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(54) **OLED TOUCH DISPLAY DEVICE**

(71) Applicant: **SuperC-Touch Corporation**, New Taipei City (TW)

(72) Inventors: **Hsiang-Yu LEE**, New Taipei City (TW); **Shang CHIN**, New Taipei City (TW); **Ping-Tsun LIN**, New Taipei City (TW); **Chia-Hsun TU**, New Taipei City (TW)

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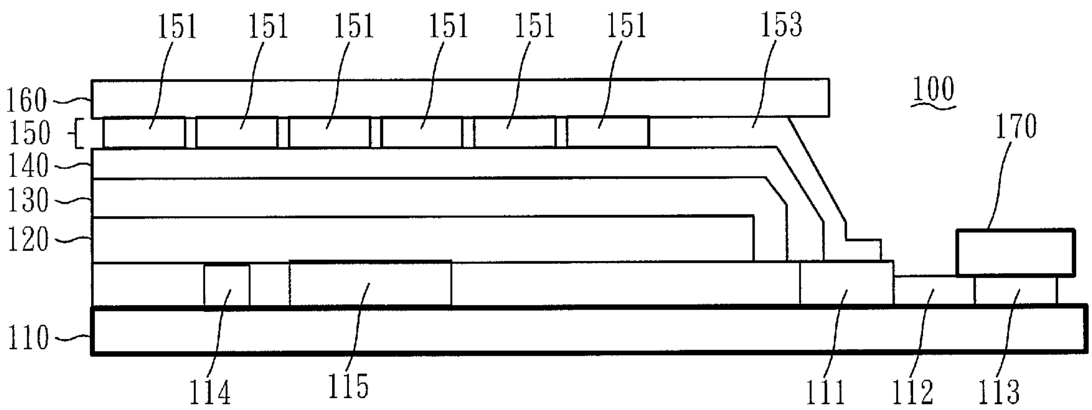
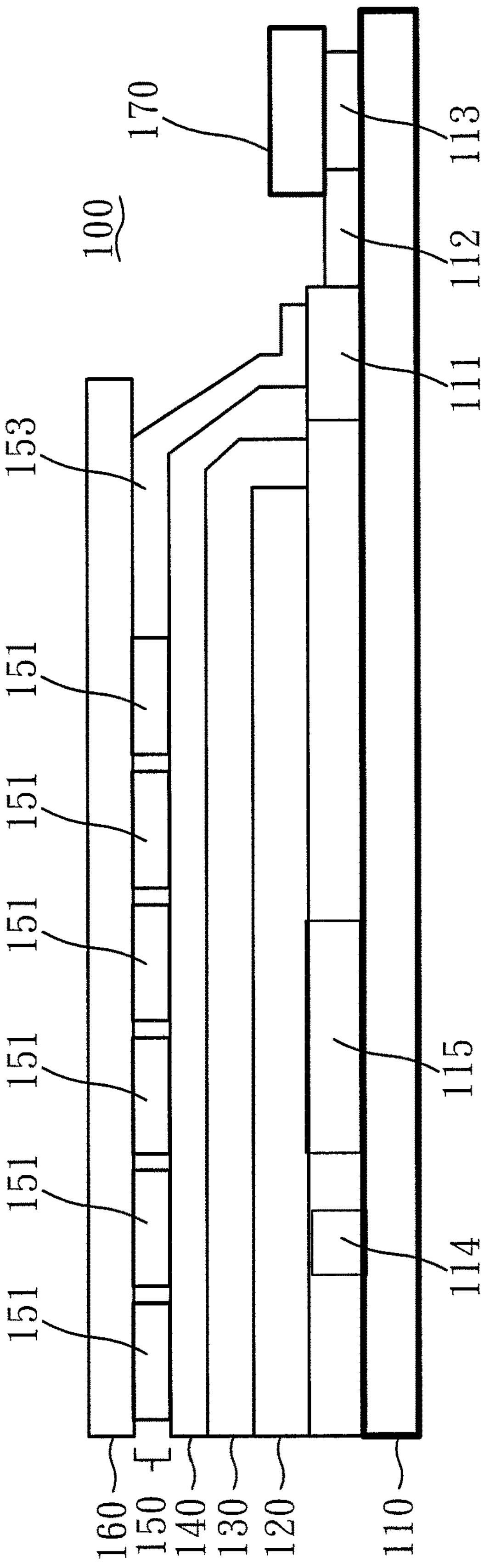
(57) **ABSTRACT**

An OLED touch display device includes a TFT substrate and a touch electrode layer. The TFT substrate has a surface formed thereon plural switch devices, plural second touch traces and plural conductive pads. Each switch device has plural touch TFT switches. The touch electrode layer includes plural first touch traces and plural touch sense electrodes divided into plural groups each having at least one touch sense electrode, and each group is corresponding to one of the conductive pads. The touch sense electrodes are corresponding to the first touch traces one by on. Each touch sense electrode is connected to the corresponding first touch trace. Each first touch trace is connected to one touch TFT switch of the corresponding switch device, and each switch device is connected to one second touch trace and the corresponding conductive pad.

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112
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151
151
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151
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114
160
150
140
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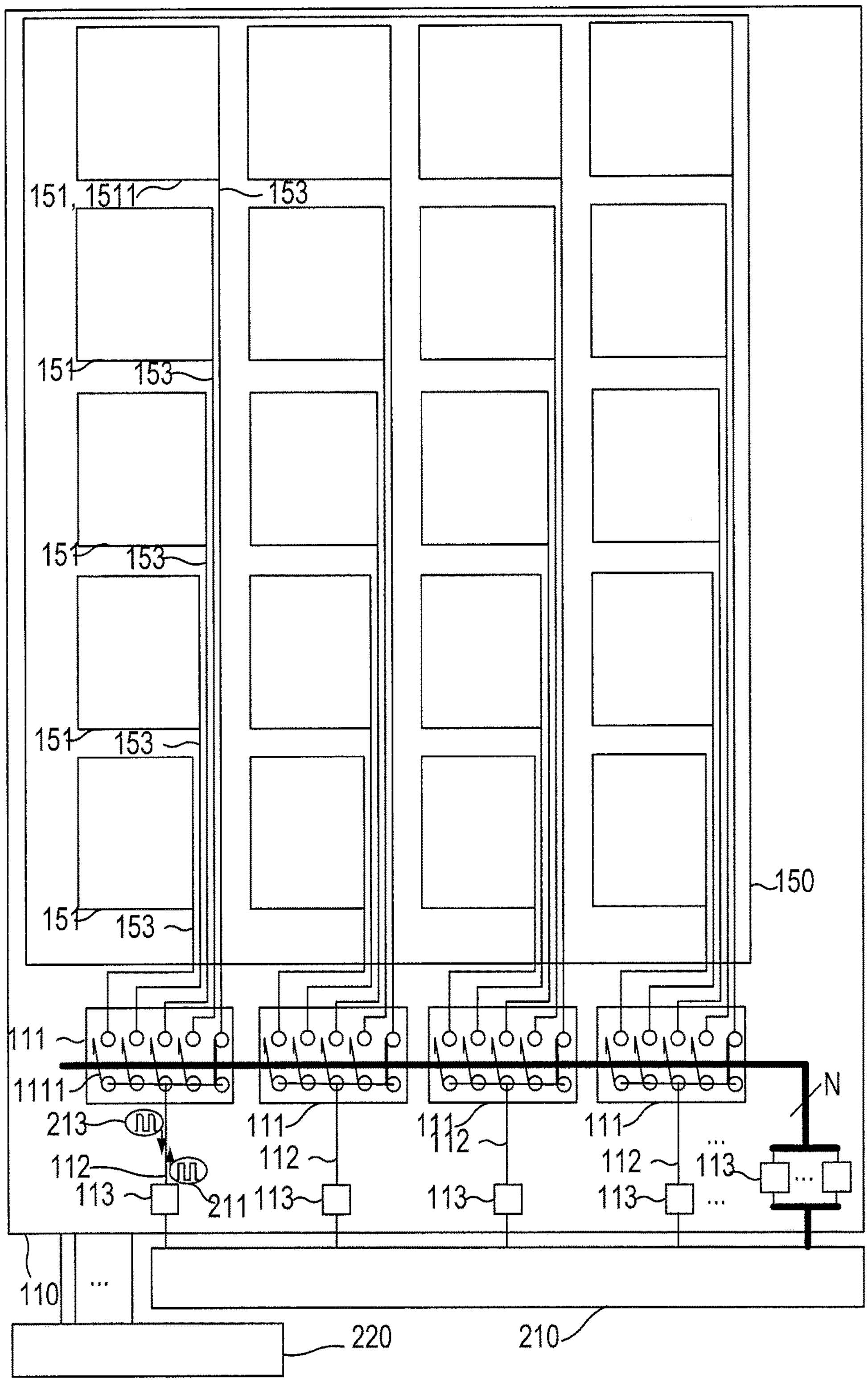
120
110

FIG. 1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153
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153
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150
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1111
N
213
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113
211
113
110
...
220
210

