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Display panel and manufacturing method thereof, and electronic device

Abstract

The present application provides a display panel and a manufacturing method thereof, and an electronic device. The display panel includes a light-transmitting region and a light-shielding region disposed at a periphery of the light-transmitting region. A thickness of a passivation layer of the display panel in the light-transmitting region is less than a thickness of the passivation layer in the light-shielding region, so as to reduce a thickness of an insulating layer between a pixel electrode and a common electrode. In this way, when a certain electric field is formed, a driving voltage which is required can be reduced, so as to reduce power consumption of the display panel, thereby alleviating an urgent need to reduce power consumption of display screen in prior art.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS

(1) This application claims the benefits of International Application No. PCT/CN2023/094528, filed May 16, 2023, which claims priority to Chinese Application No. 202310456914.8, filed on Apr. 25, 2023. The entire disclosures of each of the applications are incorporated herein by reference.

TECHNICAL FIELD

(2) The present application relates to the field of display technologies, and especially relates to a display panel and a manufacturing method thereof, and an electronic device.

BACKGROUND

(3) With development of display technologies, momentum of smart mobile devices such as flat panel displays, etc. is becoming more and more obvious, the smart mobile devices are increasingly applied to production and daily life due to characteristics such as lightness, etc. However, in a case that development of battery technologies is slow, as display screens are components of which power consumption is highest, power consumption of the display screens determines a standby time of mobile devices, etc. to a large extent. For this, a reduction of power consumption has become a consistent goal in the industry in order to make the mobile devices more power-saving and have a longer standby time. Therefore, a reduction of power consumption of the display screens has become an urgent problem to be solved in the industry.

SUMMARY

(4) The present application provides a display panel and a manufacturing method thereof, and an electronic device, so as to alleviate a technical problem that power consumption of display screens in prior art is urgently needed to be reduced.

TECHNICAL SOLUTIONS

(5) In order to solve above problems, technical solutions provided by the present application are as follows:

(6) The present application provides a display panel including a light-transmitting region and a light-shielding region disposed at a periphery of the light-transmitting region, and further including: a first substrate; a first electrode layer disposed on the first substrate and including a pixel electrode formed in the light-transmitting region; a gate insulating layer covering the first electrode layer and the first substrate; a source-drain electrode layer disposed on the gate insulating layer and including a data line formed in the light-shielding region; a passivation layer covering the source-drain electrode layer and the gate insulating layer; and a second electrode layer disposed on the passivation layer and including a light-shielding electrode formed in the light-shielding region and a common electrode formed in the light-transmitting region, the light-shielding electrode being disposed corresponding to the data line, and the common electrode being disposed corresponding to the pixel electrode; wherein a thickness of the passivation layer in the light-transmitting region is less than a thickness of the passivation layer in the light-shielding region.

(7) In the display panel provided by an embodiment of the present application, the passivation layer is provided with a first opening corresponding to the light-transmitting region, the first opening at least goes through the passivation layer to expose the gate insulating layer, and the common electrode is disposed in the first opening and disposed on the gate insulating layer.

(8) In the display panel provided by an embodiment of the present application, the first opening further extends into the gate insulating layer, and a thickness of the gate insulating layer in the light-transmitting region is less than a thickness of the gate insulating layer in the light-shielding region.

(9) In the display panel provided by an embodiment of the present application, an orthographic

