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(54) **DISPLAY DEVICE**

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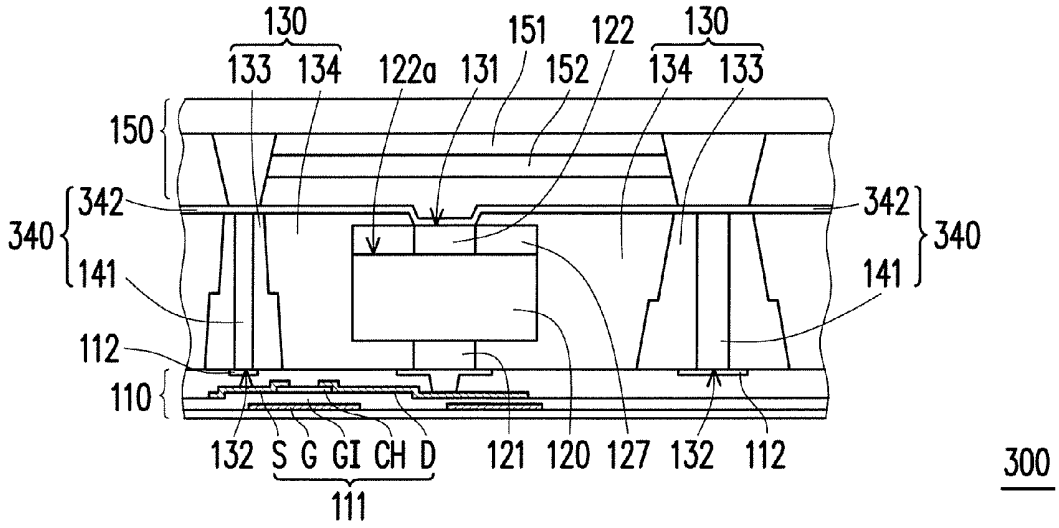
H01L 29/786	(2006.01)

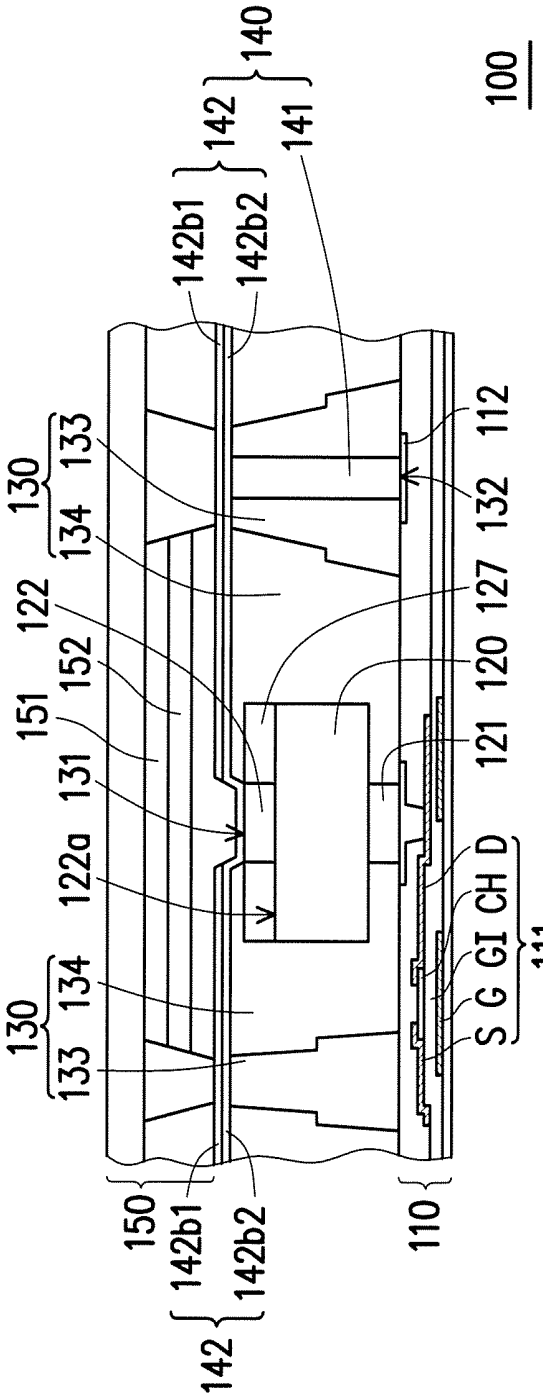
(52) **U.S. Cl.**

CPC ***H01L 25/167*** (2013.01); ***H01L 25/0753*** (2013.01); ***H01L 27/1222*** (2013.01); ***H01L 27/1225*** (2013.01); ***H01L 27/124*** (2013.01); ***H01L 33/507*** (2013.01); ***H01L 33/505*** (2013.01); ***G09G 3/32*** (2013.01); ***H01L 33/62*** (2013.01); ***H01L 33/58*** (2013.01); ***H01L 27/1248*** (2013.01); *H01L 29/78633* (2013.01); *H01L 29/78663* (2013.01); *H01L 29/78672* (2013.01); *H01L 29/7869* (2013.01); *H01L 2933/0091* (2013.01); *H01L 2933/0066* (2013.01)

(57) **ABSTRACT**

The disclosure relates to a display device, including a first substrate, a light emitting component, an insulating layer, and a conductive element. The first substrate has a driving component and a common line. The light emitting component is disposed on the first substrate and has a first electrode and a second electrode. The first electrode is electrically connected to the driving component. The insulating layer is disposed to the first substrate and has a first opening and a second opening. The first opening exposes the second electrode of the light emitting component. The second opening exposes the common line. The common line is electrically connected to the second electrode through the conductive element.




100
140
142
141
142b1
142b2
130
133
134
122
152
151
131
122a
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134
133
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142b1
142b2
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112
132
127
120
121
S G GI CH D
111
110

FIG. 1

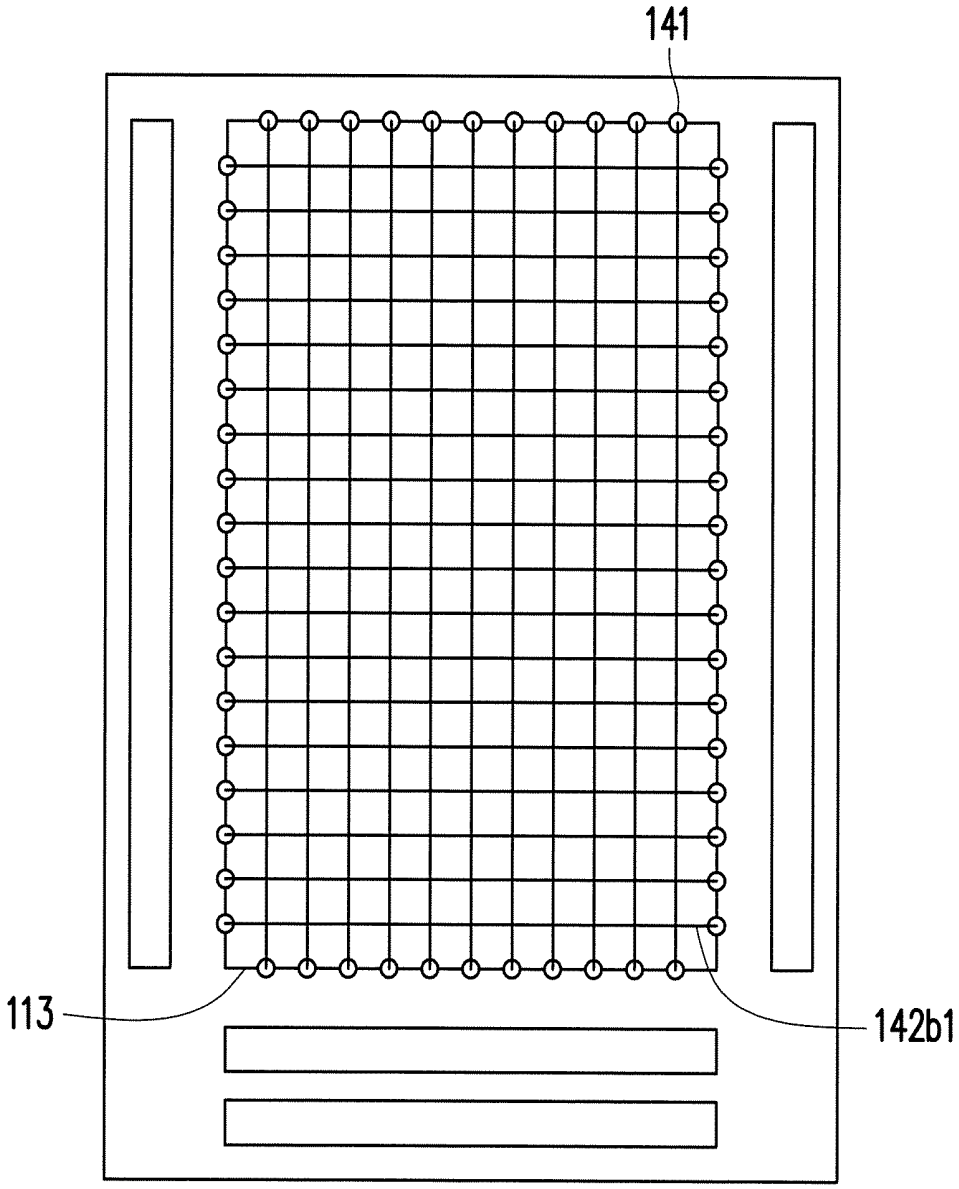
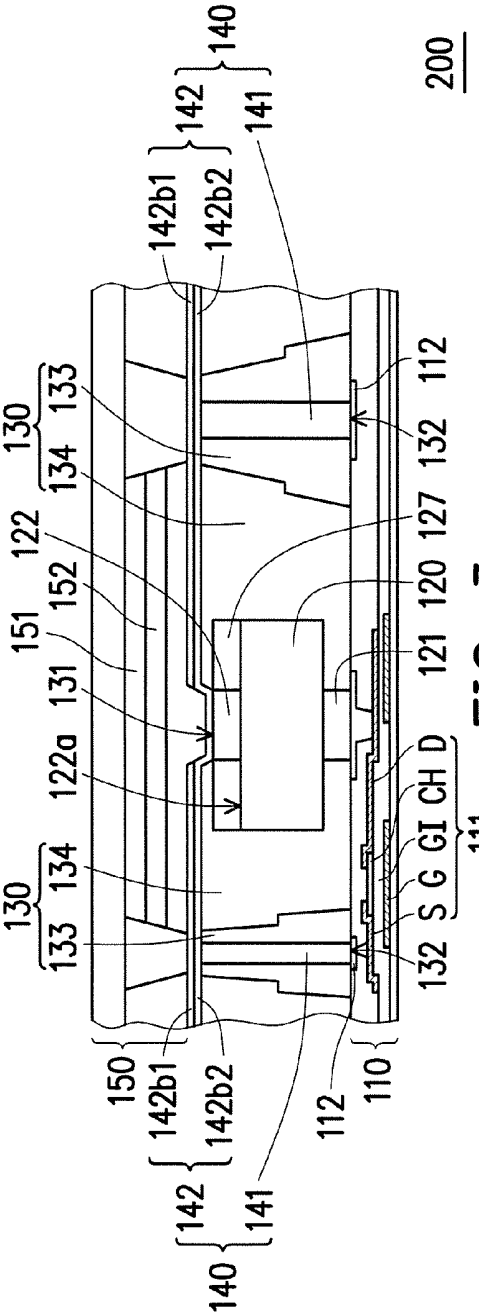


FIG. 2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142
141
142b1
142b2
130
133
134
122
151
152
131
122a
S G GI CH D
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127
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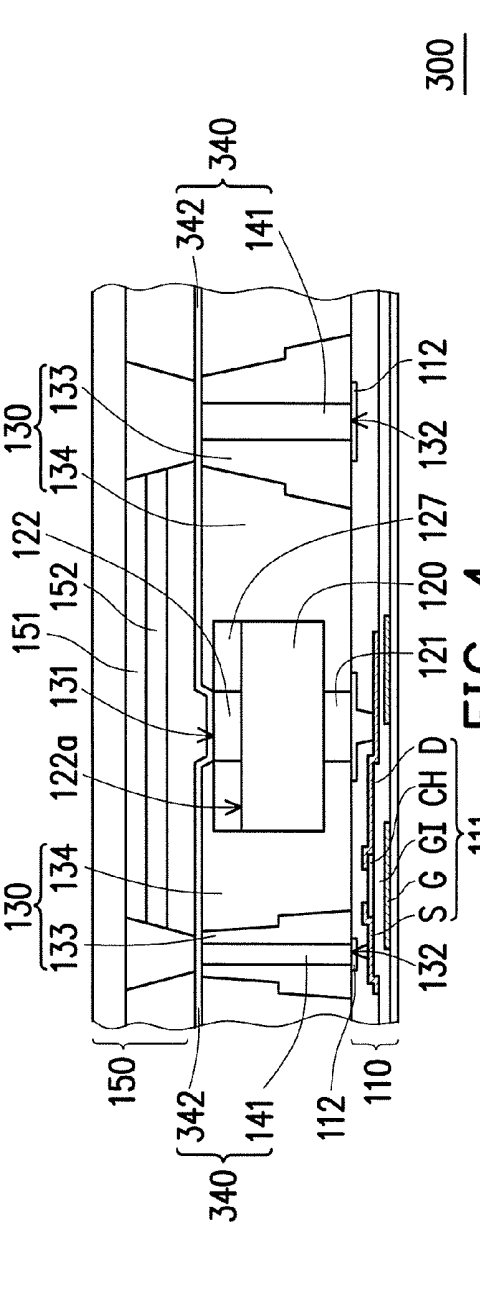
121
110
150

