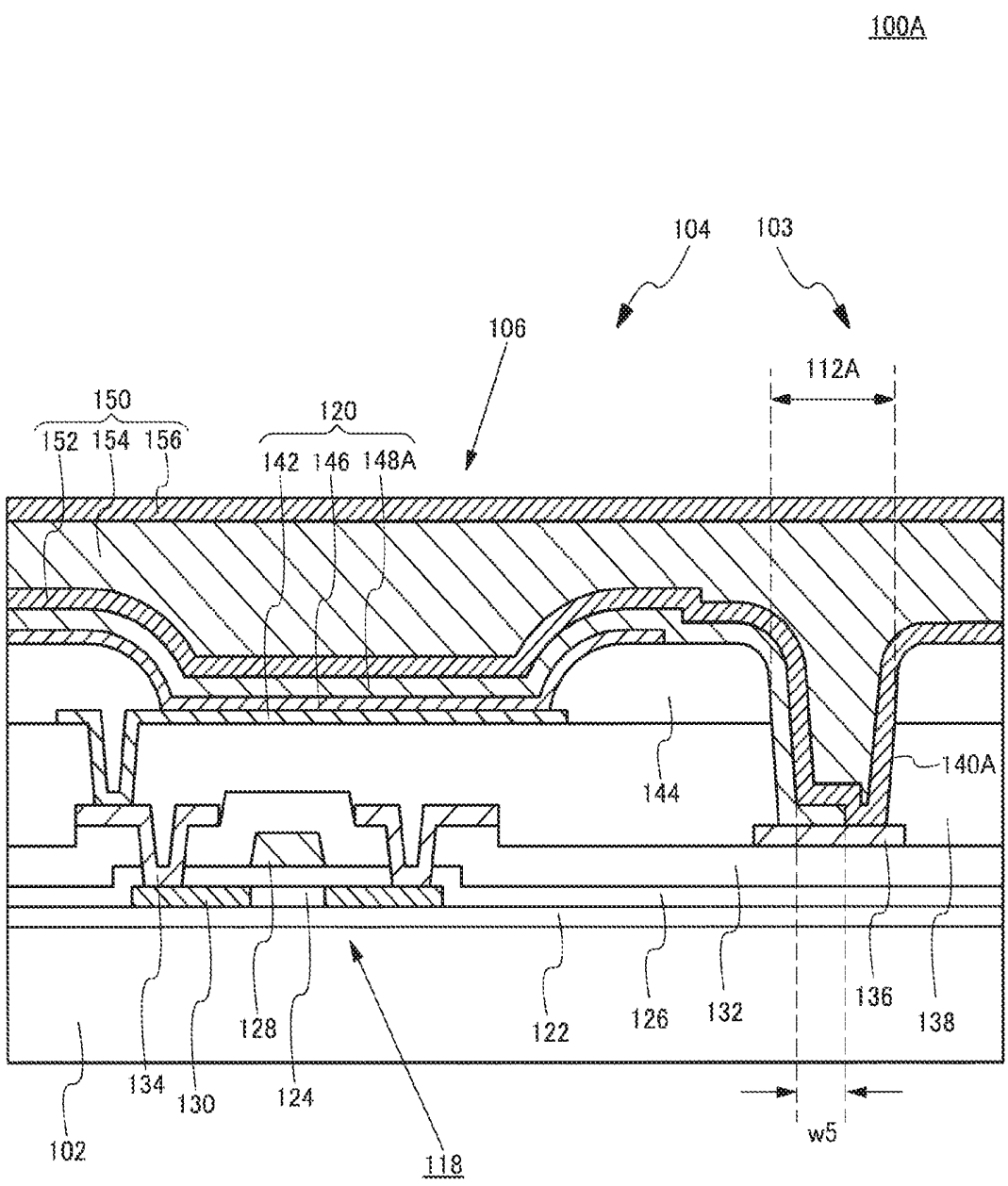

100A
104
103
106
112A
150
152 154 156
120
142 146 148A
144
140A
128
134
130
124
118
122
126
132
136
138
102
w5