FIG. 2

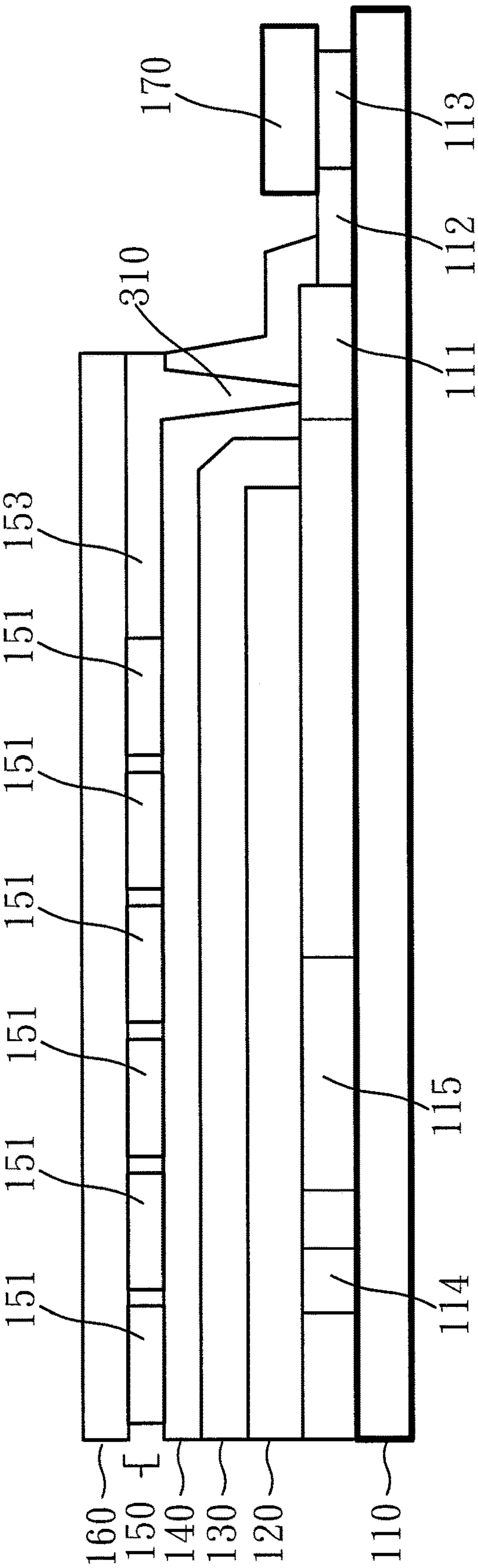
170
113
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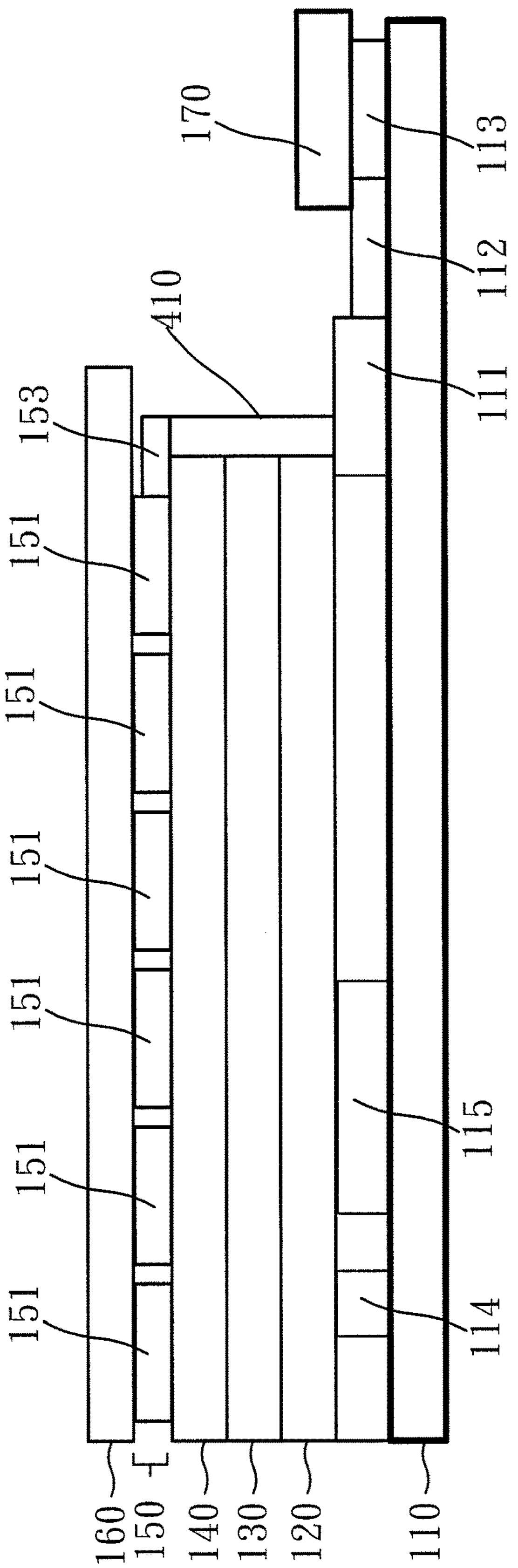
FIG. 3


170
113
112
410
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151
151
151
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115
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160
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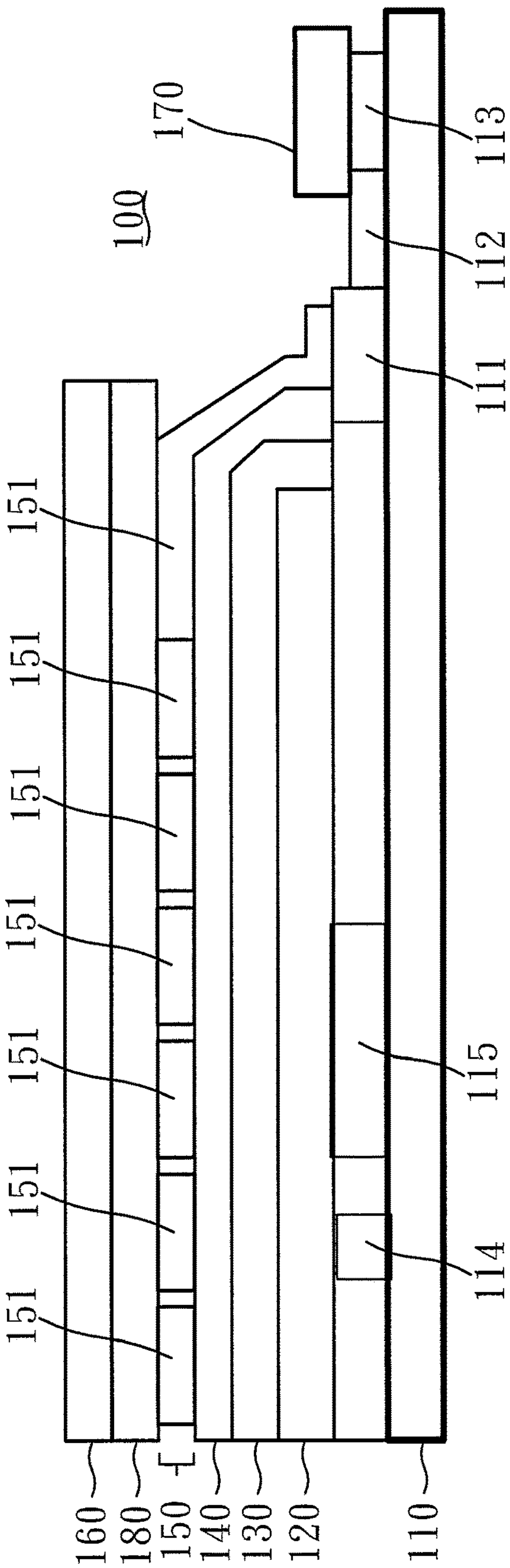
130
120
110

FIG. 4


100
170
113
112
111
151
151
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151
151
115
114
160
180
150
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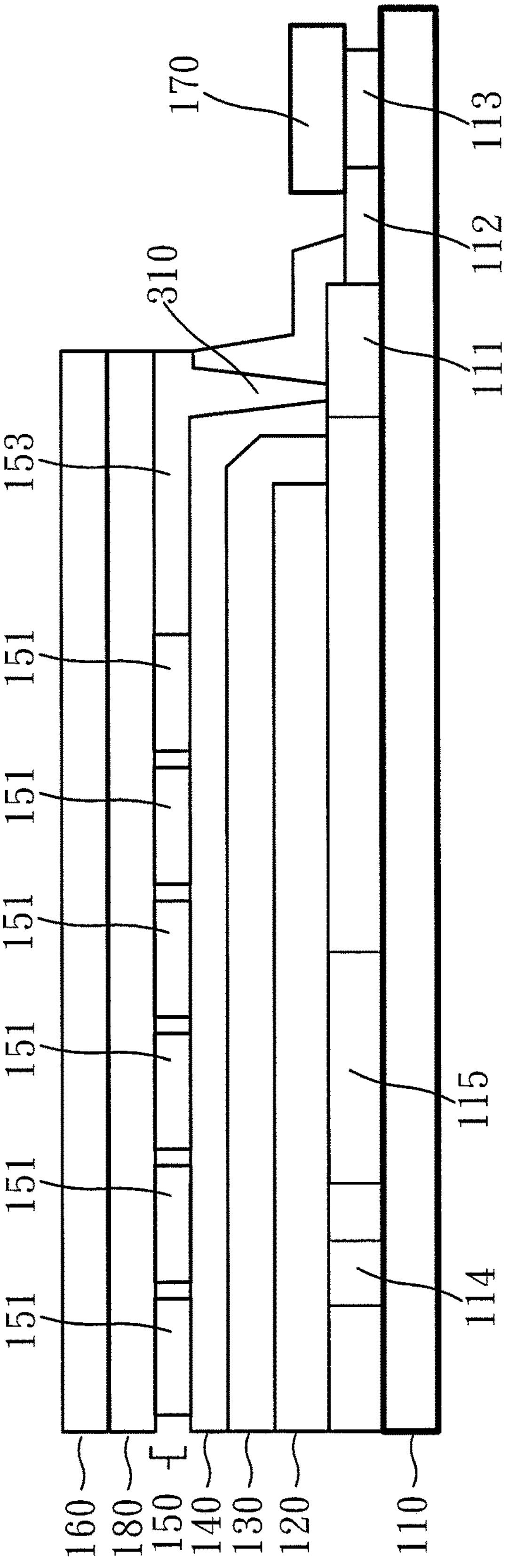
130
120
110

FIG. 5


170
113
112
310
111
153
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151
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151
151
115
114
160
180
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140
130
120
110

