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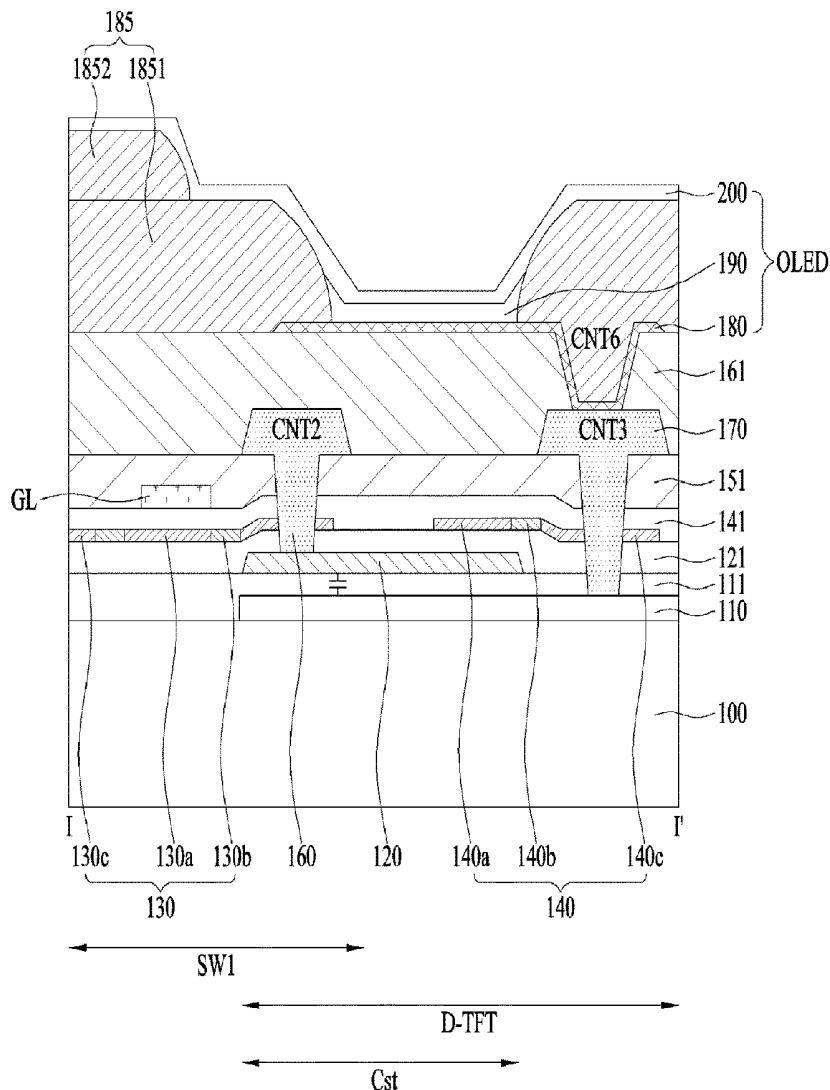
(19) **United States**(12) **Patent Application Publication**
OH et al.(10) **Pub. No.: US 2017/0062545 A1**(43) **Pub. Date: Mar. 2, 2017**(54) **ORGANIC LIGHT EMITTING DISPLAY
DEVICE AND METHOD FOR
MANUFACTURING THE SAME****Publication Classification**(51) **Int. Cl.****H01L 27/32** (2006.01)**H01L 51/56** (2006.01)(52) **U.S. Cl.**CPC **H01L 27/3276** (2013.01); **H01L 27/3265**(2013.01); **H01L 27/3262** (2013.01); **H01L****27/3246** (2013.01); **H01L 51/56** (2013.01)(71) Applicant: **LG Display Co., Ltd.**, Seoul (KR)(72) Inventors: **KUM-MI OH**, Seoul (KR); **Hye-Seon
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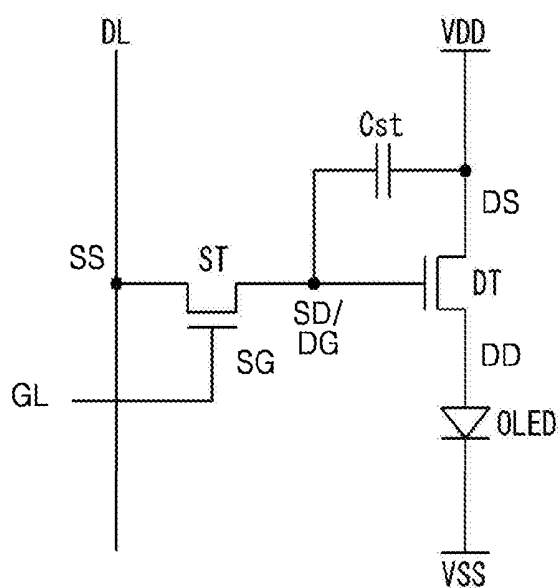
ABSTRACT

Disclosed are an organic light emitting display device capable of achieving an intra-pixel integration design with sufficient storage capacitance and a method for manufacturing the same in which the organic light emitting display device includes a first active layer connected to the driving gate electrode and the data line while crossing the gate line, and a second active layer spaced apart from the first active layer while overlapping the driving gate electrode and being connected to the current drive line and storage electrode.