FIG. 9

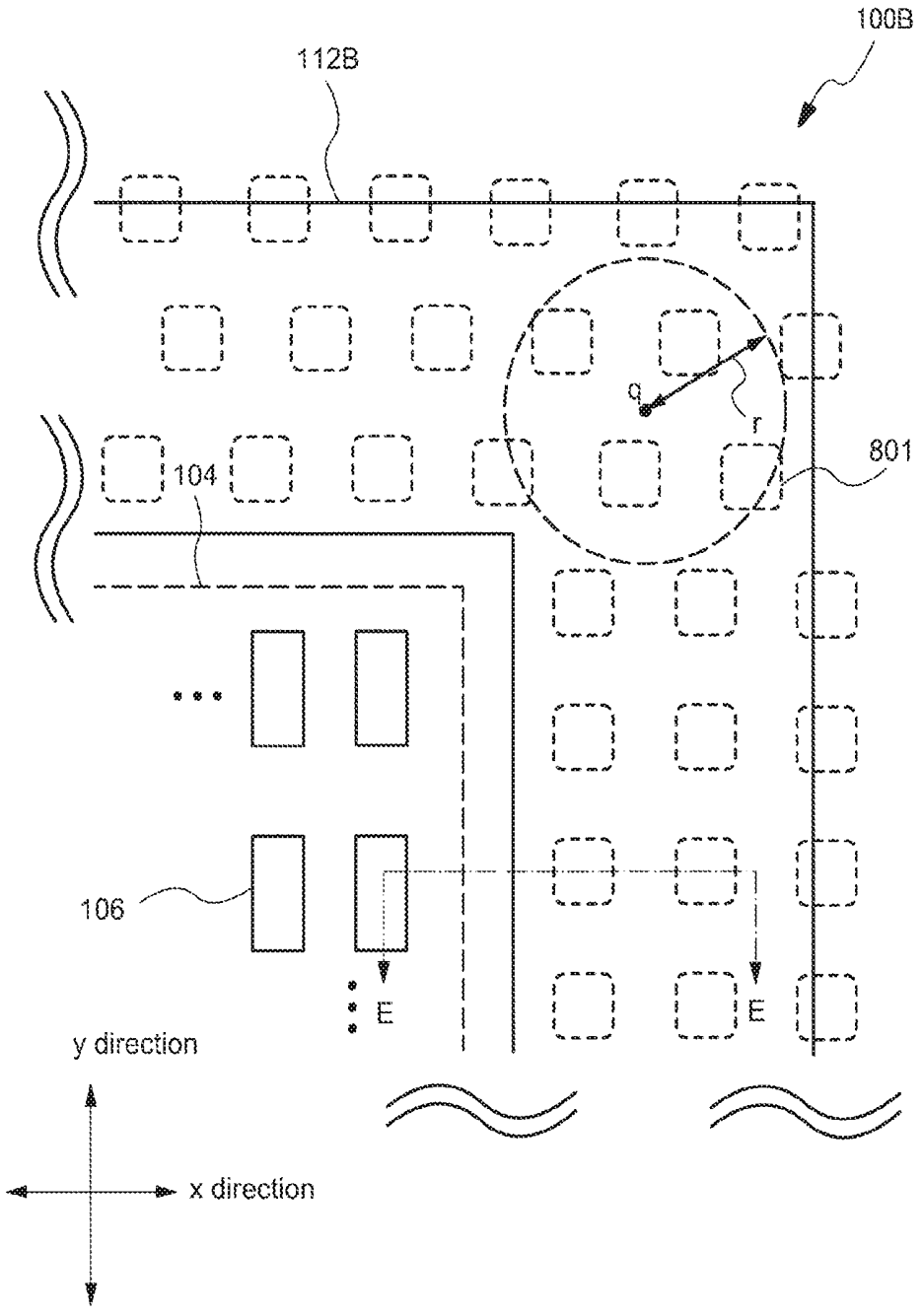
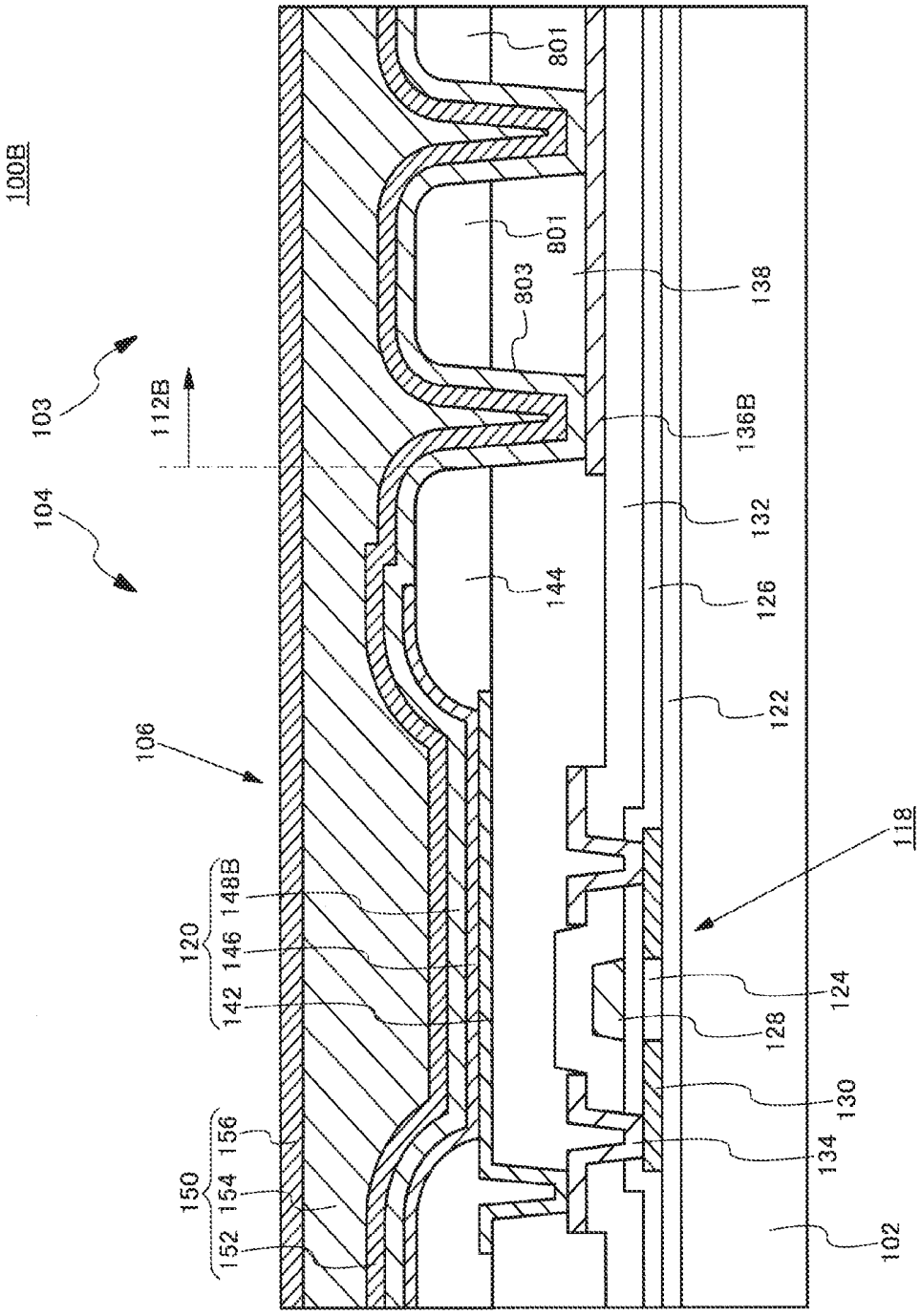