FIG. 6

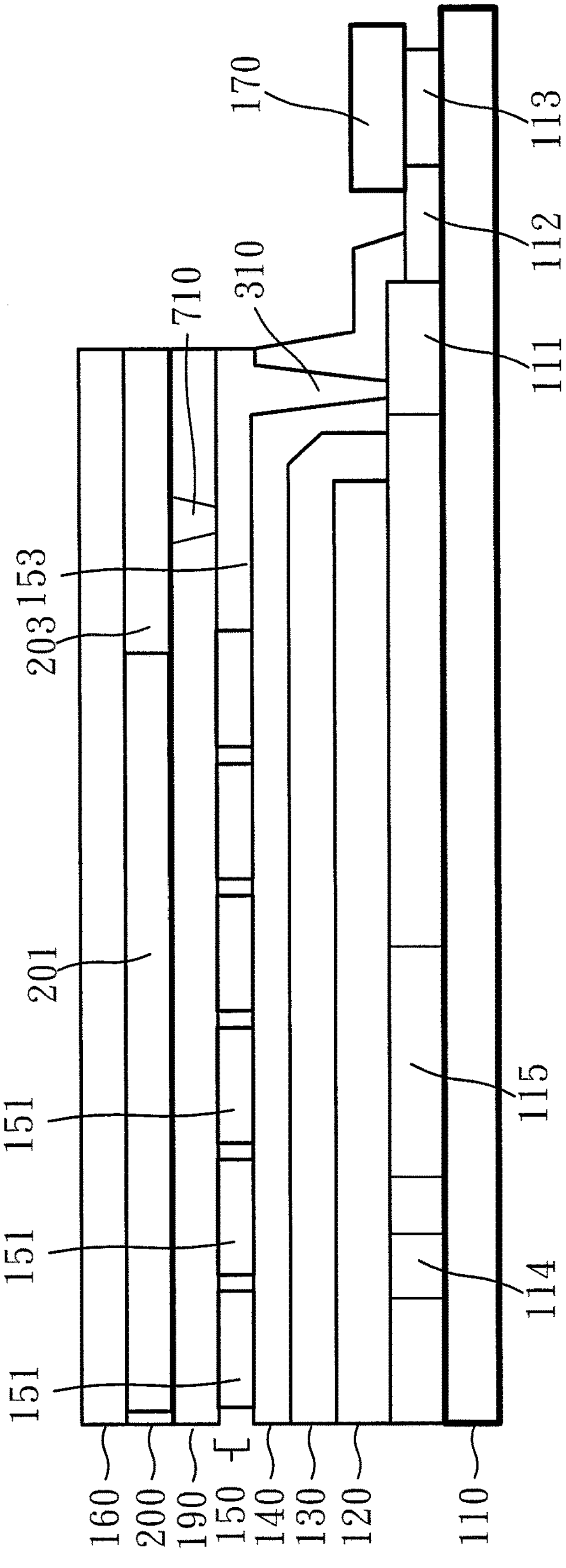
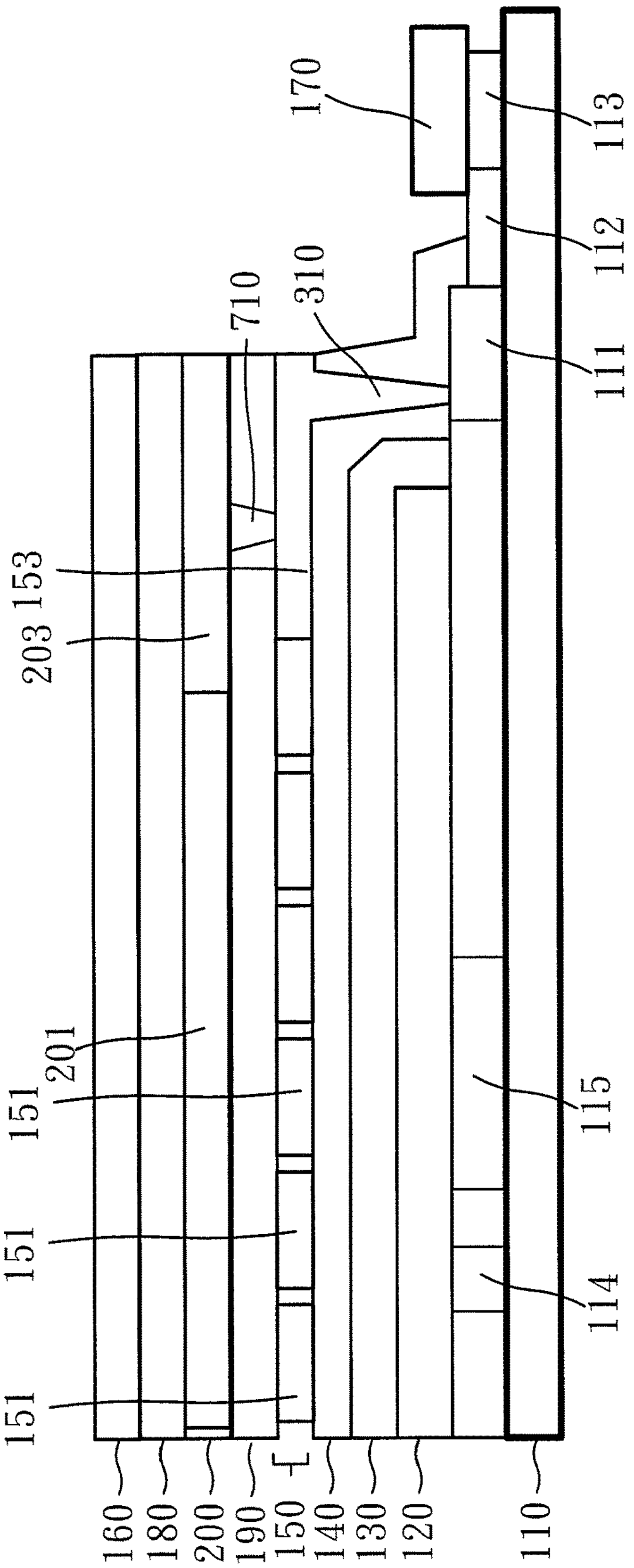

170
113
112
111
310
710
153
203
201
151
151
151
115
114
160
200
190
150
140
130
120
110

FIG. 7


170
113
112
310
710
111
203
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201
151
151
151
115
114
160
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150
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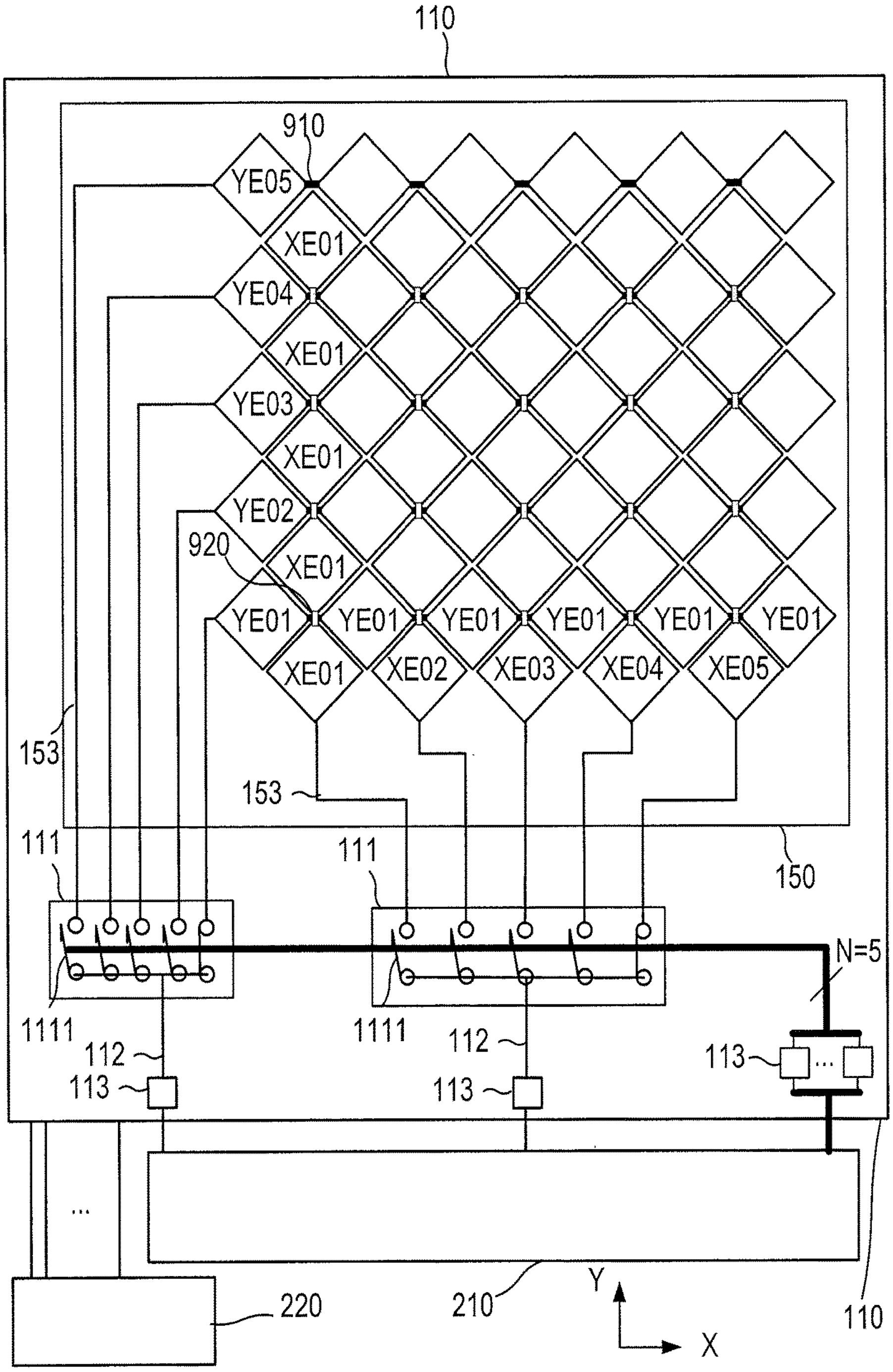
130
120
110

FIG. 8


110
910
YE05
XE01
YE04
XE01
YE03
XE01
YE02
920
XE01
YE01
YE01
YE01
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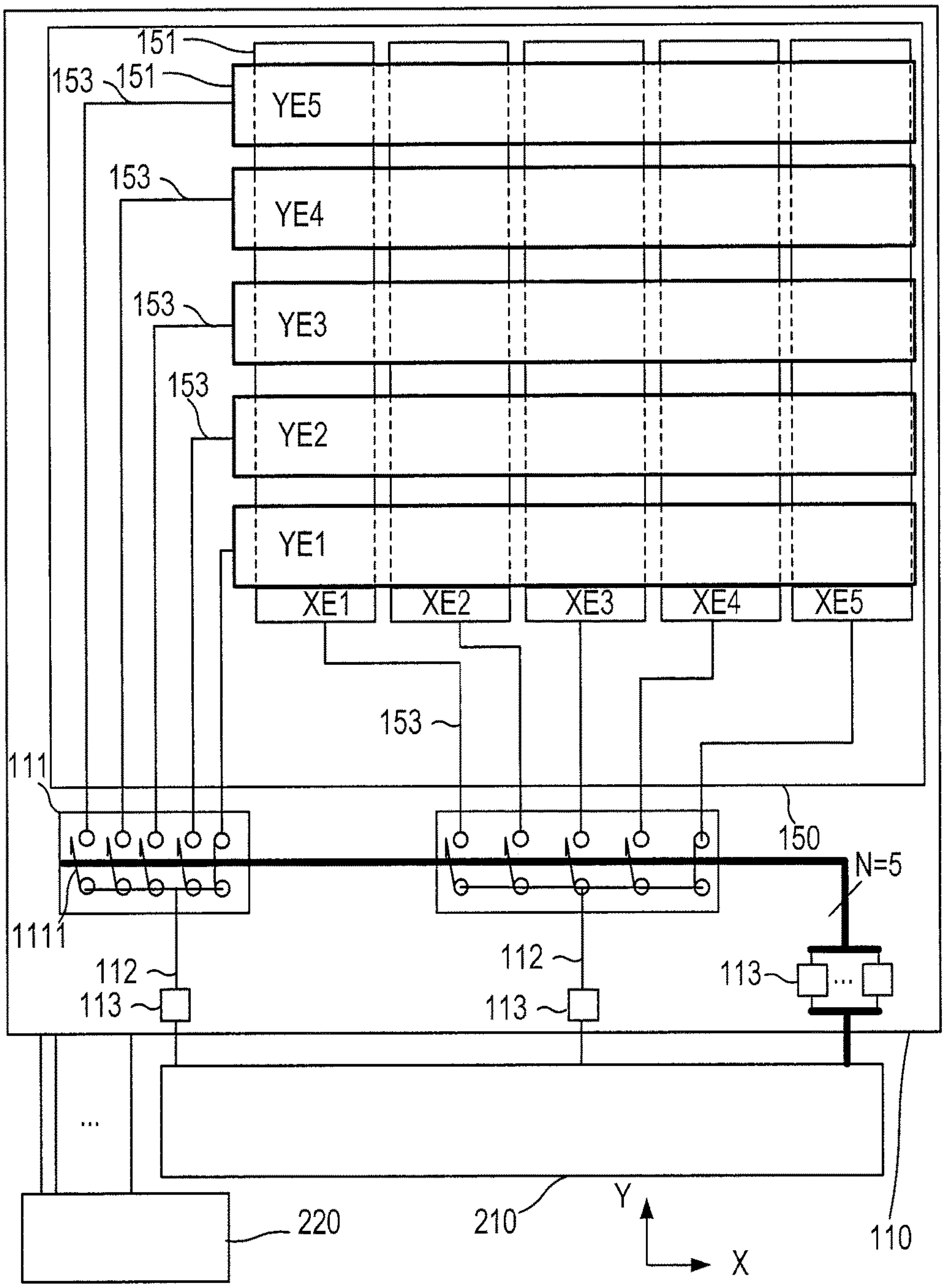
YE01
YE01
XE01
XE02
XE03
XE04
XE05
153
153
150
111
111
N=5
1111
1111
112
112
113
113
113
220
210
Y
X
110