FIG. 3


300
340
342
141
130
133
134
122
151
152
131
122a
S G GI CH D
111
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112
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120
121
110
150

FIG. 4

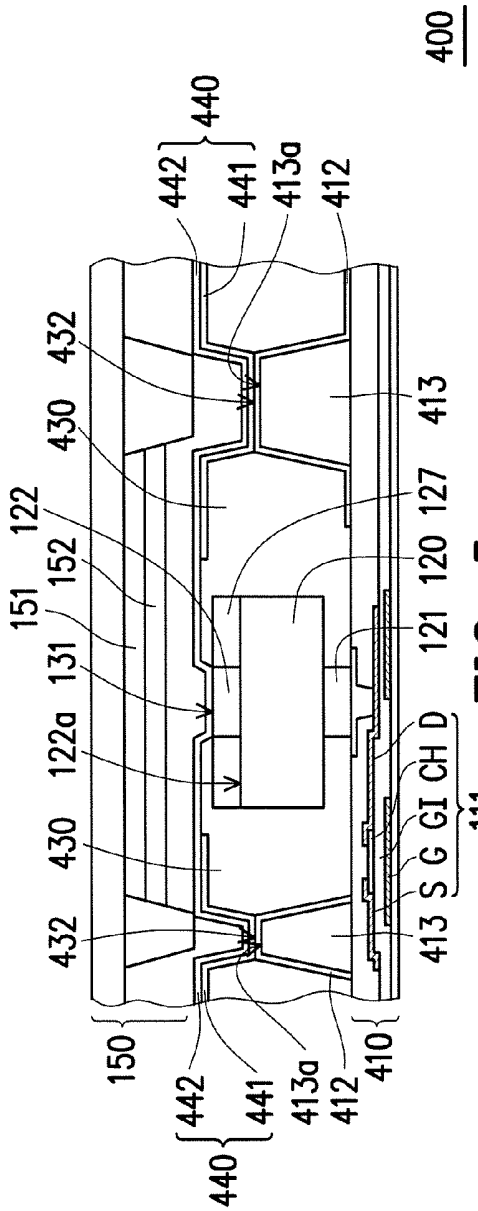

400
440
442
441
413a
412
432
430
413
122
151
152
127
120
131
121
122a
D
CH
GI
G
S
111
150
410

FIG. 5

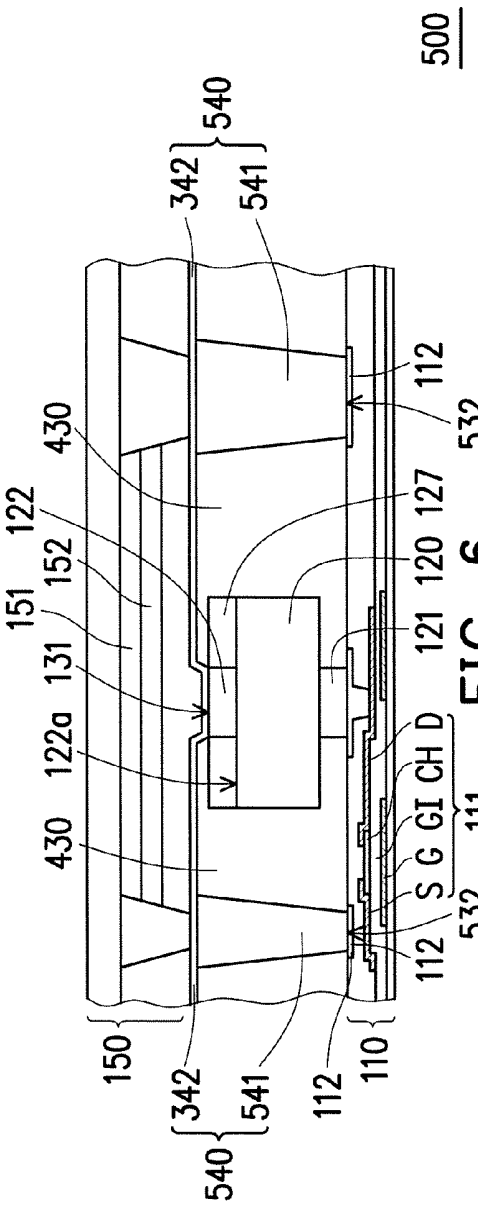

500
540
342
541
112
532
430
122
151
152
127
120
131
121
122a
D
CH
GI
G
S
111
150
110

FIG. 6

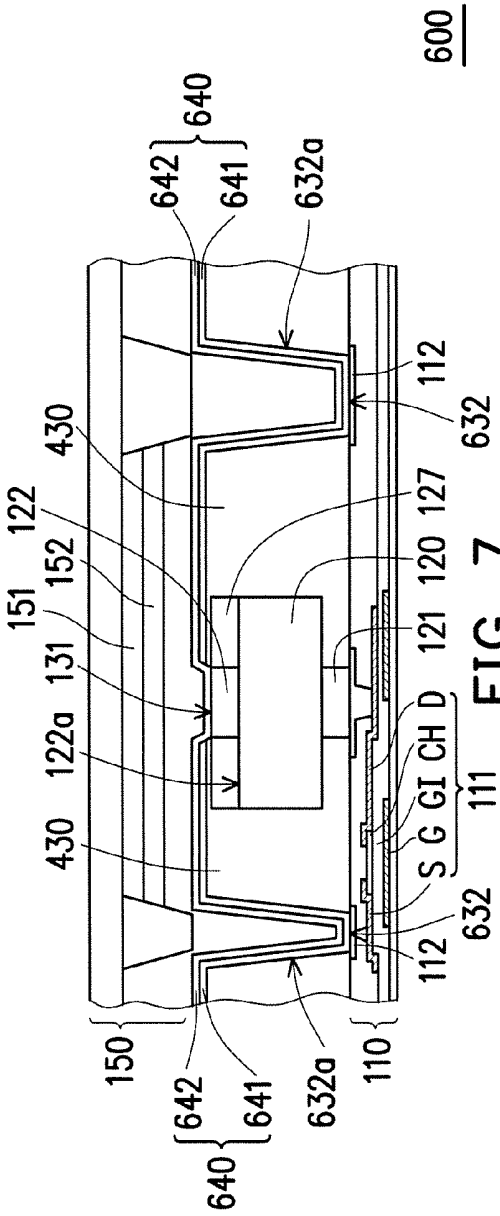

600
640
642
641
632a
112
632
430
122
151
152
131
127
120
121
S G GI CH D
111
150
110

FIG. 7

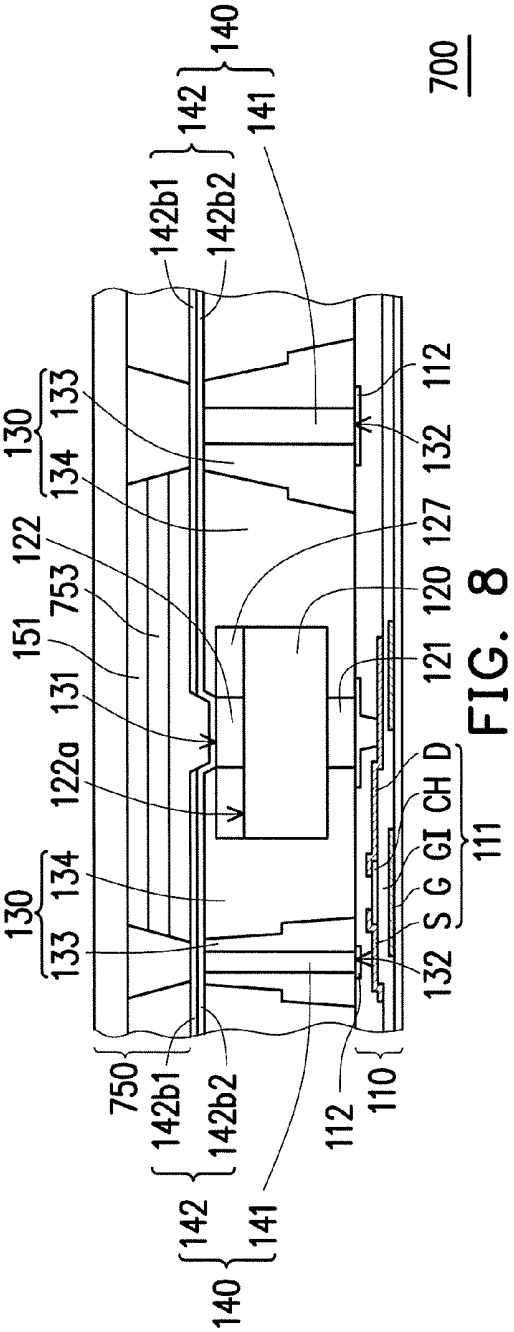

700
140
142
141
142b1
142b2
130
133
134
753
122
151
131
122a
127
120
121
S G GI CH D
111
132
112
750
110

