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(54) AMOLED display with optical feedback compensation

AMOLED-Anzeige mit optischem Rückkoppelungsausgleich

Affichage d'écran AMOLED avec compensation optique de réaction

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Description

FIELD OF THE INVENTION

[0001] The present invention relates generally to an organic light emitting diode (OLED) display, and more particularly, to an active matrix organic light emitting diode (AMOLED) display having each pixel structure incorporated with a photo sensor for optical feedback compensation so as to improve the performance of the AMOLED display.

BACKGROUND OF THE INVENTION

[0002] Organic light emitting diode (OLED) panel has a faster response, lighter weight, lesser viewing angle restrictions and greater contrast compared with a liquid crystal display panel, and thus has drawn great attention of the display industry. The OLED panel can be classified as a passive matrix organic light emitting diode (PMOLED) panel or an active matrix organic light emitting diode (AMOLED) panel. Generally, the AMOLED panel is particularly adapted to the production of high resolution and large size display panels.

[0003] The brightness of a pixel in the AMOLED panel is proportional to the conducting current of the organic light emitting diode and the conducting current is decided by thin film transistors (TFTs). In other words, the emission property, such as brightness and uniformity of emitted light, of the AMOLED is very sensitive to the performance of the TFTs.

[0004] Particularly, for an AMOLED display panel having a low-temperature polysilicon (LTPS) backplane crystallized by the excimer laser anneling (ELA), crystallization and non-uniformity of defeats may result in a line mura effect in the display panel, as shown in Fig. 1. The mura defects are defects that exhibit as non-uniform contract regions on OLED display pane and are attributed to pulse-to-pulse variations in the laser beam energy that is used to crystallize the amorphous silicon film. These defects are more pronounced when a constant gray value image or pattern is displayed. In AMOLED display panels, the laser annal irradiation of the non-TFT regions, such as the OLED circuit portion, on the TFT back panel often results in line-shaped mura defects. The non-uniform laser beam energy caused by pulse-to-pulse variations in the laser beam energy results in a non-uniform performance of polycrystalline silicon. Since the TFT characteristic is sensitive to the performance of the polycrystalline silicon, and the TFT devices drive the OLED devices, the non-uniform TFT characteristics result in non-uniformity in OLED's brightness. This non-uniformity causes the line mura defects, which deteriorate the display quality of the AMOLED display panel.

[0005] Therefore, a heretofore unaddressed need exists in the art to address the aforementioned deficiencies and inadequacies.

[0006] US 2001/028060 A1 relates to a semiconductor display device including a plurality of pixels. Each pixel includes an electroluminescence element a plurality of transistors and a photo sensing diode. However, document D1 does not refer to a control mechanism for the intensity of the diode. Further examples for display devices are described by Xue J. et al. ("Organic optical bistable switch", Applied Physics Letters, AIP, Melville, US, vol.82, No.1, January 6, 2003, pages 136 to 138, XP012033419), US 2004/031966 A1, US 2006/097296 A1 and US 2007/257250 A1.

[0007] Starting from the prior art, it is the object of the present application to provide a display which has improved performance properties.

SUMMARY OF THE INVENTION

[0008] The above-mentioned object is solved by the display according to claim 1, which incorporates a photo sensor for optical feedback compensation. Advantageous improvements of the invention are described by dependant claims.

[0009] The anode layer of the OLED may be formed such that at least a portion that overlaps the photosensitive layer of the photo sensor is partially transparent to light emitted from the emissive layer of the OLED. The photo sensor is adapted for measuring brightness of an ambient light that is proportional to light emitted from the OLED and generates a sensing signal corresponding to the measured brightness of the ambient light, wherein the sensing signal is utilized to adjust a driving voltage of the OLED accordingly.

[0010] The OLED may include a top-emitting OLED or a bottom-emitting OLED. In one embodiment, the photosensitive layer defines a photo sensing area, where the photo sensing area for the top-emitting OLED is larger than that for bottom-emitting OLED. In one embodiment, the photosensitive layer is formed of a Si-rich dielectric material.

[0011] In one embodiment, each of the driving transistor and the read-out transistor comprises an NMOS transistor or PMOS transistor. Each of the driving transistor and the read-out transistor comprises a back channel etched (BCE) type thin film transistor (TFT), an IS type TFT, a coplanar type TFT, a bottom-gate type TFT, or a top-gate type TFT.

[0012] The first supply voltage OVSS and the second supply voltage OVDD may be a negative supply voltage and a positive supply voltage, respectively.

[0013] In one aspect, the present invention relates to a method of driving a display as recited in claim 1, the display having an active matrix organic light emitting diode (AMOLED) panel having a plurality of pixels arranged in an array, each pixel comprising an organic light emitting diode (OLED). In one embodiment, the method includes the steps of measuring brightness of an ambient light that is proportional to light emitted from the OLED so as to generate a sensing signal corresponding to the measured brightness of the ambient light, and adjusting a driving voltage of the OLED according to the sensing signal.

[0014] In one embodiment, the measuring step is performed with a photo sensor coupled to the OLED.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The accompanying drawings illustrate one or more embodiments of the invention and, together with the written description, serve to explain the principles of the invention. Wherever possible, the same reference numbers are used throughout the drawings to refer to the same or like elements of an embodiment, and wherein:

Fig. 1 shows a conventional AMOLED display panel with the line mura defect problem;

Fig. 2 shows a schematic cross-sectional view illustrating a top emission AMOLED pixel structure according to one embodiment of the invention;

Fig. 3 shows a schematic cross-sectional view illustrating a bottom emission AMOLED pixel structure according to another embodiment of the invention;

Fig. 4 shows a schematic circuit diagram of a pixel structure of the AMOLED display according to one embodiment of the invention;

Fig. 5 shows a schematic cross-sectional view illustrating a top emission AMOLED pixel structure according to one non-claimed embodiment;

Fig. 6 shows a schematic cross-sectional view illustrating a bottom emission AMOLED pixel structure according to another non-claimed embodiment;

Fig. 7 shows a schematic circuit diagram of a pixel structure of the AMOLED display according to one non-claimed embodiment; and

Figs. 8A-8D show schematically cross-sectional views illustrating a top emission AMOLED pixel structure according to various embodiments of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0016] The present disclosure is more particularly described in the following examples that are intended as illustrative only since numerous modifications and variations therein will be apparent to those skilled in the art. Various embodiments of the disclosure are now described in detail. Referring to the drawings, like numbers indicate like components throughout the views. As used in the description herein and throughout the claims that follow, the meaning of "a", "an", and "the" includes plural reference unless the context clearly dictates otherwise. Also, as used in the description herein and throughout the claims that follow, the meaning of "in" includes "in" and "on" unless the context clearly dictates otherwise.

[0017] The terms used in this specification generally have their ordinary meanings in the art, within the context of the disclosure, and in the specific context where each term is used. Certain terms that are used to describe the disclosure are discussed below, or elsewhere in the specification, to provide additional guidance to the practitioner regarding the description of the disclosure. The use of examples anywhere in this specification, including examples of any terms discussed herein, is illustrative only, and in no way limits the scope and meaning of the disclosure or of any exemplified term. Likewise, the disclosure is not limited to various embodiments given in this specification.

[0018] As used herein, the terms "comprising," "including," "having," "containing," "involving," and the like are to be understood to be open-ended, i.e., to mean including but not limited to.

[0019] The present invention can be employed in most OLED display configurations. These include very simple structures comprising single anode and cathode to more complex displays, such as passive matrix displays including orthogoanl arrays of anodes and cathodes to form light emitting elements, and active matrix displays where each light emitting element is controlled independently, for example, within thin film transistors. In accordance with the purposes of this invention, as embodied and broadly described herein, this invention, in one aspect, relates to an improved layout of AMOLED pixel structure which incorporates a photo sensitive layer to serve as a photo sensor for optical feedback compensation.

[0020] Fig. 2 illustrates a cross-sectional view of a pixel structure 200 of an AMOLED display according to one embodiment of the invention. In this exemplary embodiment, the pixel 200 of the AMOLED display includes at least structures as set forth below. A supporting substrate 210 has a first end portion corresponding to a driving TFT 240 and an opposite, second end portion corresponding to a read-out TFT 250. A semiconductor layer having a first portion 242 and a second portion 252 is correspondingly disposed on the first and second end portions of the substrate 210. A gate insulator layer 220 is formed on the substrate 210 and covers the semiconductor layer. A gate metal layer having a first portion 241 and a second portion 251 is correspondingly disposed on the two end portions of the gate insulator layer 220 via an interlayer dielectric (ILD) 230. A first source metal layer 243 and a first drain metal layer 244 are electrically connected to the first portion 242 of the semiconductor layer and correspondingly disposed on the first end portion of the interlayer dielectric 230. A second source metal layer 253 and a second drain metal layer 254 are electrically connected to the second portion 252 of the semiconductor layer and correspondingly disposed on the second end portion of the interlayer dielectric 230. The first portion 241 of the gate metal layer, the first portion 242 of the semiconductor layer, the first source metal layer 243 and a first drain metal layer 244 constitute the driving TFT 240. The second portion 251 of the gate metal layer, the second portion 252 of the semiconductor layer, the second source metal layer 253 and a second drain metal layer 254 constitute the driving TFT 250.