projection of the light-shielding electrode on the first substrate covers an orthographic projection of the data line on the first substrate.
(10) In the display panel provided by an embodiment of the present application, the light-shielding electrode is electrically connected to the common electrode.
(11) In the display panel provided by an embodiment of the present application, the display panel further includes a gate metal layer disposed between the first electrode layer and the source-drain electrode layer; the gate metal layer includes a gate scanning line formed in the light-shielding region, and the first electrode layer further includes a first conductive part formed in the light-shielding region and covering the gate scanning line.
(12) In the display panel provided by an embodiment of the present application, the display panel further includes a semiconductor layer disposed on the gate insulating layer; the source-drain electrode layer is covered on the semiconductor layer, the semiconductor layer includes a first semiconductor part formed in the light-shielding region, and the data line covers the first semiconductor part.
(13) In the display panel provided by an embodiment of the present application, the gate scanning line extends along a first direction, the data line extends along a second direction, the gate scanning line and the data line adjacent to each other define the light-transmitting region, and the first direction differs from the second direction.
(14) In the display panel provided by an embodiment of the present application, the display panel further includes a light-shielding layer and a color filter layer disposed on a side of the second electrode layer away from the first substrate, the light-shielding layer is provided with a second opening corresponding to the light-transmitting region, and the color filter layer is disposed in the second opening.
(15) The present application further provides a manufacturing method of a display panel, including: providing a first substrate defined with a light-transmitting region and a light-shielding region disposed at a periphery of the light-transmitting region; forming a first electrode layer disposed on the first substrate, the first electrode layer includes a pixel electrode formed in the light-transmitting region; covering the first electrode layer and the first substrate with a gate insulating layer; forming a source-drain electrode layer disposed on the gate insulating layer, the source-drain electrode layer includes a data line formed in the light-shielding region; covering the source-drain electrode layer and the gate insulating layer with a passivation layer, a thickness of the passivation layer in the light-transmitting region is less than a thickness of the passivation layer in the light-shielding region; and forming a second electrode layer disposed on the passivation layer, the second electrode layer includes a light-shielding electrode formed in the light-shielding region and a common electrode formed in the light-transmitting region; the light-shielding electrode is disposed corresponding to the data line, and the common electrode is disposed corresponding to the pixel electrode.
(16) In the manufacturing method of the display panel provided by an embodiment of the present application, the step of covering the source-drain electrode layer and the gate insulating layer with the passivation layer, and the thickness of the passivation layer in the light-transmitting region is less than the thickness of the passivation layer in the light-shielding region includes: depositing a passivation layer on the source-drain electrode layer and the gate insulating layer, and carrying out a photoresist process for the passivation layer to form a first opening in the passivation layer in the light-transmitting region; the first opening goes through at least a portion of the passivation layer, so that the thickness of the passivation layer in the light-transmitting region is less than the thickness of the passivation layer in the light-shielding region.
(17) The present application further provides an electronic device including a house and a display panel disposed in the house, the display panel includes a light-transmitting region and a light-shielding region disposed at a periphery of the light-transmitting region, and the display panel further includes: a first substrate; a first electrode layer disposed on the first substrate and including

a pixel electrode formed in the light-transmitting region; a gate insulating layer covering the first electrode layer and the first substrate; a source-drain electrode layer disposed on the gate insulating layer and including a data line formed in the light-shielding region; a passivation layer covering the source-drain electrode layer and the gate insulating layer; and a second electrode layer disposed on the passivation layer and including a light-shielding electrode formed in the light-shielding region and a common electrode formed in the light-transmitting region, the light-shielding electrode is disposed corresponding to the data line, and the common electrode is disposed corresponding to the pixel electrode; a thickness of the passivation layer in the light-transmitting region is less than a thickness of the passivation layer in the light-shielding region.

(18) In the electronic device provided by an embodiment of the present application, the passivation layer is provided with a first opening corresponding to the light-transmitting region, the first opening at least goes through the passivation layer to expose the gate insulating layer, and the common electrode is disposed in the first opening and disposed on the gate insulating layer.

(19) In the electronic device provided by an embodiment of the present application, the first opening further extends into the gate insulating layer, and a thickness of the gate insulating layer in the light-transmitting region is less than a thickness of the gate insulating layer in the light-shielding region.

(20) In the electronic device provided by an embodiment of the present application, an orthographic projection of the light-shielding electrode on the first substrate covers an orthographic projection of the data line on the first substrate.

(21) In the electronic device provided by an embodiment of the present application, the light-shielding electrode is electrically connected to the common electrode.

(22) In the electronic device provided by an embodiment of the present application, the display panel further includes a gate metal layer disposed between the first electrode layer and the source-drain electrode layer, the gate metal layer includes a gate scanning line formed in the light-shielding region, and the first electrode layer further includes a first conductive part formed in the light-shielding region and covering the gate scanning line.