RELATED ART

FIG. 1



RELATED ART

FIG. 2

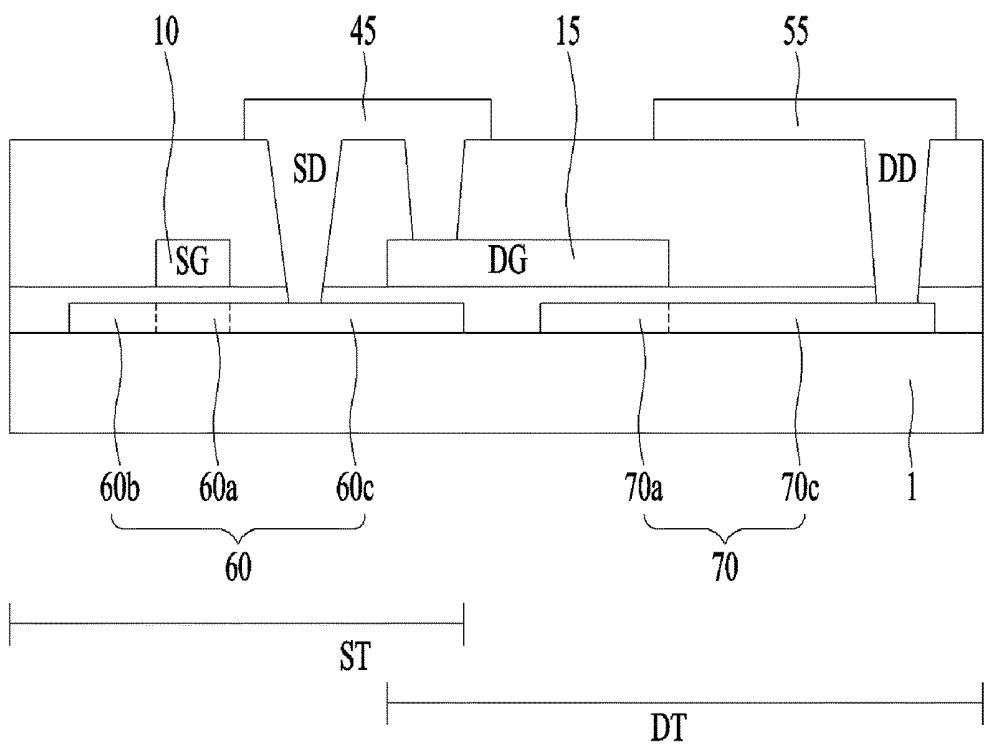


FIG. 3

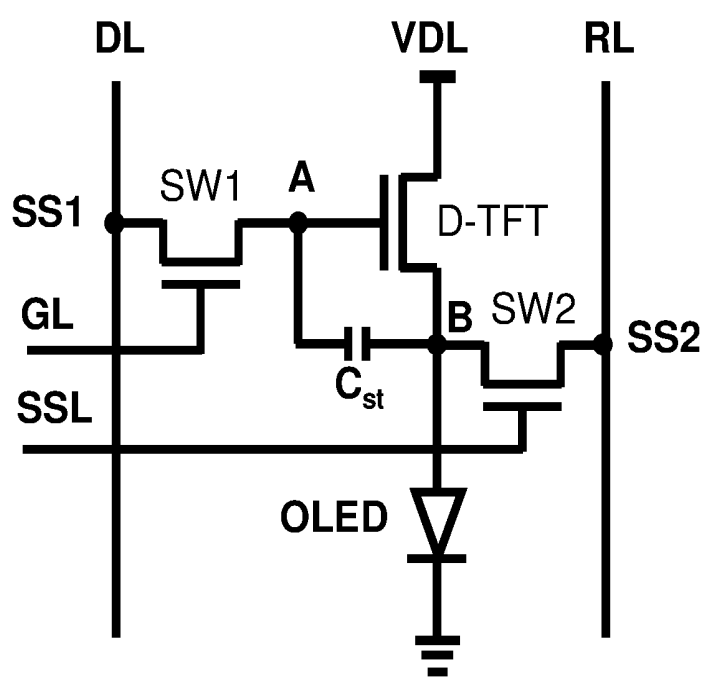


FIG. 4

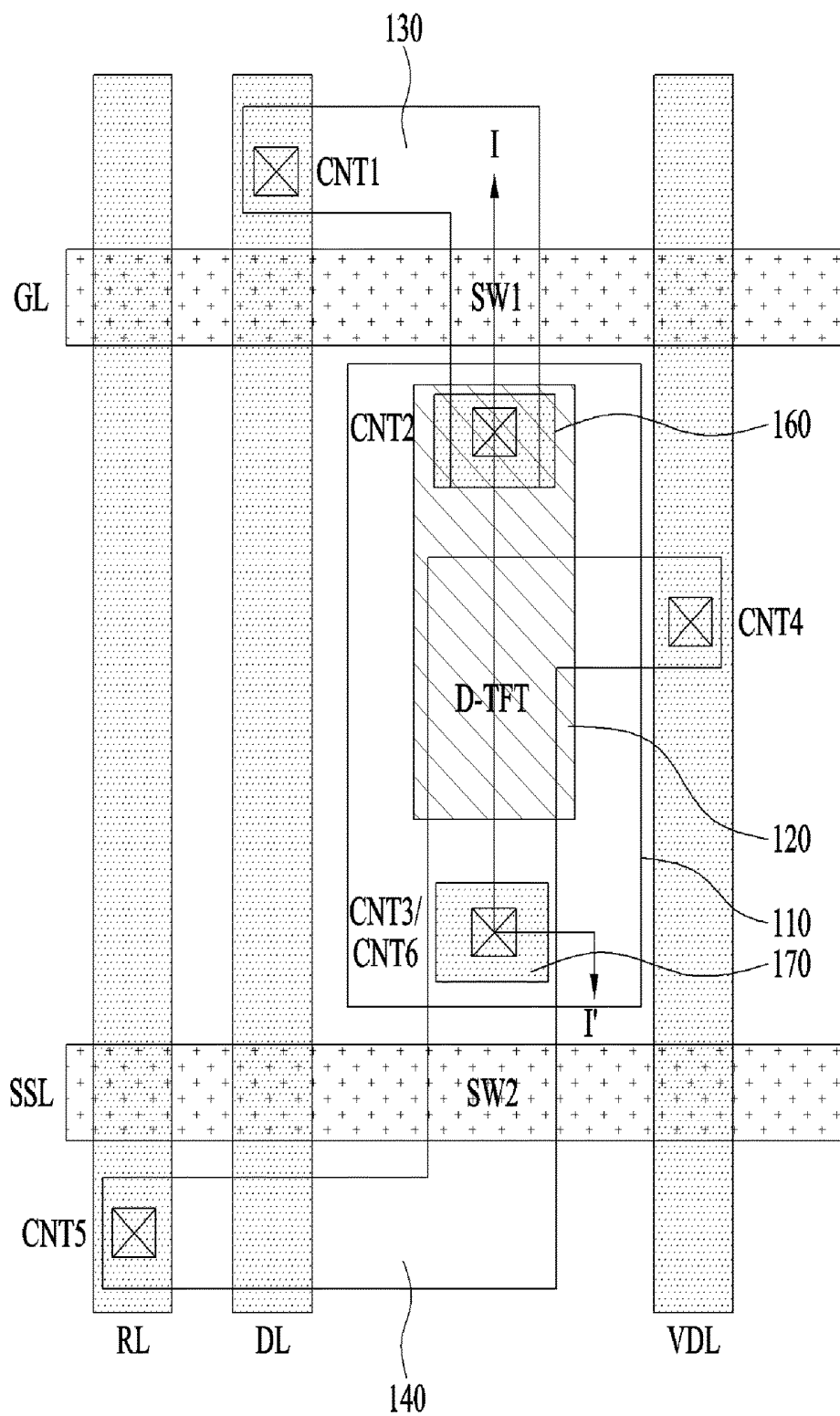


FIG. 5

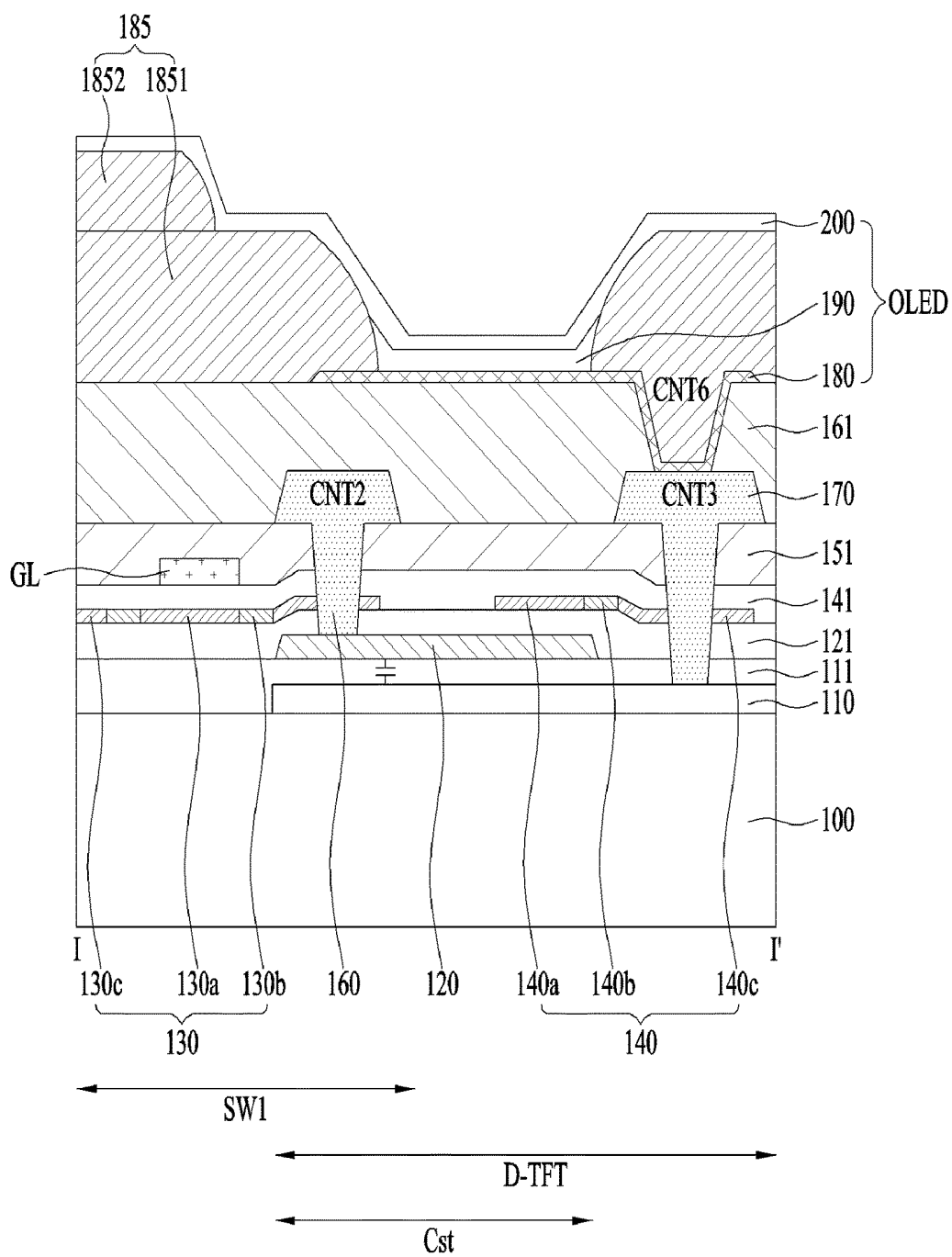


FIG. 6

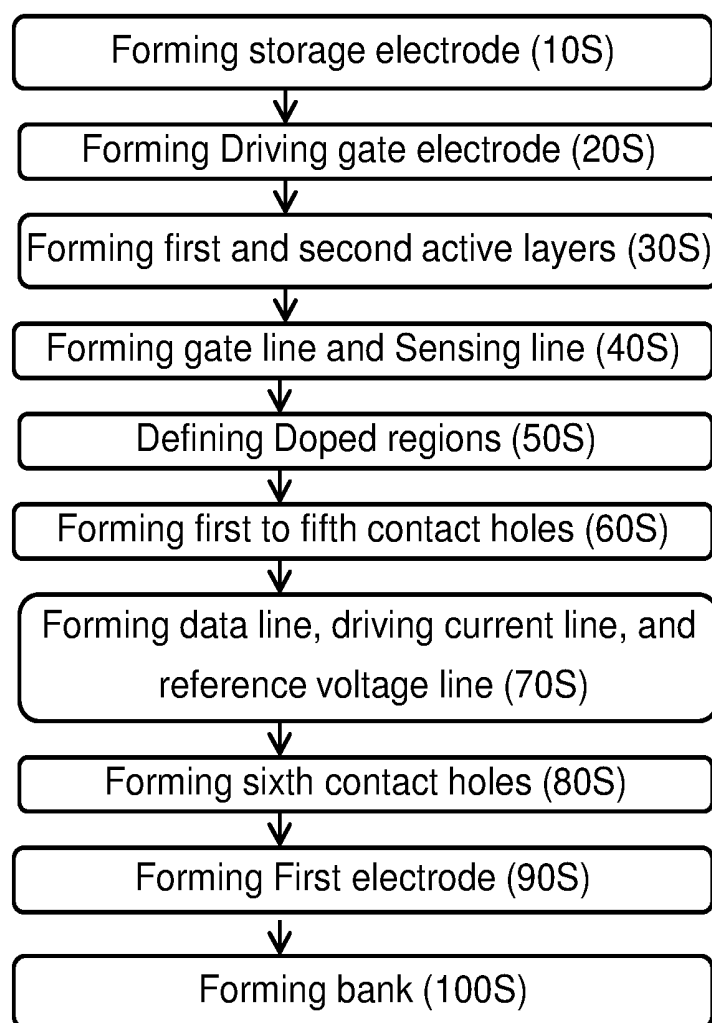


FIG. 7

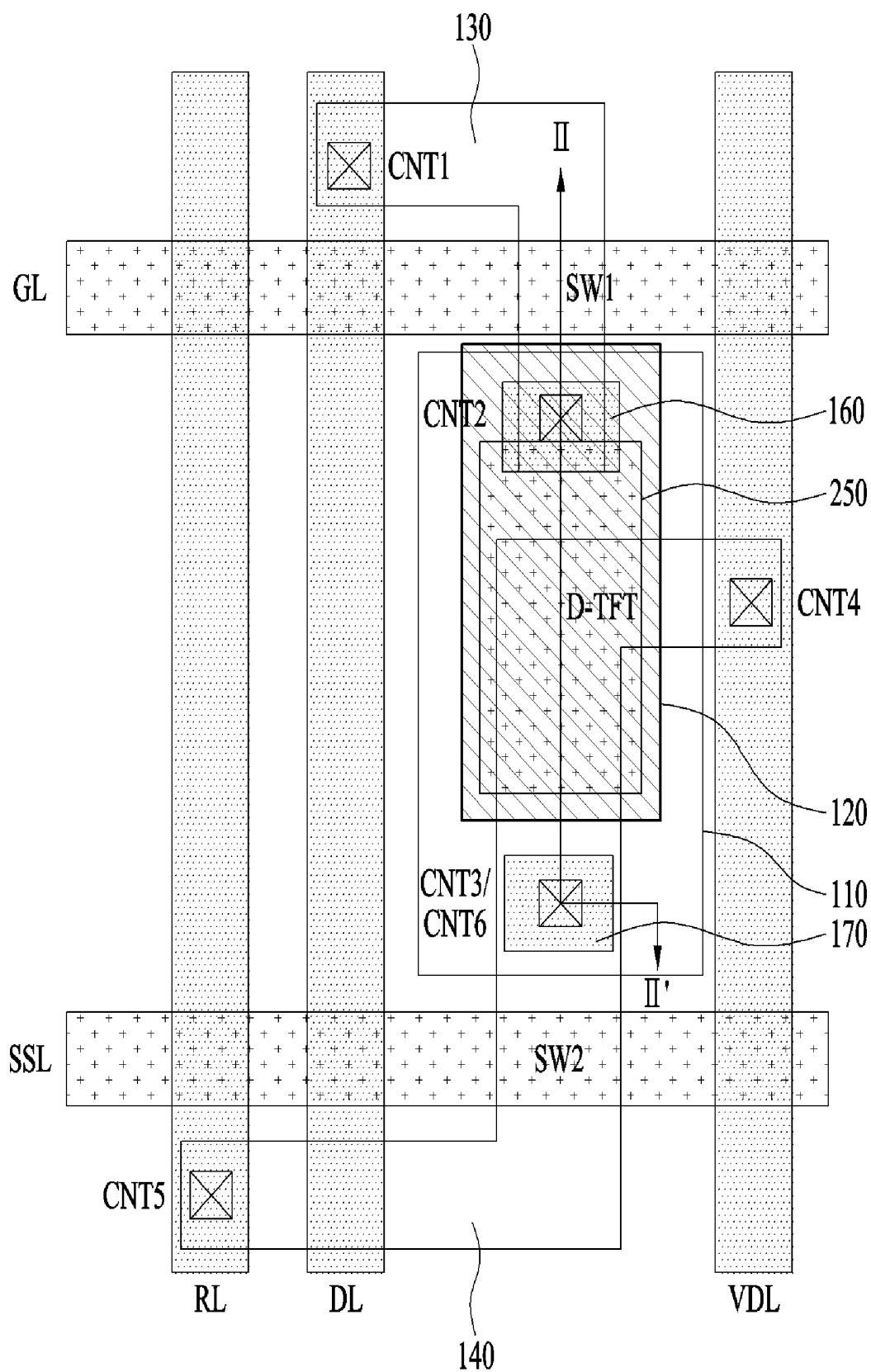


FIG. 8A

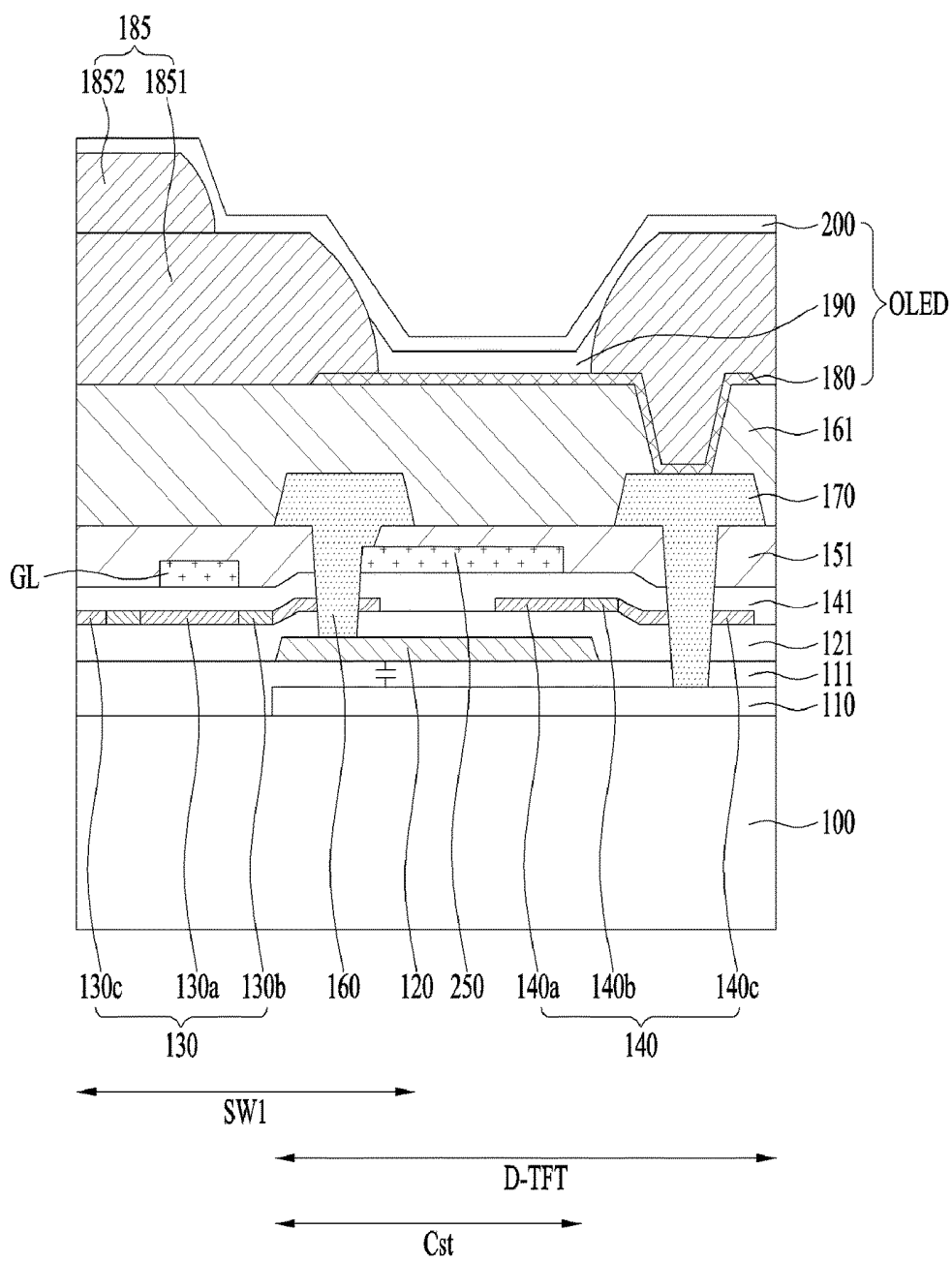


FIG. 8B

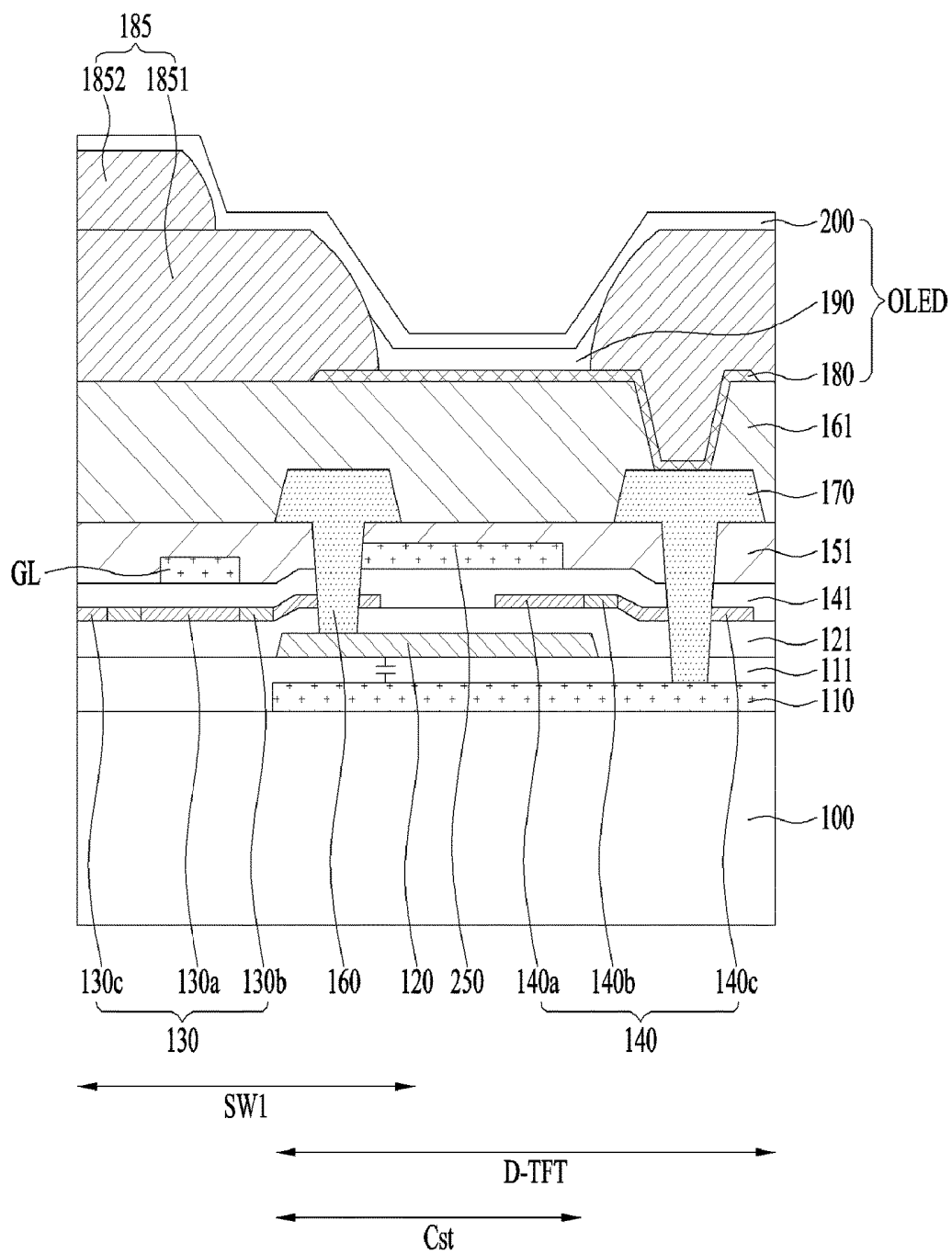


FIG. 8C

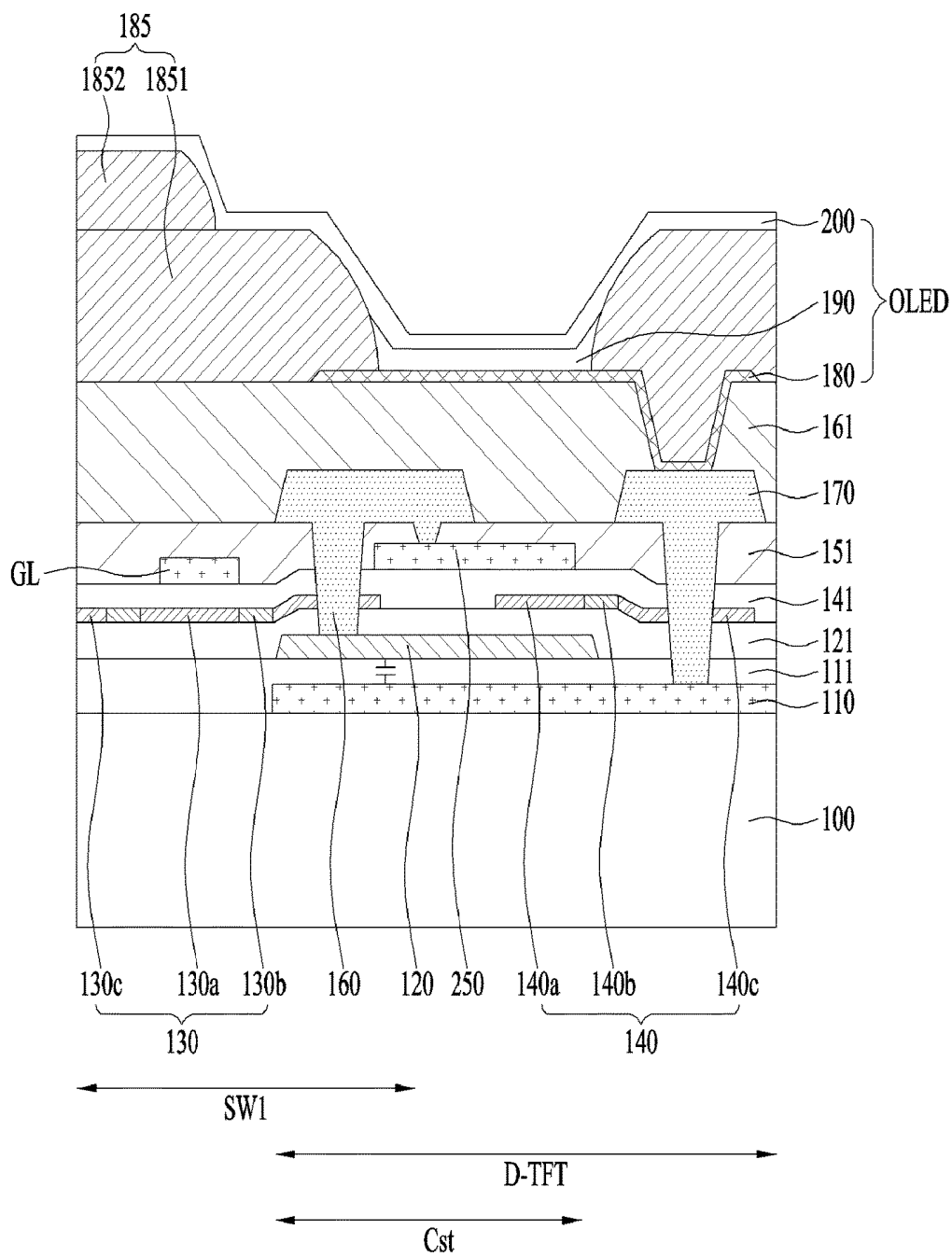


FIG. 9

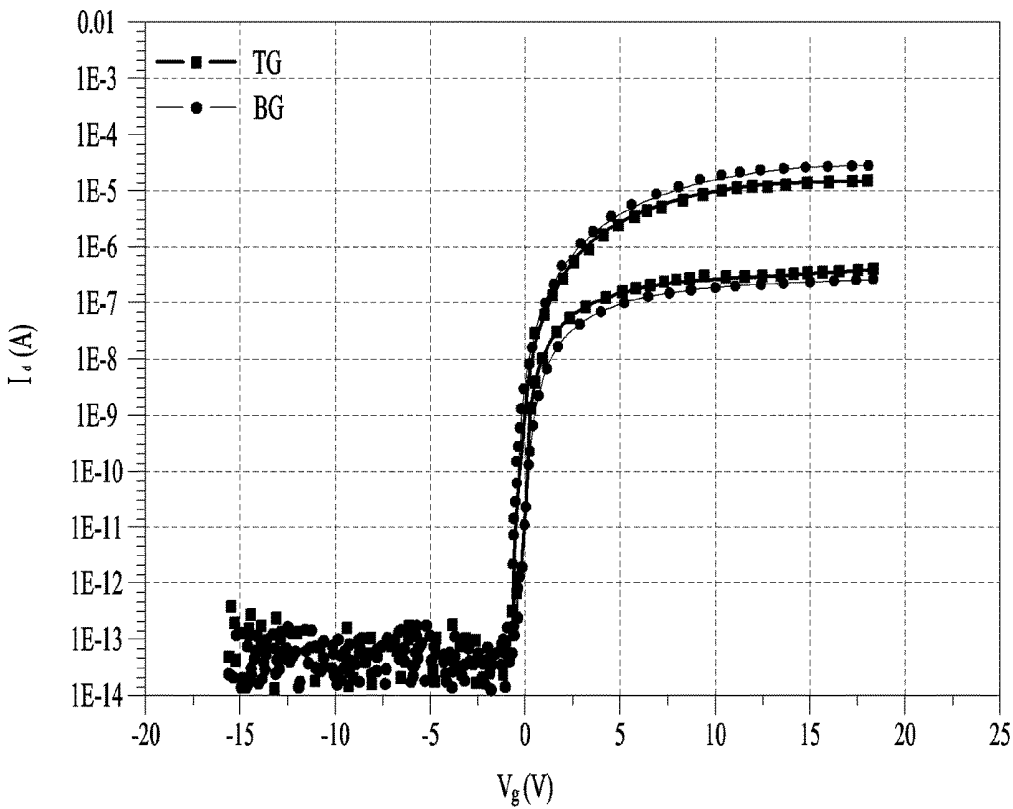
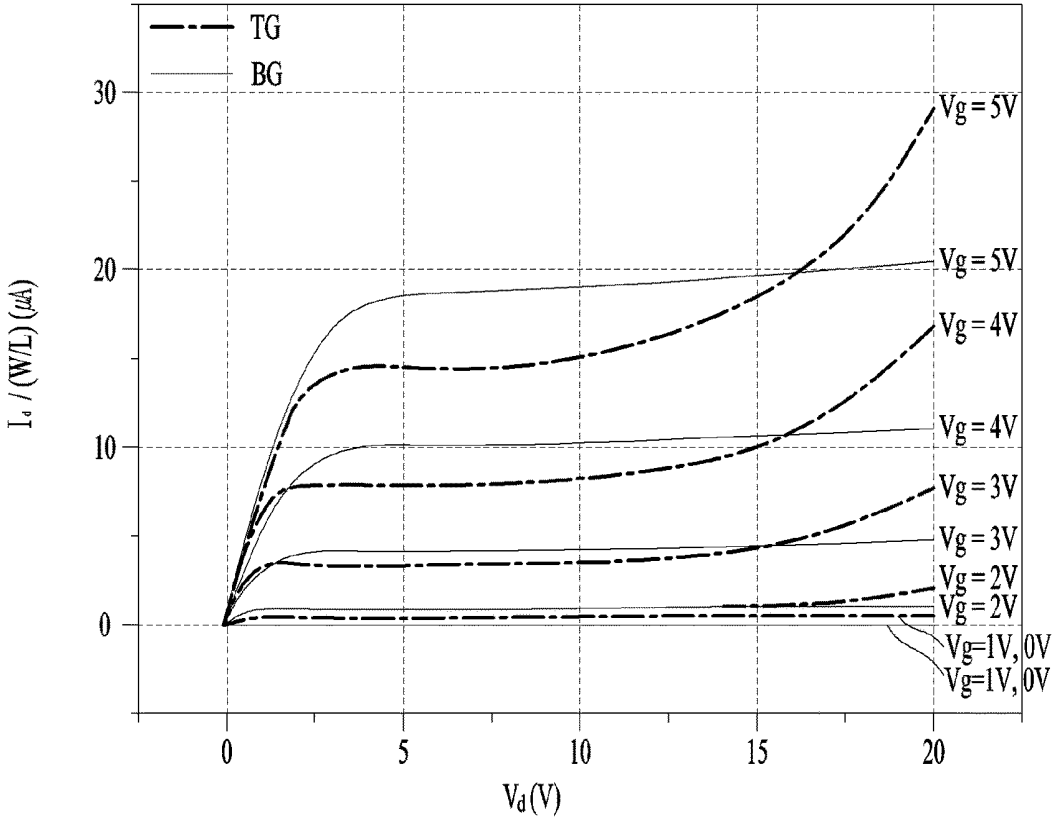


FIG. 10



ORGANIC LIGHT EMITTING DISPLAY DEVICE AND METHOD FOR MANUFACTURING THE SAME

[0001] This application claims the benefit of Korean Patent Application No. 10-2015-0120071, filed on Aug. 26, 2015, which is hereby incorporated by reference as if fully set forth herein.

BACKGROUND OF THE INVENTION

[0002] Field of the Invention

[0003] The present invention relates to an organic light emitting display device, and more particularly to an organic light emitting display device capable of achieving an intra-pixel integration design with sufficient storage capacitance and a method of manufacturing the same.

[0004] Discussion of the Related Art

[0005] With the recent development of various portable electronic appliances such as mobile communication terminals and notebook computers, demand for flat panel display devices applicable to portable electronic appliances is increasing.

[0006] Examples of flat panel display devices being currently researched include a liquid crystal display device, a plasma display device, a field emission display device, and an organic or inorganic light emitting diode display device. In particular, in the case of the organic light emitting display device, the application field thereof is being expanded by virtue of its various advantages such as advanced technologies for mass production, easy implementation of driving means, low power consumption, high picture quality, realization of a large screen, and flexibility.

[0007] Such an organic light emitting device includes an organic light emitting diode in each pixel for light emission and a pixel circuit for controlling current flowing through the organic light emitting diode. The pixel circuit typically includes at least two thin film transistors, and a storage capacitor.

[0008] Meanwhile, thin film transistors are classified into a thin film transistor having a top gate structure and a thin film transistor having a bottom gate structure.

[0009] For formation of thin film transistors (TFTs) having a top gate structure, an amorphous silicon layer is first formed over a substrate. The amorphous silicon layer is then crystallized using an excimer layer and, as such, is formed into a polysilicon layer. A photoresist film (not shown) is subsequently coated over the crystallized polysilicon layer. The photoresist film is subjected to a light exposure and development to form a photoresist film pattern. Using the photoresist film pattern as a mask, the polysilicon layer is then etched, to leave an active layer in regions each corresponding to a desired portion of each pixel. A gate insulating film is then formed to cover the active layer. Gate electrodes are finally formed on the gate insulating film, to correspond to the active layer.