FIG. 10


100B
103
104
106
112B
801
801
803
138
136B
132
144
126
122
118
120
148B
146
142
124
128
130
134
150
156
154
152
102

DISPLAY DEVICE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is based on and claims the benefit of priority from the prior Japanese Patent Application No. 2018-117904, filed on Jun. 21, 2018, the entire contents of which are incorporated herein by reference.

FIELD

[0002] An embodiment of the present invention relates to a display device.

BACKGROUND

[0003] An organic electroluminescent display device using organic electroluminescent elements exists as a display device which displays images.

[0004] In the case of a top-emission type organic electroluminescent display device, a transparent electrode or a semitransparent electrode is used as an upper electrode since light is extracted from a light emitting layer of the organic electroluminescent element through the upper electrode. When using a microcavity effect to improve luminous efficiency, as described in Japanese Laid-Open Patent Publication Number 2011-009790, a semi-light transmissive material such as a MgAg alloy is used as an electrode material for the upper electrode.

SUMMARY

[0005] According to an embodiment of the present invention, a display device is provided including a first electrode provided corresponding to each of a plurality of pixels in a pixel region in which the plurality of pixels are provided, a second electrode provided throughout the plurality of pixels and extending to a contact region provided outside the pixel region, a light emitting layer provided between the first electrode and the second electrode, a third electrode provided in the contact region, an organic insulating layer covering the third electrode and provided with a contact hole exposing the third electrode, and a connection portion between the second electrode and the third electrode provided in the contact hole in which the maximum distance between any two points on the outer periphery of the connection portion is 1 μm or more and 100 μm or less.

[0006] According to an embodiment of the present invention, a display device is provided including a first electrode provided corresponding to each of a plurality of pixels in a pixel region in which the plurality of pixels is provided, a second electrode provided throughout the plurality of pixels and extending to a contact region adjacent to the pixel region in a peripheral region provided surrounding the pixel region, a light emitting layer provided between the first electrode and the second electrode, a third electrode provided in the contact region and electrically connected to the second electrode, and a plurality of island-shaped organic layers provided in the contact region, at least one of which is within a range of 1 μm to 100 μm from any point.

BRIEF DESCRIPTION OF DRAWINGS

[0007] FIG. **1** is a schematic view showing the structure of an organic electroluminescent display device according to an embodiment of the present invention;

[0008] FIG. **2** is an enlarged view of a region A shown in FIG. **1**;

[0009] FIG. **3** is an enlarged view of a contact hole shown in FIG. **2**;

[0010] FIG. **4** is a cross-sectional view corresponding to line B-B in FIG. **2**;

[0011] FIG. **5** is a diagram showing the details of an organic electroluminescent element;

[0012] FIG. **6** is an enlarged view of a display device according to an embodiment of the present invention when viewed in a plan view;

[0013] FIG. **7** is an enlarged view of a region C shown in FIG. **6**;

[0014] FIG. **8** is a cross-sectional view corresponding to line D-D in FIG. **6**;

[0015] FIG. **9** is an enlarged view of a display device according to an embodiment of the present invention when viewed in a plan view, and

[0016] FIG. **10** is a cross-sectional view corresponding to line E-E in FIG. **9**.

DESCRIPTION OF EMBODIMENTS

[0017] When an upper electrode is a counter electrode, the counter electrode and an electrode provided in a wiring substrate are electrically connected in a contact region provided outside the display region of the organic electroluminescent display device which displays images. Since the adhesion of an MgAg alloy to an inorganic film is low, when the counter electrode is formed of an MgAg alloy, the counter electrode may be peeled off in the contact region, reducing the yield of the organic electroluminescent display device.

[0018] Considering the problem above, an objective of the present invention is to prevent the peeling of the MgAg film in the contact region and to improve the yield of an organic electroluminescent display device.

[0019] Hereinafter, embodiments of the present invention will be described with reference to the drawings. However, the present invention may be implemented in many different ways, and interpretation should not be limited to the content exemplified in the embodiments below. In order to provide a clearer explanation, some components of the drawings such as the width, thickness, shape, and the like are represented schematically, however, these are merely examples, and do not limit the interpretation of the present invention. In the present specification and each of the drawings, elements similar to previously described elements are marked with the same symbols (numbers followed by a, b, and the like) and detailed descriptions are omitted accordingly. Furthermore, characters labeled as "first" and "second" are symbols used to distinguish each element, and do not have any further meaning unless otherwise specified.