(23) In the electronic device provided by an embodiment of the present application, the display panel further includes a semiconductor layer disposed on the gate insulating layer; the source-drain electrode layer is covered on the semiconductor layer, the semiconductor layer includes a first semiconductor part formed in the light-shielding region, and the data line covers the first semiconductor part.

(24) In the electronic device provided by an embodiment of the present application, the gate scanning line extends along a first direction, the data line extends along a second direction, the gate scanning line and the data line adjacent to each other define the light-transmitting region, and the first direction differs from the second direction.

(25) In the electronic device provided by an embodiment of the present application, the display panel further includes a light-shielding layer and a color filter layer disposed on a side of the second electrode layer away from the first substrate, the light-shielding layer is provided with a second opening corresponding to the light-transmitting region, and the color filter layer is disposed in the second opening.

BENEFICIAL EFFECTS

(26) In the display panel and the manufacturing method thereof, and the electronic device provided by the present application, the display panel includes the light-transmitting region and the light-shielding region disposed at the periphery of the light-transmitting region. The first electrode layer of the display panel is disposed on the first substrate, and includes a pixel electrode formed in the light-transmitting region. The gate insulating layer covers the first electrode layer and the first substrate. The source-drain electrode layer is disposed on the gate insulating layer, and includes the data line formed in the light-shielding region. The passivation layer covers the source-drain electrode layer and the gate insulating layer. The second electrode layer is disposed on the

passivation layer, and includes the light-shielding electrode formed in the light-shielding region and the common electrode formed in the light-transmitting region. The light-shielding electrode is disposed corresponding to the data line, and the common electrode is disposed corresponding to the pixel electrode. The thickness of the passivation layer in the light-transmitting region is less than the thickness of the passivation layer in the light-shielding region, so as to reduce a thickness of an insulating layer between the pixel electrode and the common electrode. In this way, when a certain electric field is formed, a driving voltage which is required can be reduced, so as to reduce power consumption of the display panel, thereby alleviating an urgent need to reduce power consumption of display screen in prior art.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) In order to more clearly illustrate embodiments or the technical solutions of the present application, the accompanying figures of the present application required for illustrating embodiments or the technical solutions of the present application will be described in brief. Obviously, the accompanying figures described below are only part of the embodiments of the present application, from which those skilled in the art can derive further figures without making any inventive efforts.

(2) FIG. **1** is a top-viewed structural schematic diagram of a display panel provided by an embodiment of the present application.

(3) FIG. **2** is a cross-sectional structural schematic diagram along N-N′ direction in FIG. **1**.

(4) FIG. **3** is a cross-sectional structural schematic diagram of a display panel provided by an embodiment of the present application.

(5) FIG. **4** is another cross-sectional structural schematic diagram of a display panel provided by an embodiment of the present application.

(6) FIG. **5** is a flowchart of a manufacturing method of a display panel provided by an embodiment of the present application.

(7) FIG. **6** to FIG. **14** are schematic diagrams of part film layer structures of the display panel manufactured by each step of the manufacturing method of the display panel provided by an embodiment of the present application.

DETAILED DESCRIPTION OF THE EMBODIMENT

(8) The descriptions of embodiments below refer to accompanying drawings in order to illustrate certain embodiments which the present application can implement. The directional terms of which the present application mentions, for example, “top”, “bottom”, “upper”, “lower”, “front”, “rear”, “left”, “right”, “inside”, “outside”, “side”, etc., only refer to directions of the accompanying figures. Therefore, the used directional terms are for illustrating and understanding the present application, but not for limiting the present application. In the figures, units with similar structures are indicated by the same reference numerals. In the drawings, the thicknesses of layers and regions are exaggerated for clarity. The dimensions and thickness of each component shown in the accompanying figures are arbitrarily shown, present application is not limited thereto.

(9) For a problem of how to reduce power consumption of display screens, inventors of the present application found in researches that, two insulating layers which include a gate insulating layer and a passivation layer are disposed between a pixel electrode and a common electrode of a display screen, and a thickness of the insulating layers is large. Thus, a large driving voltage is required by the display screen, and power consumption of the display screen is large. For this, the present application provides a display panel and a manufacturing method thereof, and an electronic device to solve a problem of high power consumption of the display screen.