FIG. 9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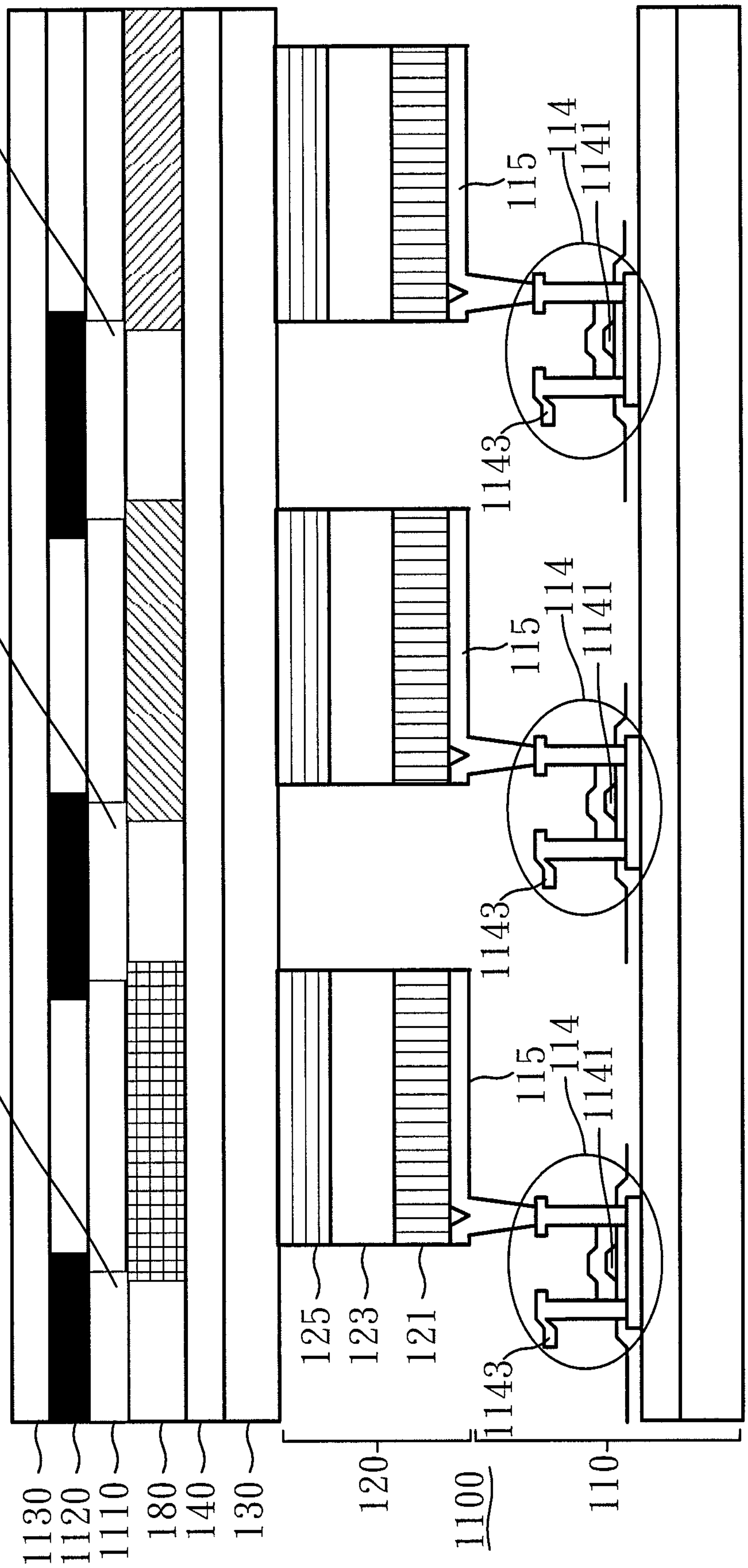
153
151
YE5
153
YE4
153
YE3
153
YE2
YE1
XE1
XE2
XE3
XE4
XE5
153
111
150
N=5
1111
112
113
112
113
113
...
...
220
210
Y
X
110

FIG. 10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1220
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115
114
1141
1143
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114
1141
1143
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1143
125
123
121
1130
1120
1110
180
140
130
120
1100
110

FIG. 11

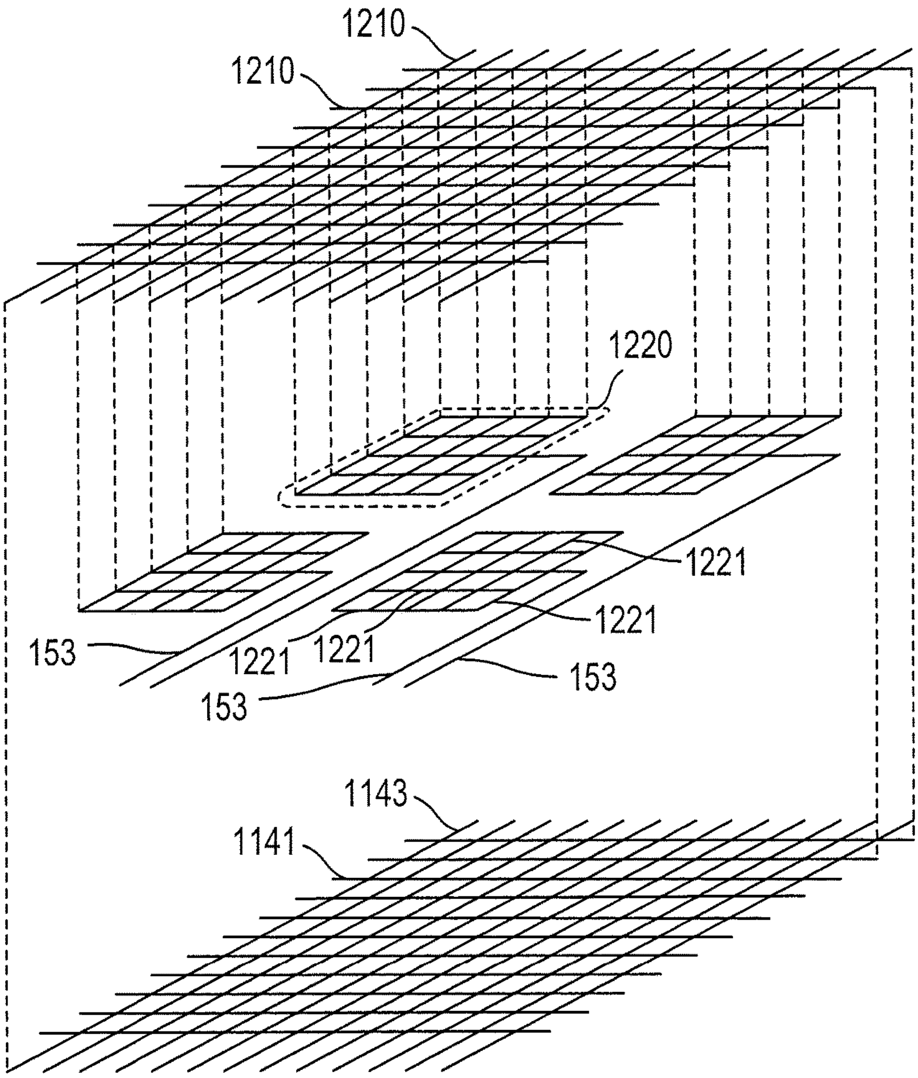
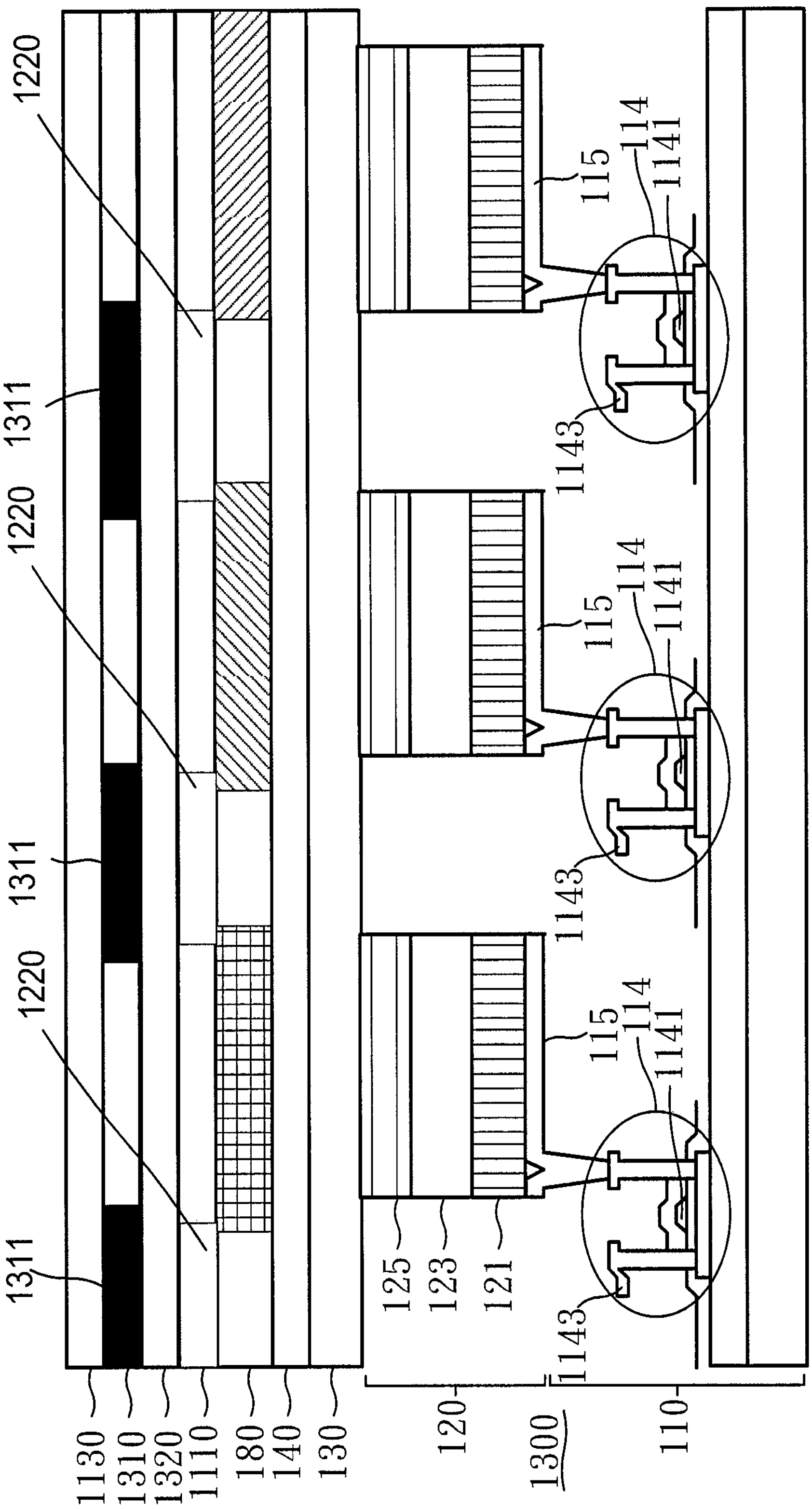


