



(11) **EP 3 343 630 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
04.07.2018 Bulletin 2018/27

(51) Int Cl.:
H01L 27/32 ^(2006.01) **H01L 51/05** ^(2006.01)
G09G 3/3225 ^(2016.01)

(21) Application number: **17207039.3**

(22) Date of filing: **13.12.2017**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD TN

(72) Inventors:
• **YOO, Juhn-Suk**
10845 Paju-si, Gyeonggi-do (KR)
• **KWON, Woo-Hyun**
10845 Paju-si, Gyeonggi-do (KR)

(74) Representative: **Viering, Jentschura & Partner mbB**
Patent- und Rechtsanwälte
Am Brauhaus 8
01099 Dresden (DE)

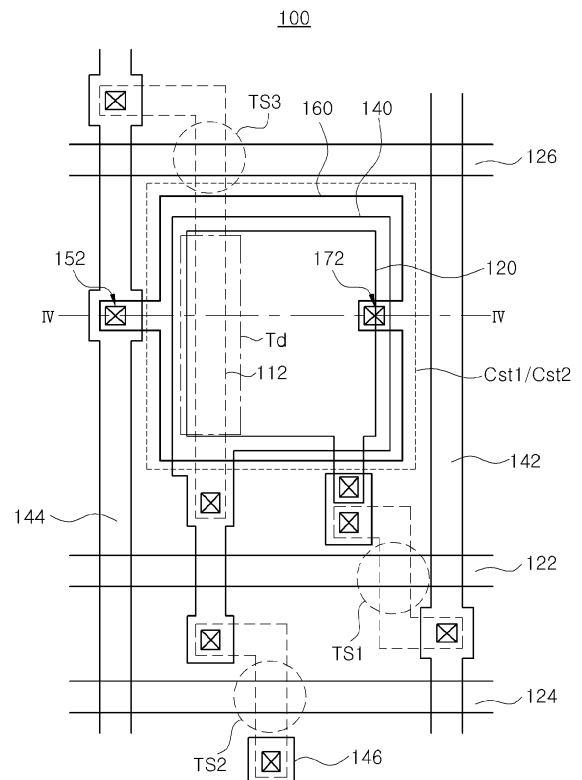
(30) Priority: **28.12.2016 KR 20160181411**

(71) Applicant: **LG Display Co., Ltd.**
Seoul, 07336 (KR)

(54) **ELECTROLUMINESCENT DISPLAY DEVICE**

(57) A display device comprising a driving thin film transistor (Td) having a two-gate overlap structure and a power line (144, 264) having a width extension structure that together allow for improved storage capacitance when compared to a display device without such structures.

FIG. 3



Description

[0001] The present application claims the benefit of Korean Patent Application No. 10-2016-0181411 filed in Korea on December 28, 2016.

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0002] The present invention relates to an electroluminescent display device and more particularly to an electroluminescent display device having an improved storage capacitance.

DISCUSSION OF THE RELATED ART

[0003] Among flat panel display devices, since an electroluminescent display device is a self-emission type, the electroluminescent display device has excellent characteristics of a wide viewing angle, a high contrast ratio in comparison to a liquid crystal display device and also the electroluminescent display device has characteristics of a thin profile and low power consumption because the electroluminescent display device does not need a back-light unit.

[0004] In addition, the electroluminescent display device can be driven by a direct low voltage and has advantages in a response time, external impact resistance, production cost, wide operating temperature range, and so on.

[0005] In an active matrix type electroluminescent display device, the voltage controlling the current applied to the pixel is charged in a storage capacitor such that the voltage is maintained until next frame. Accordingly, regardless of the number of the gate lines, the active matrix type electroluminescent display device has an emission state during one image displaying period.

[0006] FIG. 1 is a circuit diagram of one pixel region of the related art electroluminescent display device.

[0007] As shown in FIG. 1, in an electroluminescent display device, a gate line GL, a data line DL and a power line PL are formed, and a pixel region P is defined by the gate and data lines GL and DL. In the pixel region P, a switching thin film transistor (TFT) Ts, a driving TFT Td, a storage capacitor Cst and an emitting diode D are formed.

[0008] The switching TFT Ts is connected to the gate line GL and the data line DL, and the driving TFT Td and the storage capacitor Cst are connected between the switching TFT Ts and the power line PL. The emitting diode D is connected to the driving TFT Td.

[0009] In such electroluminescent display device, when the switching TFT Ts is turned on by a gate signal applied through the gate line GL, a data signal from the data line DL is applied to a gate electrode of the driving TFT Td and an electrode of the storage capacitor Cst through the switching TFT Ts. When the driving TFT Td

is turned on by the data signal, an electric current is supplied to the organic emitting diode D from the power line PL through the driving TFT Td. As a result, the emitting diode D emits light in proportion to the current passing through the driving TFT Td.

[0010] At the same time, the storage capacitor Cst is charged with the voltage in proportion to the data signal and the storage capacitor Cst serves to maintain the voltage of the gate electrode of the driving TFT Td for one frame. Accordingly, the electroluminescent display device can display images.

[0011] However, in the related art electroluminescent display device, a threshold voltage of the driving TFT Td is fluctuated (or changed) such that there is a problem in providing a desired image display. In addition, since there is a limitation of the storage capacitance, the driving property of the electroluminescent display device is decreased.

SUMMARY OF THE INVENTION

[0012] Accordingly, the present invention is directed to an electroluminescent display device that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

[0013] An object of the present invention is to provide an electroluminescent display device having an improved storage capacitance.

[0014] Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0015] To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, the present invention provides a display device comprising a driving thin film transistor (TFT) having a two-gate overlap structure and a power line having a width extension structure that together allow for improved storage capacitance when compared to a display device without such structures.

[0016] Various embodiments provide an electroluminescent display device, comprising: a scan signal line along a first direction on a substrate; a data line and a power line along a second direction crossing the first direction; a switching thin film transistor (TFT) connected to the scan signal line and the data line; a driving TFT connected to the switching TFT and the power line; and an emitting diode connected to the driving TFT, the driving TFT having a two-gate overlap structure including a second gate electrode over a first gate electrode, whereby the first and second gate electrodes act as a first capacitor.

[0017] In one or more embodiments, the data line has

a portion of its width extending over the two-gate overlap structure, whereby such width extension and the second gate electrode act as a second capacitor.