(10) Please refer to FIG. **1** to FIG. **2**, FIG. **1** is a top-viewed structural schematic diagram of a

display panel provided by an embodiment of the present application, and FIG. **2** is a cross-sectional structural schematic diagram along N-N′ direction in FIG. **1**. As shown in FIG. **1**, a display panel **100** includes a light-transmitting region TA and a light-shielding region SA disposed at a periphery of the light-transmitting region TA. The display panel **100** further includes a plurality of gate scanning lines SL extending along a first direction X and a plurality of data lines DL extending along a second direction Y. The gate scanning lines SL and the data lines DL are both disposed corresponding to the light-shielding region SA, and the gate scanning line SL and the data line DL adjacent to each other define the light-transmitting region TA. The first direction X differs from the second direction Y, for example, the first direction X is a horizontal direction, the second direction Y is a vertical direction, and the first direction X and the second direction Y are perpendicular to each other.

(11) Specifically, referring to FIG. **2**, the display panel **100** further includes a first substrate **10** and a first electrode layer **20**, a gate insulating layer **11**, a source-drain electrode layer **30**, a passivation layer **12**, and a second electrode layer **40** which are sequentially disposed on the first substrate **10**. Optionally, the first substrate **10** includes a glass substrate, etc.

(12) The first electrode layer **20** is disposed on the first substrate **10**, and the first electrode layer **20** includes a pixel electrode **21** formed in the light-transmitting region TA. Optionally, a material of the first electrode layer **20** includes a transparent conductive material such as indium tin oxide (ITO), etc.

(13) The gate insulating layer **11** covers the first electrode layer **20** and the first substrate **10**. A material of the gate insulating layer **11** includes an inorganic material such as silicon oxide (SiOx), silicon nitride (SiNx), and silicon oxynitride (SiNO), etc.

(14) The source-drain electrode layer **30** is disposed on the gate insulating layer **11**, and includes the data line DL formed in the light-shielding region SA. Of course, the source-drain electrode layer **30** further includes a source electrode and a drain electrode of a thin film transistor, and some other signal wirings, etc. formed in the light-transmitting region TA. The passivation layer **12** covers the source-drain electrode layer **30** and the gate insulating layer **11**. Optionally, a material of the passivation layer **12** includes an inorganic material such as silicon oxide, silicon nitride, and silicon oxynitride, etc. The second electrode layer **40** is disposed on the passivation layer **12**, and includes a light-shielding electrode **42** formed in the light-shielding region SA and a common electrode **41** formed in the light-transmitting region TA. The light-shielding electrode **42** is disposed corresponding to the data line DL, and the common electrode **41** is disposed corresponding to the pixel electrode **21**. Optionally, a material of the second electrode layer **40** is the same as the material of the first electrode layer **20**.

(15) Optionally, an orthographic projection of the light-shielding electrode **42** on the first substrate **10** covers an orthographic projection of the data line DL on the first substrate **10**, so that the light-shielding electrode **42** can completely block the data line DL, thereby improving light leakage in an region corresponding to the data line DL. Further, in order to improve effect of light-shielding of the light-shielding electrode **42**, the light-shielding electrode **42** may be electrically connected to the common electrode **41**.

(16) The display panel **100** further includes a second substrate **50**, and a light-shielding layer **60** and a color film layer **70** which are disposed on the second substrate **50**. The light-shielding layer **60** and the color film layer **70** are both disposed towards the second electrode layer **40**. The light-shielding layer **60** is disposed corresponding to the light-shielding region SA, the light-shielding layer **60** is provided with a second opening **601** corresponding to the light-transmitting region TA, and the color film layer **70** is disposed in the second opening **601**. In addition, since the light-shielding electrode **42** is disposed corresponding to light-shielding region SA, the light-shielding electrode **42** together with the light-shielding layer **60** play a role of shielding light. Thus, light leakage in the light-shielding region SA is improved, a width of the light-shielding layer **60** can be reduced, thereby improving aperture ratio of the display panel **100**.