FIG. 12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1311
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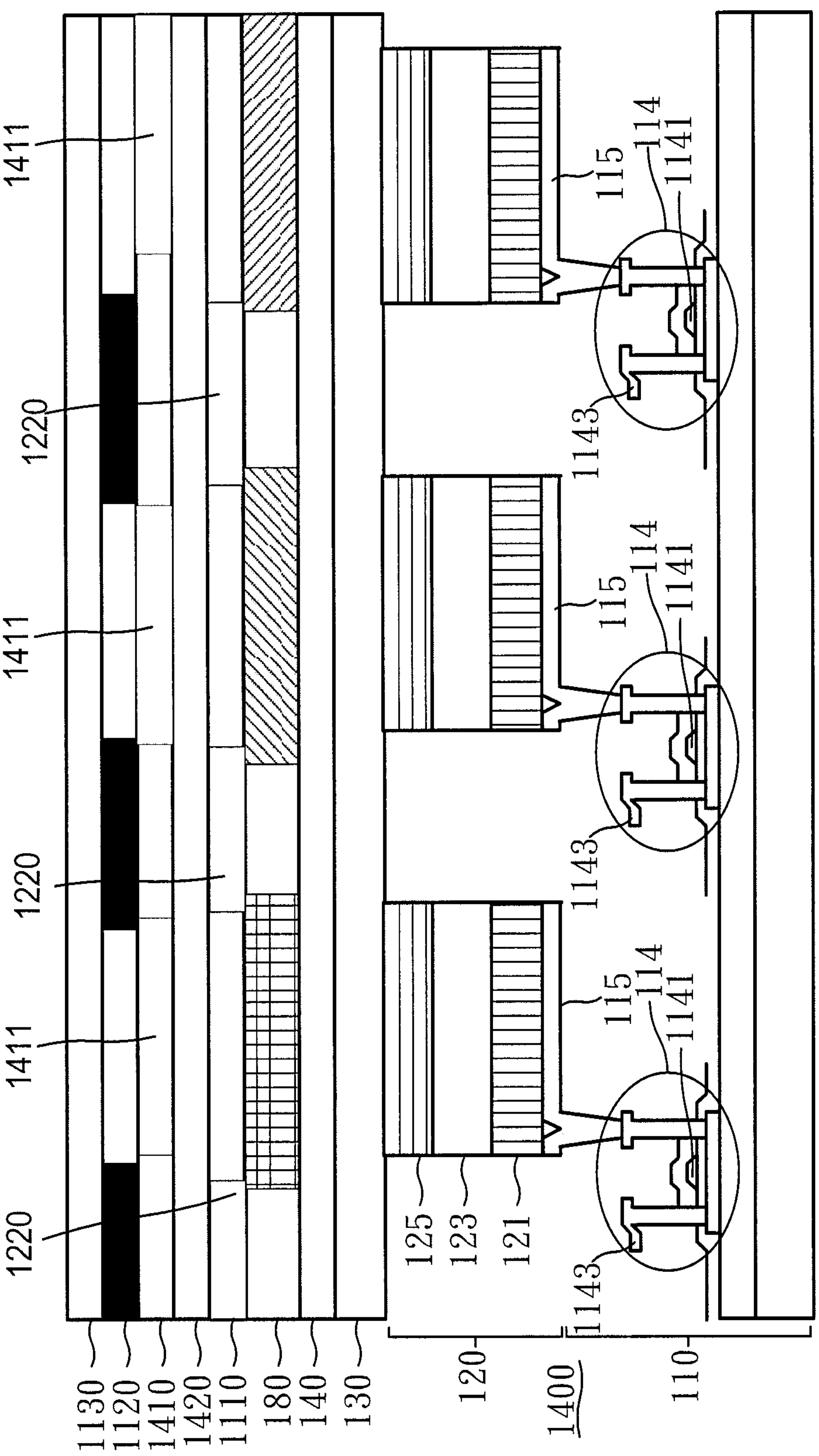
1143
125
123
121
1130
1310
1320
1110
180
140
130
120
1300
110

FIG. 13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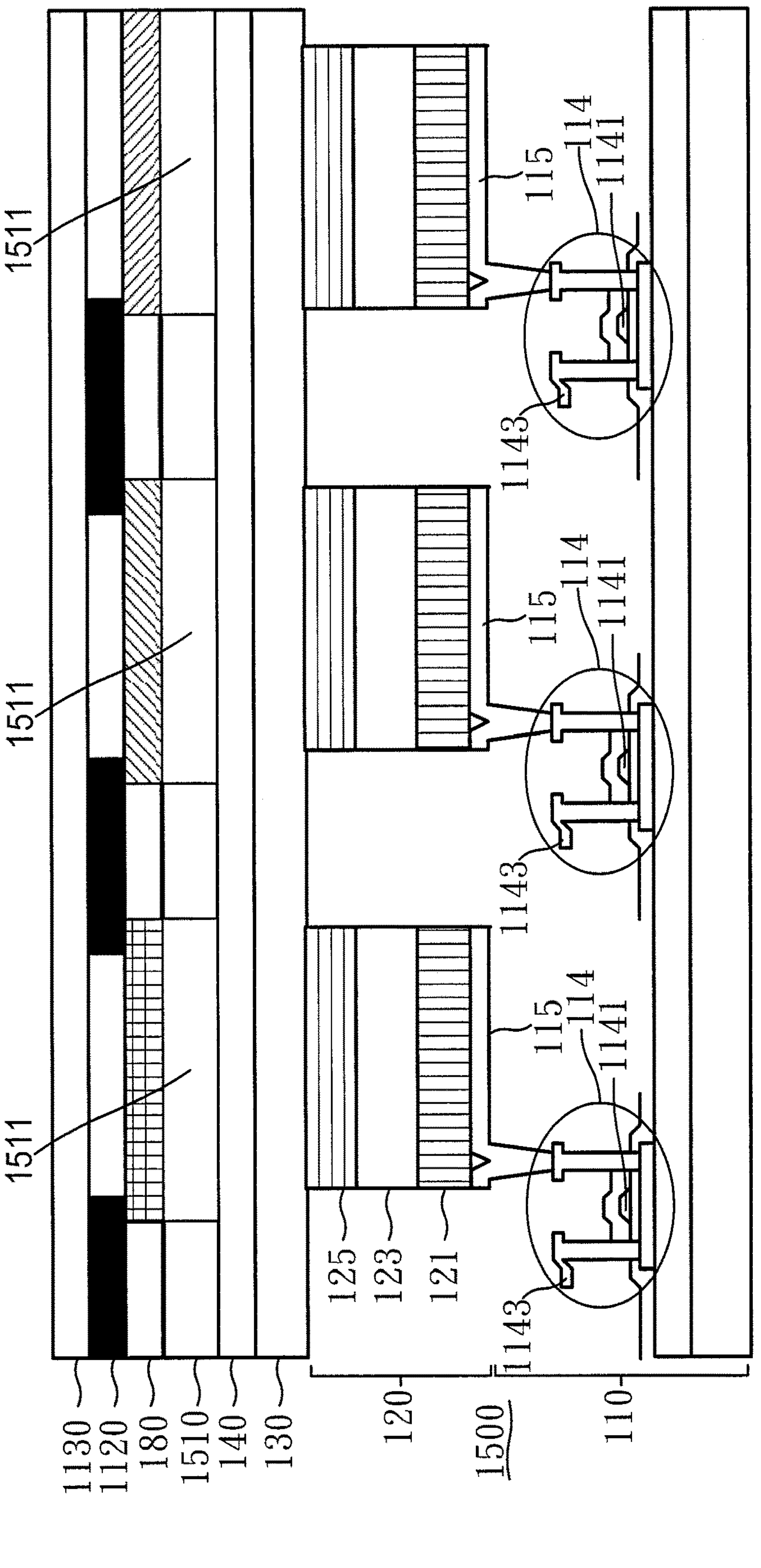
1220
1411
1220
1411
1220
115
114
1141
1143
125
123
121
1130
1120
1410
1420
1110
180
140
130
120
1400
110

FIG. 14


1511
1511
1511
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1120
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1510
140
130
120
1500
110
125
123
121
115
114
1141
1143