[0018] In one or more embodiments, the first and second capacitors overlap each other in a plane view.

[0019] In one or more embodiments, the electroluminescent display device further comprises: a semiconductor layer on the substrate; a gate insulating layer between the semiconductor layer and the first gate electrode of the driving TFT; and an interlayer insulating layer between the first gate electrode and the second gate electrode, which acts as a source terminal of the driving TFT.

[0020] In one or more embodiments, a portion of the power line contacting the semiconductor layer serves as a drain terminal of the driving TFT, and the source terminal of the driving TFT and the drain terminal of the driving TFT are disposed at a different layer from each other.

[0021] In one or more embodiments, the electroluminescent display device further comprises: a first passivation layer covering the source terminal; and a second passivation layer covering the data line and the power line, wherein the emitting diode includes first and second electrodes and an emitting layer between the first and second electrodes, and a contact hole extends through the first and second passivation layers to expose the source terminal, and wherein the first electrode is connected to the source terminal through the contact hole.

[0022] In one or more embodiments, the emitting layer includes an organic emitting material or an inorganic emitting material.

[0023] In one or more embodiments, the width extension of the data line, which acts as a source terminal of the driving TFT T_d , extends from the power line along the same plane.

[0024] Various embodiments provide an electroluminescent display device, comprising: a scan signal line along a first direction on a substrate; a data line and a power line along a second direction crossing the first direction; a switching thin film transistor (TFT) connected to the scan signal line and the data line; a driving TFT connected to the switching TFT and the power line; and an emitting diode connected to the driving TFT, the driving TFT having a gate that serves as a first capacitor electrode, and a source that serves as a second capacitor electrode, the power line having a width extension that serves as a third capacitor electrode, and wherein the gate and the source of the driving TFT constitute a first capacitor, and the width extension of the power line and the source of the driving TFT constitute a second capacitor.

[0025] In one or more embodiments, the third capacitor electrode is formed on the same layer and of the same material as a shield metal layer for preventing a crosstalk in adjacent pixel regions.

[0026] In one or more embodiments, the electroluminescent display device further comprises: a first electrode of the emitting diode; a contact hole for connection

of the first electrode of the emitting diode and a source terminal of the driving TFT; and wherein the third capacitor electrode of the second capacitor is spaced apart from the contact hole.

[0027] In one or more embodiments, the third capacitor electrode directly extends from the power line and is disposed at the same layer as the power line.

[0028] In one or more embodiments, the source terminal of the driving TFT is disposed at a different layer from the power line and the third capacitor electrode.

[0029] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

FIG. 1 is a circuit diagram of one pixel region of the related art electroluminescent display device.

FIG. 2 is a schematic circuit diagram of one pixel region of an electroluminescent display device according to the present invention.

FIG. 3 is a schematic plane view of one pixel region of an electroluminescent display device according to a first embodiment of the present invention.

FIG. 4 is a cross-sectional view taken along the line IV-IV of FIG. 3.

FIG. 5 is a schematic plane view of one pixel region of an electroluminescent display device according to a second embodiment of the present invention.

FIG. 6 is a cross-sectional view taken along the line VI-VI of FIG. 5.

FIG. 7 is a cross-sectional view taken along the line VII-VII of FIG. 5.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0031] Reference will now be made in detail to the embodiments, examples of which are illustrated in the accompanying drawings.

[0032] FIG. 2 is a schematic circuit diagram of one pixel region of an electroluminescent display device according to the present invention.

[0033] Referring to FIG. 2, an electroluminescent display device includes an emitting diode D, a driving TFT T_d , first to third switching TFTs TS_1 , TS_2 and TS_3 and first and second capacitors Cst_1 and Cst_2 in one pixel region. The electroluminescent display device may be referred to as a 4T2C type.

[0034] The electroluminescent display device may be driven by an initial period, a sampling period, a program-

ming period and an emitting period.

[0035] The first switching TFT TS1 is turned on or turned off based on a first scan signal Scan1. When the first switching TFT TS1 is turned on, a first nod N1, which is connected to a gate electrode of the driving TFT Td, and a data line DL is connected. In the initial period, the first scan signal Scan1 of high level is applied to the first switching TFT TS1 to turn on the first switching TFT TS1. Accordingly, in the initial period, a reference voltage Vref is applied to the first nod N1 from the data line DL through the first switching TFT TS1. In addition, in the programming period, the first scan signal Scan1 of high level is applied to the first switching TFT TS1. In the programming period, a data voltage Vdata is applied to the first nod N1 from the data line DL through the first switching TFT TS1.

[0036] The second switching TFT TS2 is turned on or turned off based on a second scan signal Scan2. In the initial period, the second switching TFT TS2 is turned on such that an initial voltage Vini is applied to a second nod N2, which is connected to a source terminal of the driving TFT Td.

[0037] The third switching TFT TS3 is turned on or turned off based on an emission signal EM. In the sampling period and the emitting period, the third switching TFT TS3 applies a high potential driving voltage Vdd from a Vdd supplying line (i.e., a power line PL) to a drain terminal of the driving TFT Td.

[0038] The emitting diode D includes a first terminal receiving the high potential driving voltage Vdd and a second terminal receiving a low potential driving voltage Vss. The driving TFT Td is disposed between the Vdd supplying line and a Vss supplying line, and the driving TFT Td and the emitting diode D are connected to the Vdd supplying line and the Vss supplying line in series. The driving TFT Td controls an amount of the electric current in the emitting diode D based on a voltage difference between the source terminal and the gate electrode.

[0039] The first capacitor Cst1 is located or connected between the first and second nodes N1 and N2. In the sampling period, the first capacitor Cst1 stores a threshold voltage (Vth) of the driving TFT Td. The second capacitor Cst2 is located or connected between the Vdd supplying line and the second node N2.

[0040] In the electroluminescent display device, the fluctuation of the threshold voltage of the driving TFT Td is compensated such that degradation of the display quality is prevented.

[0041] FIG. 3 is a schematic plane view of one pixel region of an electroluminescent display device according to a first embodiment of the present invention, and FIG. 4 is a cross-sectional view taken along the line IV-IV of FIG. 3.

[0042] Referring to FIGs. 3 and 4, with reference to FIG. 2, an electroluminescent display device 100 according to a first embodiment of the present invention includes an emitting diode D, a driving TFT Td, first to third switching TFTS TS1, TS2 and TS3 and first and second capac-

itors Cst1 and Cst2.