[0021] A photo sensor includes a photosensitive (Si-rich dielectric) layer 260 disposed on an extending portion 253a of the second source metal layer 253 extending to an emission region of the pixel 200 of the display. A first passivation layer 281 correspondingly disposed on the first and second end portions of the interlayer dielectric 230, so as to define a space therebetween in which the extending portion 253a of the second source metal layer 253 and the photosensitive layer 260 are deposed. A second passivation layer 282 correspondingly disposed on the first passivation layer 281.

[0022] An OLED 270 has an anode layer 271 deposed on the photosensitive layer 260 and electrically connected to the first source metal layer 243 over the emission region of the pixel 200 of the display, an OLED emissive layer 272 disposed on and covered both the second passivation layer 282 and the anode layer 271, and a cathode layer 273 disposed on and covered the OLED emissive layer 272. The anode layer 271 of the OLED 270 is formed such that at least a portion that overlaps the photosensitive layer 260 of the photo sensor is partially transparent to light emitted from the emissive layer 272 of the OLED 270. The other portion of the anode layer 271 of the OLED 270 may or may not be transparent to light emitted from the emissive layer 272 of the OLED 270.

[0023] In this embodiment, the OLED 270 is a top emission OLED, i.e., the majority portion 275 of light emitted from the OLED emissive layer 272 transmits out from the cathode layer 273. The remaining portion 276 of the light emitted from the OLED emissive layer 272 transmits out from the anode layer 271 and to the photosensitive layer 260. Accordingly, the photo sensor measures the brightness of the remaining portion 276 of the light, i.e., an ambient light to the photo sensor, which is proportional to the light emitted from the OLED emissive layer 272, and generating a sensing signal corresponding to the measured brightness of the ambient light. The read-out TFT 250 reads and outputs the sensing signal. The sensing signal in turn, is utilized to adjust a driving voltage of the OLED 270 through the driving TFT 240 accordingly.

[0024] Fig. 3 shows a pixel structure 300 of an AMOLED display according to another embodiment of the invention. The pixel structure 300 are similar to the pixel structure 200 disclosed above and shown in Fig. 2, except that the OLED 370 is a bottom emission OLED, i.e., the light 375 emitted from the OLED emissive layer 372 transmits out from the anode layer 371. The anode layer 371 is formed to be transparent to light emitted from the emissive layer 372 of the OLED 370. Accordingly, the photosensitive layer 360 defines a photo sensing area that is much less than that corresponding to the top emission OLED shown in Fig. 2. The photosensitive layer 360 is formed between the anode layer 371 of the OLED 370 and the second source layer 353 of the read-out TFT 350, as such the majority portion of the space defined between the diving TFT 340 and the read-out TFT 350 is corresponding to an emission region of the OLED 370. In operation, the majority portion of the light 375 emitted from the OLED emissive layer372 transmits out from the emission region, while the remaining portion of the light 375 transmits out from the anode layer 371 and to the photosensitive layer 360. Accordingly, the photo sensor measures the brightness of the remaining portion of the light 375, i.e., an ambient light to the photo sensor, which is proportional to the light 375 emitted from the OLED emissive layer 372, and generating a sensing signal corresponding to the measured brightness of the ambient light. The read-out TFT 350 reads and outputs the sensing signal. The sensing signal in turn, is utilized to adjust a driving voltage of the OLED 370 through the driving TFT 340 accordingly.

[0025] Fig. 4 shows a circuit diagram of a pixel 400 of an AMOLED display according to yet another embodiment of the invention. The AMOLED display has an AMOLED panel having a plurality of pixels 400 arranged in an array. Each pixel 400 includes an OLED 470 having a cathode electrically coupled to a first supply voltage, OVSS, an anode and an emissive layer formed between the cathode and the anode. The OLED 470 can be a top-emitting OLED or a bottom-emitting OLED. Each pixel 400 also includes a first transistor T1 having a gate, a drain electrically coupled to a second supply voltage, OVDD, and a source electrically coupled to the anode of the OLED 470, a second transistor T2 having a gate electrically coupled to a scan signal, Vscan(N), a drain electrode electrically coupled to the gate of the first transistor T1, and a source electrode electrically coupled to a data signal, Vdata, and a storage capacitor Cst electrically connected between the gate and the drain of the first transistor T1. The first supply voltage OVSS and the second supply voltage OVDD are a negative supply voltage and a positive supply voltage, respectively.

[0026] Further, each pixel 400 includes a read-out TFT 450 having a gate electrically coupled to a sensing control voltage, Vsense, a drain for outputting a sensing signal, Isense, and a source, and a photo sensor 460 electrically coupled between the anode of the OLED 470 and the source of the read-out transistor 450. The photo sensor 460 is adapted for optical feedback compensation, specifically, for measuring brightness of an ambient light that is proportional to light emitted from the OLED 470 and generating the sensing signal Isense corresponding to the measured brightness of the ambient light. The sensing signal Isense in turn, is utilized to adjust the data signal Vdata.

[0027] Each of the first transistor T1, the second transistor T2 and the read-out transistor 450 comprises an NMOS transistor or PMOS transistor.

[0028] Fig. 5 shows a pixel structure 500 of an AMOLED display according to one non-claimed embodiment. The display has a substrate 510, and a plurality of pixels 500 formed on the substrate 510 and arranged in an array. The pixel 500 includes a driving transistor 540 having a gate layer 541, a drain layer 544 and a source layer 543, formed on the substrate 510. The pixel

500 also includes an OLED 570 having a cathode layer 573, a anode layer 571 and an emissive layer 572 formed between the cathode layer 573 and the anode layer 571, and formed over the driving transistor 540 such that the anode layer 571 of the OLED 570 is electrically connected to the source layer 544 of the driving transistor 540. Further, the pixel 500 includes a bias layer 550 formed over the substrate 510, and a photo sensor having a photosensitive layer 560 formed between the anode layer 571 of the OLED 570 and the bias layer 550.

[0029] More specifically, the driving TFT 540 is formed on one end portion of the supporting substrate 510. A semiconductor layer 542 is disposed on the one end portion of the substrate 510. A gate insulator layer 420 is disposed on the substrate 412 and covers the semiconductor layer 542. The gate metal layer 541 is disposed on the gate insulator layer 520 at a location that is over the semiconductor layer 542. An interlayer dielectric (ILD) layer 530 is deposed on the gate insulator layer 520 and covers the gate metal layer 541. The drain layer 544 and the source layer 543 of the driving TFT 540 are spatially formed on the interlayer dielectric layer 530 and are connected to the semiconductor layer 542. Further, a metal bias electrode layer 550 is disposed on the interlayer dielectric layer 530 over the other end potion of the substrate 510 and extends into the emission region of the pixel 500.

[0030] A photosensitive layer 560 is disposed on the metal bias electrode layer 550 at an emission region of the pixel 500. The anode layer 571 of the OLED 570 is disposed on the photosensitive layer 560 having one end portion electrically connected to the source layer 543 of the driving TFT 540, and the other end portion extended over the other end portion of the substrate 510. A first passivation layer 581 is correspondingly disposed on the two ends of the interlayer dielectric 530 so that the emission region of the pixel 500 is defined therebetween. A second passivation layer 582 is correspondingly disposed on the first passivation layer 581. The OLED emissive layer 572 of the OLED 570 is disposed on the anode layer 571 and covers both the second passivation layer 582 and the anode layer 571. The cathode layer 573 of the OLED 570 is disposed on and covers the OLED emissive layer 572 of the OLED 570.

[0031] In the exemplary embodiment shown in Fig. 5, the OLED 570 is a top emission OLED, i.e., the majority portion 575 of light emitted from the OLED emissive layer 572 transmits out from the cathode layer 573. The remaining portion 576 of the light emitted from the OLED emissive layer 572 transmits out from the anode layer 573 and to the photosensitive layer 560. Accordingly, the photo sensor measures the brightness of the remaining portion 576 of the light, an ambient light to the photo sensor, which is proportional to the light emitted from the OLED emissive layer 572, and generating a sensing signal corresponding to the measured brightness of the ambient light. The read-out TFT 550 reads and outputs the sensing signal. The sensing signal is output from the bias electrode 560 and utilized to adjust a driving voltage of the OLED 570 through the driving TFT 540 accordingly.