(17) Optionally, a material of the second substrate **50** is the same as that of the first substrate **10**. A material of the light-shielding layer **60** includes an opaque material such as a black matrix (BM). The color filter layer **70** includes a red color film, a blue color film and a green color film, and color films with different colors are disposed in different second openings **601**. The color film layer **70** is used to make a light with a specific color emitted after lights pass through the color film layer **70**, for example, a red light is emitted after lights passing through the red color film, a blue light is emitted after lights passing through the blue color film, and a green light is emitted after lights passing through the green color film.

(18) Of course, the display panel **100** further includes a liquid crystal layer (not shown) disposed between the color filter layer **70** and the second electrode layer **40**. An electric field is formed between the pixel electrode **21** and the common electrode **41** to control deflection of liquid crystal molecules in the liquid crystal layer, so as to modulate backlights from a backlight source, thereby realizing color display of the display panel **100**. Specifically, the data line DL is used to receive a data voltage, and the gate scanning line is used to receive a scan signal, so as to control a thin film transistor correspondingly connected to the gate scanning line and the data line DL to be turned on or off. When the thin film transistor is turned on, the data voltage received by the data line DL to which the thin film transistor is correspondingly connected, is written into a correspondingly one of the pixel electrodes **21** through the thin film transistor which is turned on. At the same time, a corresponding one of the common electrodes **41** is loaded with a common voltage, the electric field for controlling the deflection of the liquid crystal molecules is formed between the pixel electrode **21** and the common electrode **41**. In this way, the deflection of the liquid crystal molecules in a corresponding area is controlled to modulate lights from the backlight source, and the lights after modulated are emitted from the light transmission region TA provided with the color filter layer **70**, so as to realize color display of the display panel **100**.

(19) Further, a thickness of the passivation layer **12** in the light-transmitting region TA is less than a thickness of the passivation layer **12** in the light-shielding region SA, so as to reduce a thickness of an insulating layer between the pixel electrode **21** and the common electrode **41**. In this way, when a certain electric field is formed, driving voltages for driving the pixel electrode **21** and the common electrode **41** can be reduced, so as to reduce power consumption of the display panel **100**, thereby alleviating an urgent need to reduce power consumption of display screen in prior art. At the same time, by reducing the thickness of the insulating layer between the pixel electrode **21** and the common electrode **41**, a capacitance value of a storage capacitor between the pixel electrode **21** and the common electrode **41** can also be increased, which can effectively improve variable refresh rate of the display panel **100**. In the light-shielding region SA, an insulating layer between the data line DL and the light-shielding electrode **42** is thicker, which can increase a distance between the data line DL and the light-shielding electrode **42** disposed above the data line DL. Thus, coupling effect between the data line DL and the light-shielding electrode **42** is reduced, which is beneficial to reduce a load of the data line DL.

(20) In the following, how to realize that the thickness of the passivation layer **12** in the light-transmitting region TA is less than the thickness of the passivation layer **12** in the light-shielding region SA is specifically explained.

(21) Specifically, continuing to refer to FIG. **2**, the passivation layer **12** is provided with a first opening **121** corresponding to the light-transmitting region TA. The first opening **121** at least goes through the passivation layer **12** to expose the gate insulating layer **11**, and the common electrode **41** is disposed in the first opening **121** and disposed on the gate insulating layer **11**. Specifically, after forming a whole layer of the passivation layer **12** on the source-drain electrode layer **30** and the gate insulating layer **11**, a photoresist process is carried out on the whole layer of the passivation layer with a half-tone mask (HM). Amount of light passing through the half-tone mask in the light-shielding region SA and the light-transmitting region TA is controlled to control exposure amount. Thus, the passivation layer **12** is formed with different thicknesses in the light-

shielding region SA and the light-transmitting region TA. Wherein, the passivation layer **12** in the light transmission region TA can be completely removed, so that there is only the gate insulating layer **11** which is remained and disposed between the common electrode **41** and the pixel electrode **21**.