FIG. 8

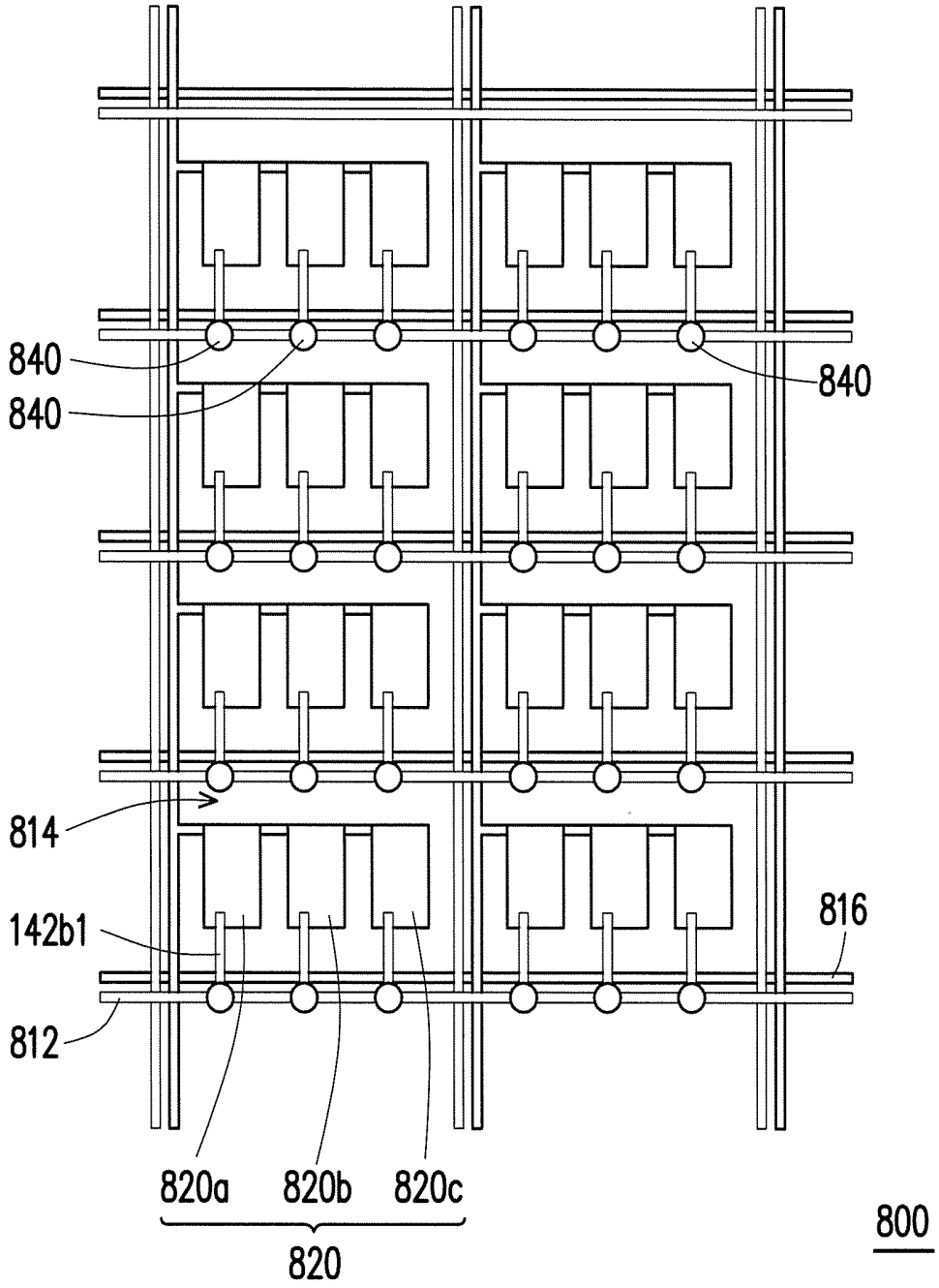


FIG. 9

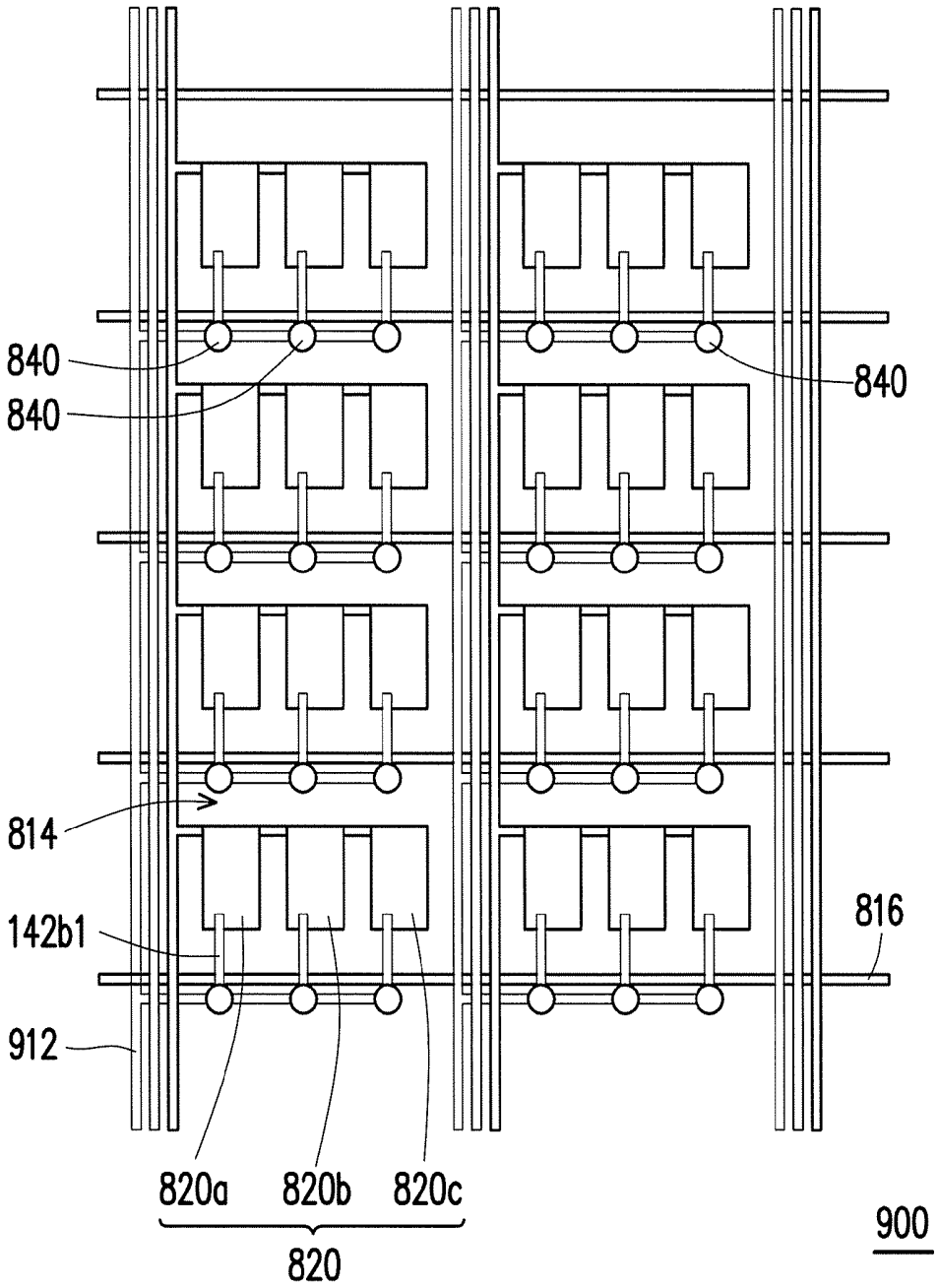


FIG. 10

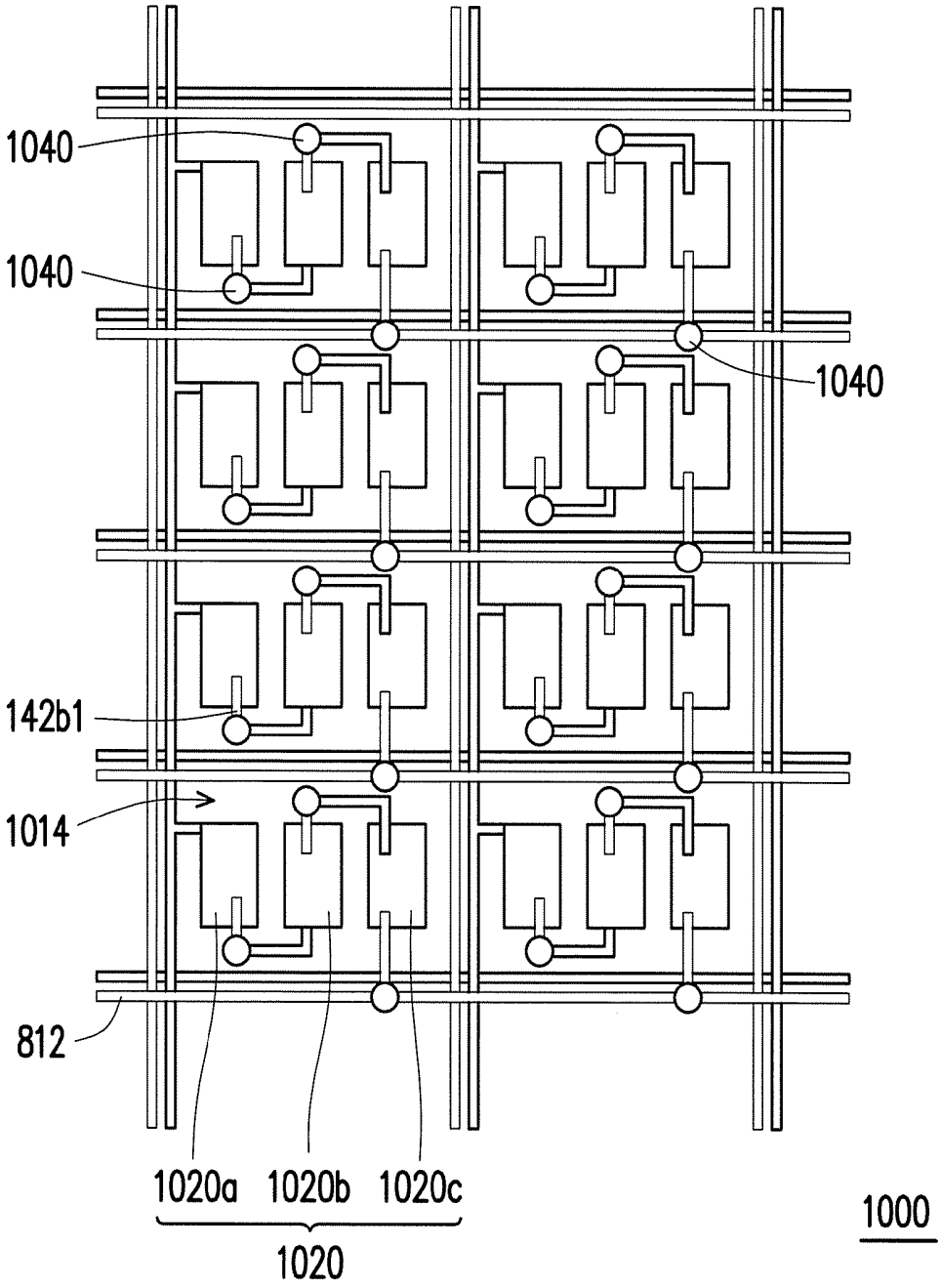
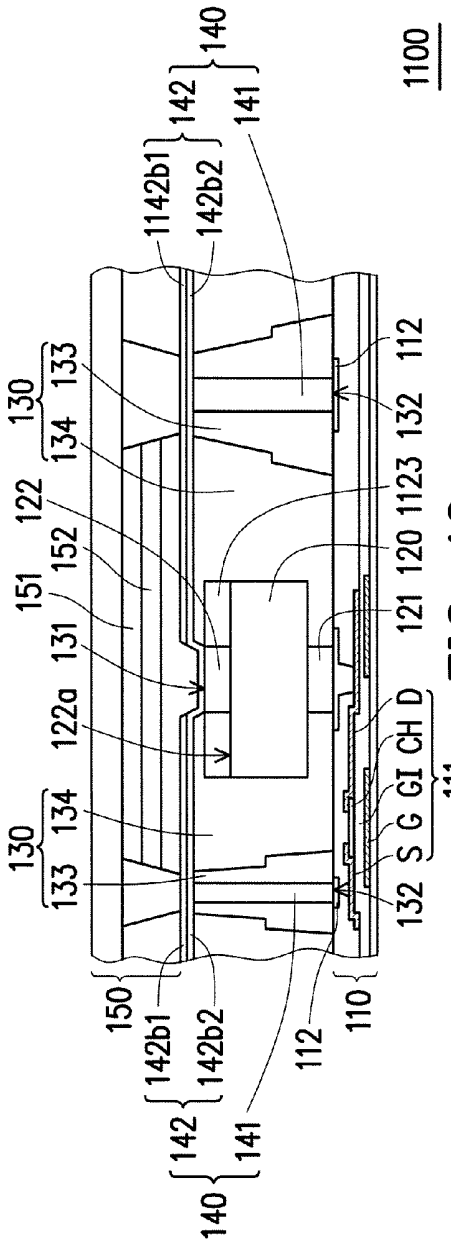


FIG. 11


1100
140
142
141
1142b1
142b2
130
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152
131
122a
111
S G GI CH D
132
112
1123
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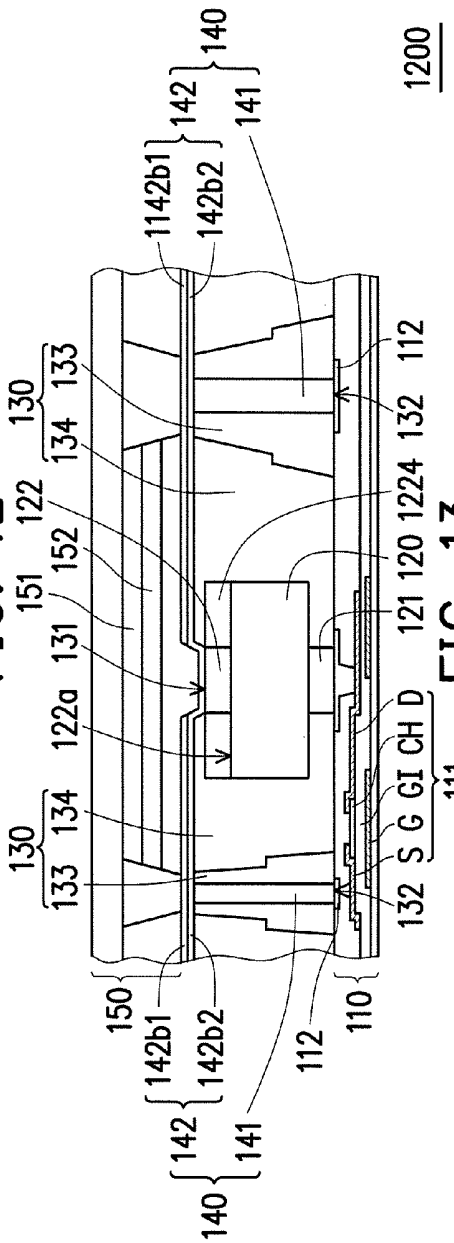
121
110
150

FIG. 12


1200
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142
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1142b1
142b2
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152
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122a
111
S G GI CH D
132
112
1224
120
121
110
150