[0010] On the other hand, formation of TFTs having a bottom gate structure is carried out in such a manner that formation of an active layer and gate electrodes is reverse to that of the TFTs having a top gate structure. Meanwhile, the crystallization process for crystallizing amorphous silicon into polysilicon is carried out at a temperature of 400° C. or more and, as such, disconnection of the active layer may occur during the crystallization process in the bottom gate structure. For this reason, recently developed organic light

emitting display devices prefer TFTs having a top gate structure in which gate electrodes are formed after completion of crystallization, in order to eliminate the problem of active layer disconnection.

[0011] Hereinafter, one pixel of a conventional organic light emitting display device including TFTs having a top gate structure will be described with reference to the accompanying drawings.

[0012] FIG. 1 is a circuit diagram illustrating one pixel of a conventional organic light emitting display device. FIG. 2 is a cross-sectional view taken along a line passing through a drive transistor and a switching TFT, which are illustrated in FIG. 1.

[0013] FIG. 1 illustrates a configuration of a pixel circuit in an organic light emitting display device having a basic structure. The pixel circuit includes a switching TFT ST, a drive TFT DT connected to the switching TFT ST, and an organic light emitting diode OLED connected to the drive TFT DT.

[0014] The switching TFT ST is formed at a region where a gate line GL and a data line DL cross each other. The switching TFT ST functions to select a pixel. As illustrated in FIG. 2, the switching TFT ST includes a switching gate electrode SG 10 protruding from the gate line GL, a switching source electrode SS branched from the data line DL, a switching drain electrode SD 45, and a first active layer 60 having a switching channel region.

[0015] In this case, the switching channel region, which is designated by reference numeral 60a, is defined by a portion of the first active layer 60 overlapping the switching gate electrode SG. Portions of the first active layer 60 disposed at opposite sides of the switching channel region 60a are doped with impurity ions and, as such, function as a source region 60b and a drain region 60c, respectively. The source region 60b and drain region 60c are connected to the switching source electrode SS and switching drain electrode SD of the switching TFT ST, respectively.