[0032] Fig. 6 shows a pixel structure 600 of an AMOLED display according to another non-claimed embodiment. The pixel structure 600 are similar to the pixel structure 500 disclosed above and shown in Fig. 5, except that the OLED 670 is a bottom emission OLED, i.e., the light 675 emitted from the OLED emissive layer 672 transmits out from the anode layer 671. Accordingly, the photosensitive layer 660 defines a photo sensing area that is much less than that corresponding to the top emission OLED shown in Fig. 5. The photosensitive layer 660 is formed between the anode layer 671 of the OLED 670 and the bias electrode 650, as such the majority portion of the space defined between the diving TFT 640 and the bias electrode 650 is corresponding to an emission region of the OLED 670. In operation, the majority portion of the light 675 emitted from the OLED emissive layer 672 transmits out from the emission region, while the remaining portion of the light 675 transmits out from the anode layer 671 and to the photosensitive layer 660. Accordingly, the photo sensor measures the brightness of the remaining portion of the light 675, i.e., an ambient light to the photo sensor, which is proportional to the light 675 emitted from the OLED emissive layer 672, and generating a sensing signal corresponding to the measured brightness of the ambient light. The bias electrode 650 outputs the sensing signal. The sensing signal in turn, is utilized to adjust a driving voltage of the OLED 670 through the driving TFT 640 accordingly.

[0033] Fig. 7 shows a circuit diagram of a pixel 700 of an AMOLED display according to yet another non-claimed embodiment. The AMOLED display has an AMOLED panel having a plurality of pixels 700 arranged in an array. Each pixel 700 includes an OLED 770 having a cathode electrically coupled to a first supply voltage, OVSS, an anode and an emissive layer formed between the cathode and the anode. The OLED 770 can be a top-emitting OLED or a bottom-emitting OLED. Each pixel 700 also includes a first transistor T1 having a gate, a drain electrically coupled to a second supply voltage, OVDD, and a source electrically coupled to the anode of the OLED 770, a second transistor T2 having a gate electrically coupled to a scan signal, Vscan(N), a drain electrode electrically coupled to the gate of the first transistor T1, and a source electrode electrically coupled to a data signal, Vdata, and a storage capacitor Cst electrically connected between the gate and the drain of the first transistor T1. The first supply voltage OVSS and the second supply voltage OVDD are a negative supply voltage and a positive supply voltage, respectively. Each of the first transistor T1 and the second transistor T2 comprises an NMOS transistor or PMOS transistor.

[0034] Further, each pixel 700 includes a photo sensor 760 electrically coupled to the anode of the OLED 770 for measuring brightness of an ambient light that is proportional to light emitted from the OLED 770 and generating the sensing signal I_2 corresponding to the measured brightness of the ambient light, and a bias electrode (line) 750 electrically coupled to the photo sensor 760 for outputting the sensing signal I_2. The generated current of the OLED 770, $I_{OLED} = (I_1 - I_2)$, where I_1 is the current flow from the drain to the source of the first TFT T1, and I_2 is the sensing current of the photo sensor 760 that is output from the bias line 750. According to the invention, the sensing current I_2 is adapted for optical feedback compensation. For example, for a pixel driven under the same value of Vdata, if a small value of Vth_T1 results in a large I_1, the light emitted from the OLED 770 will be brighter. Accordingly, the photo sensor current I2 increases, which in turn, results in a decrease of the OLED current I_{OLED}, so that the light of the OLED 770 become darker. On the other hand, if a large value of Vth_T1 results in a small I_1, the light emitted from the OLED 770 will be darker. Accordingly, the photo sensor current I2 decreases, which in turn, results in an increase of the OLED current I_{OLED}, so that the light of the OLED 770 become brighter. As a result, the AMOLED display panel will not generate line mura during operation, largely improving the display quality of the AMOLED display panel.

[0035] The above disclosed driving TFT and the read-out TFT, as shown in Figs. 2, 3, 5 and 6, are corresponding to top-gate type TFTs. Other types of TFFs can also be used as the driving TFT and the read-out TFT to practice the invention. Figs. 8A-8D disclose a pixel structure of an AMOLED display according to four different embodiments 800A-800D of the invention. Each embodiment corresponds to a different type of the driving TFT and the read-out TFT. In these embodiments, each of the driving TFT and the read-out TFT is formed with a semiconductive layer 842/852, a gate layer841/851, a source layer 843/853 and a drain layer 844/854. Different fabrication processes produce different type TFTs.

[0036] For example, as shown in Fig. 8A, the driving TFT 840A and the read-out TFT 850A are respectively formed in a bottom gate type TFT. Fig. 8B shows the driving TFT 840B and the read-out TFT 850B respectively formed in a coplanar type TFT. Fig. 8C shows the driving TFT 840C and the read-out TFT 850C respectively formed in a back channel etched (BCE) type TFT. And Fig. 8D shows the driving TFT 840D and the read-out TFT 850D respectively formed in an IS type TFT, where an etch stop layer 845/855 is deposed on the semiconductive layer 842/852.

[0037] As to the materials forming the pixel structure, the supporting substrate, which can include, but not limited to, glass, plastic, semiconductor materials, silicon, ceramics, and circuit board materials. The semiconductor layer can include, but not limited to, polysilicon, (coplanar/IS/BCE structure) metal oxide materials such as IZO, IGZO, AnO and In_2O_3. The gate insulator layer can include, but not limited to, SiOx, SiNx, SiOx/SiNx and AlOx. The gate metal layer can include, but not limited to, Mo, AlNd, Ti/AlTi, Mo/Al/Mo and Cu. The interlayer dielectric layer can include, but not limited to, SiOx, SiNx and SiOx/SiNx. The etch stop layer, as shown in Fig. 8D, can include, but not limited to, SiOx, SiNx and AlOx. The source/drain metal layer can include, but not limited to, Mo, AlNd, Ti/Al/Ti, Mo/Al/Mo and Cu. The metal bias line layer can include, but not limited to, Mo, AiNd, Ti/Al/Ti, Mo/Al/Mo and Cu. The photsenstive layer can include, but not limited to, Si-rch dielectric or other photosensitive materials. The anode layer can include, but not limited to, ITO, IZO, Al, Ag, Al/ITO, Ag/ITO, ITO/Ag/ITO and Mo/Al/ITO. The first passivation layer can include, but not limited to, SiOx, SiNx, SiOx/organic materials, SiNx/organic materials and organic materials. The second passivation layer can include, but not limited to, SiOX, SiNx and organice materials.

[0038] One aspect of the present invention relates to a method of driving a display in accordance with claim 1 and having an active matrix organic light emitting diode (AMOLED) panel having a plurality of pixels arranged in an array, each pixel comprising an organic light emitting diode (OLED). In one embodiment, the method includes the steps of measuring brightness of an ambient light that is proportional to light emitted from the OLED so as to generate a sensing signal corresponding to the measured brightness of the ambient light, and adjusting a driving voltage of the OLED according to the sensing signal.

[0039] The measuring step is performed with a photo sensor coupled to the OLED.

[0040] In sum, the present invention discloses an AMOLED display with each pixel incorporated with a photo sensor for optical feedback compensation so as to improve the performance of the AMOLED display.

Claims

1. A display, comprising:

an active matrix organic light emitting diode (AMOLED) panel having a plurality of pixels (400) arranged in an array, each pixel (400) comprising:

(a) an organic light emitting diode (470) having a cathode electrically coupled to a first supply voltage (OVSS), a anode and an emissive layer formed between the cathode and the anode;

(b) a driving circuit having:

(i) a first transistor (T1) having a gate, a drain electrically coupled to a second supply voltage(OVDD) and a source electrically coupled to the anode of the organic light emitting diode (470);

(ii) a second transistor (T2) having a gate electrically coupled to a scan signal (Vscan(N)), a drain electrode electrically coupled to the gate of the first transistor (T1), and a source electrode

electrically coupled to a data signal (Vdata); and
(iii) a storage capacitor (Cst) electrically connected between the gate and the drain of the first transistor (T1);

(c) a read-out transistor (450) having a gate electrically a sensing control voltage (Vsense), a drain for outputting a sensing signal (Isense), and a source; and
(d) a photo sensor (460)

characterized in that
the photo sensor (460) is electrically coupled between the anode of the organic light emitting diode (450) and the source of the read-out transistor (450),
wherein the photo sensor (460) is adapted for measuring brightness of an ambient light that is proportional to light emitted from the organic light emitting diode (450) and for generating a sensing signal (Vbias) corresponding to the measured brightness of the ambient light, wherein the data signal (Vdata) is adjusted according to the sensing signal (Vbias).

2. The display of claim 1, wherein the organic light emitting diode (470) comprises a top-emitting OLED or a bottom-emitting OLED.

3. The display of claim 2, wherein the photosensitive layer defines a photo sensing area, wherein the photo sensing area for the top-emitting OLED is larger than that for bottom-emitting OLED.

4. The display of claim 1, wherein each of the transistors (T1, T2, 460) comprises an NMOS transistor or PMOS transistor.