FIG. 15

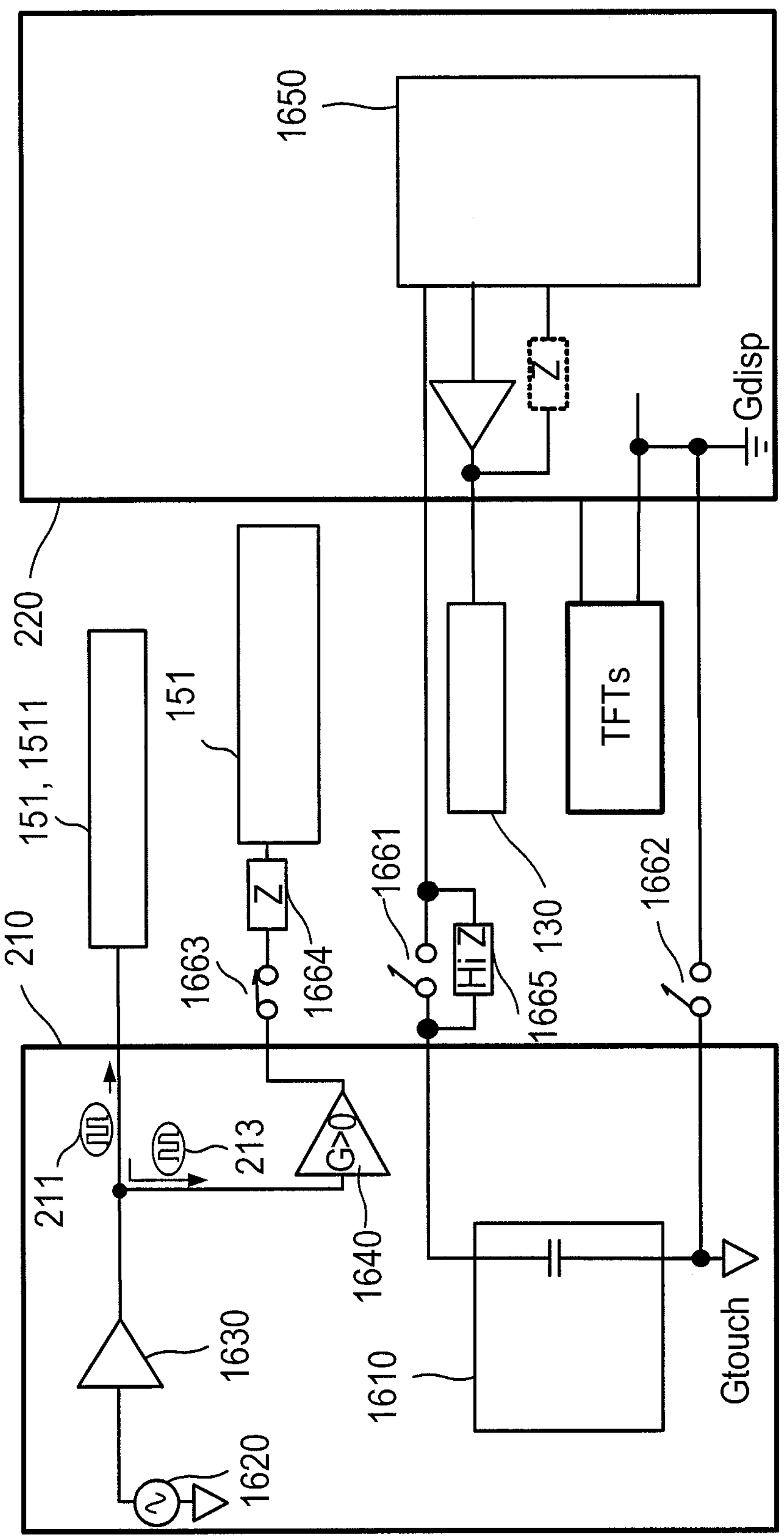
1650
Z
Gdisp
220
151, 1511
151
TFTs
130
1661
1662
Hi Z
1665
1663
Z
1664
210
211
213
G>0
1640
1630
1610
Gtouch
1620

FIG. 16

OLED TOUCH DISPLAY DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a touch display panel and, more particularly, to an organic light emitting diode display (OLED) touch display device.

2. Description of Related Art

[0002] In recent years, the flat panel display industry has been rapidly developed, and many products have also been made in pursuit of light weight, thinness, small volume and fine image quality for developing several types of flat panel displays to replace traditional cathode ray tube display (CRT). The flat panel display includes liquid crystal display (LCD), plasma display panel (PDP), organic light emitting diode (OLED) display, field emission display (FED), and vacuum fluorescence display (VFD).

[0003] Among these types of flat panel displays, the organic light emitting diode display (OLED) technology is the one with great potential. The OLED display is provided with not only the advantages of LCD display including thinness, power-saving and full-color display, but also the features of wide viewing angle, self-illumination and fast response that are better than LCD.

[0004] Modern consumer electronic apparatuses are typically equipped with touch panels for use as their input devices. With the widespread use of smartphones, the multi-touch technique is getting more and more important. Generally, the multi-touch is implemented by projected capacitive touch technique.

[0005] When the touch sense resolution is increasing, the number of the touch sense electrodes and the number of the corresponding traces connected to the touch sense electrodes are also dramatically increasing. Typically, the touch sense electrodes are connected to a touch control circuit through the traces. With the large number of traces, it is difficult to route the number of traces between the touch sense electrodes and the touch control circuit. Moreover, the layout of the traces may occupy a lot of area, resulting in reducing the display area and lowering the display quality.

[0006] Therefore, it is desirable to provide an improved touch device to mitigate and/or obviate the afore-mentioned problems.

SUMMARY OF THE INVENTION

[0007] The object of the present invention is to provide an OLED touch display device capable of greatly reducing the number of traces, significantly saving layout area and reducing the manufacturing cost in comparison with the prior art.

[0008] To achieve the object, there is provided an OLED touch display device, which comprises: a thin film transistor (TFT) substrate, a common voltage electrode layer, an OLED layer, an encapsulation layer, and at least one touch electrode layer. The TFT substrate has a surface formed thereon a plurality of switch devices, a plurality of second touch traces, a plurality of conductive pads, a plurality of display TFTs, a plurality of display pixel electrodes, a plurality of gate lines, and a plurality of data lines. Each switch device comprises a plurality of touch TFT switches. The common voltage electrode layer includes at least one common voltage electrode. The OLED layer is disposed between the TFT substrate and the common voltage electrode layer. The encapsulation layer is disposed at one side of the common voltage electrode layer opposite to the OLED layer. The at least one touch electrode layer is disposed at one side of the common voltage electrode layer opposite to the OLED layer, and includes a plurality of first touch traces and a plurality of touch sense electrodes divided into a plurality of groups each having at least one touch sense electrode, and each group is corresponding to one of the conductive pads. The plurality of touch sense electrodes are corresponding to the plurality of first touch traces one by one and each of the touch sense electrodes is connected to the corresponding first touch trace, while any tow touch sense electrodes are not connected with each other. Each of the first touch traces is connected to one touch TFT switch of one switch device corresponding thereto, and each of the switch devices is connected to one second touch trace and one conductive pad corresponding thereto.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. **1** is a first exemplary stack-up diagram of the OLED touch display device in accordance with the present disclosure;

[0010] FIG. **2** is a schematic diagram of the OLED touch display device in accordance with the present disclosure;

[0011] FIG. **3** is a second exemplary stack-up diagram of the OLED touch display device in accordance with the present disclosure;

[0012] FIG. **4** is a third exemplary stack-up diagram of the OLED touch display device in accordance with the present disclosure;

[0013] FIG. **5** is a fourth exemplary stack-up diagram of the OLED touch display device in accordance with the present disclosure;

[0014] FIG. **6** is a fifth exemplary stack-up diagram of the OLED touch display device in accordance with the present disclosure;

[0015] FIG. **7** is a sixth exemplary stack-up diagram of the OLED touch display device in accordance with the present disclosure;

[0016] FIG. **8** is a seventh exemplary stack-up diagram of the OLED touch display device in accordance with the present disclosure;

[0017] FIG. **9** is another schematic diagram of the OLED touch display device in accordance with the present disclosure;

[0018] FIG. **10** is still another schematic diagram of the OLED touch display device in accordance with the present disclosure;

[0019] FIG. **11** is an eighth exemplary stack-up diagram of the OLED touch display device in accordance with the present disclosure;

[0020] FIG. **12** is a schematic view of the black matrix layer and the metal mesh touch sense electrode layer in accordance with the present disclosure;

[0021] FIG. **13** is a ninth exemplary stack-up diagram of the OLED touch display device in accordance with the present disclosure;

[0022] FIG. **14** is a tenth exemplary stack-up diagram of the OLED touch display device in accordance with the present disclosure;

[0023] FIG. **15** is an eleventh exemplary stack-up diagram of the OLED touch display device in accordance with the present disclosure; and

[0024] FIG. 16 is a schematic diagram illustrating the OLED touch display device with the touch sense electrodes being powered by a dedicated touch power source in accordance with the present disclosure.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0025] The present invention relates to an OLED touch display device. FIG. 1 is a first exemplary stack-up diagram of the OLED touch display device 100 in accordance with the present disclosure. As shown, the OLED touch display device 100 includes a thin film transistor (TFT) substrate 110, an OLED layer 120, a common voltage electrode layer 130, an encapsulation layer 140, at least one touch electrode layer 150, and a touch protective layer 160.

[0026] The TFT substrate 110 has a surface formed thereon a plurality of switch devices 111, a plurality of second touch traces 112, a plurality of conductive pads 113, a plurality of display thin film transistors 114, a plurality of display pixel electrodes 115, a plurality of gate lines (not shown), and a plurality of data lines (not shown). The material of the TFT substrate 110 can be selected from the group consisting of: polyethylene terephthalate (PET), polyimide (PI), polycarbonate (PC), cyclo-olefin polymers (COP), Poly methyl methacrylate (PPMA), triacetyl cellulose (TAC), and glass.

[0027] The common voltage electrode layer 130 includes at least one common voltage electrode. In this example, the common voltage electrode layer 130 is an anode common voltage electrode layer. In another example, the common voltage electrode layer 130 is a cathode common voltage electrode layer.

[0028] The OLED layer 120 is disposed between the TFT substrate 110 and the common voltage electrode layer 130. The encapsulation layer 140 is disposed at one side of the common voltage electrode layer 130 opposite to the OLED layer 120. The material of the encapsulation layer 140 can be the thermosetting resin or the UV-curing resin.

[0029] The at least one touch electrode layer 150 is disposed at one side of the common voltage electrode layer 130 opposite to the OLED layer 120, and includes a plurality of first touch traces 153 and a plurality of touch sense electrodes 151. The touch sense electrodes 151 are divided into a plurality of groups each having at least one touch sense electrode, and each group is corresponding to one of the conductive pads 113. The plurality of touch sense electrodes 151 are each a transparent conductive electrode.