[0020] In the present specification, when certain components or regions are described as being "above" or "below" other components or regions, as long as there are no limitations, it does not necessarily mean they are directly above or below. This description includes cases in which a component or region is located higher or lower than another component or region. In other words, other components or regions are located between the component or region being described and the component or region above or below. Further, in the description below, unless otherwise noted, in a cross-sectional view, the side on which the pixel region and contact region are arranged with respect to the main

surface of the substrate will be described as "above" and the other side will be described as "below."

[0021] Additionally, in the present specification, expressions such as "a includes A, B, or C," "a includes any of A, B, and C," or "a includes one of A, B, and C selected from a group composed thereof," unless otherwise specified, does not exclude cases in which a includes a plurality of combinations of A-C. Further, these expressions do not exclude cases in which a includes other elements.

[0022] Additionally, in the present specification, "display device" indicates a device which displays images using organic electroluminescent elements. Accordingly, this includes display devices having a display module (also known as display panels) including organic electroluminescent elements and other elements with respect to the display module (for example, cover glass and the like.)

First Embodiment

[0023] FIG. **1** is a schematic view showing the structure of an organic electroluminescent display device **100** according to an embodiment of the present invention, and shows a schematic structure of the organic electroluminescent display device **100** in a plan view. In the present specification, a state in which the organic electroluminescent display device **100** is viewed from the direction perpendicular to the screen (image region) is referred to as a "plan view". In FIG. **1**, a direction in which a gate line (scanning line GL) described below extends is shown as an x direction, and a direction in which a video signal line (video signal line DL) described below extends is shown as a y direction.

[0024] In the display device **100**, a pixel region **104**, a peripheral region **103**, a first drive circuit **108**, a second drive circuit **110**, and a flexible printed circuit **114** are provided above a substrate **102**. A plurality of pixels **106** are arranged in the pixel region **104**. The peripheral region **103** is provided in the periphery of the pixel region **104**. In the peripheral region **103**, the first drive circuit **108**, the second drive circuit **110**, and the flexible printed circuit **114** are arranged. The first drive circuit **108** outputs a scanning signal to each pixel **106** in the pixel region **104** via the gate line GL, and the second drive circuit **110** outputs a video signal to each pixel **106** via the video signal line DL. The flexible printing circuit **114** is provided with a terminal electrode **116**. A signal and power for driving the display device **100** are input to the terminal electrode **116** from an external circuit.

[0025] Although not shown in detail in FIG. **1**, the pixel **106** includes an organic electroluminescent element. Details of the organic electroluminescent element are described below. The organic electroluminescent element includes a first electrode individually formed corresponding to each pixel **106**, a second electrode formed substantially on one surface of the pixel region **104**, and an organic layer between the first electrode and the second electrode. In the present embodiment, the display device **100** is a top-emission type display device which extracts light from the upper side of the organic electroluminescent element.

[0026] In the peripheral region **103**, a contact region **112** is provided outside the pixel region **104** adjacent to the pixel region **104**. The contact hole **112** is a region in which the second electrode of the organic electroluminescent element is electrically connected to the third electrode connected to the terminal electrode **116**. In the present embodiment, the second electrode substantially overlap the entire surface of the contact region **112**. The third electrode may be connected to the terminal electrode **116** via a wiring provided in the substrate **102**. The third electrode may be a wiring provided in the substrate **102** and connected to the terminal electrode **116**.

[0027] FIG. **2** is an enlarged view of a region A shown in FIG. **1**. As shown in FIG. **2**, in the contact region **112**, the second electrode is connected to the third electrode via a plurality of contact holes **140**. The contact hole **140** is provided with a connection portion in which the second electrode and the third electrode are connected. The maximum distance between any two points on the outer periphery of the connection portion between the second electrode and the third electrode in the contact hole **140** is 1 μm or more and 100 μm or less.

[0028] FIG. **3** is an enlarged view of the contact hole **140** shown in FIG. **2**. When the second electrode overlaps the entire contact hole **140** as in the present embodiment, the outer periphery of the connection portion with the second electrode and the third electrode corresponds to the outer periphery of the bottom of the contact hole **140**. Therefore, the maximum distance between any two points on the outer periphery of the bottom of the contact hole **140** is 1 μm or more and 100 μm or less. That is, as shown in FIG. **3**, when the contact hole **140** is rectangular, when a width w**3** is the largest among a width w**1** in the x direction of the contact hole **140**, a width w**2** in the y direction and the width w**3** in the diagonal direction, 1 μm≤w**3**≤100 μm. In FIG. **2**, the second electrode and the third electrode are omitted to clearly show the contact hole.

[0029] The shape of the contact hole **140** is not limited to a rectangular shape. For example, if the contact hole **140** has a circular shape, the size of the diameter of the contact hole may be 1 μm or more and 100 μm or less. Additionally, for example, if the contact hole **140** has an elliptical shape, the major diameter of the contact hole **140** may be 1 μm or more and 100 μm or less.

[0030] FIG. **4** shows a cross-sectional structure corresponding to line B-B in FIG. **2**. As shown in FIG. **4**, the pixels **106** are arranged above the substrate **102**. The pixel **106** is configured to include a transistor **118** and an electroluminescent element **120**.