FIG. 13

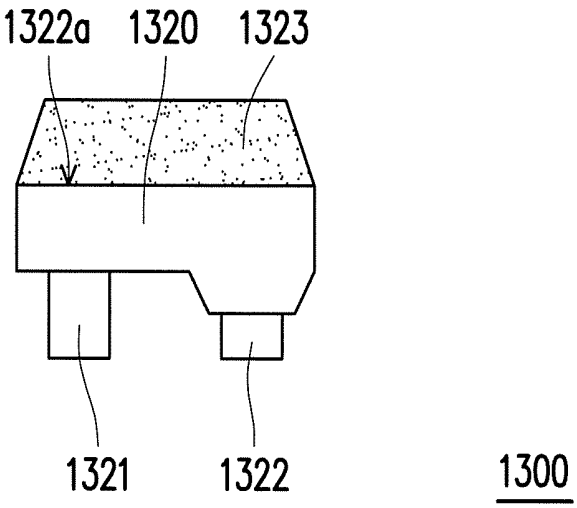

1322a
1320
1323
1321
1322
1300

FIG. 14

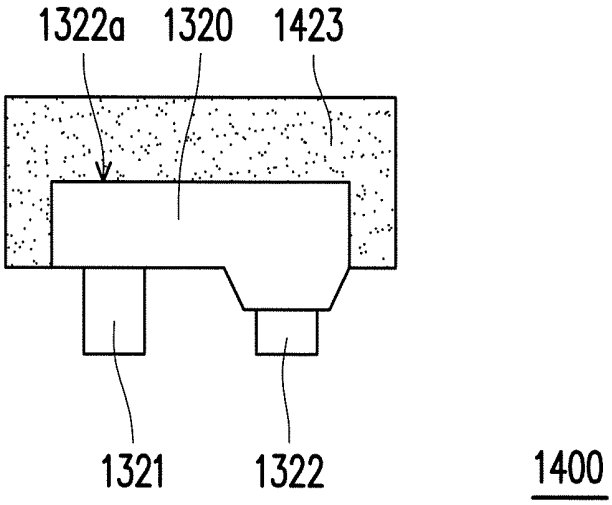
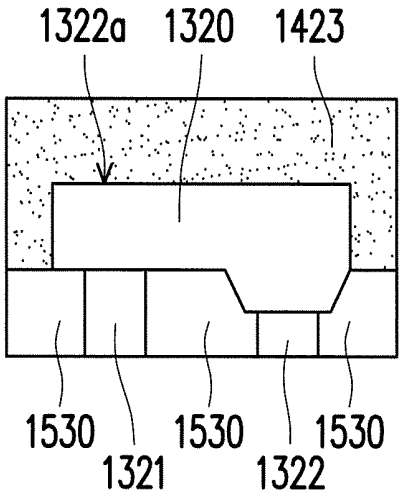

1322a
1320
1423
1321
1322
1400

FIG. 15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1321
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1322
1530
1500

FIG. 16

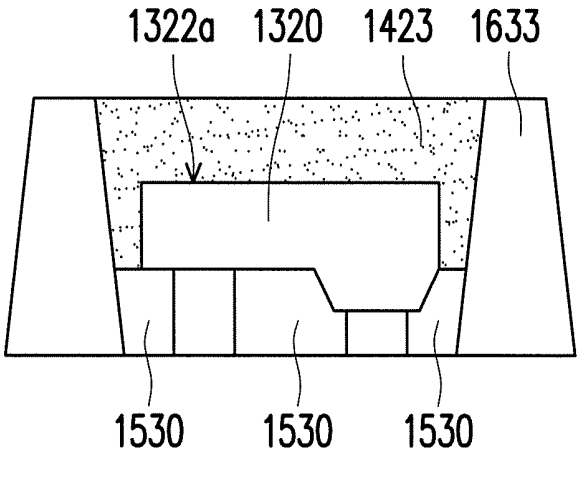

1322a
1320
1423
1633
1530
1530
1530
1600

FIG. 17

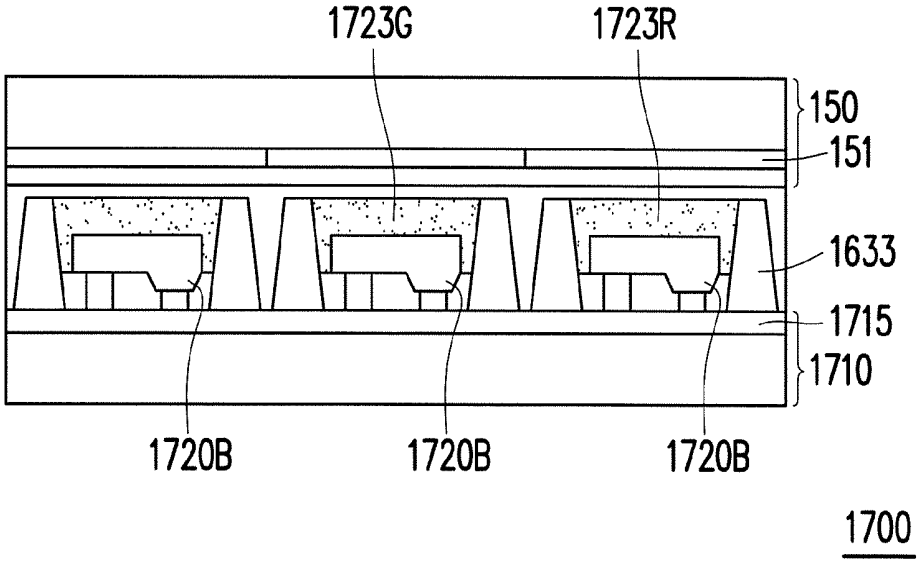

1723G
1723R
150
151
1633
1715
1710
1720B
1720B
1720B
1700

FIG. 18

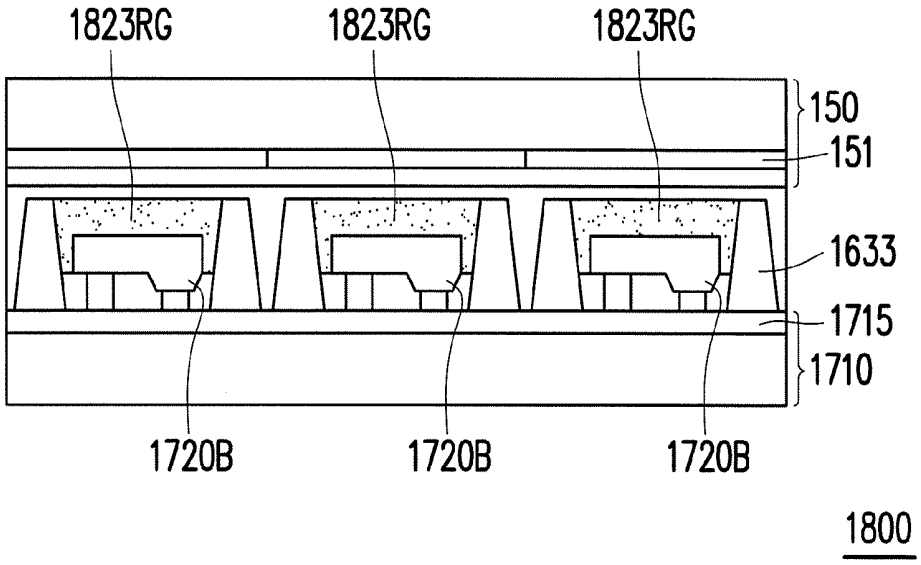
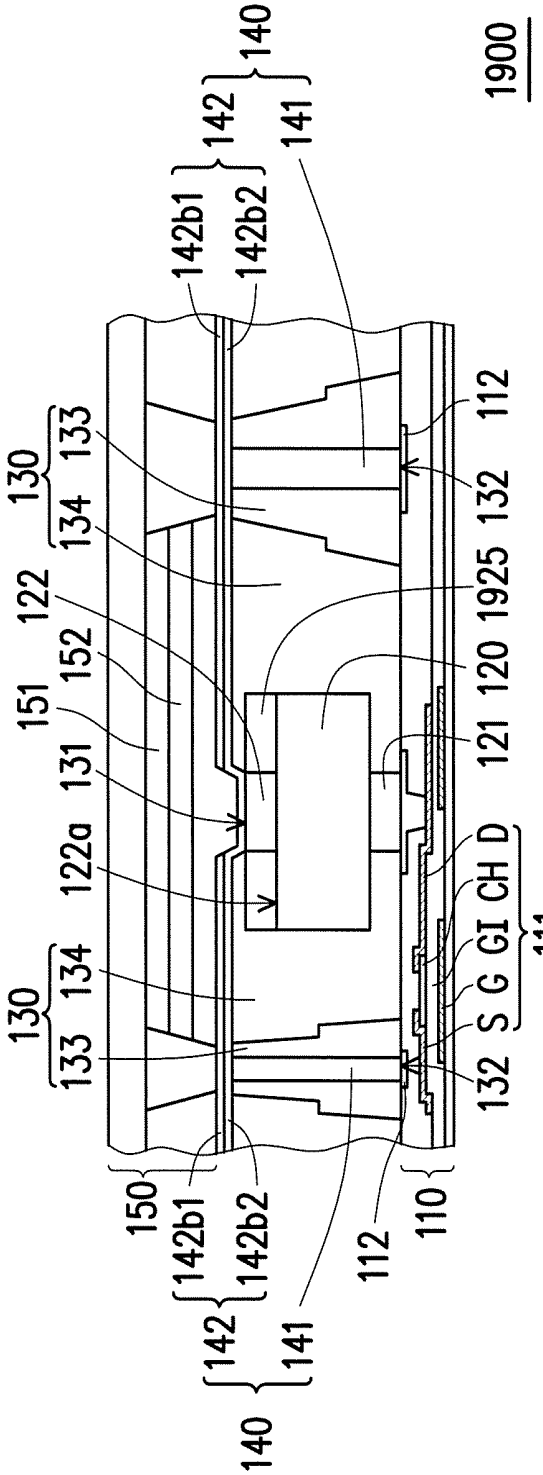

1823RG
1823RG
1823RG
150
151
1633
1715
1710
1720B
1720B
1720B
1800

FIG. 19


1900
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142b2
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1925
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121
D
CH
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G
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111
150
110

FIG. 20

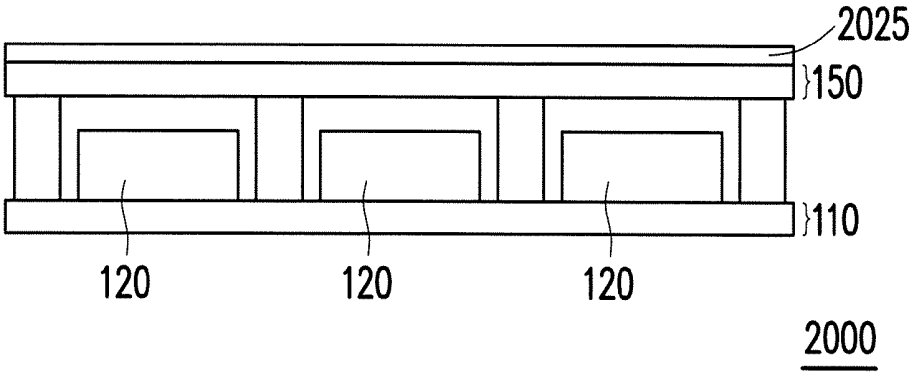


FIG. 21

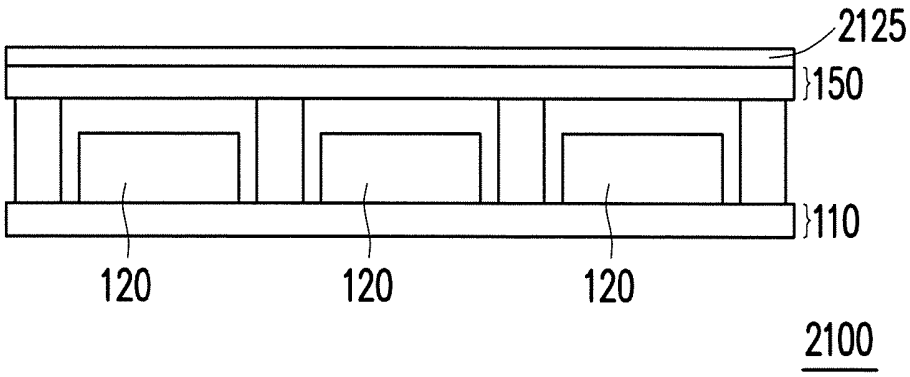
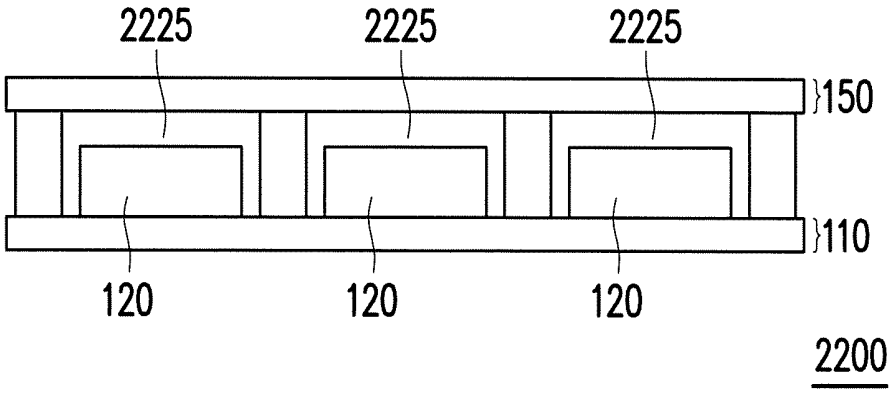