Patentansprüche

1. Anzeige, umfassend:

ein Paneel mit organischen Leuchtdioden mit aktiver Matrix (AMOLED) mit einer Vielzahl von Bildpunkten (400), die in einem Feld angeordnet sind, wobei jeder Bildpunkt (400) umfasst:

a) eine organische Leuchtdiode (470) mit einer Kathode, die elektrisch mit einer ersten Versorgungsspannung (OVSS) verbunden ist, einer Anode und einer abstrahlenden Schicht, die zwischen der Kathode und der Anode ausgebildet ist,
b) einen Treiberschaltkreis umfassend:

i. einen ersten Transistor (T1), der einen Gate-Anschluss, einen Drain-Anschluss, der elektrisch mit einer zweiten Versorgungsspannung (OVDD) verbunden ist, und einen Source-Anschluss aufweist, der elektrisch mit der Anode der organischen Leuchtdiode (470) verbunden ist,
ii. einen zweiten Transistor (T2), der einen Gate-Anschluss, der elektrisch mit einem Abtastsignal (Vscan(N)) verbunden ist, eine Drain-Elektrode, die elektrisch mit dem Gate-Anschluss des ersten Transistors (T1) verbunden ist, und eine Source-Elektrode aufweist, die elektrisch mit einem Datensignal (Vdata) verbunden ist, und
iii. einen Speicherkondensator (Cst), der elektrisch mit dem Gate-Anschluss und dem Drain-Anschluss des ersten Transistors (T1) verbunden ist,

c) einen Auslesetransistor (450), der einen Gate-Anschluss, der elektrisch mit einem Messsignal (Vsense) verbunden ist, einen Drain-Anschluss für die Ausgabe eines Messsignals (Isense) und einen Source-Anschluss aufweist, und
d) einen Fotosensor (460),

dadurch gekennzeichnet, dass
der Fotosensor (460) elektrisch mit der Anode der organischen Leuchtdiode (450) und dem Source-Anschluss des Auslesetransistors (450) verbunden ist, wobei der Fotosensor (460) angepasst ist, die Helligkeit eines Umgebungslichts zu messen, das proportional zu dem von der organischen Leuchtdiode (450) abgestrahlten Licht ist, und ein Messsignal (Vbias) zu erzeugen, das der gemessenen Helligkeit des Umgebungslichts entspricht, wobei das Datensignal (Vdata) gemäß dem Messsignal (Vbias) angepasst ist.

2. Anzeige nach Anspruch 1, wobei die organische Leuchtdiode (470) eine oben abstrahlende OLED und eine unten abstrahlende OLED umfasst.

3. Anzeige nach Anspruch 2, wobei die fotoempfindliche Schicht einen Fotomessbereich definiert, wobei der Fotomessbereich der oben abstrahlenden OLED größer ist als der der unten abstrahlenden OLED ist.

4. Anzeige nach Anspruch 1, wobei jeder der Transistoren (T1, T2, 460) einen NMOS Transistor oder PMOS Transistor umfasst.

Revendications

1. Affichage d'écran comprenant :

un panneau à diodes électroluminescentes organiques à matrice active (AMOLED) ayant une pluralité de pixels (400) disposés dans un réseau, chaque pixel (400) comprenant :

(a) une diode électroluminescente organique (470) ayant une cathode couplée électriquement à une première tension d'alimentation (OVSS), une anode et une couche émettrice formée entre la cathode et l'anode ;
(b) un circuit d'entraînement ayant :

(i) un premier transistor (T1) ayant une grille, un drain couplé électriquement à une seconde tension d'alimentation (OVDD) et une source couplée électriquement à l'anode de la diode électroluminescente organique (470) ;
(ii) un second transistor (T2) ayant une grille couplée électriquement à un signal de balayage (Vscan(N)), une électrode de drain couplée électriquement à la grille du premier transistor (T1), et une électrode de source couplée électriquement à un signal de données (Vdata) ; et
(iii) un condensateur de puissance (Cst) raccordé électriquement entre la grille et le drain du premier transistor (T1) ;

(c) un transistor de lecture (450) ayant une grille couplée électriquement à une tension de commande de détection (Vsense), un drain pour produire un signal de détection (Isense), et une source ; et
(d) un photodétecteur (460)

caractérisé par le fait que le photodétecteur (460) est couplé électriquement entre l'anode de la diode électroluminescente organique (450) et la source du transistor de lecture (450), dans lequel le photodétecteur (460) est adapté pour mesurer l'intensité d'une lumière ambiante qui est proportionnelle à la lumière émise par la diode électroluminescente organique (450) et pour générer un signal de détection (Vbias) correspondant à l'intensité mesurée de la lumière ambiante, dans lequel le signal de données (Vdata) est réglé en fonction du signal de détection (Vbias).

2. Affichage d'écran selon la revendication 1, dans lequel la diode électroluminescente organique (470) comprend une DELo à émission par la surface supérieure ou une DELo à émission par la surface inférieure.

3. Affichage d'écran selon la revendication 2, dans lequel la couche photosensible définit une zone photosensible, dans lequel la zone photosensible pour la DELo à émission par la surface supérieure est plus grande que pour la DELo à émission par la surface inférieure.

4. Affichage d'écran selon la revendication 1, dans lequel chacun des transistors (T1, T2, 460) comprend un transistor NMOS ou un transistor PMOS.

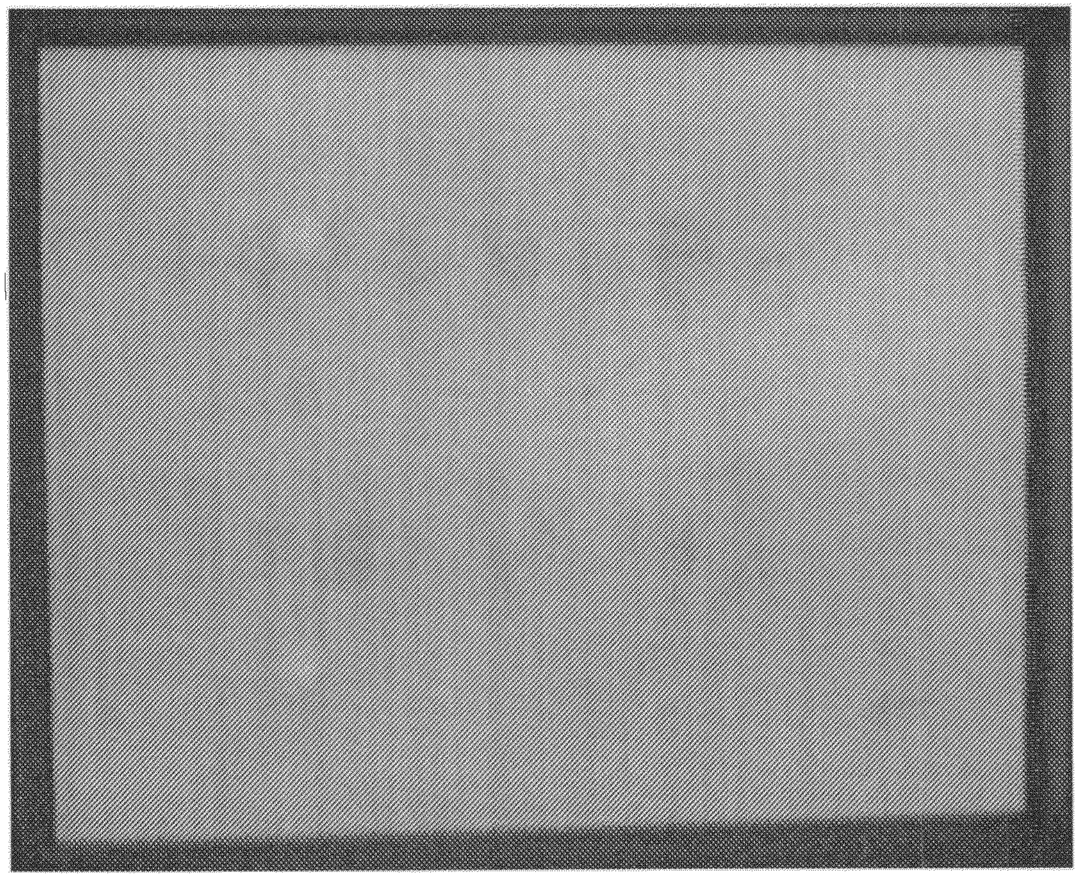
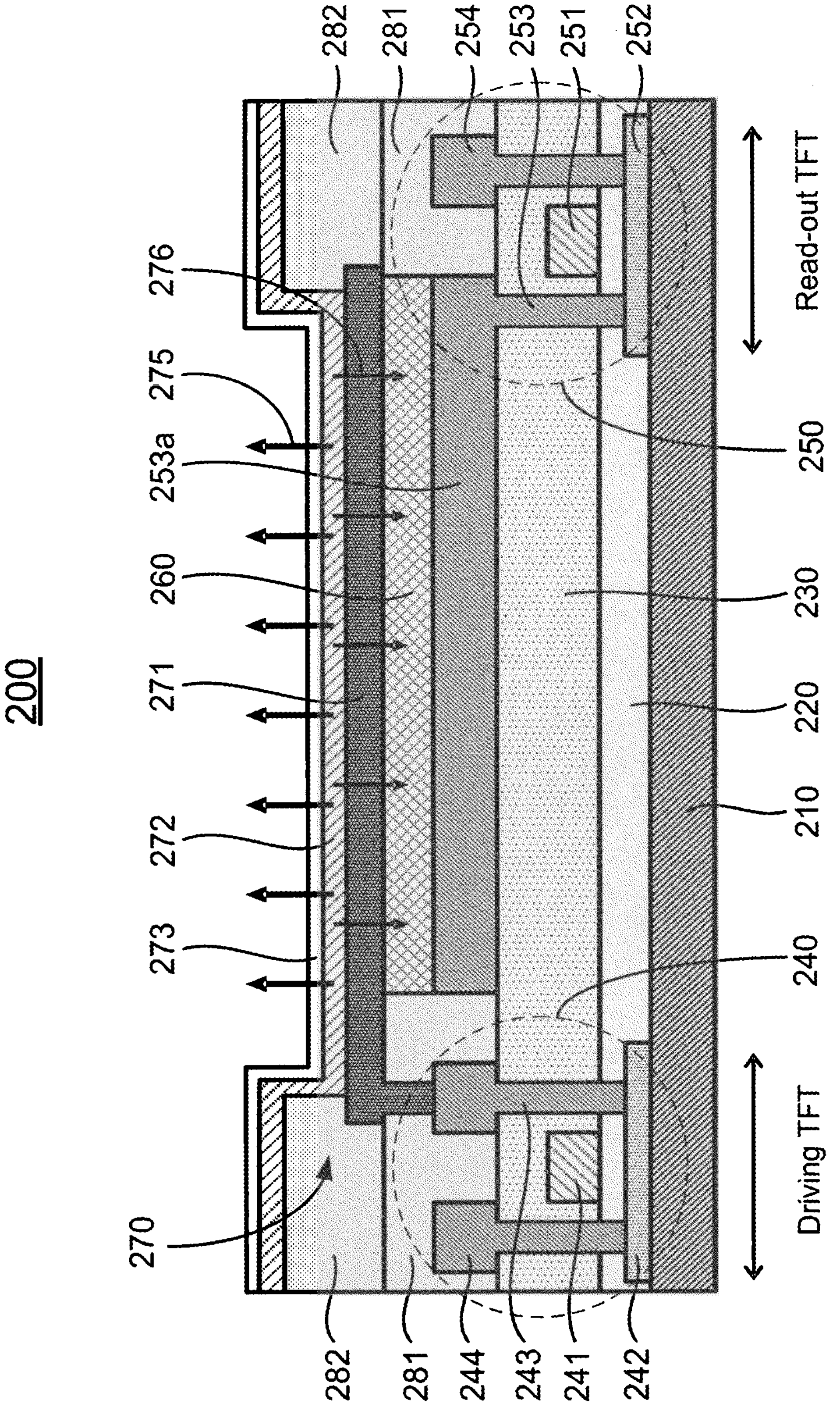