[0031] As the substrate **102**, a glass substrate, an organic resin film, or the like is applied. A base coat layer **122** is provided on a first surface of the substrate **102**. The base coat layer **122** is formed of an inorganic insulating film. The transistor **118** has a structure in which a semiconductor layer **124**, a gate insulating layer **126**, and a gate electrode **128** are stacked. The transistor **118** has a source/drain region **130** with added impurity elements creating a one conductivity type semiconductor outside of a channel formation region which is a region in which the semiconductor layer **124** and the gate electrode **128** overlap.

[0032] The organic electroluminescent element **120** has a structure in which a first electrode **142**, an organic layer **146**, and a second electrode **148** are stacked. In the present embodiment, the first electrode **142** is an anode and the second electrode **148** is a cathode. The first electrode **142** is individually arranged in each pixel **106** and is electrically connected to the transistor **118**. Specifically, the first electrode **142** is electrically connected to the source/drain electrode **134**. The source/drain electrode **134** is also electrically connected to the source/drain region **130** of the transistor **118**. By this, the organic electroluminescent element **120** is

substantially electrically connected to the transistor **118**. The light emission of the organic electroluminescent element **120** is controlled by the transistor **118**. The second electrode **148** is formed substantially on one surface of the pixel region **104** and is electrically connected to the third electrode **136** in the contact region **112** outside the pixel region **104**.

[0033] An interlayer insulating layer **132** is provided between the gate electrode **128** of the transistor **118** and the source/drain electrode **134**. A planarization layer **138** is provided between the source/drain electrode **134** and the first electrode **142**. Furthermore, above the planarization layer **138**, a partition layer **144** which covers the peripheral portion of the first electrode **142** is provided.

[0034] In the stacked structure shown in FIG. **4**, the base coat layer **122**, the gate insulating layer **126**, and the interlayer insulating layer **132** are formed of an inorganic insulating film. For example, a silicon oxide film, a silicon nitride film or the like is used as the inorganic insulating film. On the other hand, the planarization layer **138** and the partition layer **144** are formed of an organic insulating film. As the organic insulating film, for example, a polyimide film, an acrylic film, an epoxy film or the like is used. The semiconductor layer **124** is formed of a silicon semiconductor or an oxide semiconductor. The gate electrode **128** is formed of a metal material such as molybdenum (Mo), tungsten (W), or a molybdenum-tungsten alloy (MoW). The source/drain electrode **134** has, for example, a structure in which a titanium (Ti) film is stacked above and below an aluminum (Al) film. The third electrode **136** is formed in the same conductive layer as the source/drain electrode **134** or the same conductive layer as the gate electrode **128**. FIG. **4** shows an embodiment in which the third electrode **136** is provided in the same conductive layer as the source/drain electrode **134**.

[0035] In the contact region **112**, the third electrode **136** is arranged below the planarization layer **138** and the partition layer **144** and is covered by the planarization layer **138** and the partition layer **144**. For this reason, the upper surface of the third electrode **136** is exposed by the contact holes **140** formed in the planarization layer **138** and the partition layer **144**. The second electrode **148** extends from the pixel region **104** to the peripheral region **103** and is electrically connected to the third electrode **136** in the contact hole **140**.

[0036] A sealing layer **150** is provided above the organic electroluminescent element **120**. The sealing layer **150** has a structure in which a plurality of films are stacked. FIG. **4** shows an example of a case in which the sealing layer **150** has a structure in which a first inorganic insulating film **152**, an organic resin film **154**, and a second inorganic insulating film **156** are stacked. The sealing efficiency of the sealing layer **150** is enhanced by a stacked structure in which different materials are combined. For example, even if a defect is included in the first inorganic sealing film **152**, the sealing layer **150** has a structure in which the organic resin film **154** buries the defect portion, and the second inorganic insulating film **156** is further provided to compensate for the deterioration of the sealing efficiency due to the defect.

[0037] FIG. **5** shows the details of the organic electroluminescent element **120**. The organic electroluminescent element **120** has a structure in which the organic layer **146** is sandwiched between the first electrode **142** and the second electrode **148**. In addition to a light emitting layer **164** including organic electroluminescent materials, the organic layer **146** may be stacked with a plurality of layers having different carrier transport properties (for example, carrier mobility). For example, the organic layer **146** may have a structure in which a hole injection layer **158**, a hole transport layer **160**, an electron blocking layer **162**, the light emitting layer **164**, a hole blocking layer **166**, an electron transport layer **168**, and an electron injection layer **170** are stacked from the first electrode **142** side.

[0038] The first electrode **142** of the organic electroluminescent element **120** is an anode and is formed of a conductive material having a large work function (specifically, 4.0 eV or greater) in order to inject holes into the organic layer **146**. For example, the first electrode **142** may be manufactured using a conductive metal oxide material such as an indium tin oxide (ITO) or an indium zinc oxide (IZO). The first electrode **142** is manufactured by a sputtering method or a vacuum evaporation method using a conductive metal oxide material.

[0039] The hole injection layer **158** is preferably provided so as to lower the injection barrier of the holes from the first electrode **142** to the light emitting layer **164**, and alleviates the difference in energy levels between the first electrode **142** and the hole transport layer **160** to facilitate hole injection. An organic material of a phthalocyanine type, an amine type or a carbazole type is used for the hole injection layer **158**.