(22) In one embodiment, referring to FIG. **1** to FIG. **3**, FIG. **3** is a cross-sectional structural schematic diagram of a display panel provided by an embodiment of the present application. As shown in FIG. **3**, the display panel **100** further includes a gate metal layer **80** disposed between the first electrode layer **20** and the source-drain electrode layer **30**. The gate metal layer **80** includes a gate scanning line SL formed in the light-shielding region SA, and at the same time, the gate metal layer **80** further includes a gate of the thin film transistor and some other lines. The first electrode layer **20** further includes a first conductive part **22** formed in the light-shielding region SA, and the gate scanning line SL is covered on the first conductive part **22**. In this way, the first electrode layer **20** and the gate metal layer **80** are patterned by a same photoresist process, so that one photomask is saved, thereby saving costs.

(23) Further, the display panel **100** further includes a semiconductor layer **90**. The semiconductor layer **90** is disposed on the gate insulating layer **11**, the source-drain electrode layer **30** is covered on the semiconductor layer **90**. The semiconductor layer **90** includes a first semiconductor part **91** formed in the light-shielding region SA and an active layer of the thin film transistor formed in the light transmission region TA. The data line DL is covered on the first semiconductor part **91**. Similarly, the semiconductor layer **90** and the source-drain electrode layer **30** are also patterned by a same photoresist process, so that one photomask is saved, thereby saving costs.

(24) In one embodiment, please refer to FIG. **1** to FIG. **4**. FIG. **4** is another cross-sectional structural schematic diagram of a display panel provided by an embodiment of the present application. A first opening **121** further extends into the gate insulating layer **11**, and a thickness of the gate insulating layer **11** in the light-transmitting region TA is less than a thickness of the gate insulating layer **11** in the light-shielding region SA. Thus, the thickness of the insulating layer between the pixel electrode **21** and the common electrode **41** is further reduced, so as to further reduce driving voltages for driving the pixel electrode **21** and the common electrode **41**, thereby reducing power consumption of the display panel **100**.

(25) Based on a same idea of invention, a manufacturing method of a display panel is provided by an embodiment of the present application further. Please refer to FIG. **1** to FIG. **14**, FIG. **5** is a flowchart of a manufacturing method of a display panel provided by an embodiment of the present application, FIG. **6** to FIG. **14** are schematic diagrams of part film layer structures of the display panel manufactured by each step of the manufacturing method of the display panel provided by an embodiment of the present application. Referring to FIG. **5**, a manufacturing method of a display panel includes following steps:

(26) S**301**: providing a first substrate **10** defined with a light-transmitting region TA and a light-shielding region SA disposed at a periphery of the light-transmitting region TA;

(27) Specifically, referring to FIG. **6**, the first substrate **10** is provided, and processes such as cleaning and drying are performed on the first substrate **10**. The first substrate **10** is defined with the light-transmitting region TA and the light-shielding region SA disposed at the periphery of the light-transmitting region TA. The first substrate **10** includes a hard substrate such as a glass substrate.

(28) S**302**: forming a first electrode layer **20** disposed on the first substrate **10**, and the first electrode layer **20** includes a pixel electrode **21** formed in the light-transmitting region TA;

(29) Specifically, referring to FIG. **7** and FIG. **8**. The first electrode layer **20** and the gate metal layer **80** are sequentially deposited on the first substrate **10**, and a photoresist process is carried out on the first electrode layer **20** and the gate metal layer **80** with a first mask. Thus, the first electrode layer **20** includes the pixel electrode **21** formed in the light-transmitting region TA and a first conductive part **22** formed in the light-shielding region SA, and the gate metal layer **80** includes a

gate scanning line SL formed in the light-shielding region SA. The gate scanning line SL is disposed corresponding to the first conductive part **22** and is covered on the first conductive part **22**. Of course, the gate metal layer **80** further includes a gate of a thin film transistor and some other signal lines formed in the light-transmitting region TA. Wherein, the first mask includes a half-tone mask (HTM).

(30) Optionally, a material of the first electrode layer **20** includes a transparent conductive material such as indium tin oxide (ITO), and a material of the gate metal layer **80** includes metals such as copper, titanium, molybdenum and alloys thereof.