FIG. 22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120
120
2200

FIG. 23

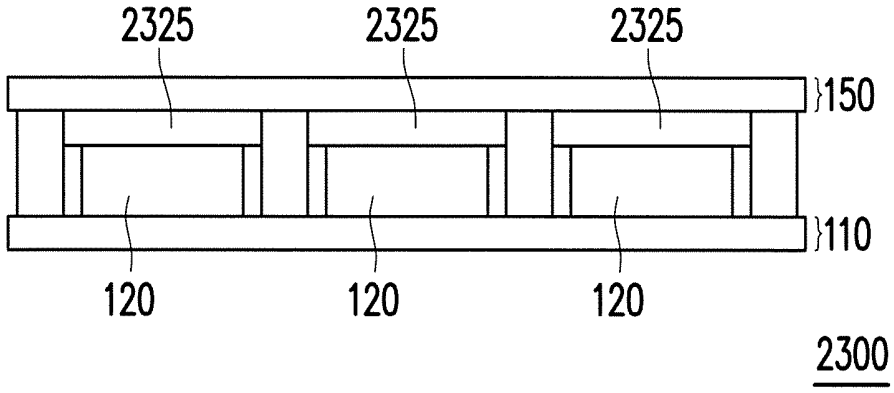

2325
2325
2325
150
110
120
120
120
2300

FIG. 24

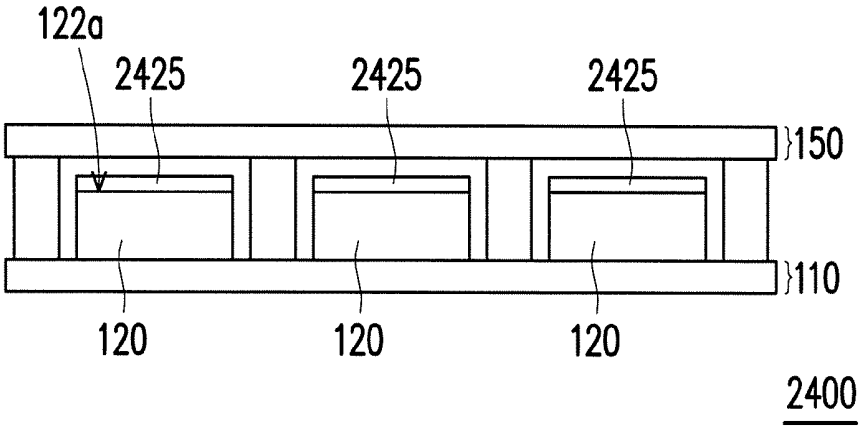
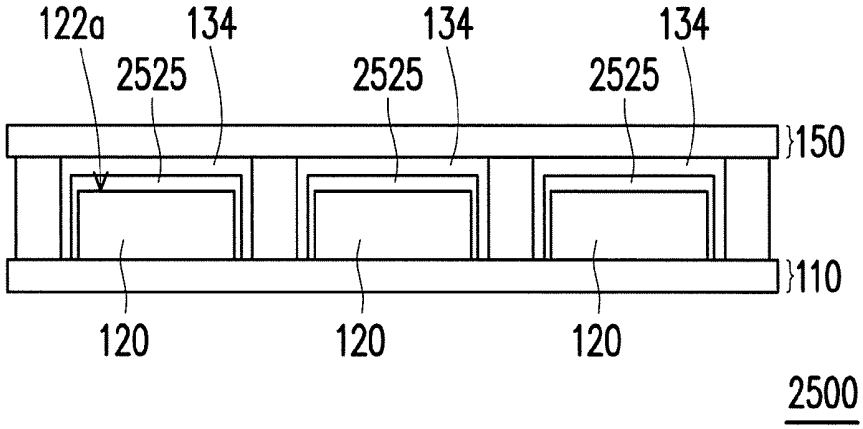

122a
2425
2425
2425
150
110
120
120
120
2400

FIG. 25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134
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134
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2525
2525
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120
120
120
2500

FIG. 26

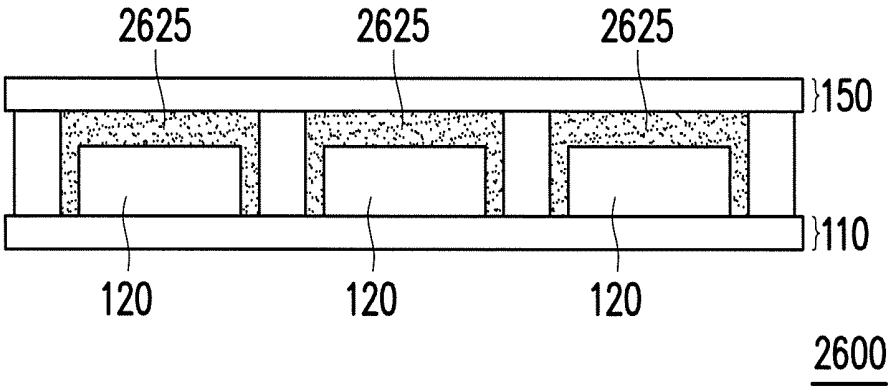
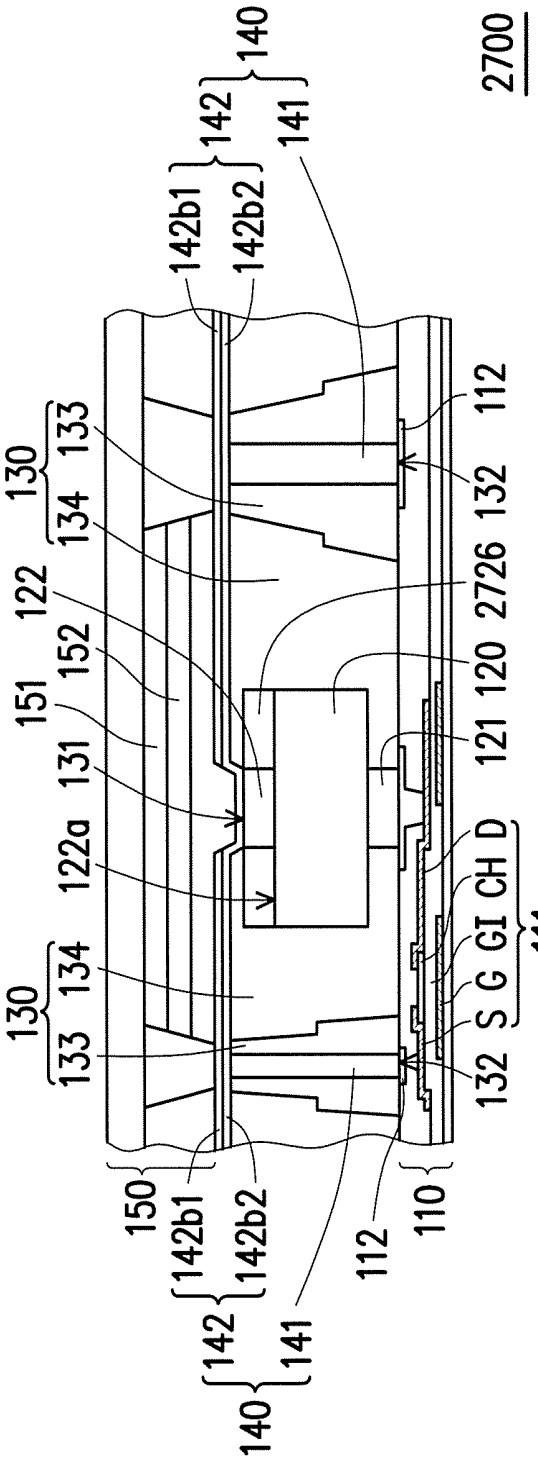


FIG. 27


2700
140
142
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142b1
142b2
130
133
134
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2726
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151
120
131
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D
CH
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G
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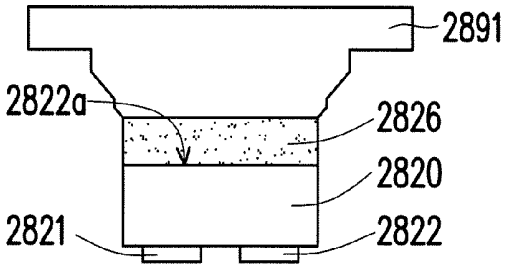
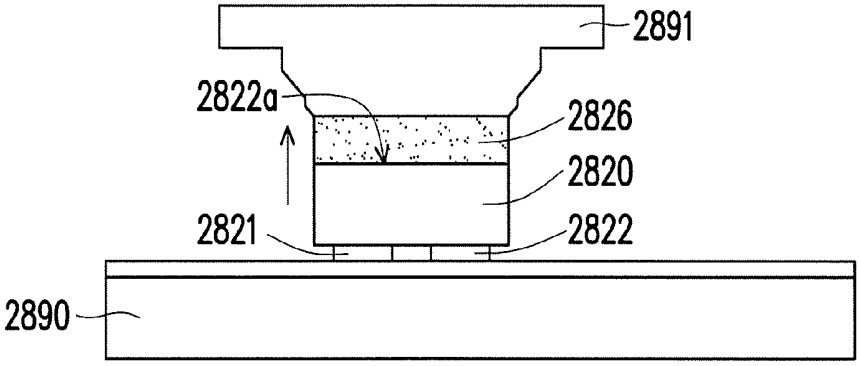
111
150
110