[0043] In addition, the electroluminescent display device 100 includes first and second scan signal lines 122 and 124 along a first direction, an emitting signal line 126, a data line 142 along a second direction crossing the first direction, a power line 144 and an initial signal line 146. The first and second scan signal lines 122 and 124 and the emitting signal line 126 extend along a first direction, and the data line 142, the power line 144 and the initial signal line 146 extend along a second direction crossing the first direction.

[0044] The first switching TFT TS1 is connected to the first scan signal line 122 and the data line 142, and the second switching TFT TS2 is connected to the initial signal line 146 and the driving TFT Td. The third switching TFT TS3 is connected to the emitting signal line 126 and the driving TFT Td, and the driving TFT Td is connected to the first switching TFT TS1 and the emitting diode D.

[0045] In addition, the first capacitor Cst1 is connected between a source terminal of the first switching TFT TS1, i.e., a gate electrode 120 of the driving TFT Td, and a source terminal 140 of the driving TFT Td. The second capacitor Cst2 is connected between the power line 144 and the source terminal 140 of the driving TFT Td.

[0046] In more detail, an active layer 112 of a semiconductor material is formed on a substrate 110, and a gate insulating layer 116 is formed over the substrate 110 to cover the active layer 112.

[0047] On the gate insulating layer 116, the gate electrode 120 of the driving TFT Td is formed, and an interlayer insulating layer 130 is formed to cover the gate electrode 120.

[0048] On the interlayer insulating layer 130, the source terminal 140 of the driving TFT Td, the data line 142 and the power line 144 are formed. The source terminal 140 of the driving TFT Td overlaps the gate electrode 120 of the driving TFT Td to form the first capacitor Cst1. Namely, an overlapped portion of the gate electrode 120 of the driving TFT Td serves as a first capacitor electrode, an overlapped portion of the source terminal 140 of the driving TFT Td serves as a second capacitor electrode, and the interlayer insulating layer 130 therebetween serves as a dielectric layer.

[0049] A first passivation layer 150 covering the source terminal 140 of the driving TFT Td, the data line 142 and the power line 144 and having a first contact hole 152, which exposes the power line 144, is formed above the substrate 110, and a third capacitor electrode 160, which is connected to the power line 144 through the first contact hole 152, is formed on the first passivation layer 150. For example, the third capacitor electrode 160 may be formed on the same layer and of the same material as a shield metal layer for preventing a cross-talk in adjacent pixel regions.

[0050] The third capacitor electrode 160 overlaps the second capacitor electrode as a portion of the source terminal 140 of the driving TFT Td. Accordingly, the second capacitor electrode, the third capacitor electrode 160

and the first passivation layer 150 therebetween constitute the second capacitor Cst2.

[0051] A second passivation layer 170 is formed on the third capacitor electrode 160. A second contact hole 172 exposing the source terminal 140 of the driving TFT Td is formed through the second passivation layer 170 and the first passivation layer 150.

[0052] On the second passivation layer 170, a first electrode 180, which is connected to the source terminal 140 of the driving TFT Td through the second contact hole 172, and a bank 182, which covers an edge of the first electrode 180, are formed.

[0053] An emitting layer 184 is formed on the first electrode 180 surrounded by the bank 182, and a second electrode 186 is formed over an entire surface of the substrate 110 covering the bank 182 and the emitting layer 184.

[0054] The first electrode 180, the emitting layer 184 and the second electrode 186 constitute the emitting diode D.

[0055] The first electrode 180 may be formed of a conductive material having a relatively high work function to serve as an anode. For example, the first electrode 180 may be formed of a transparent conductive material, e.g., indium-tin-oxide (ITO) or indium-zinc-oxide (IZO).

[0056] In addition, the first electrode 180 may further include a reflection layer or a reflection electrode to have a multi-layered structure. For example, the first electrode 180 may have a triple-layered structure of first and second layers, each of which is formed of ITO, and a third layer, which is disposed between the first and second layers and is formed of aluminum-palladium-copper (APC) alloy.

[0057] The second electrode 186 may be formed of a conductive material having a relatively low work function to serve as a cathode. For example, the second electrode 186 may be formed of one of aluminum (Al), magnesium (Mg) and Al-Mg alloy.

[0058] The emitting layer 184 may include an organic emitting material or an inorganic emitting material, e.g., a quantum dot.

[0059] As mentioned above, the electroluminescent display device 100 has the 4T2C structure such that the fluctuation of the threshold voltage of the driving TFT Td is compensated. Accordingly, an image quality of the electroluminescent display device is improved. In addition, with the first and second capacitors Cst1 and Cst2, the driving property of the electroluminescent display device 100 is also improved.

[0060] However, in the electroluminescent display device 100, the third capacitor electrode 160 of the second capacitor Cst2 should be spaced apart from the second contact hole 172 for connection of the first electrode 180 of the emitting diode D and the source terminal 140 of the driving TFT Td, and the source terminal 140 of the driving TFT Td should be spaced apart from the power line 144.

[0061] As a result, there are limitations in an area of

the second capacitor Cst2 and in a storage capacitance of the second capacitor Cst2.

[0062] FIG. 5 is a schematic plane view of one pixel region of an electroluminescent display device according to a second embodiment of the present invention.

[0063] Referring to FIG. 5, with respect to FIG. 2, an electroluminescent display device 200 according to a second embodiment of the present invention includes an emitting diode D, a driving TFT Td, first to third switching TFTS TS1, TS2 and TS3 and first and second capacitors Cst1 and Cst2.

[0064] In addition, the electroluminescent display device 200 includes first and second scan signal lines 222 and 224, an emitting signal line 226, a data line 262, a power line 264 and an initial signal line 266. The first and second scan signal lines 222 and 224 and the emitting signal line 226 extend along a first direction, and the data line 262, the power line 264 and the initial signal line 266 extend along a second direction crossing the first direction.

[0065] The first switching TFT TS1 is connected to the first scan signal line 222 and the data line 262, and the second switching TFT TS2 is connected to the initial signal line 266 and the driving TFT Td. The third switching TFT TS3 is connected to the emitting signal line 226 and the driving TFT Td, and the driving TFT Td is connected to the first switching TFT TS1 and the emitting diode D.