(31) S**303**: covering the first electrode layer **20** and the first substrate **10** with a gate insulating layer **11**;

(32) Specifically, referring to FIG. **9**, a gate insulating layer **11** is deposited on the first electrode layer **20** and the first substrate **10**, and the gate insulating layer **11** covers the pixel electrode **21**, the gate scanning line SL and a part of the first substrate **10**. A material of the gate insulating layer **11** includes an inorganic material such as silicon oxide (SiOx), silicon nitride (SiNx), silicon oxynitride (SiNO), etc.

(33) S**304**: forming a source-drain electrode layer **30** on the gate insulating layer **11**, and the source-drain electrode layer **30** includes a data line DL formed in the light-shielding region SA;

(34) Specifically, referring to FIG. **10** and FIG. **11**. A semiconductor layer **90** and a source-drain electrode layer **30** are sequentially deposited on the gate insulating layer **11**, and a photoresist process is carried out on the semiconductor layer **90** and the source-drain electrode layer **30** with a second mask. Thus, the semiconductor layer **90** includes a first semiconductor part **91** formed in the light-shielding region SA, the source-drain electrode layer **30** includes a data line DL formed in the light-shielding region SA. The data line DL is covered on the first semiconductor part **91**. Wherein, the second mask includes a half-tone mask (HTM).

(35) Of course, the semiconductor layer **90** further includes an active layer of the thin film transistor formed in the light transmission region TA. The source-drain electrode layer **30** further includes a source electrode and a drain electrode of the thin film transistor formed in the light transmission region TA. The source electrode and the drain electrode cover a part of the active layer. In this way, the semiconductor layer **90** and the source-drain electrode layer **30** are also patterned in a same photoresist process, so that one photomask is saved, thereby saving costs.

(36) Optionally, a material of the semiconductor layer **90** includes a semiconductor material such as low temperature polysilicon and metal oxide semiconductor material, and a material of the source-drain electrode layer **30** includes metals such as copper, titanium, molybdenum and alloys thereof.

(37) S**305**: covering the source-drain electrode layer **30** and the gate insulating layer **11** with a passivation layer **12**, and a thickness of the passivation layer **12** in the light-transmitting region TA is less than a thickness of the passivation layer **12** in the light-shielding region SA;

(38) Specifically, referring to FIG. **12** and FIG. **13**. The passivation layer **12** is deposited on the source-drain electrode layer **30** and the gate insulating layer **11**, and a photoresist process is carried out on the passivation layer **12** with a third photomask. Thus, the thickness of the passivation layer **12** in the light-transmitting region TA is less than the thickness of the passivation layer **12** in the light-shielding region SA. Specifically, the passivation layer **12** is provided with a first opening **121** in the light-transmitting region TA, and the first opening **121** goes through at least a part of the passivation layer **12**. In this embodiment, the first opening **121** completely goes through the passivation layer **12**, the passivation layer **12** in the light-transmitting region TA is completely removed, which is used as an example for illustration. Wherein, the third mask includes a half-tone mask (HTM).

(39) Optionally, a material of the passivation layer **12** includes an inorganic material such as silicon oxide (SiOx), silicon nitride (SiNx), silicon oxynitride (SiNO), etc.

(40) S**306**: forming a second electrode layer **40** disposed on the passivation layer **12**, the second electrode layer **20** includes a light-shielding electrode **42** formed in the light-shielding region SA

and a common electrode **41** formed in the light-transmitting region TA; the light-shielding electrode **42** is disposed corresponding to the data line DL, and the common electrode **41** is disposed corresponding to the pixel electrode **21**.

(41) Specifically, referring to FIG. **14**. The second electrode layer **40** is deposited on the passivation layer **12**, the second electrode layer **40** is covered on the passivation layer **12** and the gate insulating layer **11**, and a photoresist process is carried out on the second electrode layer **40** with a fourth mask. Thus, the first electrode layer **20** includes the light-shielding electrode **42** formed in the light-shielding region SA and the common electrode **41** formed in the light-transmitting region TA. The light-shielding electrode **42** is disposed corresponding to the data line DL, and the common electrode **41** is disposed corresponding to the pixel electrode **21**. Optionally, a material of the second electrode layer **40** is the same as that of the first electrode layer **20**.