Fig. 1
(Related Art)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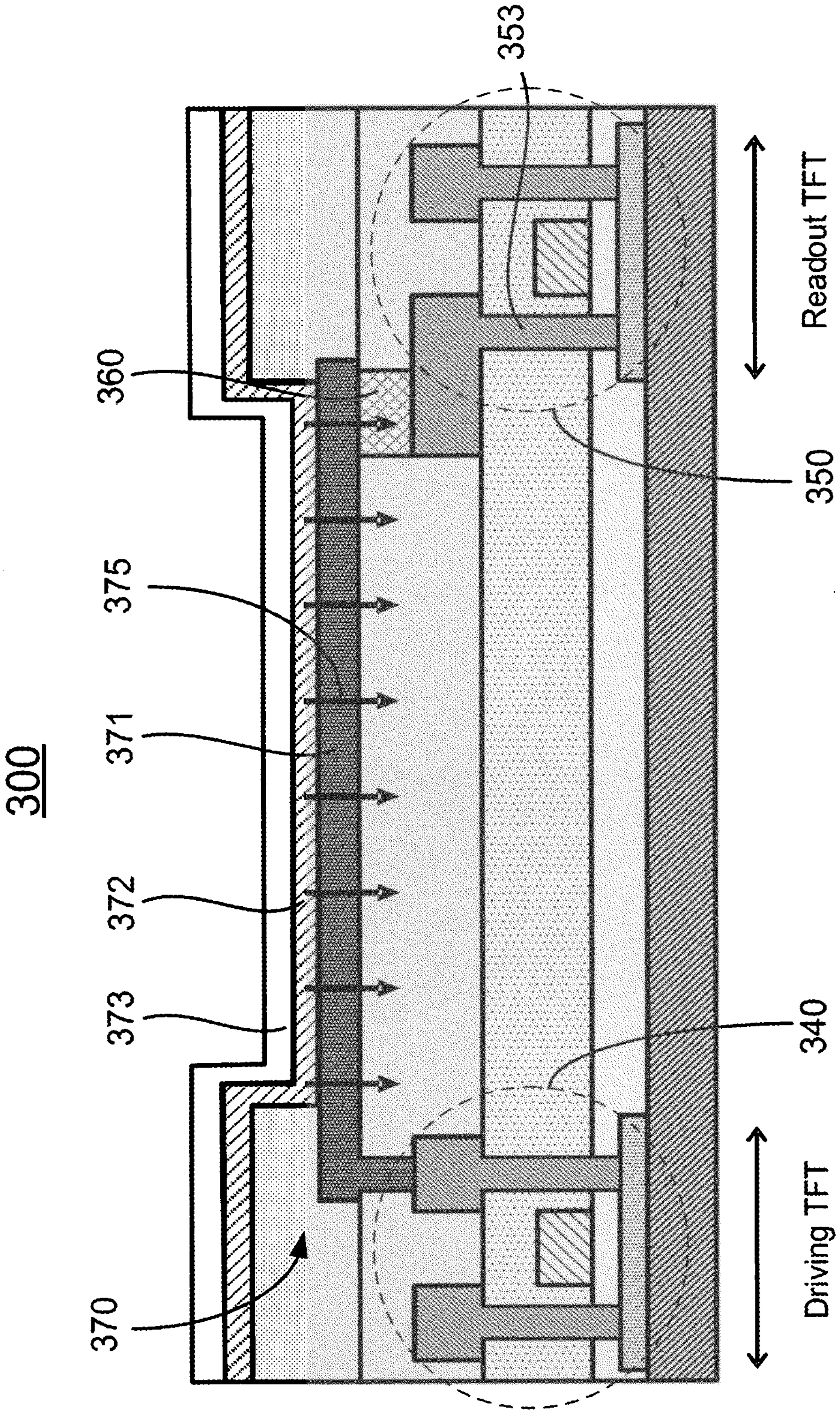
281
254
253
251
252
276
275
253a
260
271
272
273
270
Read-out TFT
250
230
220
210
240
Driving TFT
282
281
244
243
241
242

Fig. 2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360
375
371
372
373
370
350
340
Readout TFT
Driving TFT