[0066] In addition, the first capacitor Cst1 is connected to a source terminal of the first switching TFT TS1, i.e., a gate electrode 220 of the driving TFT Td, and a source terminal 240 of the driving TFT Td. The second capacitor Cst2 is connected to the power line 264 and the source terminal 240 of the driving TFT Td. The first and second capacitors Cst1 and Cst2 overlap each other in a plane view. Here, the source terminal 240 of the driving TFT Td overlapping the gate electrode 220 of the driving TFT Td can be said to form a two-gate overlap structure for the driving TFT Td.

[0067] FIG. 6 is a cross-sectional view taken along the line VI-VI of FIG. 5, and FIG. 7 is a cross-sectional view taken along the line VII-VII of FIG. 5.

[0068] Referring to FIGs. 6 and 7, a semiconductor layer 212 of a semiconductor material is formed on a substrate 210, and a gate insulating layer 216 is formed over the substrate 210 to cover the semiconductor layer 212.

[0069] On the gate insulating layer 216, the gate electrode 220 of the driving TFT Td is formed. The gate electrode 220 overlaps the semiconductor layer 212, and the overlapped portion of the semiconductor layer 212 is defined as an active region.

[0070] An interlayer insulating layer 230 is formed to cover the gate electrode 220, and the source terminal 240 of the driving TFT Td is formed on the interlayer insulating layer 230.

[0071] The source terminal 240 of the driving TFT Td overlaps the gate electrode 220 of the driving TFT Td to form the first capacitor Cst1. Namely, an overlapped portion of the gate electrode 220 of the driving TFT Td serves

as a first capacitor electrode, an overlapped portion of the source terminal 240 of the driving TFT Td serves as a second capacitor electrode, and the interlayer insulating layer 230 therebetween serves as a dielectric layer.

[0072] A first passivation layer 250 is formed on the source terminal 240 of the driving TFT Td, and the data line 262, the power line 264 and a third capacitor electrode 260 are formed on the first passivation layer 250.

[0073] The third capacitor electrode 260 extends (along the same planar layer) from the power line 264 to overlap the second capacitor electrode as a portion of the source terminal 240 of the driving TFT Td. Accordingly, the second capacitor electrode, the third capacitor electrode 260 and the first passivation layer 250 constitute the second capacitor Cst2.

[0074] A first contact hole 252 exposing a portion of the semiconductor layer 212 is formed through the first passivation layer 250, the interlayer insulating layer 230 and the gate insulating layer 216, and a portion of the power line 264 contacts the semiconductor layer 212 through the first contact hole 252. The portion of the power line 264 serves as a drain terminal of the driving TFT.

[0075] The drain terminal 267 of the driving TFT Td is disposed at the same layer as the power line 264, and the source terminal 240 of the driving TFT Td is disposed under the power line 264. Namely, the source terminal 240 of the driving TFT Td and the drain terminal 267 of the driving TFT Td are disposed at a different layer from each other.

[0076] A second passivation layer 270 is formed on the third capacitor 260, the data line 262 and the power line 264. A second contact hole 272 exposing the source terminal 240 of the driving TFT Td is formed through the second passivation layer 270 and the first passivation layer 250.

[0077] On the second passivation layer 270, a first electrode 280, which is connected to the source terminal 240 of the driving TFT Td through the second contact hole 272, and a bank 282, which covers an edge of the first electrode 280, are formed.

[0078] An emitting layer 284 is formed on the first electrode 280 surrounded by the bank 282, and a second electrode 286 is formed above the substrate 210 to cover the bank 282 and the emitting layer 284.

[0079] The first electrode 280, the emitting layer 284 and the second electrode 286 constitute the emitting diode D.

[0080] The first electrode 280 may be formed of a conductive material having a relatively high work function to serve as an anode. For example, the first electrode 280 may be formed of a transparent conductive material, e.g., ITO or IZO.

[0081] In addition, the first electrode 280 may further include a reflection layer or a reflection electrode to have a multi-layered structure. For example, the first electrode 280 may have a triple-layered structure of first and second layers, each of which is formed of ITO, and a third layer, which is disposed between the first and second

layers and is formed of APC alloy.

[0082] The second electrode 286 may be formed of a conductive material having a relatively low work function to serve as a cathode. For example, the second electrode 286 may be formed of one of Al, Mg and Al-Mg alloy.

[0083] The emitting layer 284 may include an organic emitting material or an inorganic emitting material, e.g., a quantum dot.

[0084] As mentioned above, the electroluminescent display device 200 has the 4T2C structure such that the fluctuation of the threshold voltage of the driving TFT Td is compensated. Accordingly, an image quality of the electroluminescent display device is improved.

[0085] In addition, with the first and second capacitors Cst1 and Cst2, the driving property of the electroluminescent display device 200 is also improved. Moreover, since the third capacitor electrode 260 for the second capacitor Cst2 directly extends from the power line 264 (along the same planar layer) and is disposed at the same layer as the power line 264, an area of the second capacitor Cst2 is increased.

[0086] Namely, since the source terminal 240 of the driving TFT Td as the second capacitor electrode is disposed at a different layer from the power line 264 and the third capacitor electrode 260, the source terminal 240 of the driving TFT Td can be formed under the power line 264 to overlap the power line 264. Accordingly, a portion of the power line 264 serves as the third capacitor electrode 260 such that the area of the second capacitor Cst2 is increased. As a result, the storage capacitance of the capacitors in the electroluminescent display device 200 is increased, and the driving property of the electroluminescent display device 200 is further improved.

[0087] Here, it can be said that the driving TFT has a two-gate overlap structure including a second gate electrode over a first gate electrode, whereby the first and second gate electrodes act as a first capacitor. In addition, the data line has a portion of its width extending over the two-gate overlap structure, whereby such width extension and the second gate electrode act as a second capacitor.

[0088] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims.