[0016] Meanwhile, the drive TFT DT functions to drive the organic light emitting diode OLED of the pixel selected by the switching TFT ST. The drive TFT DT includes a driving gate electrode DG 15 connected to the switching drain electrode SD of the switching TFT ST, a drive source electrode DS included in a reference voltage line RL, a driving electrode pattern DD 55 spaced apart from the drive source electrode DS, and a second active layer 70 having a driving channel region 70a and source and drain regions 70b and 70c respectively connected to the drive source electrode DS and driving electrode pattern DD 55 around the driving channel region 70a. The driving electrode pattern DD of the drive TFT DT is connected to a first electrode of the organic light emitting diode OLED.

[0017] The driving gatedriving gate electrode DG 15 is arranged over the switching TFT ST and beneath the drive TFT DT while overlapping the switching drain electrode 45 and driving electrode pattern, respectively. Electrical connection is provided at overlapping portions of the driving gate electrode DG 15 and switching drain electrode 45 and, as such, the drain electrode of the switching TFT ST and the gate electrode of the drive TFT DT are connected.

[0018] In addition, a storage capacitor Cst may be defined by the overlapping portions of the driving gate electrode DG 15 and driving electrode pattern 55 of the drive TFT DT.

[0019] In the conventional organic light emitting display device, the switching drain electrode SD and driving gate

electrode DG, which are formed to have a straight shape on a planar surface, overlap each other on the planar surface for a connection between the drain electrode of the switching TFT and the gate electrode of the drive TFT. The switching drain electrode SD and the driving gate electrode DG have an elongated planar straight electrode shape. In this case, the driving electrode pattern DD 55 used as one electrode of the storage capacitor Cst is beneficially not be connected to the driving gate electrode DG 15 even though the driving electrode pattern DD 55 overlaps the driving gate electrode DG 15 when viewed in plan. Accordingly, at least the driving gate electrode DG 15 and the connection portions of the second active layer 70 and driving electrode pattern 55 are spaced apart from each other when viewed in plane. Since the driving gate electrode DG 15 maintains a planar spacing from the connection portions of the second active layer 70 and driving electrode pattern DD 55, the overlap area between the driving electrode pattern DD 55 and the driving gate electrode DG 15 is small. As a result, the storage capacitance determined by the overlap area may be insufficient.

[0020] Meanwhile, development of organic light emitting display devices is being accelerated to satisfy demand for large area and high density displays in accordance with gradual expansion of application fields thereof. In particular, as resolution increases, the size of the unit pixel is decreased. The decrease in unit pixel size means that the space of the unit pixel where TFTs and a storage capacitor are arranged is reduced. In the above-mentioned conventional organic light emitting display device, the pixel size may need to be increased to secure a sufficient storage capacitor area. For this reason, it may be difficult to simultaneously secure both high resolution and sufficient capacity of a storage capacitor.