Fig. 3

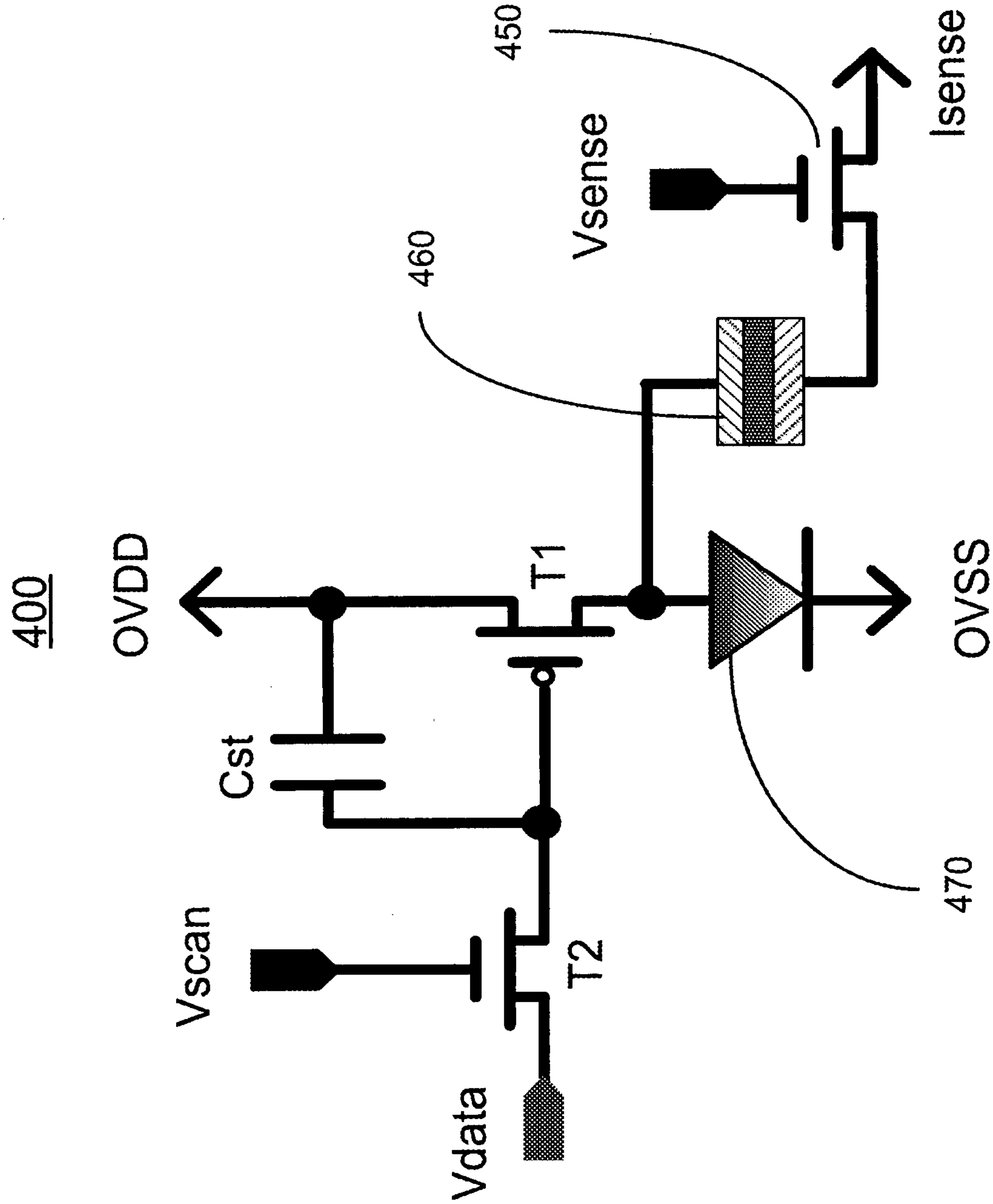


Fig. 4

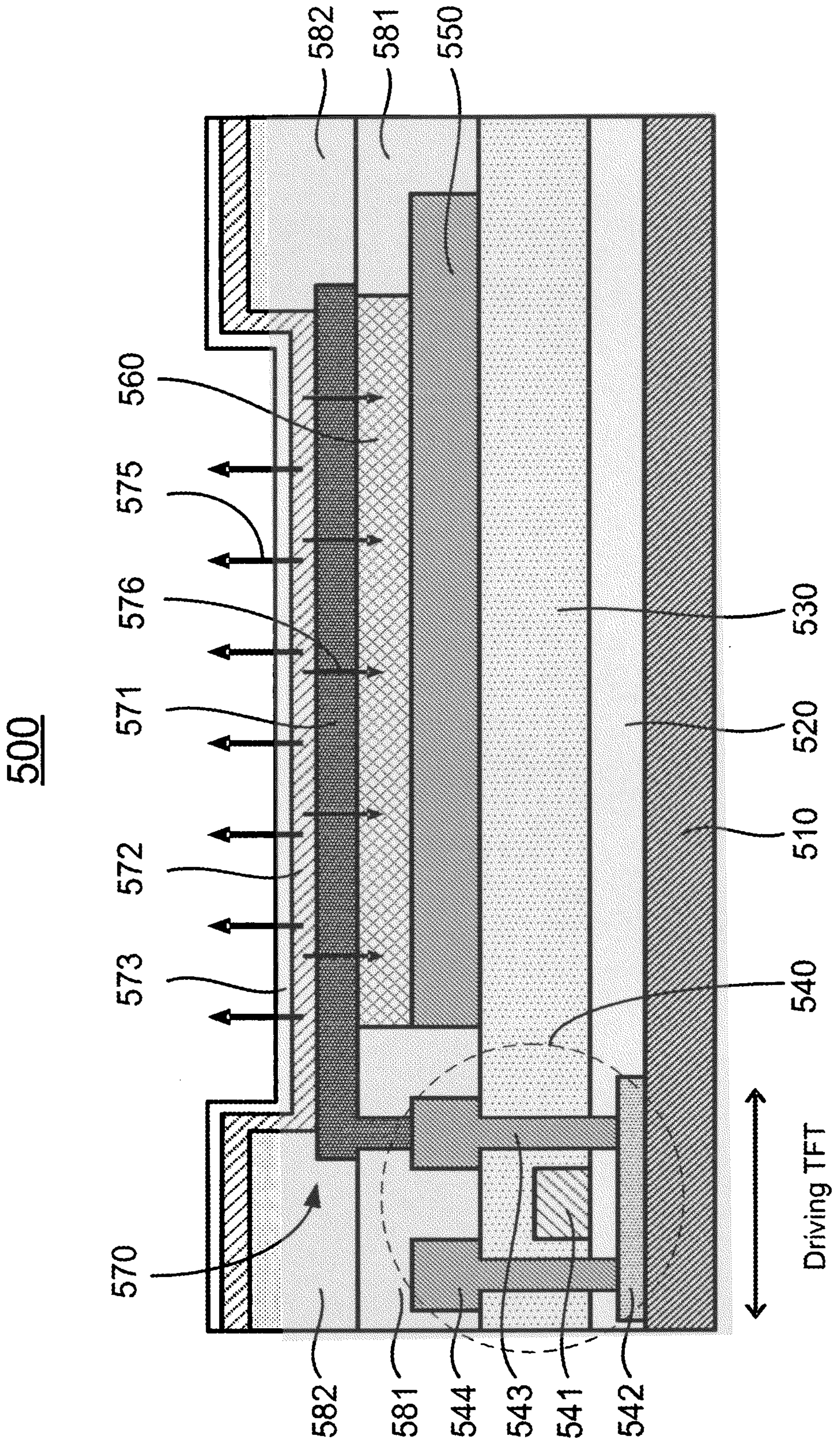

500
582
581
550
560
575
576
571
572
573
570
530
520
510
540
Driving TFT
582
581
544
543
541
542