Claims

1. An electroluminescent display device (100, 200), comprising:

a scan signal line along a first direction on a substrate (110, 210);
a data line (142, 262) and a power line (144,

- 264) along a second direction crossing the first direction;
 a switching thin film transistor (TS1) connected to the scan signal line and the data line;
 a driving thin film transistor (Td) connected to the switching thin film transistor (TS1) and the power line; and
 an emitting diode (D) connected to the driving thin film transistor (Td),
 the driving thin film transistor (Td) having a two-gate overlap structure including a second gate electrode over a first gate electrode, whereby the first and second gate electrodes act as a first capacitor (Cst1).
2. The electroluminescent display device (100, 200) according to claim 1, wherein the data line (142, 262) has a portion of its width extending over the two-gate overlap structure, whereby such width extension and the second gate electrode act as a second capacitor (Cst2).
 3. The electroluminescent display device (100, 200) according to claim 2, wherein the first and second capacitors (Cst1, Cst2) overlap each other in a plane view.
 4. The electroluminescent display device (200) according to claim 2 or 3, further comprising:
 - a semiconductor layer (212) on the substrate (210);
 - a gate insulating layer (216) between the semiconductor layer (212) and the first gate electrode of the driving thin film transistor (Td); and
 - an interlayer insulating layer (230) between the first gate electrode and the second gate electrode, which acts as a source terminal (240) of the driving thin film transistor (Td).
 5. The electroluminescent display device (200) according to claim 4, wherein a portion of the power line (264) contacting the semiconductor layer (212) serves as a drain terminal (267) of the driving thin film transistor (Td), and the source terminal (240) of the driving thin film transistor (Td) and the drain terminal (267) of the driving thin film transistor (Td) are disposed at a different layer from each other.
 6. The electroluminescent display device (100, 200) according to claim 4 or 5, further comprising:
 - a first passivation layer (150, 250) covering the source terminal (140, 240); and
 - a second passivation layer (170, 270) covering the data line (142, 262) and the power line (144, 264)),
 - wherein the emitting diode (D) includes first and
- second electrodes (180, 280; 186, 286) and an emitting layer (184, 284) between the first and second electrodes, and a contact hole extends through the first and second passivation layers to expose the source terminal (140, 240), and wherein the first electrode is connected to the source terminal (140, 240) through the contact hole.
7. The electroluminescent display device (100, 200) according to claim 6, wherein the emitting layer (184, 284) includes an organic emitting material or an inorganic emitting material.
 8. The electroluminescent display device (100, 200) according to any one of claims 2 to 7, wherein the width extension of the data line (142, 262), which acts as a source terminal (140, 240) of the driving thin film transistor (Td), extends from the power line (144, 264) along the same plane.
 9. An electroluminescent display device (100, 200), comprising:
 - a scan signal line along a first direction on a substrate (110, 210);
 - a data line (142, 262) and a power line (144, 264) along a second direction crossing the first direction;
 - a switching thin film transistor (TS1) connected to the scan signal line and the data line (142, 262);
 - a driving thin film transistor (Td) connected to the switching thin film transistor (TS1) and the power line (144, 264); and
 - an emitting diode (D) connected to the driving thin film transistor (Td),
 - the driving thin film transistor (Td) having a gate that serves as a first capacitor electrode, and a source that serves as a second capacitor electrode,
 - the power line (144, 264) having a width extension that serves as a third capacitor electrode, and
 - wherein the gate and the source of the driving thin film transistor (Td) constitute a first capacitor (Cst1), and the width extension of the power line (144, 264) and the source of the driving thin film transistor (Td) constitute a second capacitor (Cst2).
 10. The electroluminescent display device (100, 200) according to claim 9, wherein the third capacitor electrode is formed on the same layer and of the same material as a shield metal layer for preventing a cross-talk in adjacent pixel regions.
 11. The electroluminescent display device (100, 200)

according to claim 9 or 10, further comprising:

a first electrode of the emitting diode (D);
a contact hole for connection of the first electrode of the emitting diode (D) and a source terminal (140, 240) of the driving thin film transistor (Td); and
wherein the third capacitor electrode of the second capacitor (Cst2) is spaced apart from the contact hole.

12. The electroluminescent display device (100, 200) according to any one of claims 9 to 11, wherein the third capacitor electrode directly extends from the power line (144, 264) and is disposed at the same layer as the power line (144, 264).
13. The electroluminescent display device (100, 200) according to any one of claims 9 to 12, wherein the source terminal (140, 240) of the driving thin film transistor (Td) is disposed at a different layer from the power line (144, 264) and the third capacitor electrode.