[0021] Meanwhile, the organic light emitting diode OLED is formed through a lamination of a first electrode connected to the drain electrode DD 55 of the drive TFT DT, organic layers including an organic light emitting layer, and a second electrode.

[0022] In addition, the inter-pixel position of the organic light emitting diode may vary in accordance with light emission types. For example, in a top emission type, the organic light emitting diode can emit light at the top side thereof, irrespective of overlap thereof with a pixel circuit including light-shielding metal wirings. In a bottom emission type, however, the light-shielding metal wirings may shield emission of light and, as such, the aperture ratio of the organic light emitting diode may be reduced as the area of the pixel circuit increases.

[0023] In the above-mentioned conventional organic light emitting display device having a top gate structure, the switching drain electrode and driving gate electrode, which are connected in one direction, are beneficially arranged between the active layers of the switching TFT and drive TFT spaced apart from each other when viewed in plane. For this reason, it may be difficult to achieve a desired intra-pixel circuit integration. Accordingly, the conventional organic light emitting display device having a top gate structure may need to secure a space between intra-pixel circuit regions, which makes it difficult to secure high resolution.

[0024] In addition, due to the features of the top gate structure, the gate electrode layer occupying a relatively small area in the pixel area is arranged over the active layer and, as such, it may be difficult to secure an area for a storage capacitor. That is, it may be difficult to secure an area

overlapping the gate metal layer having a small area for the storage capacitor to have sufficient capacity.

SUMMARY

[0025] Accordingly, the present invention is directed to an organic light emitting display device and a method for manufacturing the same that substantially obviate one or more problems due to limitations and disadvantages of the related art.

[0026] An advantage of the present invention is to provide an organic light emitting display device capable of achieving an intra-pixel integration design with sufficient storage capacitance.

[0027] Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0028] To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, an organic light emitting display device may, for example, include a gate line and a data line crossing each other on a substrate, a sensing line extending in parallel to the gate line, and a current driving line and a reference voltage line extending in parallel to the data line, a storage capacitor provided by an overlap between a storage electrode and a driving gate electrode, wherein the storage electrode and the driving gate electrode are disposed on different layers, respectively, a first active layer crossing the gate line, wherein opposite ends of the first active layer connected to the driving gate electrode and the data line and a second active layer spaced apart from the first active layer while overlapping the driving gate electrode, wherein the second active layer protruding from the driving gate electrode has opposite side portions respectively connected to the current drive line and the storage electrode.

[0029] The second active layer may extend from the portion connected to the storage electrode such that the second active layer is connected to the reference voltage line while crossing the sensing line.

[0030] The first and second active layers may be arranged on the same layer, the driving gate electrode is arranged beneath the first and second active layer and the storage electrode is arranged beneath the driving gate electrode.

[0031] The organic light emitting display device may further comprise a switching electrode pattern arranged over the first active layer in a region where the first active layer and the driving gate electrode overlap each other.

[0032] And, the switching electrode pattern may penetrate through one end of the first active layer such that the switching electrode pattern is connected to an upper surface of the driving gate electrode while being laterally connected to the first active layer. Also, first active layer has a first switching channel region at a portion thereof overlapping the gate line and a first switching thin film transistor is defined by the gate line, the first active layer, the switching electrode pattern laterally connected to one end of the first active layer, and the data line connected to the other end of the first active layer.

[0033] Furthermore, the organic light emitting display device may further comprise a driving electrode pattern arranged over the second active layer, wherein the driving electrode pattern does not overlap with the driving gate electrode while overlapping the storage electrode.

[0034] Furthermore, the driving electrode pattern penetrates through the second active layer, wherein the driving electrode pattern is connected to an upper surface of the storage electrode is laterally connected to the second active layer, the second active layer has a driving channel region at a portion thereof overlapping the driving gate electrode; and a drive thin film transistor is defined by the driving gate electrode, the second active layer, the current driving line connected to the second active layer, and the driving electrode pattern.

[0035] The organic light emitting display device may further comprise an auxiliary driving gate electrode connected to the switching electrode pattern while overlapping the driving gate electrode.

[0036] And, the gate line and the sensing line may be arranged over the first active layer and the second active layer, respectively and the data line, the reference voltage line and the current driving line may be arranged over the gate line and the sensing line.

[0037] The auxiliary driving gate line may be arranged at the same layer as the gate line while partially overlapping the second active layer.

[0038] Further, the lateral connection between the switching electrode pattern and the first active layer may be provided in a doped region of the first active layer and the lateral connection between the driving electrode pattern and the second active layer may be provided in a doped region of the second active layer.

[0039] The organic light emitting display device further comprises a bank for defining a light emission area and an organic light emitting diode comprising a first electrode connected to the driving electrode pattern, a light emitting layer arranged in the light emission area, and a second electrode arranged on the light emitting layer.

[0040] Meanwhile, the light emission area may completely overlap the storage capacitor.

[0041] Also, an organic light emitting display device according to a different embodiment may, for example, include a substrate having a plurality of pixels in a matrix, a storage electrode at each of the pixels on the substrate, a driving gate electrode over the storage electrode via a first interlayer insulating film wherein the driving gate electrode overlaps the storage electrode, to define a storage capacitor, first and second active layers over the driving gate electrode via a gate insulating film, wherein the first and second active layers are spaced apart from each other while overlapping the driving gate electrode and the storage electrode, respectively, a gate line and a sensing line over the first active layer via a second gate insulating film extending in parallel, to cross the first and second active layers, a data line, a current driving line and a reference voltage line extending in a direction crossing the gate line, arranged over the gate line and the sensing line via a second interlayer insulating film while, wherein the data line is connected to one end of the first active layer, the current driving line and the reference voltage line are connected to opposite ends of the second active layer, respectively and a switching electrode pattern and a driving electrode pattern arranged on a second interlayer insulating film, wherein the switching electrode pattern

and the driving electrode pattern are disposed on the same layer as the data line, the switching electrode pattern is connected to the other end of the first active layer, and the driving electrode pattern is connected to a portion of the storage electrode protruding from the driving gate electrode.

[0042] In this case, the organic light emitting display device further comprise an auxiliary driving gate electrode arranged on the second gate insulating film overlapping the driving gate electrode, wherein the auxiliary driving gate electrode is connected to the switching electrode pattern.

[0043] Furthermore, a method for manufacturing an organic light emitting display device may, for example, include preparing a substrate having a plurality of pixels in a matrix, forming a storage electrode at each of the pixels on the substrate, forming a driving gate electrode over the storage electrode via a first interlayer insulating film such that the driving gate electrode overlaps the storage electrode, to define a storage capacitor, forming first and second active layers over the driving gate electrode via a gate insulating film such that the first and second active layers are spaced apart from each other while overlapping the driving gate electrode and the storage electrode, respectively, forming a gate line and a sensing line over the first active layer via a second gate insulating film such that the gate line and the sensing line extend in parallel, to cross the first and second active layers and forming a data line, a current driving line and a reference voltage line over the gate line and the sensing line via a second interlayer insulating film such that the data line, the current driving line and the reference voltage line extend in a direction crossing the gate line, the data line is connected to one end of the first active layer, and the current driving line and the reference voltage line are connected to opposite ends of the second active layer, respectively, and forming a switching electrode pattern and a driving electrode pattern in the same layer as the data line on a second interlayer insulating film, wherein the switching electrode pattern is connected to the other end of the first active layer, and the driving electrode pattern is connected to a portion of the storage electrode protruding from the driving gate electrode.

[0044] It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0045] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and along with the description serve to explain the principle of the invention. In the drawings:

[0046] FIG. 1 is a circuit diagram illustrating one pixel of a conventional organic light emitting display device;

[0047] FIG. 2 is a cross-sectional view taken along a line passing through a drive transistor and a switching thin film transistor (TFT), which are illustrated in FIG. 1;

[0048] FIG. 3 is a circuit diagram illustrating one pixel of an organic light emitting display device according to an embodiment of the present invention;

[0049] FIG. 4 is a plan view illustrating one pixel of an organic light emitting display device according to a first embodiment of the present invention;

[0050] FIG. 5 is a cross-sectional view taken along line I-I' in FIG. 4;

[0051] FIG. 6 is a flowchart illustrating a procedure of manufacturing an organic light emitting display device according to an embodiment of the present invention;

[0052] FIG. 7 is a plan view illustrating one pixel of an organic light emitting display device according to a second embodiment of the present invention;

[0053] FIG. 8A is a cross-sectional view taken along line II-II' in FIG. 7;

[0054] FIGS. 8B and 8C are cross-sectional views illustrating embodiments modified from the second embodiment;

[0055] FIG. 9 is a graph depicting V_g - I_d characteristics exhibited when a drive TFT has a top gate structure and when the drive TFT has a bottom gate structure; and

[0056] FIG. 10 is a graph depicting V_d - I_d characteristics exhibited when the drive TFT has a top gate structure and when the drive TFT has a bottom gate structure.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

[0057] Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings. Throughout the disclosure, the same reference numerals designate substantially the same constituent elements. In describing the present invention, moreover, the detailed description will be omitted when a specific description of publicly known technologies to which the invention pertains is judged to obscure the gist of the present invention. In addition, names of constituent elements used in the following description are selected for easy understanding of the present invention, and may differ from names of practical products.

[0058] As mentioned above, in a bottom gate structure, an active layer is formed along a taper portion of a gate electrode, and crystalline components of the active layer are agglomerated during the crystallization of the active layer, thereby causing the active layer to be disconnected at the taper portion of the gate electrode. As such, a top gate structure is used in the above-mentioned conventional organic light emitting display device to reduce or prevent such a disconnection.

[0059] The inventors of the present invention have filed Korean Patent Application No. 10-2015-0067321, which is directed to addressing such an active layer disconnection by changing the shape of a gate electrode in a bottom gate structure.

[0060] In an embodiment of the present invention, a driving gate electrode having a bottom gate structure has a gentle slope at a side portion thereof, in order to solve a disconnection of crystalline components of an active layer at a tapered portion of the gate electrode while securing a sufficient area for a storage capacitor. As a result, an effective circuit region is secured in a pixel area with increased integration degree and high resolution.

[0061] FIG. 3 is a circuit diagram illustrating one pixel of an organic light emitting display device according to an embodiment of the present invention.

[0062] First, one pixel of the organic light emitting display device according to an embodiment of the present invention will be described in conjunction with a circuit configuration thereof. As illustrated in FIG. 3, the pixel includes a first switching thin film transistor (TFT) SW1 arranged between a gate line SL and a data line DL, a drive TFT D-TFT

connected between the switching TFT SW1 and a current driving line VDL, a second switching TFT SW2 connected between the drive TFT D-TFT and a reference voltage line RL, a storage capacitor Cst connected between a connection point between the first switching TFT SW1 and the drive TFT D-TFT, namely, a first node A, and a connection point between the drive TFT D-TFT and the second switching TFT SW2, namely, a second node B, and an organic light emitting diode OLED arranged between the second node B and a ground terminal. A pixel area of the pixel is defined between the gate line GL and the data line DL, which cross each other. Pixel areas are arranged in a matrix on a substrate ("100" in FIG. 5).

[0063] Meanwhile, a switching drain electrode SD1 of the first switching TFT SW1 and a driving gate electrode DG of the drive TFT D-TFT are connected to the first node A. A driving electrode pattern DD of the drive TFT D-TFT and a second switching drain electrode SD2 of the second switching TFT SW2 are connected to the second node B.

[0064] Respective gate electrodes SG1 and SG2 of the first and second switching TFTs SW1 and SW2 are connected to the gate line GL and a sensing line SSL.