FIG. 28



2800

FIG. 29



2800

FIG. 30

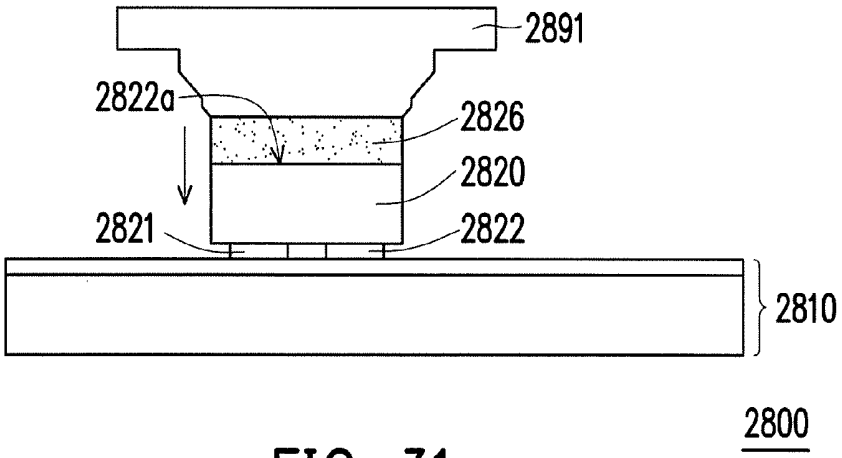

2891
2822a
2826
2820
2821
2822
2810
2800

FIG. 31

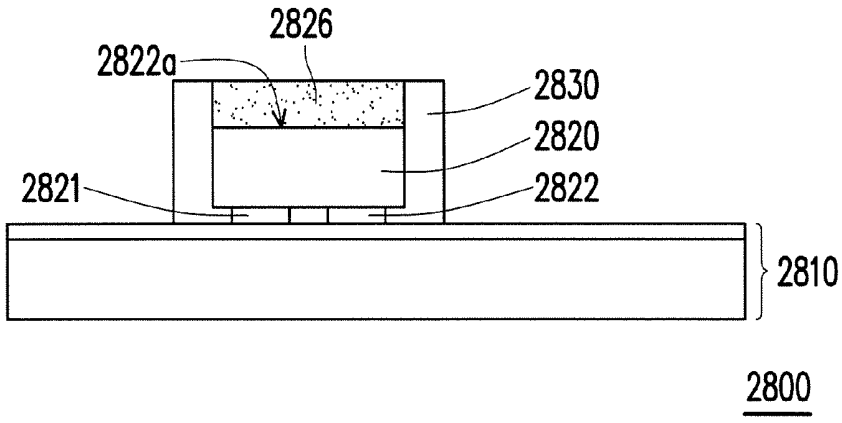

2826
2822a
2830
2820
2821
2822
2810
2800

FIG. 32

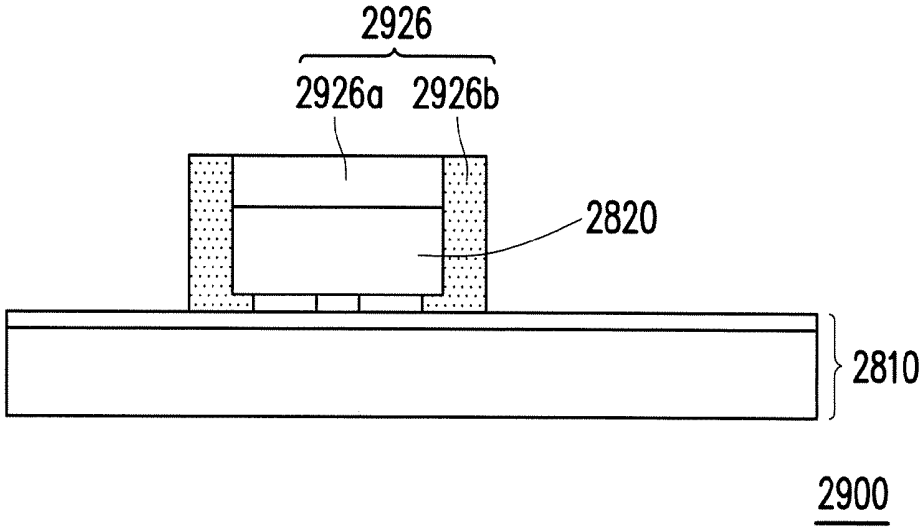

2926
2926a
2926b
2820
2810
2900

FIG. 33

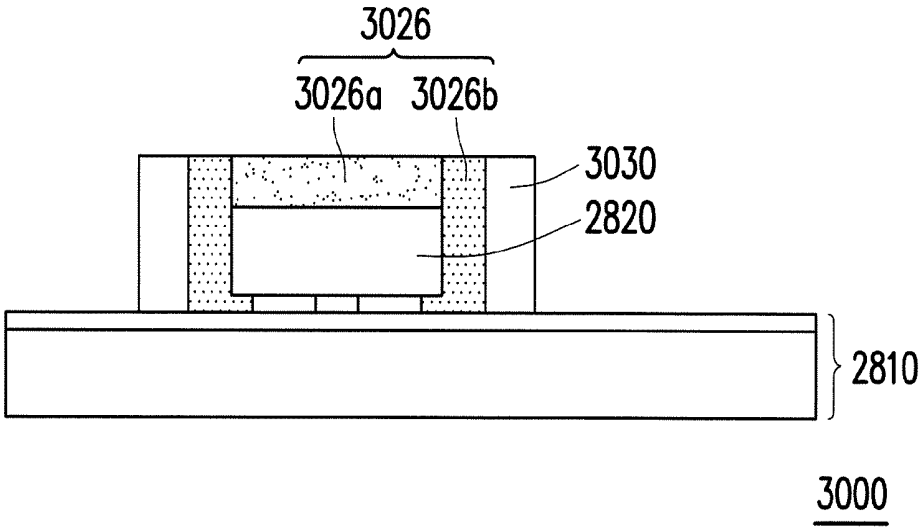

3026
3026a
3026b
3030
2820
2810
3000

FIG. 34

DISPLAY DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the priority benefits of U.S. provisional application Ser. No. 62/339,107, filed on May 20, 2016, U.S. provisional application Ser. No. 62/350,169, filed on Jun. 14, 2016, U.S. provisional application Ser. No. 62/361,543, filed on Jul. 13, 2016, and China application serial no. 201611031711.0, filed on Nov. 22, 2016. The entirety of each of the above-mentioned patent applications is hereby incorporated by reference herein and made a part of this specification.

TECHNICAL FIELD

[0002] The disclosure relates to a display device.

BACKGROUND

[0003] Light emitting diode (micro-LED) displays exhibit the characteristics of active light emission, high luminance, high contrast, and low power consumption, and are thus the display technologies in prosperous development in recent years. The technologies of the light emitting diode displays have become more and more matured through time. How to effectively reduce the electrical impedance to facilitate the performance of the light emitting diode has become an issue of the industry.

SUMMARY

[0004] The disclosure provides a display device capable of facilitating display performance.

[0005] A display device according to an embodiment of the disclosure includes a first substrate, a light emitting component, an insulating layer, and a conductive element. The first substrate has a driving component and a common line. The light emitting component is disposed on the first substrate and has a first electrode and a second electrode. The first electrode is electrically connected to the driving component. The insulating layer is disposed on the first substrate and has a first opening and a second opening. The first opening exposes the second electrode of the light emitting component. The second opening exposes the common line. The common line is electrically connected to the second electrode through the conductive element.

[0006] To make the above features and advantages of the disclosure more comprehensible, several embodiments accompanied with drawings are described in detail as follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The accompanying drawings are included to provide a further understanding of the disclosure, and are incorporated in and constitute a part of this specification. The drawings illustrate embodiments of the disclosure and, together with the description, serve to explain the principles of the disclosure.

[0008] FIG. **1** is a schematic partial cross-sectional view illustrating a display device according to a first embodiment of the disclosure.

[0009] FIG. **2** is a schematic top view illustrating the display device according to the first embodiment of the disclosure.

[0010] FIGS. **3** to **8** are schematic partial cross-sectional views illustrating a display device according to second to seventh embodiments of the disclosure.

[0011] FIGS. **9** to **11** are schematic views illustrating a partial layout of a display device according to eighth to tenth embodiments of the disclosure.

[0012] FIGS. **12** to **28** are schematic partial cross-sectional views illustrating a display device according to eleventh to twenty-seventh embodiments of the disclosure.

[0013] FIGS. **29** to **32** are schematic partial cross-sectional views illustrating a manufacturing process of a display device according to a twenty-eighth embodiment of the disclosure.

[0014] FIG. **33** is a schematic partial cross-sectional view illustrating a display device according to a twenty-ninth embodiment of the disclosure.

[0015] FIG. **34** is a schematic partial cross-sectional view illustrating a display device according to a thirtieth embodiment of the disclosure.

DETAILED DESCRIPTION OF DISCLOSED EMBODIMENTS

[0016] Reference will now be made in detail to the present preferred embodiments of the disclosure, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers are used in the drawings and the description to refer to the same or like parts.

[0017] The foregoing and other technical contents, features, and effects of the disclosure will be clearly described in the following detailed descriptions of the embodiments with reference to the accompanying drawings. The language used to describe the directions such as up, down, left, right, front, back or the like in the reference drawings is regarded in an illustrative rather than in a restrictive sense. Therefore, the directional wording is used to illustrate rather than limit the disclosure. For example, in the following descriptions, the description that a first object is on a second object covers the embodiment where the first object and the second object are in direct contact and the embodiment where the first object and the second object are not in direct contact. Besides, in the embodiment where the first object and the second object are not in direct contact, there may be another object or simply a space between the first object and the second object.

[0018] FIGS. **1** and **2** are respectively a schematic partial cross-sectional view and a schematic top view illustrating a first embodiment of the disclosure. Referring to FIG. **1**, the display device **100** includes a first substrate **110**, a light emitting component **120**, an insulating layer **130**, and a conductive element **140**. The first substrate **110** has a driving component **111** and a common line **112**. The driving component **110**, for example, includes a gate G, a gate insulating layer GI, a channel layer CH, a source S and a drain D. The channel layer CH is located above the gate G. The gate insulating layer GI separates the gate G from the channel layer CH, the source S, and the drain D. A portion of each of the source S and the drain D is located above the channel layer CH. The light emitting component **120** is disposed on the first substrate **110** and has a first electrode **121** and a second electrode **122**. The first electrode **121** is disposed on the first substrate **110** and located between the first substrate **110** and the light emitting component **120**. The first electrode **121** is electrically connected to the driving component **111**. The insulating layer **130** is disposed on the first sub-

strate **110** and has a first opening **131** and a second opening **132**. The first opening **131** exposes the second electrode **122** of the light emitting component **120**, and the second opening **132** exposes the common line **112**. The conductive element **140** is disposed on the first substrate **110**, and the conductive element **140** extends from the common line **112** to the second electrode **112**. The common line **112** is electrically connected to the second electrode **122** through the conductive element **140**.

[0019] In the display device **100** of the embodiment, the first substrate **110** has the common line **112** and the driving component **111**, the conductive element **140** may extend upward from the common line **112** and be electrically connected with the second electrode **122**. Thus, it neither requires to dispose the common line **112** or a common electrode to another substrate opposite to the first substrate **110**, nor requires to align and bond the another substrate with the second electrode **122**. According, the manufacturing time and cost are saved.

[0020] The light emitting component **120** of the embodiment includes, but is not limited to, a micro light emitting diode (Micro-LED). Here, a vertical Micro-LED is described in the embodiment as an example. However, it should be understood that the disclosure is not limited thereto. In other embodiments, the light emitting component **120** may also be a flip-chip Micro-LED. In another embodiment, an organic light emitting diode may also be adopted. Besides, in an embodiment, a length and a width of the light emitting component **120** may be respectively smaller than 300 μm, whereas a height of the light emitting component **120** may be smaller than 20 μm. The driving component **111** of the embodiment includes, for example, an amorphous silicon thin film transistor, an oxide semiconductor thin film transistor, a low-temperature polycrystalline silicon thin film transistor, a silicon-based thin film transistor, a microcrystalline silicon thin film transistor, or other driving components. Besides, in the embodiment, the driving component **111** is a bottom gate transistor. However, the disclosure is not limited thereto. In other embodiments, the driving component **111** may also be a top gate transistor.

[0021] In the embodiment, the conductive element **140** includes a first portion **141** and a second portion **142**. The first portion **141** is located in the second opening **132**, and the second portion **142** is located outside the second opening **132**. In other words, a portion of the conductive element **140** filled in the second opening **132** is referred to as the first portion **141**, and a portion of the conductive element **140** formed outside the second opening **132** is referred to as the second portion **142**. The first portion and the second portion may be formed in a single process or in two stages. A material of the first portion **141** may include metal, such as gold, silver, titanium, nickel, copper, aluminum, molybdenum, palladium, neodymium, indium, tin, or a conductive oxide thereof. However, it should be noted that the material of the first portion is not limited thereto. The first portion **141** is formed in the second opening **132** by performing an electroplating process, for example. The first portion **141** is configured to electrically connect a transparent conductive material **142***b***2** and the common line **112**.

[0022] In this embodiment, the second portion **142** is a composite layer of a metal **142***b***1** and the transparent conductive material **142***b***2**. In the embodiment, the transparent conductive material **142***b***2** is formed as a complete surface (as shown in FIG. **1**), whereas the metal **142***b***1** is arranged to be grid-like (as shown in FIG. **2**). The metal **142***b***1** can reduce the influence of a high impedance of the transparent conductive material **142***b***2** on electrical connection between the light emitting component **120** and the common line **112**, and thereby facilitates the display quality of the display device **100**. Besides, since the metal **142***b***1** may shield and reflect light, designing the metal **142***b***1** to be grid-like may reduce the influence of the metal **142***b***1** on the aperture opening rate and display style. In another embodiment, an oxidation layer or a nitridation layer may be deposited on the metal **142***b***1**, so as to form a black metal layer reducing the influence of the metal **142***b***1** on the aperture opening rate and display style.

[0023] Referring to FIGS. **1** and **2**, in the embodiment, the first portion **141** is a metal column, for example. However, the disclosure is not limited thereto. The first portion **141** may be formed by performing a chemical deposition process and an electroplating process. When the display device **100** includes a plurality of the light emitting components **120** arranged into a plurality of groups, an area with the groups of the light emitting components **120** are referred to as an active area **113**, namely an area for displaying a frame. The first portion **141** of the conductive element **140** may be disposed on a boundary of the active area **113** to reduce the influence on the displayed frame.

[0024] In the embodiment, the insulating layer **130** includes a light shielding column **133** and a filling material **134**. The filling material **134** is filled between the light emitting component **120** and the light shielding column **133**. The filling material **134** has the first opening **131**, and the light shielding column **133** has the second opening **132**. The filling material **134** may include a polymer, such as resin. However, the disclosure is not limited thereto. When the display device **100** has the light emitting components **120**, disposing the light shielding column **133** allows to shield light emitted by the nearby light emitting components, so as to reduce the interference between the adjacent light emitting components **120**. In an embodiment, the light shielding column **133** is a black material (BM) and able to effectively shield the light emitted by the nearby light emitting components. The light emitting component **120** includes, for example, a light emitting diode emitting white light, red light, green light, blue light, or light in other wave bands. However, the disclosure is not limited thereto.

[0025] In the embodiment, the light emitting component **120** includes a protection layer **127** disposed on a light emitting surface **122***a* of the light emitting component **120** and surrounding the second electrode **122**. The second electrode **122** is electrically connected to the conductive element **140** through the first opening **131**, so that the light emitting component **120** is electrically connected to the common line **112**. The protection layer **127** includes, for example, SiO_2 or SiN_x. However, the disclosure is not limited thereto.