Fig. 5

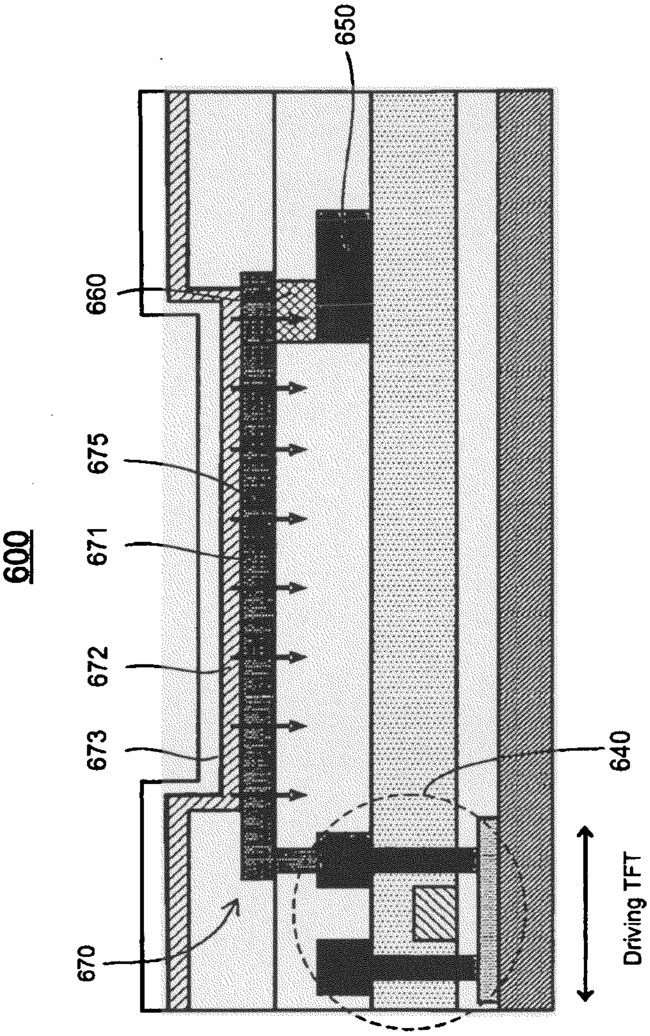


Fig. 6

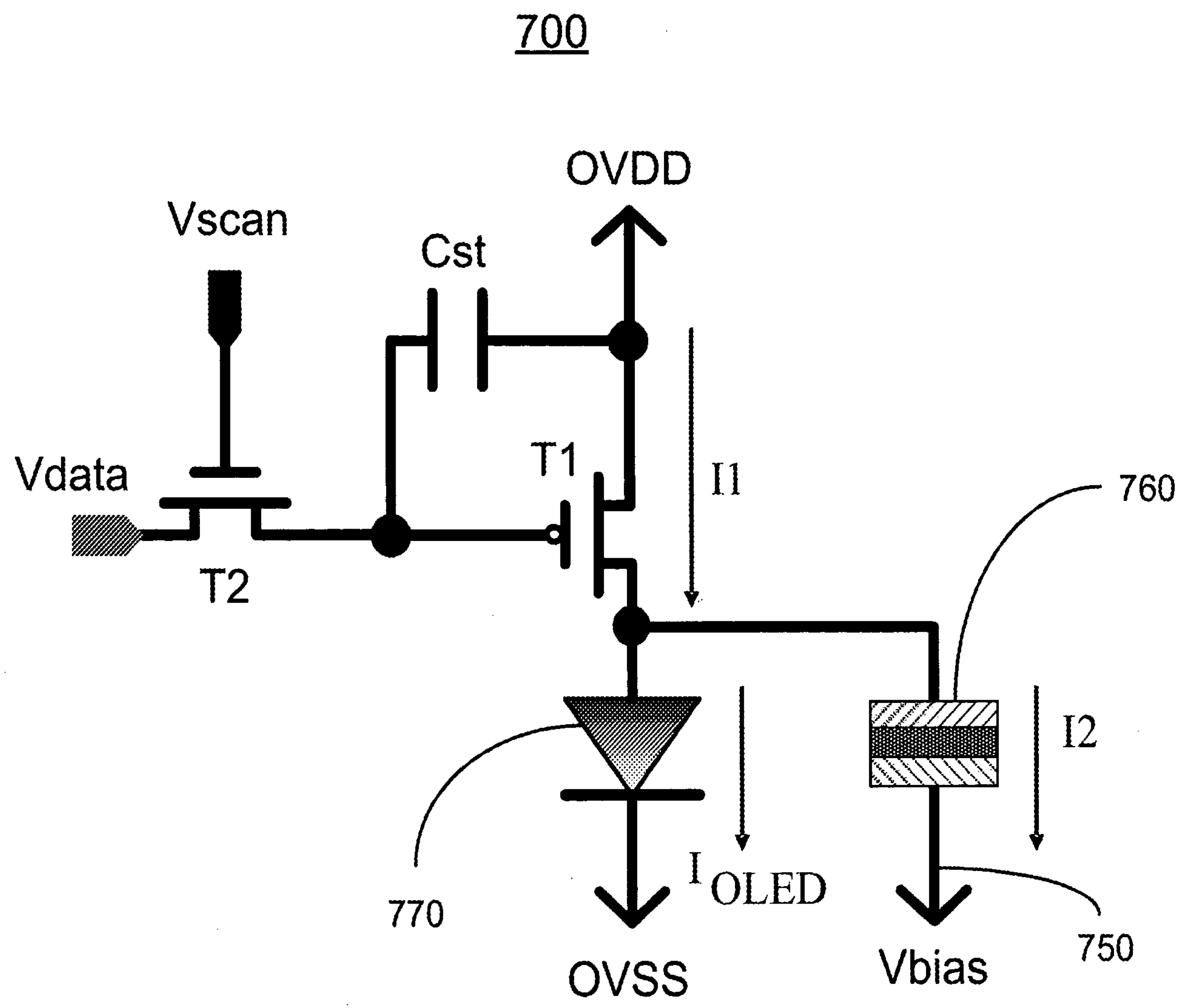
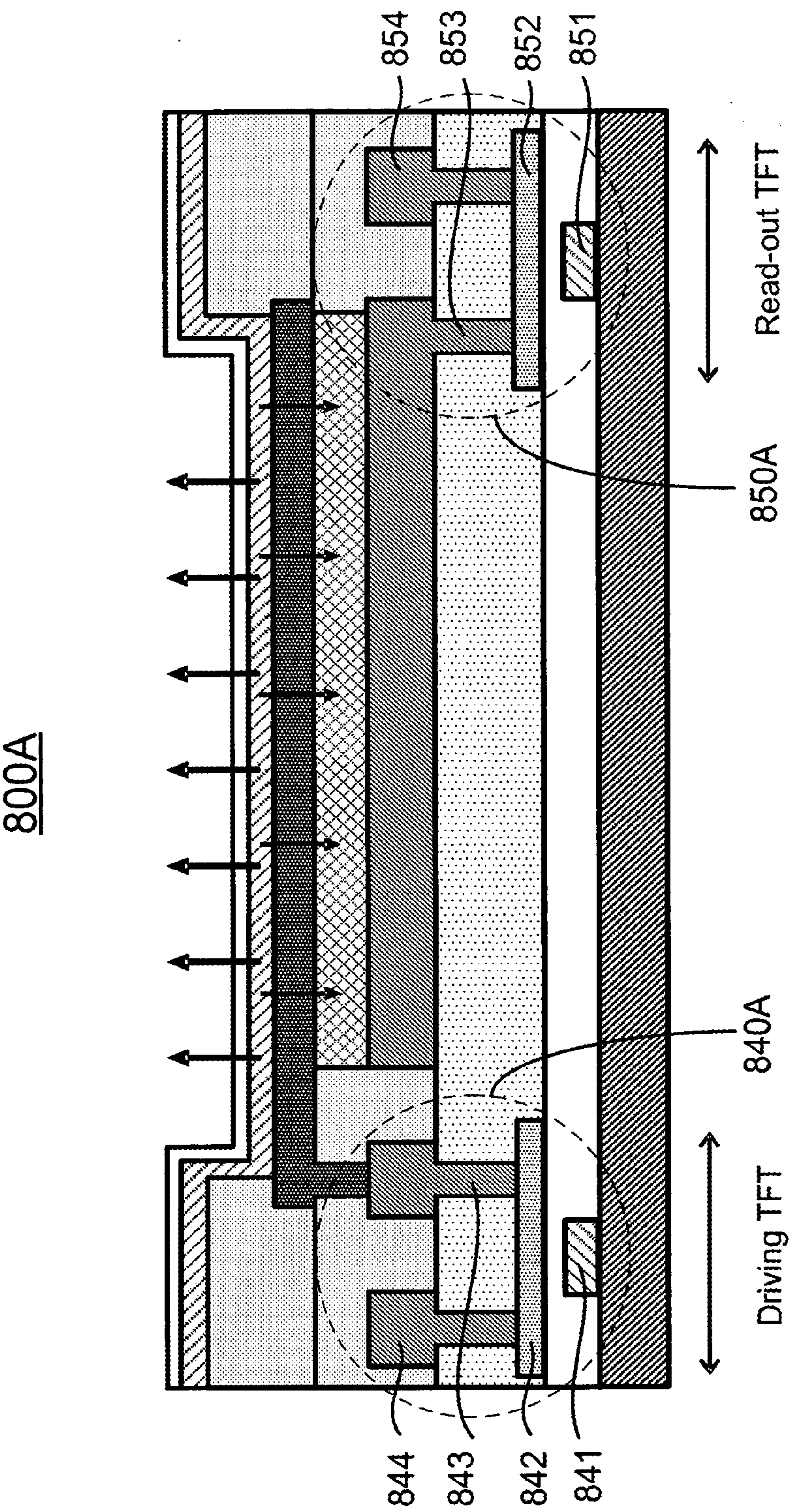

700
OVDD
Vscan
Cst
T1
Vdata
T2
I1
760
I2
770
I_{OLED}
750
OVSS
Vbias

Fig. 7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854
853
852
851
850A
Read-out TFT
840A
Driving TFT
844
843
842
841

Fig. 8A

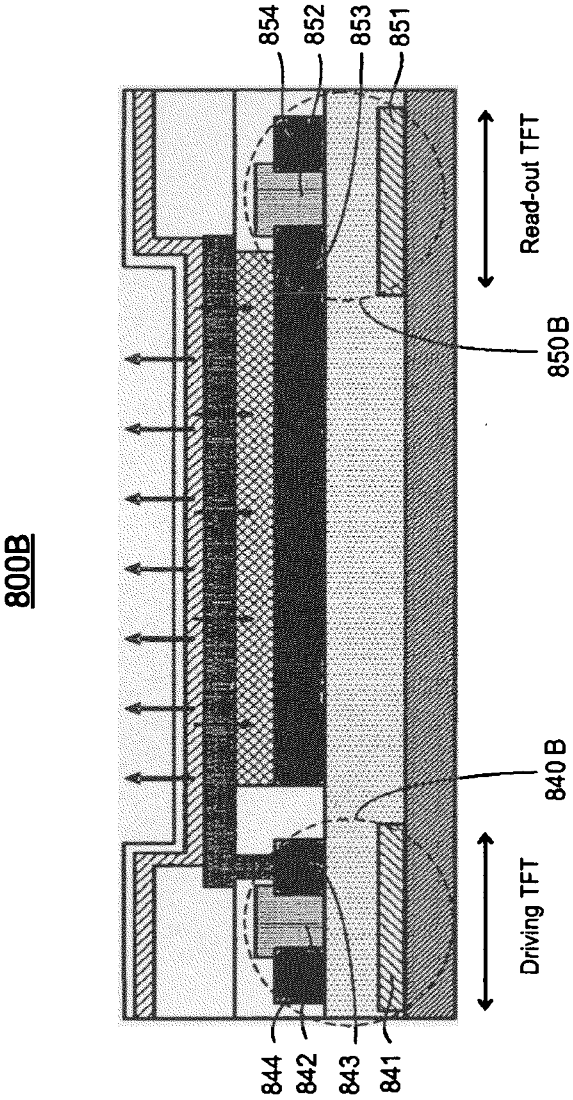
800B
854
852
853
851
Read-out TFT
850B
840B
Driving TFT
844
842
843
841