[0065] The first switching TFT SW1 selects a corresponding one of pixels, which is driven in accordance with a signal applied to the gate line GL. The drive TFT D-TFT, which is connected to the first switching TFT SW1, controls a drive current of the selected pixel, and supplies the controlled drive current to the organic light emitting diode OLED. Meanwhile, the storage capacitor Cst maintains a voltage supplied from the first switching TFT SW, for one frame, and, as such, the drive TFT D-TFT is maintained at a predetermined voltage. To this end, the storage capacitor Cst is arranged between the driving gate electrode DG of the drive TFT D-TFT and the driving electrode pattern DD. In this case, the storage capacitor Cst, which is connected to the second switching TFT SW2, supplies, to the second node B, an initialization voltage supplied from the reference voltage line RL while the second switching TFT SW2 is turned on in accordance with supply of a sensing signal from the sensing line SSL. This means that initialization is achieved in accordance with application of the sensing signal from the sensing line SSL in a specific period.

First Embodiment

[0066] FIG. 4 is a plan view illustrating one pixel of an organic light emitting display device according to a first embodiment of the present invention. FIG. 5 is a cross-sectional view taken along line I-I' in FIG. 4.

[0067] Hereinafter, the organic light emitting display device according to the first embodiment of the present invention, which has the circuit configuration of the above-described organic light emitting display device, will be described with reference to FIGS. 4 and 5. The organic light emitting display device according to the first embodiment of the present invention has the same electrical connection configuration as the above-described circuit configuration, except for planar and cross-sectional arrangements thereof.

[0068] As illustrated in FIGS. 4 and 5, one pixel area of the organic light emitting display device according to the first embodiment of the present invention may be defined by a gate line GL and a data line DL, which cross each other.

[0069] In each pixel area of the organic light emitting display device, a sensing line SSL is arranged in parallel to the gate line, and a current driving line VDL and a reference

voltage line RL are arranged in parallel to the data line DL. The organic light emitting display device includes, in each pixel area, a storage capacitor Cst defined by a storage electrode 110 and a driving gate electrode 120, which are arranged on different layers in the pixel area while overlapping each other, a first active layer 130 connected, at opposite ends thereof, to the driving gate electrode 120 and the data line DL, and a second active layer 140 spaced apart from the first active layer 130 while overlapping the driving gate electrode 120. The second active layer 140 has opposite side portions connected to the current drive line VDL and the storage electrode 110 while protruding laterally from the driving gate electrode 120.

[0070] In this case, the second active layer 140 extends from a portion thereof connected to the storage electrode 110 while crossing the sensing line SSL, and, as such, is connected to the reference voltage line RL.

[0071] The first and second active layers 130 and 140 are arranged on the same layer. The driving gate electrode 120 is arranged beneath the first and second active layers 130 and 140. The storage electrode 110 is arranged beneath the driving gate electrode 120.

[0072] The organic light emitting display device further includes, in each pixel area, a switching electrode pattern 160 arranged over the first active layer 130 in a region where the first active layer 130 and driving gate electrode 120 overlap each other. The switching electrode pattern 160 corresponds to the node A in the circuit of FIG. 3. The switching electrode pattern 160 itself functions as a drain electrode of a first switching TFT SW1. The first switching TFT SW1 is connected to the switching electrode pattern 160, together with a drive TFT D-TFT and a storage capacitor Cst.

[0073] The switching electrode pattern 160 extends through one end of the first active layer 130 while being laterally connected to the first active layer 130. The switching electrode pattern 160 is also connected to an upper surface of the driving gate electrode 120. Thus, electrical connection among the driving gate electrode 120, first active layer 130 and switching electrode pattern 160 is provided.

[0074] The organic light emitting display device further includes, in each pixel area, a driving electrode pattern 170 arranged over the second active layer 140 such that the driving electrode pattern 170 overlaps the storage electrode 110 without overlapping the driving gate electrode 120. In this case, the driving electrode pattern 170 extends through the second active layer 140 while being laterally connected to the second active layer 140. The driving electrode pattern 170 is also connected to an upper surface of the storage electrode 110. Thus, electrical connection among the storage electrode 110, second active layer 140 and driving electrode pattern 170 is provided. In this case, the drive TFT D-TFT is defined by the driving gate electrode 120, the second active layer 140, which has a driving channel region 140a at a portion thereof overlapping the driving gate electrode 120, the current driving line VDL connected to the second active layer 140, and the driving electrode pattern 170. The storage capacitor Cst is formed between the drive TFT D-TFT and the switching electrode pattern 160, which functions as the drain electrode of the first switching TFT SW1 when a voltage signal is applied to the storage electrode 110 via the driving electrode pattern 170. Meanwhile, the driving electrode pattern 170 corresponds to the node B in the circuit of FIG. 3. The driving electrode pattern 170 itself functions as

a drain electrode of the drive TFT D-TFT. The drive TFT D-TFT and storage capacitor Cst are connected to the driving electrode pattern 170, together with a second switching TFT SW2.

[0075] In this case, the first switching TFT SW1 is defined by the gate line GL, the first active layer 130, which has a first switching channel region 160a at a portion thereof overlapping the gate line GL, the switching electrode pattern 160, which is laterally connected to one end of the first active layer 130, and the data line DL, which is connected to the other end of the first active layer. Meanwhile, as described above, the drive TFT D-TFT is defined by the driving gate electrode 120, the second active layer 140, which has the driving channel region 140a at the portion thereof overlapping the driving gate electrode 120, the current driving line VDL connected to the second active layer 140, and the driving electrode pattern 170.

[0076] In this case, the driving gate electrode 120 not only functions as a gate electrode of the drive TFT D-TFT, but also functions as an opposite storage electrode of the storage capacitor Cst in accordance with overlap thereof with the storage electrode. The driving gate electrode 120 is formed to overlap with both the area where the first switching TFT SW1 is arranged and the area where the drive TFT D-TFT is arranged. Accordingly, a separate area for formation of the storage capacitor Cst is not required, and the area of the first switching TFT SW1 and the area of the drive TFT D-TFT share the area of the storage capacitor Cst with each other. Thus, the circuit integration degree of the pixel area is enhanced.

[0077] Meanwhile, the second switching TFT SW2 is also included in the organic light emitting display device. The second switching TFT SW2 is arranged at the portion of the second active layer 140 extending to the sensing line SSL. The second switching TFT SW2 is constituted by the second active layer 140, which has a second switching channel at a portion thereof overlapping the sensing line SSL, the reference voltage line RL connected to the second active layer 140, and the driving electrode pattern 170.

[0078] In addition, the first switching TFT SW1 and drive TFT D-TFT are directly connected without using a separate electrode. That is, the switching electrode pattern 160, which functions as a switching drain electrode of the first switching TFT SW1 while being arranged at an upper side, is directly connected to the driving gate electrode 120 of the drive TFT D-TFT, which is arranged at a lower side. Accordingly, it may be possible to eliminate degradation of integration degree occurring in the conventional planar double connection structure.

[0079] Meanwhile, gate electrodes of the first switching TFT SW1 and second switching TFT SW2 are defined by portions of the gate line GL and sensing line SSL crossing the first and second active layers 130 and 140, respectively. The gate line GL and sensing line SSL are arranged over the first and second active layers 130 and 140 and, as such, have top gate structures, respectively. On the other hand, the driving gate electrode 120 is arranged beneath the first and second active layers 130 and 140 and, as such, has a bottom gate structure. In this case, there may be an advantage in forming the first and second switching TFTs and drive TFT in an overlapping manner. As a result, a circuit having a high integration degree may be formed in the pixel area. Accordingly, high resolution may be easily secured. In this case, the gate line GL and sensing line SSL are arranged over the first

and second active layers, respectively, and the data line DL, reference voltage line RL and current drive line VDL are arranged over both the gate line GL and the sensing line SSL.

[0080] The first active layer **130** has a “180°-rotated L” shape such that the first active layer **130** is laterally connected to the switching electrode pattern **160** at one end thereof while being laterally connected to the data line DL at the other end thereof. The opposite ends of the active layer **130** have highly doped regions **130c** formed through doping with impurity ions at a high concentration, at lateral connection portions thereof, respectively. A lightly doped region **130b** may be provided between an undoped region of the first active layer **130**, namely, the first switching channel region **160a**, and each highly doped region **130c**, in order to achieve a reduction in off-current. Provision of the lightly doped region **130b** is selective and, as such, may be omitted.

[0081] The second active layer **140** has a reversed Z” shape. The second active layer **140** has the drive TFT D-TFT and second switching TFT SW2 at the portions thereof overlapping the driving gate electrode **120** and sensing line SSL, respectively. The second active layer **140** is connected, at opposite ends thereof, to the current drive line VDL and reference voltage line RL, which are arranged over the second active layer **140**, respectively. The driving electrode pattern **170**, which is shared as an electrode pattern by the drive TFT D-TFT and second switching TFT SW2, is formed over a portion of the second active layer **140** arranged outside the driving gate electrode **120** while being connected to the second active layer **140**. In this case, the driving electrode pattern **170** may be a common drain electrode or common source electrode of the drive TFT D-TFT and second switching TFT SW2. The electrode function of the driving electrode pattern **170** may be varied in accordance with whether the conduction type of each TFT is n type or p type. The common drain electrode or common source electrode is connected to a first electrode of the organic light emitting diode OLED and, as such, supplies a drive current to the organic light emitting diode OLED.

[0082] The second active layer **140** has highly doped regions **140c** at a portion thereof connected to the driving electrode pattern **170** protruding from the driving gate electrode **120** and a portion thereof connected to the drive current line VDL. The second active layer **140** also has a highly doped region **140c** at a portion thereof connected to the reference voltage line RL. Similar to the first active layer **130**, the driving channel region of the second active layer **140** overlapping the driving gate electrode **120** and the second switching channel region of the second active layer **140** crossing the sensing line SSL are undoped regions **140a**. A lightly doped region **140b** may be provided between each undoped channel region **140a** and the corresponding highly doped region **140c**, in order to achieve a reduction in off-current. The lateral connection between the driving electrode pattern **170** and the second active layer **140** is provided at the corresponding highly doped region **140c** and, as such, the driving electrode pattern **170** and second active layer **140** may be connected at low resistance.

[0083] Meanwhile, shapes of the first and second active layers **130** and **140** are limited to the illustrated shapes. The first and second active layers **130** and **140** may have various shapes, so long as they are spaced apart from each other.

[0084] The organic light emitting diode OLED includes a first electrode **180**, an organic light emitting layer **190**

arranged in a light emission area, and a second electrode **200** disposed on the organic light emitting layer **190**. If necessary, a hole injection layer and a hole transport layer may be disposed beneath the organic light emitting layer **190**. In addition, an electrode transport layer and an electrode injection layer may be disposed over the organic light emitting layer **190**. In this case, the hole injection layer, hole transport layer, organic light emitting layer, electrode transport layer and electrode injection layer are made of organic materials. Each organic material is deposited using a metal mask having an opening, in accordance with an evaporation process in which the organic material is deposited through the opening through evaporation.

[0085] In addition, the organic light emitting diode OLED includes a bank **185** arranged on the first electrode **180** along a boundary of the pixel area, in order to define the light emission area. The bank **185** may have a double step structure and, as such, may have a first thickness portion **1851** and a second thickness portion **1852**. In the double step structure, the first thickness portion **1851** substantially functions to define the light emission area, and the second thickness portion **1852** directly prevents the metal mask from coming into contact with the first thickness portion **1851** when the metal mask is bent downwards due to the weight thereof during deposition of organic materials including the organic light emitting layer **190**, thereby preventing the first thickness portion **1851** from collapsing.