[0026] In the embodiment, the display device **100** further includes a second substrate **150** having a color filter film **151**. The light emitting component **120** is located between the first substrate **110** and the color filter film **151**. In addition, an orthogonal projection of the color filter film **151** on the first substrate **110** overlaps with an orthogonal projection of the light emitting component **120** on the first substrate **110**. The orthogonal projection refers to a combination of projection points of projection lines parallel to each other at respective points passing through a projection

object (the color filter film **151** and the light emitting component **120** here) on a projection surface (the surface of the first substrate **110** here), the projection lines parallel to each other being perpendicular to the projection surface. In other words, the orthogonal projection of the color filter film **151** projected onto the first substrate **110** through the parallel projection lines overlaps with the orthogonal projection of the light emitting component **120** projected onto the first substrate **110** through the parallel projection lines. In the embodiment, after the light emitted by the light emitting component **120** passes through the protection layer **127**, the light may firstly pass through the color filter film **151** and then be emitted from the second substrate **150**. Accordingly, a specific color is displayed.

[0027] In the embodiment, the second substrate **150** further includes a light scattering layer and/or a quantum dot layer located between the color filter layer **151** and the light emitting component **120**. The embodiment takes a light scattering layer **152** as an example. However, the disclosure is not limited thereto. After the light emitted by the light emitting component **120** passes through the protection layer **127**, the light may firstly pass through the light scattering layer **152**, so that the light emitted from the display device **100** may become more uniform and gentle.

[0028] FIG. **3** is a schematic partial cross-sectional view illustrating a display device according to a second embodiment of the disclosure. In a display device **200** of FIG. **3**, the same components are configured and function in a way similar to that of the embodiment of FIG. **1**. For example, the light scattering layer **152** is similar to the light scattering layer **152** of FIG. **1**. Therefore, details in this respect will not be repeated. In the embodiment, the insulating layer **130** includes a plurality of the light shielding columns **133** and a plurality of the filling materials **134**. The conductive element **140** includes a plurality of the first portions **141**, so as to further reduce an overall impedance of the conductive element **140**. The embodiment is applicable in a serial circuit.

[0029] FIG. **4** is a schematic partial cross-sectional view illustrating a display device according to a third embodiment of the disclosure. In a display device **300** shown in FIG. **4**, the same components are configured and function in a way similar to that of the embodiment of FIG. **3**. Thus, details in this respect will not be repeated in the following. In the embodiment, a second portion **342** of a conductive element **340** may comprise a uniform transparent conductive layer, so as to reduce the complexity of the conductive element **340** to thereby simplify and facilitate the overall manufacturing process of the display device **300**.

[0030] FIG. **5** is a schematic partial cross-sectional view illustrating a display device according to a fourth embodiment of the disclosure. In a display device **400** shown in FIG. **5**, the same components are configured and function in a way similar to that of the embodiment of FIG. **1**. Thus, details in this respect will not be repeated in the following. In the embodiment, an insulating layer **430** is a uniform material layer. The display device **400** further includes a black matrix **413**. The common line **412**is located between the black matrix **413** and a conductive element **440**. The common line **412** climbs up to a top surface **413***a* of the black matrix **413**, and a second opening **432** is located above the top surface **413***a* of the black matrix **413**. In the embodiment, the common line **412** disposed on the top surface **413***a* of the black matrix **413** is firstly electrically connected with a first portion **441** of the conductive element **440** and then electrically connected with the second electrode **122** through a second portion **442** of the conductive element **440**.

[0031] FIG. **6** is a schematic partial cross-sectional view illustrating a display device according to a fifth embodiment of the disclosure. In a display device **500** shown in FIG. **6**, the same components are configured and function in a way similar to that of the embodiment of FIG. **4**. Thus, details in this respect will not be repeated in the following. In the embodiment, a first portion **541** of a conductive element **540** fills a second opening **532**. In the embodiment, merely metal is used in the second opening **532**, so as to further reduce the structural complexity and facilitate the efficiency of the overall manufacturing process of the display device **500**.

[0032] FIG. **7** is a schematic partial cross-sectional view illustrating a display device according to a sixth embodiment of the disclosure. In a display device **600** shown in FIG. **7**, the same components are configured and function in a way similar to that of the embodiment of FIG. **6**. Thus, details in this respect will not be repeated in the following. In the embodiment, a first portion **641** and a second portion **642** of a conductive element **640** only cover a wall **632***a* of a second opening **632**. In the embodiment, the first portion **641** only requires a smaller amount of material to reduce the cost of material.

[0033] FIG. **8** is a schematic partial cross-sectional view illustrating a display device according to a seventh embodiment of the disclosure. In a display device **700** shown in FIG. **8**, the same components are configured and function in a way similar to that of the embodiment of FIG. **3**. Thus, details in this respect will not be repeated in the following. In the embodiment, a second substrate **750** further includes a light scattering layer and/or a quantum dot layer **753** located between the color filter layer **151** and the light emitting component **120**. The embodiment takes the quantum dot layer **753** as an example. However, the disclosure is not limited thereto. After the light emitted by the light emitting component **120** passes through the protection layer **127**, the light may pass through the quantum dot layer **753** capable of converting the wavelength of the light passing through. Accordingly, the display device **700** may display a desired color.

[0034] FIG. **9** is a schematic view illustrating a partial layout of a display device according to an eighth embodiment of the disclosure. In a display device **800** shown in FIG. **9**, the same components are configured and function in a way similar to that of the embodiment of FIG. **2**. Thus, details in this respect will not be repeated in the following. In the embodiment, a plurality of light emitting components **820** are provided. The light emitting components **820** include a plurality of first light emitting components **820***a*, a plurality of second light emitting components **820***b*, and a plurality of third light emitting components **820***c*. A first substrate **810** has a plurality of pixel areas **814** arranged into groups. Each of the pixel areas **814** has one of the first light emitting components **820***a*, one of the second light emitting components **820***b*, and one of the third light emitting components **820***c* connected in parallel. The first light emitting components **820***a*, the second light emitting components **820***b*, and the third light emitting components **820***c* are respectively configured to directly provide red light, green light, and blue light or configured together with a wavelength conversion layer or a color filter film to provide red

light, green light, and blue light, for example. A common line **812** is arranged laterally, i.e., parallel to a scan line **816**, and is electrically connected to respective conductive elements **840**.

[0035] In the embodiment, when one of the first light emitting component **820***a*, the second light emitting component **820***b*, and the third light emitting component **820***c* is damaged, due to the characteristic of a parallel connection circuit, light emitting capabilities of the rest of the first light emitting component **820***a*, the second light emitting component **820***b*, and the third light emitting component **820***c* are not affected. Accordingly, the influence when some of the light emitting components **820** are damaged on the display device **800** is reduced.

[0036] FIG. **10** is a schematic view illustrating a partial layout of a display device according to a ninth embodiment of the disclosure. In a display device **900** shown in FIG. **10**, the same components are configured and function in a way similar to that of the embodiment of FIG. **9**. Thus, details in this respect will not be repeated in the following. In the embodiment, a common line **912** is arranged vertically, i.e., perpendicular to the scan line **816**. Therefore, the embodiment is able to achieve a similar function with different parallel connection structures to allow the designer to bring forth a more suitable arrangement based on practical needs.

[0037] FIG. **11** is a schematic view illustrating a partial layout of a display device according to a tenth embodiment of the disclosure. In a display device **1000** shown in FIG. **11**, the same components are configured and function in a way similar to that of the embodiment of FIG. **9**. Thus, details in this respect will not be repeated in the following. In the embodiment, light emitting components **1020** are serially connected through conductive elements **1040**. In each pixel area **1040**, a first light emitting component **1020***a*, a second light emitting component **1020***b*, and a third light emitting component **1020***c* in serial connection are disposed.

[0038] FIG. **12** is a schematic partial cross-sectional view illustrating a display device according to an eleventh embodiment of the disclosure. In a display device **1100** shown in FIG. **12**, the same components are configured and function in a way similar to that of the embodiment of FIG. **3**. Thus, details in this respect will not be repeated in the following. In the embodiment, a wavelength conversion layer **1123** or a color filter film is disposed on the light emitting surface **122***a* of the light emitting component **120**. The embodiment takes the wavelength conversion layer **1123** as an example. The wavelength conversion layer **1123** may be one of a phosphorous layer, a fluorescent layer, and a quantum dot layer. However, the disclosure is not limited thereto. In the embodiment, the wavelength conversion layer **1123** may convert the light emitted by the light emitting component **120** through the light emitting surface **122***a* into light of different colors and emit the converted light. By directly disposing the wavelength conversion layer **1123** on the light emitting surface **122***a* of the light emitting component **120**, an alignment process required when the two components are manufactured separately may be omitted. Therefore, the overall manufacturing process of the display device **1100** becomes easier. Besides, by incorporating the wavelength conversion layer **1123** onto the light emitting component **120** in advance, the waste of material may be reduced, making the overall material usage more efficient.

[0039] FIG. **13** is a schematic partial cross-sectional view illustrating a display device according to a twelfth embodiment of the disclosure. In a display device **1200** shown in FIG. **13**, the same components are configured and function in a way similar to that of the embodiment of FIG. **12**. Thus, details in this respect will not be repeated in the following. In the embodiment, a wavelength conversion layer or a color filter film **1224** is disposed on the light emitting surface **122***a* of the light emitting component **120**. The embodiment takes the color filter film **1224** as an example. However, the disclosure is not limited thereto. The light emitted from the light emitting surface **122***a* is configured to enter the color filter film **1224**. The color filter film **1224** only allows light in a specific color to pass through, thereby enabling colored display.

[0040] FIG. **14** is a schematic partial cross-sectional view illustrating a display device according to a thirteenth embodiment of the disclosure. In the embodiment, a first electrode **1321** and a second electrode **1322** of a light emitting component **1320** are located on the same side. A wavelength conversion layer **1323** is disposed on a light emitting surface **1322***a* of the light emitting component **1320**. By disposing the wavelength conversion layer **1323** on the light emitting surface **1322***a* of the light emitting component **1320**, a wavelength conversion layer on the second substrate may be omitted, so as to reduce the waste of material and the cost.

[0041] FIG. **15** is a schematic partial cross-sectional view illustrating a display device according to a fourteenth embodiment of the disclosure. In a display device **1400** shown in FIG. **15**, the same components are configured and function in a way similar to that of the embodiment of FIG. **14**. Thus, details in this respect will not be repeated in the following. In the embodiment, a wavelength conversion layer **1423** further covers a side surface of the light emitting component **1320**. By increasing a coverage area of the wavelength conversion layer **1423**, the display performance of the display device **1400** is facilitated.

[0042] FIG. **16** is a schematic partial cross-sectional view illustrating a display device according to a fifteenth embodiment of the disclosure. In a display device **1500** shown in FIG. **16**, the same components are configured and function in a way similar to that of the embodiment of FIG. **15**. Thus, details in this respect will not be repeated in the following. In the embodiment, an insulating layer **1530** is filled around the light emitting component **1320**. For example, the insulating layer **1530** is a polymer, such as resin, so as to facilitate electrical insulation and overall structural strength. However, the disclosure is not limited thereto.

[0043] FIG. **17** is a schematic partial cross-sectional view illustrating a display device according to a sixteenth embodiment of the disclosure. In a display device **1600** shown in FIG. **17**, the same components are configured and function in a way similar to that of the embodiment of FIG. **16**. Thus, details in this respect will not be repeated in the following. In the embodiment, the display device **1600** further includes a light shielding column **1633** disposed around the light emitting component **1320**, so as to prevent the adjacent light emitting components **1320** from interfering each other.

[0044] FIG. **18** is a schematic partial cross-sectional view illustrating a display device according to a seventeenth embodiment of the disclosure. In the embodiment, a first substrate **1710** includes an anisotropic conductive film **1715**. The light emitting component is electrically connected with circuits on the first substrate through the anisotropic conductive film **1715**. The light emitting component is a blue

light emitting diode **1720**B, and the wavelength conversion layer includes a red wavelength conversion layer **1723**R and a green wavelength conversion layer **1723**G. Light emitted by the blue light emitting diode **1720**B is absorbed by the red wavelength conversion layer **1723**R or the green wavelength conversion layer **1723**G, and the red wavelength conversion layer **1723**R or the green wavelength conversion layer **1723**G emits red light or green light. After the color filter film **151** located at the second substrate **150** receives the light emitted from the wavelength conversion layer, the color filter film **151** filters light again.