[0030] The touch protective layer 160 is disposed at one side of the at least one touch electrode layer 150 opposite to the OLED layer 120, wherein the touch protective layer 160 is a substrate or a hardened coating layer.

[0031] FIG. 2 is a schematic diagram of the OLED touch display device 100 in accordance with the present disclosure. As shown in FIG. 2, the OLED touch display device 100 further comprises a touch control circuit 210 and a display control circuit 220. As shown, each switch device 111 comprises a plurality of touch TFT switches 1111. There are M switch devices 111 and each switch device 111 comprises N touch TFT switches 1111, where M and N are each a positive integer. In this example, M is equal to 4 and N is equal to 5. It is noted that the values of M and N used herein are for illustrative purpose only, rather than for limitation of the claim scope.

[0032] The touch control circuit 210 may be soldered on an integrated circuit soft board (IC soft board) 170, which is electrically connected to the conductive pads 113. The touch control circuit 210 may be electrically connected to the conductive pads 113 through a soft cable.

[0033] The touch control circuit 210 is electrically connected to the N conductive pads 113 for controlling the plurality of touch TFT switches 1111 of the switch devices 111 to be turned on or off, so as to select a specific touch sense electrode 151 to be connected to the corresponding conductive pad 113. In this example, the touch control circuit 210 is electrically connected to M (=4) conductive pads 113 for transmitting touch stimulation signal and receiving touch sense signal, and N (=5) conductive pads 113 for controlling the switch devices 111.

[0034] In FIG. 2, the touch control circuit 210 outputs the control signal through the five conductive pads 113 to control the five touch TFT switches 1111 of each switch device 111 to be turned on or off. As shown, the rightmost touch TFT switch 1111 of each switch device 111 is turned on.

[0035] The plurality of touch sense electrodes 151 are corresponding to the plurality of first touch traces 153 one by one and each of the touch sense electrodes 113 is connected to the corresponding first touch trace 153, while any tow touch sense electrodes 151 are not connected with each other. Each of the first touch traces 153 is connected to one touch TFT switch 1111 of one switch device 111 corresponding thereto, and each of the switch devices 111 is connected to one second touch trace 112 and one conductive pad 113 corresponding thereto.

[0036] As shown, the touch sense electrode 1511 is connected to the corresponding touch TFT switch 1111 of the switch device 111 by the first touch trace 153. Due to the corresponding touch TFT switch 1111 being turned on, the touch sense electrode 1511 is electrically connected to the touch control circuit 210 through the second touch trace 112 and the conductive pad 113.

[0037] The touch control circuit 210 outputs a touch stimulation signal 211 to the selected touch sense electrode 1511 or receiving a touch sense signal 213 from the selected touch sense electrode 1511, so as to perform a touch detection operation.

[0038] The display control circuit 220 sequentially outputs a scan signal to one gate line, outputs a data signal to one data line, and outputs a zero voltage signal, a negative voltage signal or a positive voltage signal to the common voltage electrode layer 130 for performing a display operation.

[0039] In the prior art, it needs M×N (=20) traces to be routed between the touch sense electrodes and the touch control circuit. In contrast, from the aforementioned description, the present invention only needs M+N (=9) traces to connect the touch sense electrodes 151 and the touch control circuit 210. As the touch resolution is getting increased, it can dramatically reduce the number of traces, thereby greatly saving layout area and reducing the manufacturing cost.

[0040] FIG. 3 is a second exemplary stack-up diagram of the OLED touch display device 100 in accordance with the present disclosure. The difference between FIG. 1 and FIG. 3 is that: in FIG. 1, the first touch traces 153 are connected to the touch TFT switches 1111 of the switch devices 111 along the edge of the encapsulation layer 140 and, in FIG.

3, the first touch traces **153** are connected to the touch TFT switches **1111** of the switch devices **111** by vias **310** in the encapsulation layer **140**.

[0041] FIG. **4** is a third exemplary stack-up diagram of the OLED touch display device **100** in accordance with the present disclosure. The difference between FIG. **1** and FIG. **4** is that: in FIG. **1**, the first touch traces **153** are connected to the touch TFT switches **1111** of the switch devices **111** along the edge of the encapsulation layer **140** and, in FIG. **4**, the first touch traces **153** are connected to the touch TFT switches **1111** of the switch devices **111** by the conductive pillars **410** along the edge of the encapsulation layer **140**. Each of the conductive pillars **410** is formed of conductive metal material which is selected from the group consisting of: chromium, barium, aluminum, silver, copper, titanium, nickel, tantalum, cobalt, tungsten, magnesium, calcium, potassium, lithium, indium, and an alloy thereof.

[0042] FIG. **5** is a fourth exemplary stack-up diagram of the OLED touch display device **100** in accordance with the present disclosure. FIG. **5** is similar to FIG. **1** except that there is a color filter layer **180** disposed between the at least one touch electrode layer **150** and the touch protective layer **160**.

[0043] FIG. **6** is a fifth exemplary stack-up diagram of the OLED touch display device **100** in accordance with the present disclosure. FIG. **6** is similar to FIG. **3** except that there is a color filter layer **180** disposed between the at least one touch electrode layer **150** and the touch protective layer **160**.

[0044] FIG. **7** is a sixth exemplary stack-up diagram of the OLED touch display device **100** in accordance with the present disclosure. FIG. **7** is similar to FIG. **3** except that, in FIG. **7**, the OLED touch display device **100** further comprises an insulation layer **190** and a second touch electrode layer **200**.

[0045] The second touch electrode layer **200** is disposed at one side of the touch protective layer **160** facing the OLED layer **120**, and includes a plurality of third touch traces **203** and a plurality of touch sense electrodes **201**. The touch sense electrodes **201** can be connected to the first touch traces **153** through the third touch traces **203** and the vias **710** in the insulation layer **190**. Then, by using the first touch traces **153**, the vias **310**, the switch devices **111**, the second touch traces **112** and the conductive pads **113**, the touch sense electrodes **201** can be connected to touch control circuit **210**. The OLED touch display device **100** in FIG. **7** has two touch layers to perform touch detection.

[0046] The insulation layer **190** is disposed at one side of the second touch electrode layer **200** facing the OLED layer **120**.

[0047] FIG. **8** is a seventh exemplary stack-up diagram of the OLED touch display device **100** in accordance with the present disclosure. FIG. **8** is similar to FIG. **7**, except that, in FIG. **8**, the OLED touch display device **100** further comprises a color filter layer **180** disposed between the second touch electrode layer **200** and the touch protective layer **160**.

[0048] FIG. **9** is another schematic diagram of the OLED touch display device **100** in accordance with the present disclosure. As shown in FIG. **9**, the at least one touch electrode layer **150** comprises a plurality of touch sense electrodes **151** divided into touch sense electrodes YE**01**, YE**02**, . . . , YE**05** arranged along a first direction (X-axis direction) and touch sense electrodes XE**01**, XE**02**, . . . , XE**05** arranged along a second direction (Y-axis direction). The touch sense electrode YE**01** is connected to the adjacent touch sense electrode YE**01** through a first touch bridge **910**. A strip touch sense line along the first direction (X) is formed by the connected touch sense electrodes YE**01**. The touch sense electrode XE**01** is connected to the adjacent touch sense electrode XE**01** through a second touch bridge **920**. A strip touch sense line along the second direction (Y) is formed by the connected touch sense electrodes XE**01**.

[0049] In the prior art, it needs 10 traces to be routed between the touch sense electrodes and the touch control circuit. In the instant application, it only needs M+N (=2+5=7) traces to connect the touch sense electrodes **151** and the touch control circuit **210**. The OLED touch display device **100** may have only one touch electrode layer **150** to perform the self-capacitance touch detection or the mutual-capacitance touch detection by using the strip touch sense lines along the first direction (X-axis direction) and the second direction (Y-axis direction).

[0050] FIG. **10** is still another schematic diagram of the OLED touch display device **100** in accordance with the present disclosure. As shown in FIG. **10** with reference to FIG. **7** and FIG. **8**, the at least one touch electrode layer **150** comprises a plurality of touch sense electrodes **151**, each having a strip line shape, which are divided into first touch sense electrodes XE1, XE**2**, . . . , XE**5** arranged along the first direction (X-axis direction) and second touch sense electrodes YE1, YE**2**, . . . , YE**5** arranged along the second direction (Y-axis direction).

[0051] In the prior art, it needs 10 traces to be routed between the touch sense electrodes and the touch control circuit. In the instant application, it only needs M+N (=2+5=7) traces to connect the touch sense electrodes **151** and the touch control circuit **210**. The OLED touch display device **100** may have the touch electrode layer **150** and the second touch electrode layer **200** to perform the self-capacitance touch detection or the mutual-capacitance touch detection by using the touch sense electrodes XE1, XE**2**, . . . , XE**5** and YE1, YE**2**, YE**5** along the first direction and the second direction.

[0052] FIG. **11** is an eighth exemplary stack-up diagram of the OLED touch display device **1100** in accordance with the present disclosure. As shown, the OLED touch display device **1100** includes a thin film transistor (TFT) substrate **110**, an OLED layer **120**, a common voltage electrode layer **130**, an encapsulation layer **140**, a color filter layer **180**, a metal mesh touch sense electrode layer **1110**, a black matrix layer **1120**, and an upper substrate **1130**.

[0053] The TFT substrate **110** has a surface formed thereon a plurality of display thin film transistors **114**, a plurality of display pixel electrodes **115**, a plurality of gate lines **1141** and a plurality of data lines **1143**, as well as a plurality of switch devices, a plurality of second touch traces and a plurality of conductive pads that are shown in FIG. **1** with numerals **111**, **112** and **113**. The material of the TFT substrate **110** may be selected from the group consisting of: polyethylene terephthalate (PET), polyimide (PI), polycarbonate (PC), cyclo-olefin polymers (COP), poly methyl methacrylate (PPMA), triacetyl cellulose (TAC), and glass.

[0054] The OLED layer **120** includes an electrical hole transporting layer **121**, an emitting layer **123**, and an electron transporting layer **125**. The OLED layer **120** preferably emits white light, and the color filter layer **180** is used to filter out the whitelight thereby generating red, blue and green primary colors.

[0055] The black matrix layer **1120** is disposed at one side of the upper substrate **1130** that faces the OLED layer **120**. FIG. **12** is a schematic view of the black matrix layer **1120** and the metal mesh touch sense electrode layer **1110** in accordance with the present disclosure. As shown, the black matrix layer **1120** comprises a plurality of opaque lines **1210** with insulating material that are black and opaque. The opaque lines **1210** of black insulating material are arranged as a checkerboard pattern. The locations of the opaque lines **1210** of black insulating material are corresponding to the locations of the gate lines **1141** and data lines **1143**. Thus, a user cannot sense the existence of the gate lines **1141** and data lines **1143**.