[0086] In an embodiment of the present invention, the light emission area of the organic light emitting diode OLED may be determined to have a maximum size, so long as light emitting colors are not mixed during the deposition process. This is because the organic light emitting diode OLED according to an embodiment of the present invention emits light in a top emission manner and, as such, light emission of the organic light emitting diode OLED is achieved even though the organic light emitting diode OLED overlaps the circuit configuration in the pixel area, in detail, light shield wiring or a light shield pattern is included in the circuit configuration arranged beneath the organic light emitting diode OLED. Accordingly, the light emission area may completely overlap with the storage capacitor defined by overlapping portions of the driving gate electrode **120** and storage electrode **110**. The light emission area may also be maximally extended at a portion thereof other than the portion overlapping the storage capacitor, so long as no color mixing occurs between adjacent pixels. In this case, the first electrode **180** may be a reflective electrode, and the second electrode **200** may be a transparent electrode, in order to achieve effective top emission.

[0087] FIG. 6 is a flowchart illustrating a procedure of manufacturing the organic light emitting display device according to an embodiment of the present invention.

[0088] Hereinafter, a method for manufacturing the organic light emitting display device according to an embodiment of the present invention will be described with reference to FIGS. 4 to 6.

[0089] First, a substrate **100**, which has a plurality of pixel areas arranged in a matrix, is prepared.

[0090] The substrate **100** may be further provided with a buffer layer (not shown) formed over the substrate **100**.

[0091] Thereafter, an island-shaped storage capacitor **110** is formed on the substrate **100** at each pixel area (**10S**).

[0092] Subsequently, a driving gate electrode **120** is formed on the storage capacitor **110**, to overlap with the

storage capacitor **110**, under the condition that a first interlayer insulating film **111** is interposed between the driving gate electrode **120** and the storage capacitor **110** (20S). In this case, the driving gate electrode **120** has a low lateral slope of about 50° or less.

[0093] Thereafter, a first active layer **130** and a second active layer **140** are formed on the driving gate electrode **120** such that the first and second active layers **130** and **140** are spaced apart from each other via a first gate insulating film **121**, and overlap with the driving gate electrode **120** and storage electrode **110**, respectively (30S). The first and second active layers **130** and **140** are initially in an amorphous state. In this state, the first and second active layers **130** and **140** may not provide sufficient mobility when used as semiconductor layers of TFTs. To this end, the first and second active layers **130** and **140** are crystallized using an excimer laser before being patterned into the illustrated shapes and, as such, are formed into polysilicon layers. In the crystallization process, heat is applied to the first and second active layers **130** and **140** and, as such, the first and second active layers **130** and **140** may be disconnected at portions thereof inclined along side portions of the driving gate electrode **120**. In order to prevent such disconnection, accordingly, the driving gate electrode **120** has a small lateral slope.

[0094] Thereafter, a gate line GL and a sensing line SSL are formed in parallel on the first active layer **130**, to cross the first active layer **130** and second active layer **140**, respectively, under the condition that a second gate insulating film **141** is interposed between the first active layer **130** and the gate line GL and sensing line SSL (40S).

[0095] Subsequently, an overlap region of the gate line GL and first active layer **130** overlap each other and a peripheral region thereof, an overlap region of the sensing line SSL and second active layer **140** and a peripheral region thereof, and an overlap region of the driving gate electrode **120** and second active layer **140** and a peripheral region thereof are masked by a photoresist film pattern. In this state, doping with high-concentration impurity ions is carried out, thereby forming highly doped regions **130c** and **140c** (50S).

[0096] The photoresist film pattern is then ashed such that the photoresist film pattern is left only at the overlap region of the driving gate electrode **120** and second active layer **140**. In this state, lightly doped regions **130b** and **140b** are formed at regions exposed after the ashing, respectively.

[0097] The photoresist film pattern is removed through stripping.

[0098] Thereafter, a second interlayer insulating film **151** is formed over the second gate insulating film **141** including the gate line GL and sensing line SSL.

[0099] Subsequently, the second interlayer insulating film **151**, second gate insulating film **141**, first active layer **130**, first gate insulating film **121**, and first interlayer insulating film **111** are selectively removed in regions corresponding to opposite ends of the first active layer **130**, opposite ends of the second active layer **140**, and a portion of the second active layer **140** disposed between the opposite ends of the second active layer **140** while protruding from the driving gate electrode **120**, thereby forming first to fifth contact holes CNT1 to CNT5 (60S). In this removal process, etching is carried out until metal surfaces are exposed. For example, in a region where one end of the first active layer **130** is arranged, the first active layer **130** is completely perforated such that an upper surface of the driving gate electrode **120**

disposed beneath the first active layer **130** is exposed, and, as such, the second contact hole CNT2 is formed. Meanwhile, in a region where the second active layer **140** protrudes from the driving gate electrode **120** between the opposite ends of the second active layer **140**, the second active layer **140** is completely perforated such that an upper surface of the storage electrode **110** disposed beneath the second active layer **140** is exposed, and, as such, the third contact hole CNT3 is formed. In addition, in a region where the other end of the first active layer **130** is arranged, the first active layer **130** is completely perforated such that the first gate insulating film **121** and first interlayer insulating film **111** disposed beneath the first active layer **130** are etched, thereby forming the first contact hole CNT1. Similarly, in regions where the opposite ends of the second active layers **140** are arranged, respectively, the second active layer **140** is completely perforated such that the first gate insulating film **121** and first interlayer insulating film **111** disposed beneath the second active layer **140** are etched, thereby forming the fourth and fifth contact holes CNT4 and CNT5.

[0100] In the above-described etching process, an etchant or plasma gas exhibiting similar etching rates for the insulating films and active layers while exhibiting etching rates for metals different from the etching rates for the insulating films and active layers is used.

[0101] Thereafter, a metal is deposited over the second interlayer insulating film **151**. The deposited metal is then etched and, as such, a data line DL connected to one end of the first active layer **130**, and a current driving line VDL and a reference voltage line RL, which are connected to the opposite ends of the second active layer **140**, respectively, are formed in a direction crossing the gate line GL. In the same process as described above, a switching electrode pattern **160** connected to the other end of the first active layer **130** and a driving electrode pattern **170** connected to the storage electrode **110** protruding from the driving gate electrode **120** are formed (70S).

[0102] In this case, the data line DL extends through the first active layer **130** and insulating films **121** and **111** disposed beneath the first active layer **130** in the region corresponding to the first contact hole CNT1. Similarly, the reference voltage line RL and drive voltage line VDL, extend through the second active layer **140** and insulating films **121** and **111** disposed beneath the second active layer **140** in the regions corresponding to the fourth and fifth contact holes CNT4 and CNT5, respectively. In addition, the switching electrode pattern **160** is connected to the driving gate electrode **120** in the region corresponding to the second contact hole CNT2, and the driving electrode pattern **170** is connected to the storage electrode **110** exposed in the region corresponding to the third contact hole CNT3.

[0103] After formation of the first and second switching TFTs SW1 and SW2 and drive TFT D-TFT as described above, a passivation film **161** is formed over the entire upper surface of the second interlayer insulating film **141** including the data line DL, drive current line VDL, reference voltage line RL, switching electrode pattern **160** and driving electrode pattern **170**. Thereafter, a sixth contact hole CNT6 is formed to expose the driving electrode pattern **170** of the drive TFT D-TFT (80S).

[0104] Subsequently, a first electrode **180** is formed such that the first electrode **180** is connected to the driving electrode pattern **170** via the sixth contact hole CNT6 (90S).

[0105] A bank 185 is formed such that the bank 180 opens the light emission area while partially overlapping the first electrode 180 (100S). In this case, the bank 185 may include a first thickness portion 1851 defining the light emission area, and a second thickness portion 1852 formed on the first thickness portion 1851 while having a smaller width than the first thickness portion 1851. The second thickness portion 1852 functions as a spacer for preventing a metal mask from coming into direct contact with the first thickness portion 1851 during an organic material deposition process.

[0106] Thereafter, organic materials including an organic light emitting layer 190 are deposited using a metal mask having an opening corresponding to the light emission area.

[0107] A second electrode 200 is then formed on the organic light emitting layer 190.

[0108] In this case, the lamination structure of the first electrode 180, organic light emitting layer 190, and second electrode 200 forms an organic light emitting diode OLED.

[0109] Meanwhile, the above-described procedures 10S to 100S may require masks, respectively. In the organic light emitting display device according to an embodiment of the present invention, a lower metal pattern shielding the active layers beneath the active layers is eliminated. To this end, a bottom gate structure is applied to a portion of the drive TFT mainly and importantly acting in association with drive current characteristics. That is, the driving gate electrode is first formed, and the active layers are subsequently formed. Accordingly, even in the above-described case, it may be possible to prevent the active layers of the drive TFT from being influenced or damaged by external light incident thereupon at the bottom side. Thus, it may be possible to reduce two or more masking processes for pattern formation and voltage application when a lower metal pattern is provided, as in the conventional case.

[0110] If necessary, doping with high-concentration impurity ions and low-concentration impurity ions into the first and second active layers 130 and 140 may be carried out in separate manners before and after formation of the gate line.

[0111] Although the second electrode 200 of the organic light emitting diode OLED is illustrated in the circuit diagram of FIG. 3 as being grounded, the present invention is not limited thereto. A certain voltage may be applied to the second electrode 200. The second electrode 200 may be deposited over the entire upper surface without using a separate mask. After deposition, the second electrode 200 is connected to a common ground at a peripheral region thereof, or a predetermined common voltage is applied to the second electrode 200.

Second Embodiment

[0112] FIG. 7 is a plan view illustrating one pixel of an organic light emitting display device according to a second embodiment of the present invention. FIG. 8A is a cross-sectional view taken along line II-II' in FIG. 7.

[0113] The organic light emitting display device according to the second embodiment of the present invention illustrated in FIGS. 7 and 8A has features in that the organic light emitting display device has a double gate electrode structure in order to enhance mobility characteristics of the drive TFT, and the remaining configuration of the organic light emitting display device is identical to that of the first embodiment.

[0114] That is, the drive TFT includes a driving gate electrode arranged, as a first gate electrode, beneath the second active layer 140, and an auxiliary driving gate

electrode 250 arranged, as a second gate electrode, over the second active layer 140. In this case, the auxiliary driving gate electrode 250 is disposed on the same layer as the gate line, that is, on the second gate insulating film 141, while partially overlapping the second active layer 140. Accordingly, when the lightly doped regions 130b and 140b are omitted in the impurity doping processes, it may be possible to form the highly doped regions 130c and 140c under the condition that channel regions are protected by the gate line, sensing line and auxiliary driving gate electrode 250, without using a mask for defining a photoresist film pattern.

[0115] In accordance with formation of the double gate structure for the drive TFT, it may be possible to enhance mobility of the drive TFT and on-current characteristics, as compared to other TFTs provided in the pixel area.

[0116] Similar to the first embodiment, in the second embodiment, it may be possible to define a storage capacitor by arranging the storage electrode of the first embodiment on a layer different from that of the first embodiment under the condition that the storage electrode overlaps the driving gate electrode. In this case, the storage capacitor is not influenced by arrangement of other TFTs in the pixel area and, as such, it may be possible to enhance circuit integration degree and to secure high resolution.

[0117] In addition, the switching electrode pattern 160, which is one electrode of the first switching TFT, is connected to the auxiliary driving gate electrode 250. The switching electrode pattern 160 extends through the first active layer 130 such that the switching electrode pattern 160 is connected to the driving gate electrode 120. Accordingly, planar long secondary connection is not required for connection between the switching TFT and the drive TFT and, as such, high resolution may be easily secured. The switching electrode pattern 160 is connected to a side surface of the auxiliary driving gate electrode 250 and an upper surface portion of the auxiliary driving gate electrode 250 in order to achieve resistance reduction while securing a sufficient connection area.