25

30

35

40

45

50

55

FIG. 1
RELATED ART

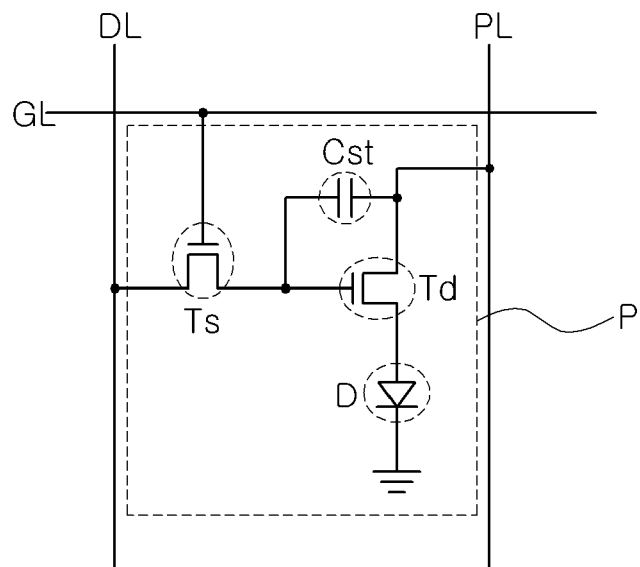


FIG. 2

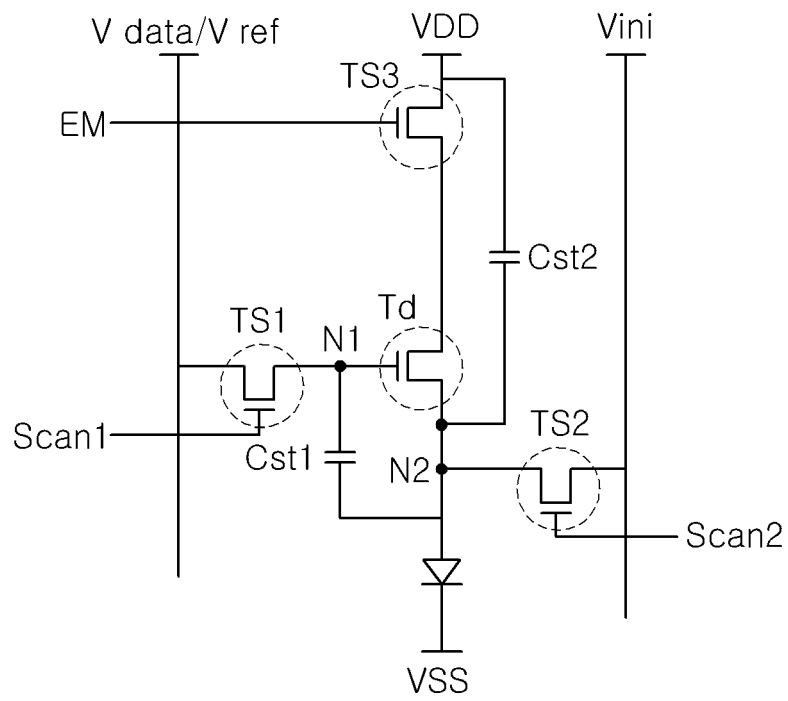


FIG. 3

100

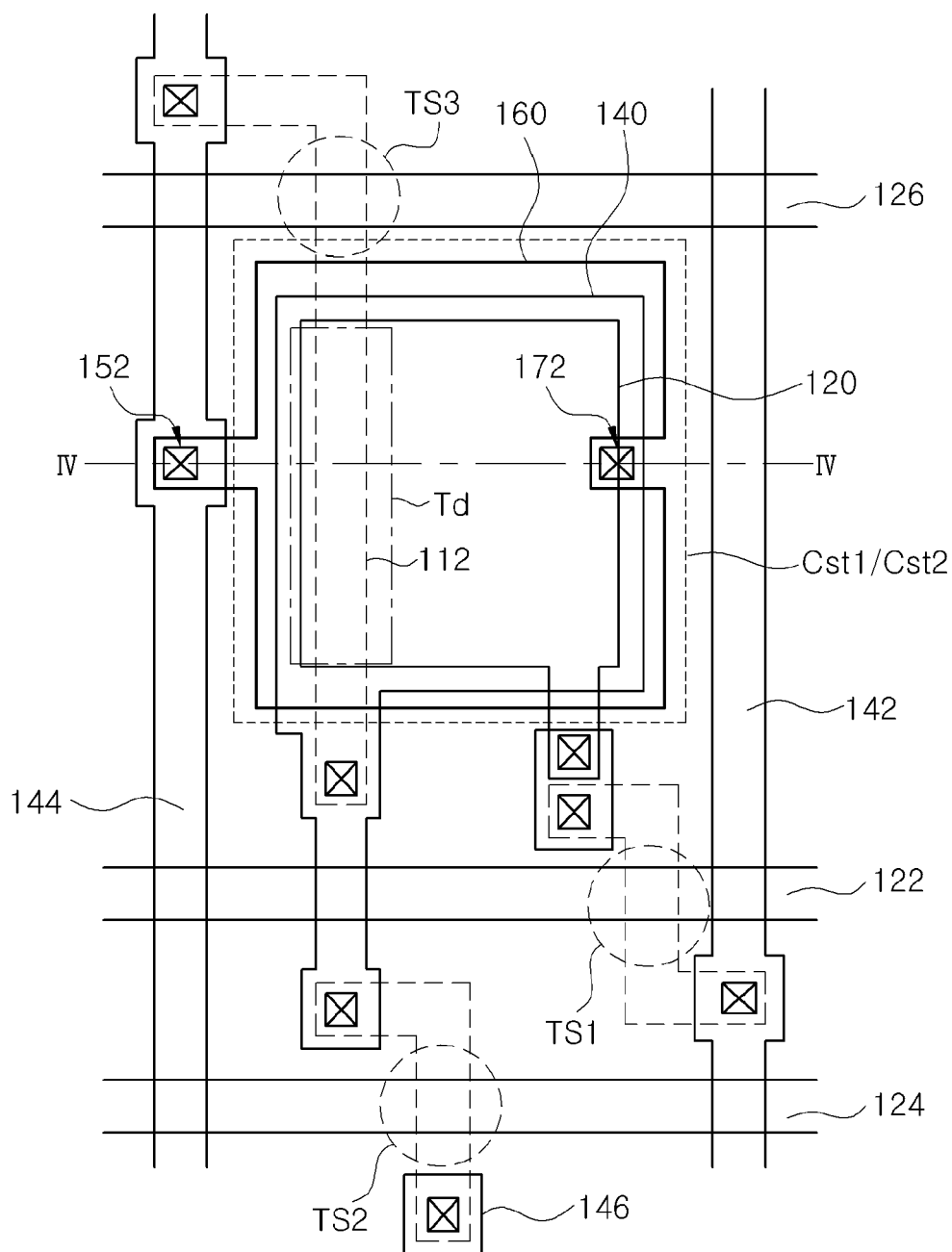


FIG. 4

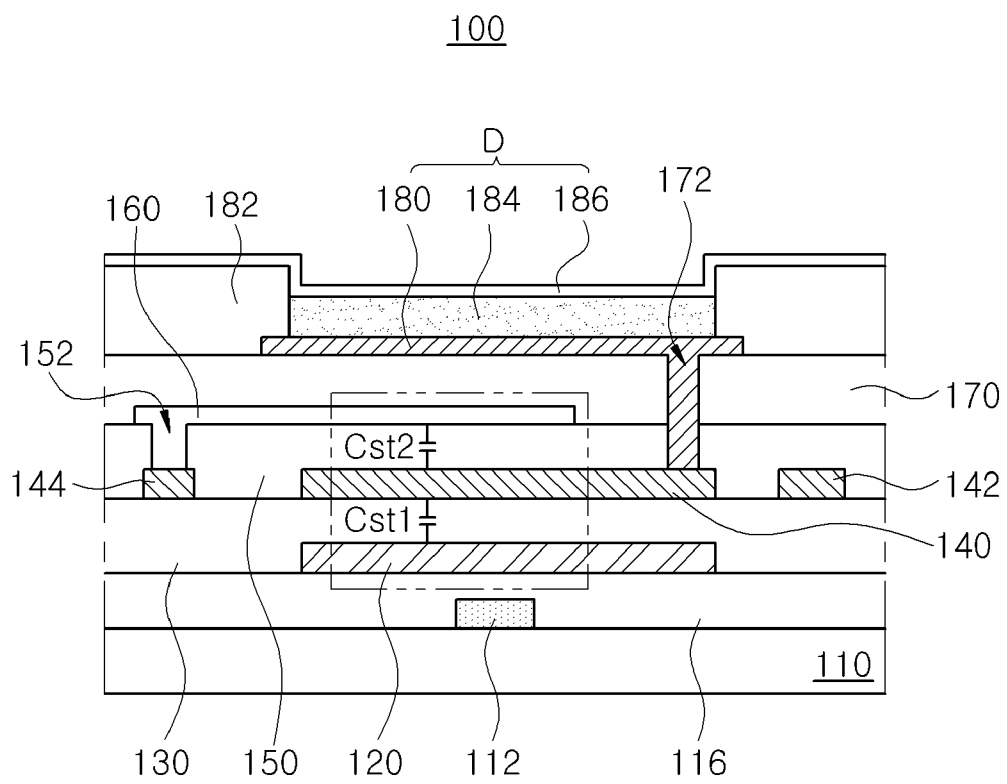


FIG. 5

200

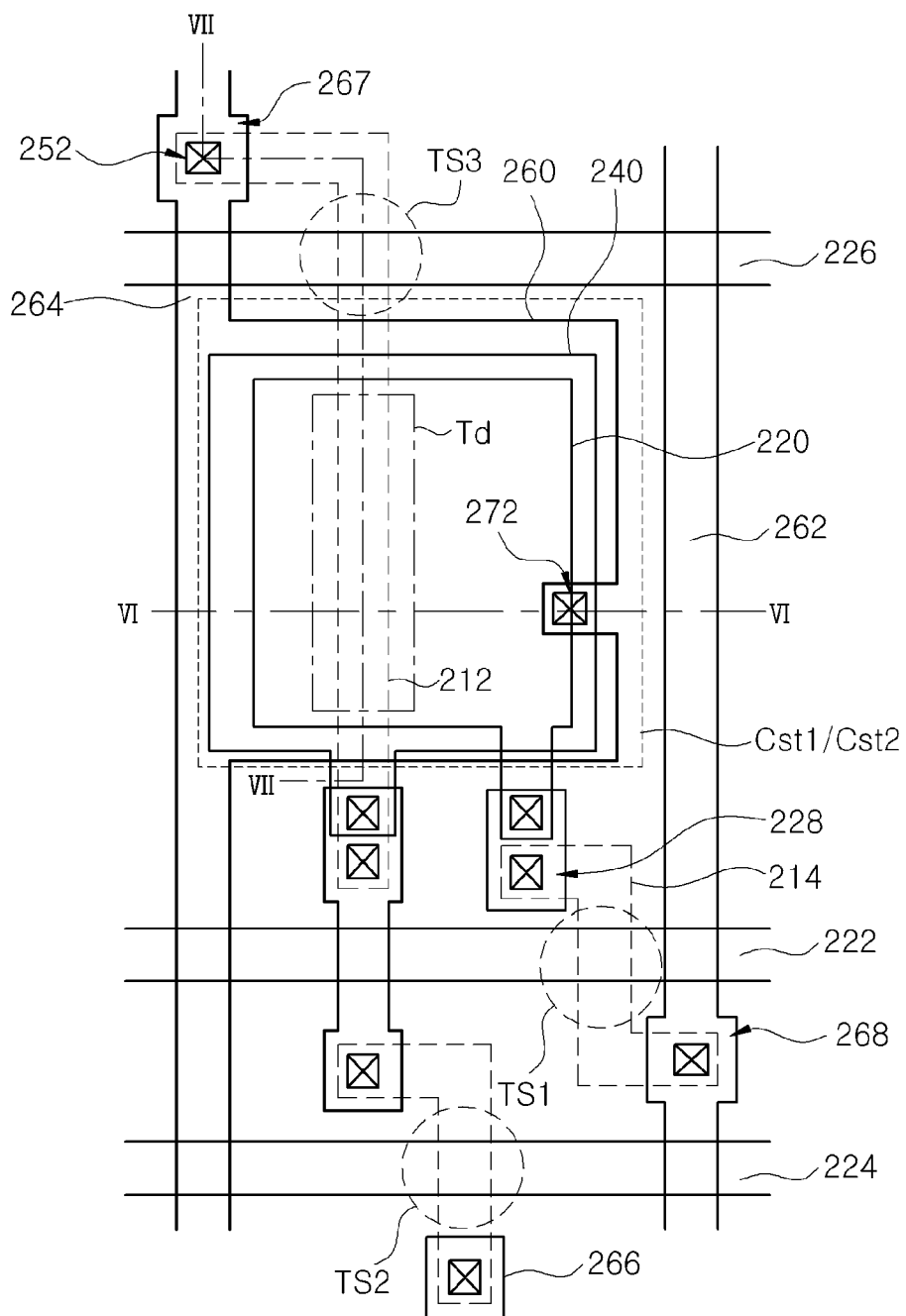


FIG. 6

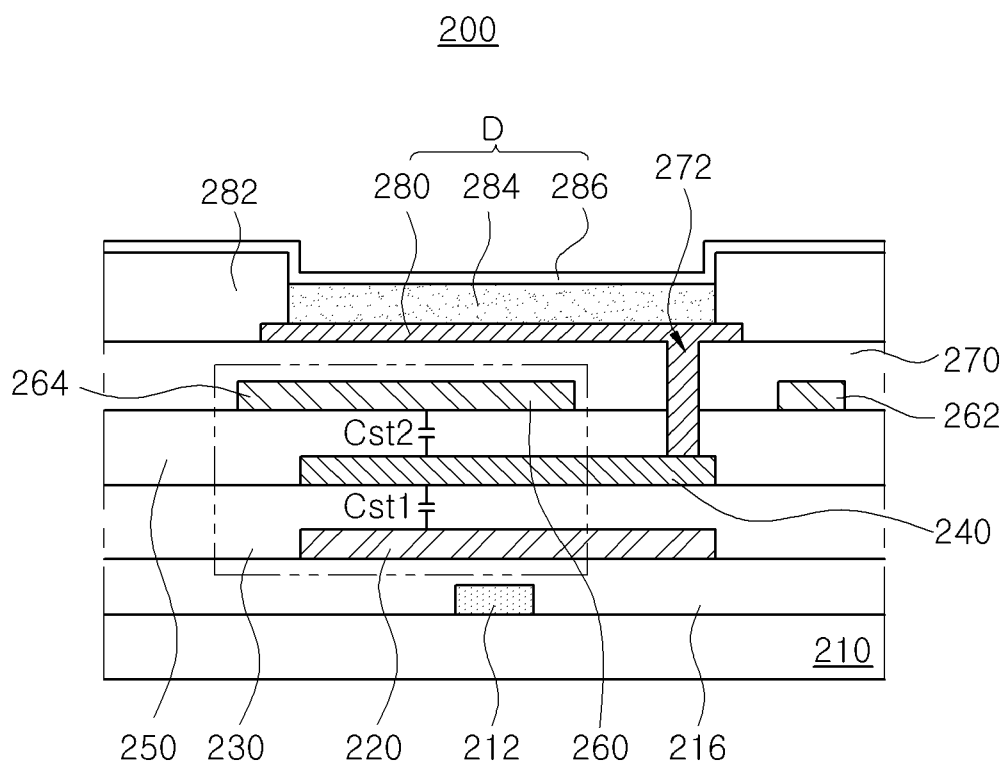
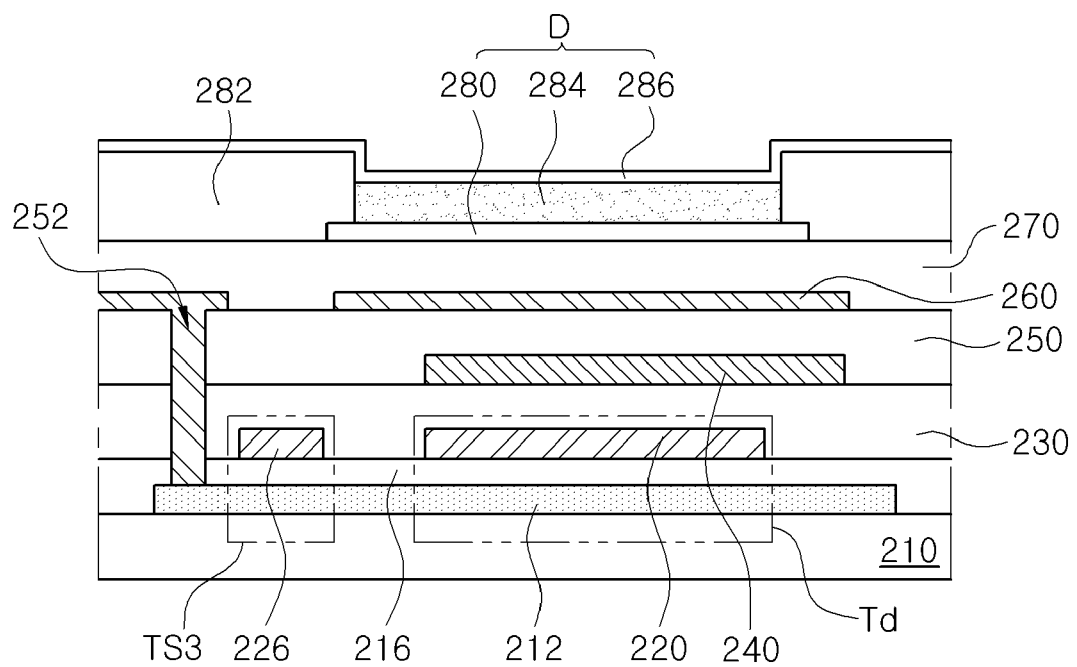


FIG. 7

200





EUROPEAN SEARCH REPORT

Application Number
EP 17 20 7039

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2016/217733 A1 (KIM MI-HAE [KR] ET AL) 28 July 2016 (2016-07-28) * paragraph [0056] - paragraph [0139]; figures 1-7 *	1-13	INV. H01L27/32 H01L51/05
A	US 2016/322442 A1 (LEE SEUNG-KYU [KR] ET AL) 3 November 2016 (2016-11-03) * paragraph [0056] - paragraph [0140]; figures 4-7 *	1-13	ADD. G09G3/3225