[0040] The hole transport layer material used for the hole transport layer **160** preferably has an appropriate ionization potential to increase the transfer rate of holes to the light emitting layer **164** described below, and at the same time, has a degree of electron affinity to prevent electrons from moving from the light emitting layer **164** to the hole transport layer **160**. The hole transport layer **160** uses an organic material having a high hole mobility, such as an arylamine compound, an amine compound containing a carbazole group, or an amine compound containing a fluorene derivative.

[0041] The light emitting layer **164** may be formed of a combination of a host material and a dopant material. By using the combination of a host material and a dopant material such as this, the energy of the excited host molecule is transferred to the molecule of the dopant material, and the molecule of the dopant material releases energy and emits light. As a host compound, an electron transport material or a positive hole transport material may be used. For example, a host material of a quinolinol metal complex such as an Alq3 doped with a pyran derivative, a quinacridone derivative or a coumarin derivative, a host material of an electron transport material described below such as a bis (2-methyl-8-hydroxyquinoline)-4-phenylphenol-aluminum complex doped with a condensed polycyclic aromatic compound such as a perylene, a host material such as a hole transport material of a 4, 4'-bis (m-tolylphenylamino) biphenyl (TPD) doped with a rubrene, or a host material of a carbazole compound doped with an iridium complex or a platinum complex may be used.

[0042] The light emitting layer **164** may be provided corresponding to each color of red (R), green (G), and blue (B) using the materials described above, and may have structure in which a layer corresponding to red (R), a layer corresponding to green (G), a layer corresponding to blue (B) are stacked, or a layer corresponding to blue (B) and yellow (Y) are stacked in order to achieve white light emission.

[0043] The electron transport material used for the electron transport layer **168** is preferably a material having an appropriate ionization potential to increase the transfer rate of the electrons to the light emitting layer **164**, and a degree of electron affinity preventing holes from moving from the light emitting layer **164** to the electron transport layer **168** side. The electron transport layer **168**, for example, may be formed using an organic substance such as an oxadiazole derivative, a triazole derivative, or a quinolinol metal complex.

[0044] The electron injection layer **170** is provided to alleviate difficulty of electron injection caused by a large energy difference between the work function of the second electrode **148** and the electron affinity (LUMO level) of the electron transport layer **168**. Specifically, the electron injection layer **170** may be formed of a substance with a small work function selected from an alkali metal such as a sodium (Na), a lithium (Li), and a cesium (Cs), an alkaline earth metal such as a calcium (Ca), a rare earth metal such as an ytterbium (Yb), a co-vapor deposited film of a lithium (Li) with an electron transport material, a fluoride such as a lithium fluoride (LiF), a cesium fluoride (CsF), an oxide such as a lithium oxide (Li_2O), or a carbonate such as a cesium carbonate (Cs2CO3).

[0045] The hole blocking layer **166** and the electron blocking layer **162** are provided so as to sandwich the light emitting layer **164**. The hole blocking layer **166** is provided to suppresses the movement of holes from the side of the first electrode **142** through the light emitting layer **164** to the side of the second electrode **148**, and the electron blocking layer **162** is provided to suppress the movement of electrons from the side of the second electrode **148** through the light emitting layer **164** to the side of the first electrode **142**. By providing a hole blocking layer **166** and an electron blocking layer **162** such as this, the probability of holes and electrons recombining in the light emitting layer **164** is improved, and the light emission efficiency (internal quantum efficiency) of the organic electroluminescent element **120** may be improved.

[0046] The material of the electron blocking layer **162** is preferably formed of a material having a high LUMO level, that is, a low electron affinity, and a HOMO level close to the HOMO level of the hole transport layer **160**. For example, the electron blocking layer **162** may be formed using an organic material such as a starburst amine-based material or a TPD.

[0047] The material of the hole blocking layer **166** is preferably formed of a material having a low HOMO level (a large ionization potential) and a LUMO level close to the LUMO level of the electron transport layer. For example, the hole blocking layer **166** may be formed using an organic material such as a triaryl borane derivative or BAlq.

[0048] The second electrode **148** is a cathode, and is preferably formed of a conductive material having a low work function in order to inject electrons into the organic layer **146**. In the present embodiment, since the display device **100** is a top-emission type, the material of the second electrode **148** uses a transparent electrode or a semitransparent electrode. In order to improve the light emission efficiency of the organic electroluminescent element **120** by a microcavity effect, in the present embodiment, a semitransparent electrode formed of an alloy of magnesium and silver (an MgAg alloy) is used as the second electrode **148**.

[0049] Additionally, the organic material which composes the organic layer **146** described above is merely an example, and a well-known material other than the above may be used. Furthermore, the stacked structure of the organic layer **146** is not limited to the structure shown in FIG. **5**. For example, the organic layer **146** may have a structure in which the hole injection layer **158**, the hole blocking layer **166**, the electron blocking layer **162**, and the like are appropriately omitted.