Fig. 8B

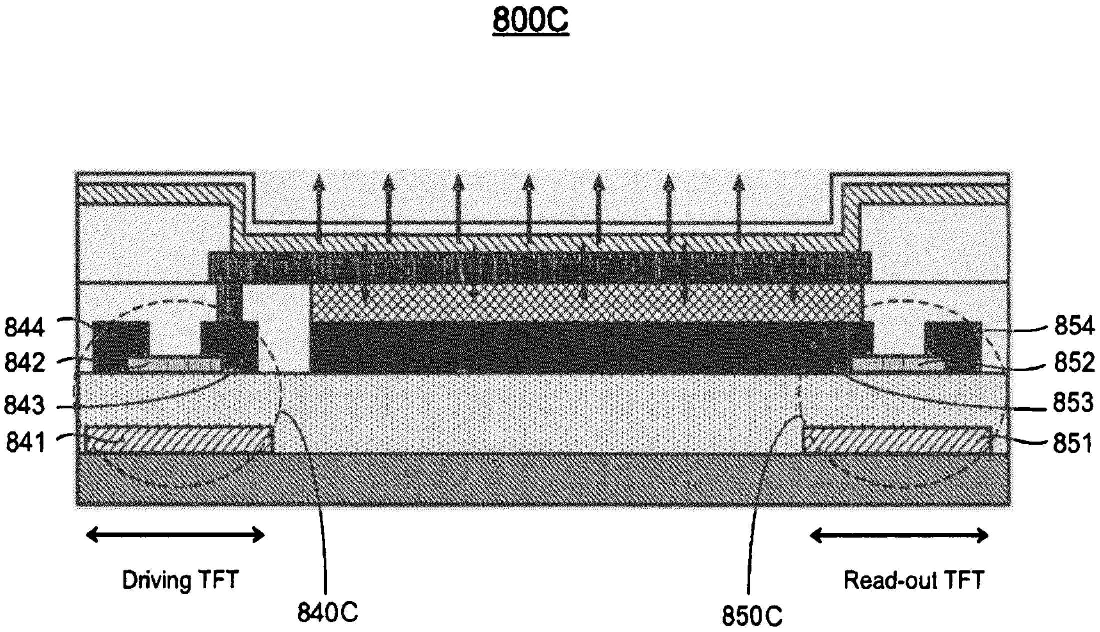
800C
844
842
843
841
854
852
853
851
Driving TFT
840C
850C
Read-out TFT

Fig. 8C

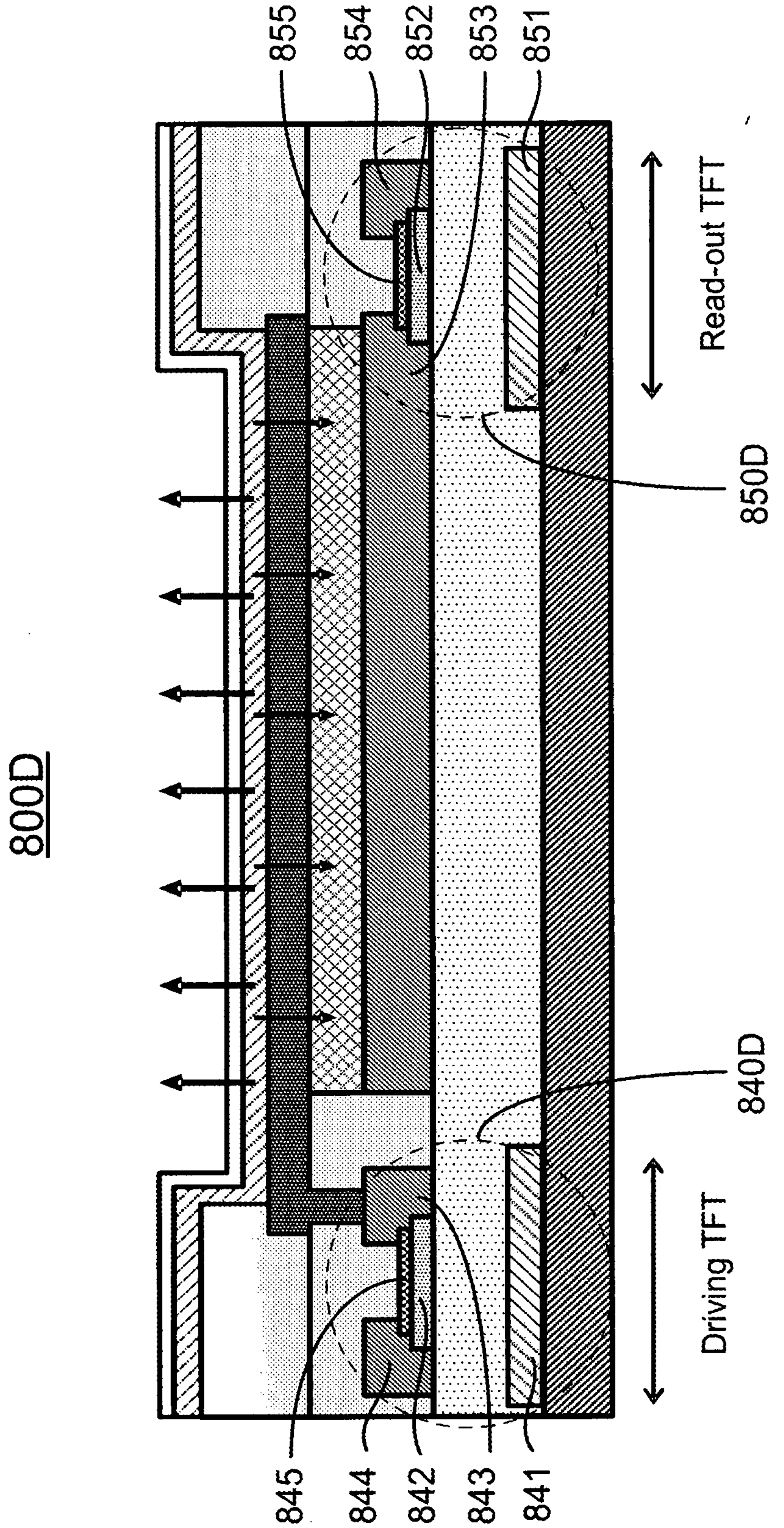
800D
855
854
852
853
851
Read-out TFT
850D
840D
Driving TFT
845
844
842
843
841

Fig. 8D

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- US 2001028060 A1 **[0006]**
- US 2004031966 A1 **[0006]**
- US 2006097296 A1 **[0006]**
- US 2007257250 A1 **[0006]**

Non-patent literature cited in the description

- **XUE J. et al.** Organic optical bistable switch. *Applied Physics Letters, AIP, Melville, US,* 06 January 2003, vol. 82 (1), 136-138 **[0006]**

专利名称(译)	AMOLED显示屏带有光学反馈补偿		
公开(公告)号	EP2365529B1	公开(公告)日	2015-09-16
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申请(专利权)人(译)	友达光电股份有限公司		
当前申请(专利权)人(译)	友达光电股份有限公司		
[标]发明人	KUO TZU YIN TSAI TSUNG TING		
发明人	KUO, TZU-YIN TSAI, TSUNG-TING		
IPC分类号	H01L27/32 G09G3/32 G09G5/10		
CPC分类号	G09G3/3258 G09G5/10 H01L27/3269		
代理机构(译)	LANG , CHRISTIAN		
优先权	12/722040 2010-03-11 US		
其他公开文献	EP2365529A2 EP2365529A3		
外部链接	Espacenet		

摘要(译)

在一个方面，本发明涉及一种显示器。在一个实施例中，显示器具有基板，以及形成在基板上并以阵列布置的多个像素。每个像素包括驱动晶体管和空间上形成在基板上的读出晶体管，其中每个晶体管具有栅电极，漏电极和源电极，具有阴极层的有机发光二极管（OLED），阳极层在所述阴极层与所述阳极层之间形成发光层，并形成在所述驱动晶体管和所述读出晶体管上方，使得所述OLED的阳极层与所述驱动晶体管的源极电连接，以及光电传感器具有在OLED的阳极层和读出晶体管的源极之间形成的光敏层。

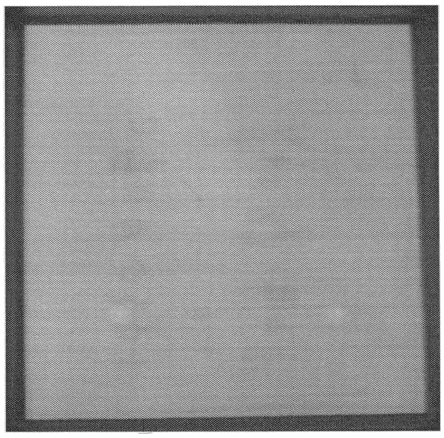

Fig. 1
(Related Art)