A	US 2016/035805 A1 (KIM YEONHONG [KR] ET AL) 4 February 2016 (2016-02-04) * paragraph [0023] - paragraph [0095]; figures 1-5 *	1-13	
			TECHNICAL FIELDS SEARCHED (IPC)
			H01L G09G
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 16 May 2018	Examiner Konráðsson, Ásgeir
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

 1
EPO FORM 1503 03 02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 17 20 7039

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

16-05-2018

10

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2016217733 A1	28-07-2016	KR 20160090949 A US 2016217733 A1	02-08-2016 28-07-2016

US 2016322442 A1	03-11-2016	KR 20160129175 A US 2016322442 A1 US 2017365651 A1	09-11-2016 03-11-2016 21-12-2017

US 2016035805 A1	04-02-2016	KR 20160017328 A US 2016035805 A1	16-02-2016 04-02-2016

15

20

25

30

35

40

45

50

55

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- KR 1020160181411 [0001]

专利名称(译)	电致发光显示装置		
公开(公告)号	EP3343630A1	公开(公告)日	2018-07-04
申请号	EP2017207039	申请日	2017-12-13
[标]申请(专利权)人(译)	乐金显示有限公司		
申请(专利权)人(译)	LG DISPLAY CO. , LTD.		
当前申请(专利权)人(译)	LG DISPLAY CO. , LTD.		
[标]发明人	YOO JUHN SUK KWON WOO HYUN		
发明人	YOO, JUHN-SUK KWON, WOO-HYUN		
IPC分类号	H01L27/32 H01L51/05 G09G3/3225		
CPC分类号	G09G3/3233 G09G2300/0819 G09G2300/0852 G09G2300/0861 G09G2300/0876 G09G2310/0251 G09G2310/0262 H01L27/1255 H01L27/3265 H01L51/0554 G09G3/3225 G09G3/3266 H01L27/3262 H01L27/3276		
优先权	1020160181411 2016-12-28 KR		
外部链接	Espacenet		

摘要(译)

一种显示装置，包括具有双栅极重叠结构的驱动薄膜晶体管（Td）和具有宽度延伸结构的电源线（144,264），与没有这种结构的显示装置相比，它们一起允许改善的存储电容。