[0118] FIGS. 8B and 8C are cross-sectional views illustrating embodiments modified from the second embodiment.

[0119] If necessary, the switching electrode pattern 160 may be connected only to the side surface of the auxiliary driving gate electrode 250, as illustrated in FIG. 8B. Alternatively, as illustrated in FIG. 8C, in a process for connecting the switching electrode pattern 160 to the driving gate electrode 120, a contact hole for exposing a portion of the auxiliary driving gate electrode 250 may be formed in addition to the contact hole for exposing the driving gate electrode 120, in order to achieve electrical connection between an upper surface of the auxiliary driving gate electrode 250 and the switching electrode pattern 160. In addition, in the case of FIG. 8C, the auxiliary driving gate electrode 250 may further extend laterally, to be laterally connected to the switching electrode pattern 160. Thus, the lateral connection and the connection through the contact hole may be simultaneously achieved.

[0120] Hereinafter, effects of the organic light emitting display device according to an embodiment of the present invention will be described.

[0121] FIG. 9 is a graph depicting V_g - I_d characteristics exhibited when the drive TFT has a top gate structure and when the drive TFT has a bottom gate structure.

[0122] In FIG. 9, transfer curve characteristics are depicted. Referring to FIG. 9, it can be seen that, when the

voltage applied to the driving gate electrode increases, the bottom gate structure has slightly higher drive current I_d than that of the top gate structure.

[0123] FIG. 10 is a graph depicting V_d - I_d characteristics exhibited when the drive TFT has a top gate structure and when the drive TFT has a bottom gate structure.

[0124] In FIG. 10, output curve characteristics are depicted. Referring to FIG. 10, it can be seen that, when a gate voltage is sequentially increased from 0V to 4V in the case in which the gate electrode of the drive TFT is of a bottom gate type, drive current I_d in the bottom gate structure is almost saturated in accordance with a voltage V_d of the drain electrode, whereas drive current I_d in the top gate structure exhibits non-linear increase in accordance with the voltage V_d of the drain electrode. This means that, in the case of the top gate structure, output characteristics thereof exhibit unstableness in accordance with a variation in the voltage V_d of the drain electrode. Accordingly, superiority of the bottom gate structure exhibiting relatively stable output characteristics may be verified.

[0125] That is, in addition to the above-described advantages, namely, high integration and high resolution, the organic light emitting display device according to an embodiment of the present invention has advantages in that the drive current exhibits saturation characteristics, and kink effects are stabilized, as the configuration of the drive TFT, which has direct influence on drive current characteristics, among elements included in the pixel area, has a bottom gate structure.

[0126] In addition, an overlap area of the storage capacitor is secured by a dual gate structure and, as such, high resolution may be secured.

[0127] In accordance with the organic light emitting display device according to an embodiment of the present invention and the method for manufacturing the same, the following effects are provided.

[0128] First, for formation of the storage electrode, no separate space is provided, except for spaces given for TFTs. The area overlapping one of the TFTs, in particular, the area overlapping the driving gate electrode of the drive TFT, is used as an opposite storage electrode, and a storage electrode is provided at a layer different from that of the driving gate electrode such that the storage electrode overlaps the driving gate electrode, to define the storage capacitor in a region where the storage electrode overlaps the driving gate electrode. Accordingly, it may be possible to obtain a sufficient storage capacitance without significant interference with arrangement of the TFT in a pixel area.

[0129] Second, a bottom gate electrode exhibiting excellent drive current saturation characteristics and stable kink characteristics is applied to the drive TFT and, as such, reliability of a pixel circuit in the organic light emitting display device may be enhanced.

[0130] Third, connection between the switching TFT and the drive TFT is achieved by extending one electrode of the switching TFT to the driving gate electrode through an active layer, to be connected to the driving gate electrode. Accordingly, it may be possible to omit a planar connection area for connection between the TFTs and, as such, there are advantages in association with high integration and high resolution.

[0131] Fourth, the drive TFT is provided with the driving gate electrode arranged beneath the active layer, whereas the switching TFT is provided with a gate line or a sensing line,

which is arranged over the active layer. In this regard, the gate electrodes (lines) of the TFTs are arranged at different layers, respectively. According, if necessary, a double gate electrode may be easily applied to a TFT having high mobility characteristics.

[0132] Fifth, a lower metal pattern used in a top gate structure to shield active layers beneath the active layers may be eliminated. A bottom gate structure may be applied to a portion of the drive TFT mainly and importantly acting in association with drive current characteristics. That is, the driving gate electrode is first formed, and the active layers are subsequently formed. Accordingly, even in the above-described case, it may be possible to prevent the active layers of the drive TFT from being influenced or damaged by external light incident thereupon at the bottom side. Thus, it may be possible to reduce two or more masking processes for pattern formation and voltage application when a lower metal pattern is provided, as in the conventional case.

[0133] Sixth, in association with the drive TFT, active layers may be formed over a driving gate electrode after formation of the driving gate electrode. Accordingly, a channel region may be defined irrespective of the shape of the driving gate electrode and, as such, the degree of design freedom may be increased.

[0134] 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 spirit or scope of the inventions. 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 and their equivalents.

What is claimed is:

1. An organic light emitting display device comprising:
 - a gate line and a data line crossing each other on a substrate;
 - a sensing line extending in parallel to the gate line, and a current driving line and a reference voltage line extending in parallel to the data line;
 - a storage capacitor provided by an overlap between a storage electrode and a driving gate electrode, wherein the storage electrode and the driving gate electrode are disposed on different layers, respectively;
 - a first active layer crossing the gate line, wherein opposite ends of the first active layer connected to the driving gate electrode and the data line; and
 - a second active layer spaced apart from the first active layer while overlapping the driving gate electrode, wherein the second active layer protruding from the driving gate electrode has opposite side portions respectively connected to the current drive line and the storage electrode.
2. The organic light emitting display device according to claim 1, wherein the second active layer extends from the portion connected to the storage electrode such that the second active layer is connected to the reference voltage line while crossing the sensing line.
3. The organic light emitting display device according to claim 2, wherein:
 - the first and second active layers are arranged on the same layer;
 - the driving gate electrode is arranged beneath the first and second active layer; and
 - the storage electrode is arranged beneath the driving gate electrode.

4. The organic light emitting display device according to claim 3, further comprising:

a switching electrode pattern arranged over the first active layer in a region where the first active layer and the driving gate electrode overlap each other.

5. The organic light emitting display device according to claim 4, wherein:

the switching electrode pattern penetrates through one end of the first active layer such that the switching electrode pattern is connected to an upper surface of the driving gate electrode while being laterally connected to the first active layer;

the first active layer has a first switching channel region at a portion thereof overlapping the gate line; and

a first switching thin film transistor is defined by the gate line, the first active layer, the switching electrode pattern laterally connected to one end of the first active layer, and the data line connected to the other end of the first active layer.

6. The organic light emitting display device according to claim 5, further comprising:

a driving electrode pattern arranged over the second active layer, wherein the driving electrode pattern does not overlap with the driving gate electrode while overlapping the storage electrode.

7. The organic light emitting display device according to claim 6, wherein:

the driving electrode pattern penetrates through the second active layer, wherein the driving electrode pattern is connected to an upper surface of the storage electrode is laterally connected to the second active layer; the second active layer has a driving channel region at a portion thereof overlapping the driving gate electrode; and

a drive thin film transistor is defined by the driving gate electrode, the second active layer, the current driving line connected to the second active layer, and the driving electrode pattern.

8. The organic light emitting display device according to claim 6, wherein a second switching thin film transistor is defined by the second active layer, the sensing line crossing the second active layer, the reference voltage line connected to the second active layer, and the driving electrode pattern.

9. The organic light emitting display device according to claim 5, further comprising:

an auxiliary driving gate electrode connected to the switching electrode pattern while overlapping the driving gate electrode.

10. The organic light emitting display device according to claim 9, wherein:

the gate line and the sensing line are arranged over the first active layer and the second active layer, respectively; and

the data line, the reference voltage line and the current driving line are arranged over the gate line and the sensing line.

11. The organic light emitting display device according to claim 10, wherein the auxiliary driving gate line is arranged at the same layer as the gate line while partially overlapping the second active layer.

12. The organic light emitting display device according to claim 7, wherein:

the lateral connection between the switching electrode pattern and the first active layer is provided in a doped region of the first active layer; and

the lateral connection between the driving electrode pattern and the second active layer is provided in a doped region of the second active layer.

13. The organic light emitting display device according to claim 6, further comprising:

a bank for defining a light emission area; and

an organic light emitting diode comprising a first electrode connected to the driving electrode pattern, a light emitting layer arranged in the light emission area, and a second electrode arranged on the light emitting layer.

14. The organic light emitting display device according to claim 13, wherein the light emission area completely overlaps the storage capacitor.

15. An organic light emitting display device comprising:

a substrate having a plurality of pixels in a matrix;

a storage electrode at each of the pixels on the substrate;

a driving gate electrode over the storage electrode via a first interlayer insulating film, wherein the driving gate electrode overlaps the storage electrode, to define a storage capacitor;

first and second active layers over the driving gate electrode via a gate insulating film, wherein the first and second active layers are spaced apart from each other while overlapping the driving gate electrode and the storage electrode, respectively;

a gate line and a sensing line over the first active layer via a second gate insulating film extending in parallel, to cross the first and second active layers.

a data line, a current driving line and a reference voltage line extending in a direction crossing the gate line, arranged over the gate line and the sensing line via a second interlayer insulating film while, wherein the data line is connected to one end of the first active layer, the current driving line and the reference voltage line are connected to opposite ends of the second active layer, respectively; and

a switching electrode pattern and a driving electrode pattern arranged on a second interlayer insulating film, wherein the switching electrode pattern and the driving electrode pattern are disposed on the same layer as the data line, the switching electrode pattern is connected to the other end of the first active layer, and the driving electrode pattern is connected to a portion of the storage electrode protruding from the driving gate electrode.

16. The organic light emitting display device according to claim 15, further comprising:

an auxiliary driving gate electrode arranged on the second gate insulating film overlapping the driving gate electrode, wherein the auxiliary driving gate electrode is connected to the switching electrode pattern.

17. A method for manufacturing an organic light emitting display device, comprising:

preparing a substrate having a plurality of pixels in a matrix;

forming a storage electrode at each of the pixels on the substrate;

forming a driving gate electrode over the storage electrode via a first interlayer insulating film such that the driving gate electrode overlaps the storage electrode, to define a storage capacitor;

forming first and second active layers over the driving gate electrode via a gate insulating film such that the first and second active layers are spaced apart from each other while overlapping the driving gate electrode and the storage electrode, respectively;

forming a gate line and a sensing line over the first active layer via a second gate insulating film such that the gate line and the sensing line extend in parallel, to cross the first and second active layers; and

forming a data line, a current driving line and a reference voltage line over the gate line and the sensing line via a second interlayer insulating film such that the data line, the current driving line and the reference voltage line extend in a direction crossing the gate line, the data line is connected to one end of the first active layer, and the current driving line and the reference voltage line are connected to opposite ends of the second active layer, respectively, and forming a switching electrode pattern and a driving electrode pattern in the same layer as the data line on a second interlayer insulating film, wherein the switching electrode pattern is connected to the other end of the first active layer, and the driving electrode pattern is connected to a portion of the storage electrode protruding from the driving gate electrode.

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摘要(译)

公开了一种能够实现具有足够的存储电容的像素内集成设计的有机发光显示装置及其制造方法，其中有机发光显示装置包括连接到驱动栅电极的第一有源层和数据以及第二有源层，与所述第一有源层间隔开，同时与所述驱动栅电极重叠，并且连接到所述电流驱动线和存储电极。