[0050] As described above, since the MgAg alloy which is the material of the second electrode **148** has low adhesion to the inorganic film, the second electrode **148** including the MgAg alloy has low adhesion to the third electrode **136**. Therefore, in the present embodiment, the maximum distance between any two points is set to 1 μm or more and 100 μm or less in the outer periphery of the connection portion between the second electrode **148** and the third electrode **136** in the contact hole **140**. By limiting the maximum distance between any two points in the connection portion between the second electrode **148** and the third electrode **136** to 100 μm or less, peeling of the second electrode **148** and the third electrode **136** may be prevented, and the yield of the display device **100** may be improved. The planarization layer **138** and the partition layer **144** which are in contact with the second electrode **148** in the periphery of the contact hole **140** and the side wall of the contact hole **140** are organic insulating films. For this reason, the adhesion between the second electrode **148** and the planarization layer **138** and the partition layer **144** is greater than the adhesion between the second electrode **148** and the third electrode **136**. Therefore, the second electrode **148** is prevented from peeling off from the contact hole **140** because the second electrode **148** is in close contact with the planarization layer **138** and the partition layer **144** in the periphery of the contact hole **140** and the side wall thereof. As a result, peeling of the second electrode **148** and the third electrode **136** is prevented, and the yield of the display device **100** is improved.

[0051] In the first embodiment described above, a case in which the second electrode **148** overlaps substantially the entire surface of the contact region **112** is described. However, at least a portion of the second electrode **148** may overlap with the contact hole **140**.

Second Embodiment

[0052] FIG. **6** is an enlarged view of a display device **100**A according to the present embodiment when viewed in a plan view. The schematic configuration of the display device **100**A is substantially the same as the schematic configuration of the display device **100** described with reference to FIG. **1**, thus, a detailed description is omitted.

[0053] As shown in FIG. **6**, in the display device **100**A according to the present embodiment, a portion of a second electrode **148**A overlaps a contact hole **140**A provided in a contact region **112**A. Specifically, an edge portion of the second electrode **148**A overlaps at least a portion of the contact hole **140**A.

[0054] FIG. **7** is an enlarged view of a region C shown in FIG. **6**. FIG. **8** shows a cross-sectional structure corresponding to line D-D in FIG. **6**. As in the first embodiment, in the contact region **112**A, the second electrode **148**A is connected to the third electrode **136** via a plurality of contact holes **140**A. The third electrode **136** is exposed by the contact hole **140**A. As described above, in the present

embodiment, the edge portion of the second electrode **148**A overlaps with at least one portion of the contact hole **140**A. In the outer periphery of the connection portion between the second electrode **148**A and the third electrode **136** in the contact hole **140**A, the maximum distance between any two points is 1 μm or more and 100 μm or less. As shown in FIG. **7**, when the contact hole **140**A is rectangular, and a width w**6** is the largest among a width w**4** in the x direction, the width w**5** in the y direction, and the width w**6** of the diagonal direction of the connection portion between the second electrode **148**A and the third electrode **136** in the contact hole **140**A, this is 1 μm≤w**6**≤100 μm. In FIG. **6** and FIG. **7**, the third electrode **136** is omitted to clearly show the contact holes.

[0055] By limiting the maximum distance between any two points in the outer periphery of the connection portion between the second electrode **148**A and the third electrode **136** to 100 μm or less, peeling between the second electrode **148**A and the third electrode **136** may be prevented, and the yield of the display device **100**A may be improved.

[0056] In the first and second embodiments described above, a case has been described in which the maximum distance between any two points in the outer periphery of the connection portion between the second electrodes **148** and **148**A and the third electrode **136** in the contact holes **140** and **140**A is limited to 1 μm or more and 100 μm or less. However, the connection mode of the second electrode and the third electrode in the contact region is not limited to this.

Third Embodiment

[0057] FIG. **9** is an enlarged view of the display device **100**B according to the present embodiment when viewed in a plan view. The schematic structure of the display device **100**B is substantially the same as the schematic structure of the display device **100** described with reference to FIG. **1**, thus, a detailed description is omitted.

[0058] As shown in FIG. **9**, in the display device **100**B according to the present embodiment, a plurality of island-shaped organic layers **801** are provided in the contact region **112**B. In the contact region **112**B, one or more island-shaped organic layers **801** are provided in a range of 1 μm to 100 μm from any point q. In other words, one or more island-shaped organic layers **801** are provided within a radius r (1≤r≤100) μm centered on any point q.

[0059] FIG. **10** is a cross-sectional view taken along line E-E in FIG. **9**. As shown in FIG. **10**, the island-shaped organic layer **801** is provided in the contact region **112**B. The organic layer **801** may be formed of a same material as the partition layer **144**. The organic layer **801** may be formed separated from the partition layer **144** by an opening **803** provided in the partition layer **144** and the planarization layer **138** extending to the contact region **112**B. A second electrode **148**B of the organic electroluminescent element **120** extends to the contact region **112**B. In the contact region **112**B, a third electrode **136**B is exposed by the opening **803** provided between the partition layer **144** and the island-shaped organic layer **801** adjacent to each other, and between the island-shaped organic layers **801** adjacent to each other. The second electrode **148**B is electrically connected to the third electrode **136**B in the opening **803**.

[0060] In the present embodiment, the size of the connection portion between the second electrode **148**B and the third electrode **136**B is set to 1 μm or more and 100 μm or less by providing one or more organic layers **801** within the range of 1 μm to 100 μm from any point q in the contact region **112**B. By this, peeling of the second electrode **1488** and the third electrode **1368** may be prevented, and the yield of the display device **1008** may be improved. In the contact hole region **1128**, the planarization layer **138** and the partition layer **144** or the island-shaped organic layer **801** which are in contact with the second electrode **148** in the periphery of the opening **803** and the side wall of the opening **803** are organic insulating films. For this reason, the adhesion between the second electrode **148** and the planarization layer **138** and the partition layer **144** or the island-shaped organic layer **801** is higher than the adhesion between the second electrode **148** and the third electrode **136**. Therefore, the second electrode **148** is prevented from peeling from the opening **803** because the second electrode **148** is adhered to the planarization layer **138** and the partition layer **144** or the island-shaped organic layer **801** in the periphery of the opening **803** and the side wall thereof. As a result, peeling of the second electrode **148** and the third electrode **136** is prevented, and the yield of the display device **1008** is improved.