[0056] The metal mesh touch sense electrode layer **1110** is disposed at one side of the black matrix layer **1120** that faces the OLED layer **120**. The metal mesh touch sense electrode layer **1110** comprises a plurality of touch sense electrodes, wherein each touch sense electrode is a metal mesh electrode **1220** formed by mesh lines **1221**. The mesh lines **1221** of the metal mesh electrodes **1220** are disposed at locations corresponding to opaque lines **1210** of the black matrix layer **1120**. The metal mesh electrodes **1220** may be connected to the touch control circuit **210** through the first touch traces **153**.

[0057] The mesh line **1221** is formed of conductive metal material which is selected from the group consisting of chromium, barium, aluminum, silver, copper, titanium, nickel, tantalum, cobalt, tungsten, magnesium, calcium, potassium, lithium, indium, and an alloy thereof.

[0058] FIG. **13** is a ninth exemplary stack-up diagram of the OLED touch display device **1300** in accordance with the present disclosure. As shown, the OLED touch display device **1300** further comprises a black matrix layer **1310** and an insulation layer **1320**. The black matrix layer **1310** is disposed at one side of the upper substrate **1130** that faces the OLED layer **120**. The black matrix layer **1310** comprises a plurality of opaque lines with black conductive material. The locations of the opaque lines **1311** of black conductive material in black matrix layer **1310** are corresponding to the locations of the gate lines **1141** and data lines **1143**. Corresponding to the metal mesh touch sense electrode layer **1110**, the opaque lines **1311** of black conductive material may be formed to be a second touch sense electrode layer.

[0059] FIG. **14** is a tenth exemplary stack-up diagram of the OLED touch display device **1400** in accordance with the present disclosure. In comparison with FIG. **11**, the OLED touch display device **1400** further comprises a second touch sense electrode layer **1410** and an insulation layer **1420**. The second touch sense electrode layer **1410** is disposed at one side of the black matrix layer **1120** opposite to the OLED layer **120**. The insulation layer **1420** is disposed at one side of the second touch sense electrode layer **1410** opposite to the OLED layer **120**.

[0060] FIG. **15** is an eleventh stack-up diagram of the OLED touch display device **1500** in accordance with the present disclosure. In comparison with FIG. **11**, the OLED touch display device **1500** comprises a transparent touch sense electrode layer **1510** disposed between the encapsulation layer **140** and the color filter layer **180**. The transparent touch sense electrode layer **1510** comprises a plurality of touch sense electrodes **1511** and each of touch sense electrodes **1511** is a transparent conductive electrode.

[0061] FIG. **16** is a schematic diagram illustrating the OLED touch display device **100** with the touch sense electrodes **151** being powered by a dedicated touch power source in accordance with the present disclosure. As shown in FIG. **16**, the touch control circuit **210** includes a dedicated touch power source **1610**, a touch stimulation signal generator **1620**, a first amplifier **1630**, and a second amplifier **1640**. The display control circuit **220** comprises a dedicated display power source **1650**.

[0062] The dedicated touch power source **1610** provides power to the touch stimulation signal generator **1620**, the first amplifier **1630**, and the second amplifier **1640** for performing touch detection. The touch stimulation signal generator **1620** generates the touch stimulation signal **211** amplified by the first amplifier and applied to a selected touch sense electrode **151**. The touch control circuit **210** receives the touch sense signal **213** from the selected touch sense electrode **1511**. The received the touch sense signal **213** is amplified by the second amplifier **1640** and applied to the other touch sense electrode **151**. The voltage level of the other touch sense electrode **151** may be the same with the voltage level of the selected touch sense electrode **1511**, such that the capacitance between the other touch sense electrode **151** and the selected touch sense electrode **1511** is zero, which can increase touch detection accuracy of the selected touch sense electrode **1511**.

[0063] In another example, the second amplifier **1640** may be connected to a third switch **1663** and an impedance component **1664**. The signal phase of the other touch sense electrode **151** may be the same with the signal phase of the selected touch sense electrode **1511**, such that the capacitance between the other touch sense electrode **151** and the selected touch sense electrode **1511** may be reduced, which can also increase touch detection accuracy of the selected touch sense electrode **1511**.

[0064] There are a first switch **1161** and a second switch **1162** disposed between the touch control circuit **210** and the display control circuit **220**. Each of the first switch **1661** and the second switch **1662** is capable of switching its two terminals to be connected or disconnected. Alternatively, the first switch **1661** may include a high impedance element **1665** connected to the two terminals of the first switch **1661**.

[0065] The dedicated display power source **1650** of the display control circuit **220** has a first grounding terminal denoted as a first ground (Gdisp). In one example of the present disclosure, the common voltage electrode layer **130**, the display thin film transistors **114**, the gate lines **1141**, and the data lines **1143** are powered by the dedicated display power source **1650**.

[0066] The display control circuit **220** is connected to the common electrode layer **130**, the display thin film transistors **114**, the gate lines **1141**, and the data lines **1143**, and so on for controlling a display unit to display an image.

[0067] In performing touch detection, the first switch **1661** and the second switch **1662** are off, and thus there is no current loop between the touch control circuit **210** and the display control circuit **220**.

[0068] In view of the foregoing, it is known that, in prior art, a large number of traces are required to be routed between the touch sense electrodes and the touch control circuit and, in the instant application, only M+N (=9) traces are required to connect the touch sense electrodes **151** and the touch control circuit **210**. As the touch resolution is getting increased, it can greatly reduce the number of traces, dramatically save layout area and decrease the manufacturing cost. Moreover, the pin number of the touch control circuit **210** can also be reduced. Thus, it can select a low pin count and low cost package to encapsulate the touch control circuit **210**.

[0069] Although the present invention has been explained in relation to its preferred embodiment, it is to be understood that many other possible modifications and variations can be made without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. An OLED touch display device, comprising:

a thin film transistor (TFT) substrate having a surface formed thereon a plurality of switch devices, a plurality of second touch traces, a plurality of conductive pads, a plurality of display TFTs, a plurality of display pixel electrodes, a plurality of gate lines, and a plurality of data lines, and each switch device comprising a plurality of touch TFT switches;

a common voltage electrode layer including at least one common voltage electrode;

an OLED layer disposed between the TFT substrate and the common voltage electrode layer;

an encapsulation layer disposed at one side of the common voltage electrode layer opposite to the OLED layer; and

at least one touch electrode layer disposed at one side of the common voltage electrode layer opposite to the OLED layer, and including a plurality of first touch traces and a plurality of touch sense electrodes divided into a plurality of groups each having at least one touch sense electrode, and each group corresponding to one of the conductive pads,

wherein the plurality of touch sense electrodes are corresponding to the plurality of first touch traces one by one and each of the touch sense electrodes is connected to the corresponding first touch trace, any tow touch sense electrodes are not connected with each other, each of the first touch traces is connected to one touch TFT switch of one switch device corresponding thereto, and each of the switch devices is connected to one second touch trace and one conductive pad corresponding thereto.

2. The OLED touch display device as claimed in claim **1**, further comprising:

a touch control circuit electrically connected to the plurality of conductive pads for controlling the plurality of touch TFT switches of the switch devices to be turned on or off so as to select a specific touch sense electrode to be connected to the corresponding conductive pad, and outputting a touch stimulation signal to the selected touch sense electrode or receiving a touch sense signal from the selected touch sense electrode for performing a touch detection operation.

3. The OLED touch display device as claimed in claim **2**, further comprising:

a display control circuit for sequentially outputting a scan signal to one gate line, outputting a data signal to one data line, and outputting a zero voltage signal, a negative signal or a positive voltage signal to the common voltage electrode layer for performing a display operation.

4. The OLED touch display device as claimed in claim **2**, further comprising:

at least one first switch disposed between the touch control circuit and the common voltage electrode layer.

5. The OLED touch display device as claimed in claim **3**, further comprising:

a second switch disposed between the touch control circuit and the display control circuit.

6. The OLED touch display device as claimed in claim **1**, further comprising:

a touch protective layer disposed at one side of the at least one touch electrode layer, wherein touch protective layer is a substrate or a hardened coating layer.

7. The OLED touch display device as claimed in claim **1**, wherein the plurality of touch sense electrodes are each a transparent conductive electrode.

8. The OLED touch display device as claimed in claim **1**, wherein the plurality of touch sense electrodes are each a metal mesh electrode.

9. The OLED touch display device as claimed in claim **8**, wherein the plurality of touch sense electrodes are each a black metal mesh electrode.

10. The OLED touch display device as claimed in claim **1**, further comprising:

a color filter layer and a black matric layer.

11. The OLED touch display device as claimed in claim **10**, wherein the plurality of touch sense electrodes are each a metal mesh electrode formed by mesh lines, and the mesh lines of the metal mesh electrodes are disposed at locations corresponding to opaque lines of the black matrix layer.

* * * * *

专利名称(译)	OLED触控显示装置		
公开(公告)号	[US20180308902A1](US20180308902A1)	公开(公告)日	2018-10-25
申请号	US15/491412	申请日	2017-04-19
[标]申请(专利权)人(译)	速博思股份有限公司		
申请(专利权)人(译)	SUPERC-TOUCH CORPORATION		
当前申请(专利权)人(译)	SUPERC-TOUCH CORPORATION		
[标]发明人	LEE HSIANG YU CHIN SHANG LIN PING TSUN TU CHIA HSUN		
发明人	LEE, HSIANG-YU CHIN, SHANG LIN, PING-TSUN TU, CHIA-HSUN		
IPC分类号	H01L27/32 G06F3/041 G06F3/044		
CPC分类号	H01L27/323 G06F3/0412 G06F3/0416 G06F2203/04104 H01L27/3262 H01L27/3276 G06F2203/04112 G06F3/044 H01L27/3244		
外部链接	Espacenet USPTO		

摘要(译)

一种OLED触控显示装置，包括TFT基板和触控电极层。TFT基板具有在其上形成有多个开关器件，多个第二触摸迹线和多个导电焊盘的表面。每个开关装置具有多个触摸TFT开关。触控电极层包括多个第一触控轨迹和多个触控感应电极，分为多组，每组具有至少一个触控感应电极，每组对应一个导电垫。触控感测电极一个接一个地对应于第一触控迹线。每个触摸感测电极连接到对应的第一触摸迹线。每个第一触摸迹线连接到相应开关装置的一个触摸TFT开关，并且每个开关装置连接到一个第二触摸迹线和相应的导电垫。