[0045] FIG. **19** is a schematic partial cross-sectional view illustrating a display device according to an eighteenth embodiment of the disclosure. In a display device **1800** shown in FIG. **19**, the same components are configured and function in a way similar to that of the embodiment of FIG. **18**. Thus, details in this respect will not be repeated in the following. In the embodiment, the wavelength conversion layer is a red and green wavelength conversion layer **1823**RG formed by mixing different materials. Light passing through the red and green wavelength conversion layer **1823**RG is further filtered by the color filter film **151** for colored display. In the embodiment, a red quantum dot and a green quantum dot may be mixed to form the red and green wavelength conversion layer **1823**RG. However, the disclosure is not limited thereto. In other embodiments, it is also plausible to form a wavelength conversion layer having a red quantum dot and then form a wavelength conversion layer having a green quantum dot. Alternatively, the layers may be formed in a reversed order.

[0046] FIG. **20** is a schematic partial cross-sectional view illustrating a display device according to a nineteenth embodiment of the disclosure. In a display device **1900** shown in FIG. **20**, the same components are configured and function in a way similar to that of the embodiment of FIG. **12**. Thus, details in this respect will not be repeated in the following. In the embodiment, an ultraviolet light resistant layer **1925** is disposed on the light emitting surface **122***a* of the light emitting component **120**. With such configuration, ambient incident light whose wavelength is shorter than a wavelength of emission of the light emitting component or the quantum dot may be prevented from being irradiated to the light emitting component **120** and generating redundant visible light. Accordingly, the display effect of the display device **1900** is facilitated. For example, the ambient ultraviolet light may be irradiated to the light emitting component **120**, and the ultraviolet light has a shorter wavelength than the wavelength of emission of the light emitting component or the quantum dot. Thus, the ambient ultraviolet light may be converted into redundant visible light by the light emitting component or the quantum dot, and the display effect may thus be affected. In another embodiment, the ultraviolet light resistant layer **1925** may be disposed on the second substrate. Accordingly, before being irradiated to the quantum dot layer or the light emitting component, the incident light may be blocked by the ultraviolet light resistant layer **1925**.

[0047] FIG. **21** is a schematic partial cross-sectional view illustrating a display device according to a twentieth embodiment of the disclosure. In the embodiment, an ultraviolet light resistant layer **2025** is disposed on a side of the second substrate **150** away from the first substrate **110**. Accordingly, the ultraviolet light resistant layer **2025** may have an increased area to facilitate a blocking effect against ultraviolet light.

[0048] FIG. **22** is a schematic partial cross-sectional view illustrating a display device according to a twenty-first embodiment of the disclosure. In a display device **2100** shown in FIG. **22**, the same components are configured and function in a way similar to that of the embodiment of FIG. **21**. Thus, details in this respect will not be repeated in the following. In the embodiment, a polarizing layer **2125** is disposed on the side of the second substrate **150** away from the first substrate **110**. The polarizing layer **2125** may be a linear polarizing layer, a circular polarizing layer, or polarizing layers of other types. The polarizing layer **2125** is capable of reducing the influence of external light on the display device **2100**.

[0049] FIG. **23** is a schematic partial cross-sectional view illustrating a display device according to a twenty-second embodiment of the disclosure. In a display device **2200** shown in FIG. **23**, the same components are configured and function in a way similar to that of the embodiment of FIG. **21**. Thus, details in this respect will not be repeated in the following. In this embodiment, an ultraviolet light resistant layer **2225** is formed by mixing an ultraviolet light resistant material and a polymer, such as resin, for example. However, the disclosure is not limited thereto. The ultraviolet light resistant layer **2225** may be filled around the light emitting component **120**.

[0050] FIG. **24** is a schematic partial cross-sectional view illustrating a display device according to a twenty-third embodiment of the disclosure. In a display device **2300** shown in FIG. **24**, the same components are configured and function in a way similar to that of the embodiment of FIG. **23**. Thus, details in this respect will not be repeated in the following. In the embodiment, an ultraviolet light resistant layer **2325** is only disposed on an upper part of the light emitting component **120**, and a side edge of the light emitting component **120** is only filled by a polymer, such as resin. However, the disclosure is not limited thereto. Accordingly, the disclosure reduces the consumption of the ultraviolet light resistant material and facilitate the material usage efficiency.

[0051] FIG. **25** is a schematic partial cross-sectional view illustrating a display device according to a twenty-fourth embodiment of the disclosure. In a display device **2400** shown in FIG. **25**, the same components are configured and function in a way similar to that of the embodiment of FIG. **24**. Thus, details in this respect will not be repeated in the following. In the embodiment, an ultraviolet light resistant layer **2425** only covers the light emitting surface **122***a* of the light emitting component **120**, so as to further reduce the consumption of the ultraviolet light resistant material.

[0052] FIG. **26** is a schematic partial cross-sectional view illustrating a display device according to a twenty-fifth embodiment of the disclosure. In a display device **2500** shown in FIG. **26**, the same components are configured and function in a way similar to that of the embodiment of FIG. **25**. Thus, details in this respect will not be repeated in the following. In the embodiment, the ultraviolet light resistant layer **2525** further covers a side surface of the light emitting component **120**, and the ultraviolet light resistant layer **2525** is disposed between the filling material **134** and the light emitting component **120**. Accordingly, the embodiment uses

less ultraviolet light resistant material while facilitate the blocking performance against ultraviolet light.

[0053] FIG. **27** is a schematic partial cross-sectional view illustrating a display device according to a twenty-sixth embodiment of the disclosure. In a display device **2600** shown in FIG. **27**, the same components are configured and function in a way similar to that of the embodiment of FIG. **23**. Thus, details in this respect will not be repeated in the following. In the embodiment, an ultraviolet light resistant layer **2625** is formed by mixing resin and ultraviolet light resistant particles. Accordingly, the consumption of the ultraviolet light material is reduced.

[0054] FIG. **28** is a schematic partial cross-sectional view illustrating a display device according to a twenty-seventh embodiment of the disclosure. In a display device **2700** shown in FIG. **28**, the same components are configured and function in a way similar to that of the embodiment of FIG. **12**. Thus, details in this respect will not be repeated in the following. In the embodiment, a light scattering layer **2726** is disposed on the light emitting surface **122***a* of the light emitting component **120**. The light emitted by the light emitting component **120** from the light emitting surface **122***a* may be uniformly scattered by the light scattering layer **2726** disposed on the light emitting surface **122***a*.

[0055] FIGS. **29** to **32** are schematic partial cross-sectional views illustrating a manufacturing process of a display device according to a twenty-eighth embodiment of the disclosure. In the embodiment, a first electrode **2821** and a second electrode **2822** of a light emitting component **2820** are located on the same side. A light scattering layer **2826** may be directly disposed on a light emitting surface **2822***a* of the light emitting component **2820**. In the embodiment, the light scattering layer **2826** may be formed by mixing resin with scattering particles. Referring to FIG. **30**, the light scattering layer **2826** may be firstly disposed on the light emitting surface **2822***a* of the light emitting component **2820**, and the light emitting component **2820** may be picked from a third substrate **2890** by having a pickup head **2891** contact the light scattering layer **2826**. Since the pickup head **2891** contacts the light scattering layer **2826** without directly contacting the light emitting component **2820**, the chance that the pickup head **2891** damages the light emitting component **2820** is reduced. Referring to FIG. **31**, the picked light emitting component **2820** may be bonded with a first substrate **2810**. Referring to FIG. **32**, after the light emitting component **2820** is configured, an insulating layer **2830** may be further filled around the light emitting component **2820**.

[0056] FIG. **33** is a schematic partial cross-sectional view illustrating a display device according to a twenty-ninth embodiment of the disclosure. In a display device **2900** shown in FIG. **33**, the same components are configured and function in a way similar to that of the embodiment of FIG. **32**. Thus, details in this respect will not be repeated in the following. In the embodiment, a light scattering layer **2926** further covers a side surface of the light emitting component **2820**. The light scattering layer **2926** includes a first light scattering layer **2926***a* and a second light scattering layer **2926***b*. The first light scattering layer **2926***a* and the second light scattering layer **2926***b* are not formed at the same time, and the first light scattering layer **2926***a* and the second light scattering layer **2926***b* may include the same or different materials.

[0057] FIG. **34** is a schematic partial cross-sectional view illustrating a display device according to a thirtieth embodiment of the disclosure. In a display device **3000** shown in FIG. **34**, the same components are configured and function in a way similar to that of the embodiment of FIG. **33**. Thus, details in this respect will not be repeated in the following. In the embodiment, a light scattering layer **3026** is disposed between an insulating layer **3030** and the light emitting component **2820**. A first light scattering layer **3026***a* and a second light scattering layer **3026***b* are formed in different steps. The first light scattering layer **3026***a* is directly formed on the light emitting component **2820**, whereas the second light scattering layer **3026***b* is formed after the light emitting component **2820** is bonded with the substrate. With the insulating layer **3030** in a dark color, the light emitting components **2820** may be prevented from interfering each other.

[0058] In view of the foregoing, in the display device according to the embodiments of the disclosure, the common line and the driving component are located on the same substrate, and the conductive element may extend upward from the common line and be electrically connected with another electrode of the light emitting component. Accordingly, it neither requires another substrate to dispose the common line or common electrode nor requires to align and bond the another substrate with another electrode of the light emitting component. Accordingly, the manufacturing time is saved, the cost is reduced, and the yield rate is facilitated.

[0059] It will be apparent to those skilled in the art that various modifications and variations can be made to the structure of the disclosure without departing from the scope or spirit of the disclosure. In view of the foregoing, it is intended that the disclosure covers modifications and variations of the disclosure provided they fall within the scope of the following claims and their equivalents.

What is claimed is:

1. A display device, comprising:

a first substrate, having a driving component and a common line;

a light emitting component, disposed on the first substrate and having a first electrode and a second electrode, wherein the first electrode is electrically connected to the driving component;

an insulating layer, disposed on the first substrate and having a first opening and a second opening, wherein the first opening exposes the second electrode of the light emitting component, and the second opening exposes the common line; and

a conductive element, wherein the common line is electrically connected to the second electrode through the conductive element.

2. The display device as claimed in claim **1**, wherein the conductive element comprises a first portion and a second portion, the first portion is located in the second opening, the second portion is located outside the second opening, and a material of the first portion comprises metal.

3. The display device as claimed in claim **2**, wherein the second portion comprises a transparent conductive layer.

4. The display device as claimed in claim **2**, wherein the second portion is a composite layer comprising metal and a transparent conductive material.

5. The display device as claimed in claim **1**, further comprising a black matrix, wherein the common line is located between the black matrix and the conductive element.

6. The display device as claimed in claim 1, wherein the conductive element fills the second opening.

7. The display device as claimed in claim 1, wherein the conductive element only covers a wall of the second opening.

8. The display device as claimed in claim 1, wherein the insulating layer comprises a light shielding column and a filling material, the filling material is filled between the light emitting component and the light shielding column, the filling material has the first opening, and the light shielding column has the second opening.

9. The display device as claimed in claim 1, further comprising a second substrate having a color filter film, wherein the light emitting component is located between the first substrate and the color filter film, and an orthogonal projection of the color filter film on the first substrate overlaps with an orthogonal projection of the light emitting component on the first substrate.

10. The display device as claimed in claim 9, wherein the second substrate further comprises a light scattering layer or a quantum dot layer located between the color filter film and the light emitting component.

11. The display device as claimed in claim 1, wherein a wavelength conversion layer is disposed on a light emitting surface of the light emitting component.

12. The display device as claimed in claim 11, wherein the wavelength conversion layer further covers a side surface of the light emitting component.

13. The display device as claimed in claim 1, wherein a color filter film is disposed on a light emitting surface of the light emitting component.

14. The display device as claimed in claim 13, wherein the color filter film further covers a side surface of the light emitting component.

15. The display device as claimed in claim 1, wherein an ultraviolet light resistant layer is disposed on a light emitting surface of the light emitting component.

16. The display device as claimed in claim 15, wherein the ultraviolet light resistant layer further covers a side surface of the light emitting component.

17. The display device as claimed in claim 1, wherein a light scattering layer is disposed on a light emitting surface of the light emitting component.

18. The display device as claimed in claim 17, wherein the light scattering layer further covers a side surface of the light emitting component.

19. The display device as claimed in claim 1, wherein the light emitting component is a micro light emitting diode.

20. The display device as claimed in claim 1, wherein the driving component is an amorphous silicon thin film transistor, an oxide semiconductor thin film transistor, a low-temperature polycrystalline silicon thin film transistor, a silicon-based thin film transistor or a microcrystalline silicon thin film transistor.

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[标]申请(专利权)人(译)	群创光电股份有限公司		
申请(专利权)人(译)	群创光电		
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摘要(译)

本发明涉及一种显示装置，包括第一基板，发光组件，绝缘层和导电元件。第一基板具有驱动组件和公共线。发光组件设置在第一基板上并具有第一电极和第二电极。第一电极电连接到驱动组件。绝缘层设置在第一基板上，并具有第一开口和第二开口。第一开口暴露发光组件的第二电极。第二个开口暴露了公共线。公共线通过导电元件电连接到第二电极。