Example

[0061] An organic electroluminescent display device is manufactured on a 730 mm×920 mm glass substrate based on the organic electroluminescent display device **100** according to the first embodiment described with reference to FIG. **4** and FIG. **5**. At this time, an organic electroluminescent display device in which the maximum distance between any two points on the outer periphery of the connection portion between a second electrode (cathode) and a third electrode connected to the second electrode in a contact hole is 100 μm is referred to as Example 1. Additionally, as a comparative example, an organic electroluminescent display device in which the maximum distance between any two points on the outer periphery of the connection portion between the second electrode (cathode) and the third electrode in the contact hole is 200 μm, and an organic electroluminescent display device in which the maximum difference between any two points on the outer periphery of the connection portion between the second electrode (cathode) and the third electrode is 500 μm have been prepared as comparative example 1 and comparative example 2.

[0062] The incidence rate of peeling between the second electrode and the third electrode in example 1 and comparative examples 1 and 2 described above is as shown in Table 1 below.

TABLE 1

	Maximum Distance (μm) Between Any Two Points at the Connection Portion Between the Second Electrode and the Third Electrode	Incidence Rate of Peeling (%)
Example 1	100	0
Comparative Example 1	200	20
Comparative Example 2	500	70

[0063] As apparent from Table 1 above, by setting the maximum distance between any two points on the outer periphery of the connection portion between the second electrode and the third electrode in the contact region to 1

μm or more and 100 μm or less, it is understood that peeling of the second electrode and the third electrode is prevented and the yield of the display device is improved.

What is claimed is:

1. A display device comprising:

a first electrode provided corresponding to each of a plurality of pixels in a pixel region in which the plurality of pixels are provided;

a second electrode provided over the plurality of pixels and extending to a contact region provided outside the pixel region;

a light emitting layer provided between the first electrode and the second electrode;

a third electrode provided in the contact region;

an organic insulating layer covering the third electrode and provided with a contact hole exposing the third electrode, and

a connection portion between the second electrode and the third electrode provided in the contact hole, wherein the maximum distance between any two points in the outer periphery of the connection portion is 1 μm or more and 100 μm or less.

2. The display device according to claim **1**, wherein

the second electrode includes a MgAg alloy.

3. The display device according to claim **1**, wherein

an edge portion of the second electrode overlaps with at least one portion of the contact hole.

4. The display device according to claim **1**, wherein

the light emitting layer includes an organic electroluminescent material.

5. The display device according to claim **1**, wherein

the organic insulating layer includes,

a first organic insulating layer provided above a first surface of the first electrode, and

a second organic insulating layer provided above a second surface opposite to a second surface of the first electrode and provided between the first electrode and the second electrode.

6. A display device comprising:

a first electrode provided corresponding to each of a plurality of pixels in a pixel region in which the plurality of pixels is provided;

a second electrode provided over the plurality of pixels and extending to a contact region adjacent to the pixel region in a peripheral region provided surrounding the pixel region;

a light emitting layer provided between the first electrode and the second electrode;

a third electrode provided in the contact region and electrically connected to the second electrode, and

a plurality of island-shaped organic layers provided in the contact region, wherein at least one of the plurality of island-shaped organic layers is within a range of 1 μm to 100 μm from any point.

7. The display device according to claim **6**, wherein

the second electrode includes a MgAg alloy.

8. The display device according to claim **6**, wherein

the third electrode is connected to the second electrode in the contact region via an opening provided between a plurality of island-shaped organic layers adjacent to each other.

9. The display device according to claim **6**, wherein

the light emitting layer includes an organic electroluminescent material.

* * * * *

专利名称(译)	显示装置		
公开(公告)号	US20190393442A1	公开(公告)日	2019-12-26
申请号	US16/445782	申请日	2019-06-19
[标]申请(专利权)人(译)	株式会社日本显示器		
申请(专利权)人(译)	日本展示INC.		
当前申请(专利权)人(译)	日本展示INC.		
[标]发明人	MIYAMOTO MITSUHIDE AKIMOTO HAJIME MATSUMOTO YUKO TADA YUSUKE		
发明人	MIYAMOTO, MITSUHIDE AKIMOTO, HAJIME MATSUMOTO, YUKO TADA, YUSUKE		
IPC分类号	H01L51/52 H01L51/50 H01L27/32		
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外部链接	Espacenet USPTO		

摘要(译)

一种显示装置，具有：第一电极，其与设置有多个像素的区域中的多个像素中的每一个相对应；第二电极，其设置在多个像素上方并延伸至设置在像素区域外部的接触区域；以及 设置在第一电极和第二电极之间的发光层，设置在接触区域中的第三电极，覆盖第三电极并设置有暴露第三电极的接触孔的有机绝缘层以及第二电极和第二电极之间的连接部分接触孔中的第三电极，其中，连接部分的外周上的任意两点之间的最大距离为1μm以上且100μm以下。