(42) It should be noted that, referring to FIG. **3**, the manufacturing method of the display panel of the embodiment of the present application further includes: providing a second substrate **50**, and forming a light-shielding layer **60** and a color filter layer **70** on the second substrate **50**. The light-shielding layer **60** and the color filter layer **70** are disposed towards the second electrode layer **40**. The light-shielding layer **60** is disposed corresponding to the light-shielding region SA, the light-shielding layer **60** is provided with a second opening **601** corresponding to the light-transmitting region TA, and the color film layer **70** is disposed in the second opening **601**. In addition, since the light-shielding electrode **42** is disposed corresponding to light-shielding region SA, the light-shielding electrode **42** together with the light-shielding layer **60** play a role of shielding light. Thus, light leakage in the light-shielding region SA is improved, so that a width of the light-shielding layer **60** can is reduced, thereby improving aperture ratio of the display panel **100**.

(43) Based on a same idea of invention, an embodiment of the present application further provides an electronic device. The electronic device includes a house and the display panel **100** according to one of the embodiments mentioned above. The display panel **100** is disposed in the house. The electronic device includes display devices such as mobile phones, tablets, and televisions, etc.

(44) It can be known according to above-mentioned embodiments:

(45) The present application provides the display panel and the manufacturing method thereof, and the electronic device, the display panel includes the light-transmitting region and the light-shielding region disposed at the periphery of the light-transmitting region. The first electrode layer of the display panel is disposed on the first substrate, and includes a pixel electrode formed in the light-transmitting region. The gate insulating layer covers the first electrode layer and the first substrate. The source-drain electrode layer is disposed on the gate insulating layer, and includes the data line formed in the light-shielding region. The passivation layer covers the source-drain electrode layer and the gate insulating layer. The second electrode layer is disposed on the passivation layer, and includes the light-shielding electrode formed in the light-shielding region and the common electrode formed in the light-transmitting region. The light-shielding electrode is disposed corresponding to the data line, and the common electrode is disposed corresponding to the pixel electrode. The thickness of the passivation layer in the light-transmitting region is less than the thickness of the passivation layer in the light-shielding region, so as to reduce a thickness of an insulating layer between the pixel electrode and the common electrode. In this way, when a certain electric field is formed, a driving voltage which is required can be reduced, so as to reduce power consumption of the display panel, thereby alleviating an urgent need to reduce power consumption of display screen in prior art.

(46) In the foregoing embodiments, description of each embodiment have their own emphases, and for parts not described in detail in a certain embodiment, reference may be made to relevant descriptions of other embodiments.

(47) The embodiments of present application are described in detail above. This article uses specific cases for describing the principles and the embodiments of the present application, and the description of the embodiments mentioned above is only for helping to understand the method and

the core idea of the present application. It should be understood by those skilled in the art, that it can perform changes in the technical solution of the embodiments mentioned above, or can perform equivalent replacements in part of technical characteristics, and the changes or replacements do not make the essence of the corresponding technical solution depart from the scope of the technical solution of each embodiment of the present application.

Claims

1. A display panel, comprising a light-transmitting region and a light-shielding region disposed at a periphery of the light-transmitting region, and further comprising: a first substrate; a first electrode layer disposed on the first substrate and comprising a pixel electrode formed in the light-transmitting region; a gate insulating layer covering the first electrode layer and the first substrate; a source-drain electrode layer disposed on the gate insulating layer and comprising a data line formed in the light-shielding region; a passivation layer covering the source-drain electrode layer and the gate insulating layer; a first opening in the light-transmitting region, wherein the first opening goes through the passivation layer and further extends into the gate insulating layer; and a second electrode layer comprising a light-shielding electrode formed in the light-shielding region and a common electrode formed in the light-transmitting region, the light-shielding electrode being disposed corresponding to the data line and on the passivation layer, and the common electrode being disposed in the first opening and being in direct contact with the gate insulating layer; wherein a thickness of the gate insulating layer disposed between the pixel electrode and the common electrode in the light-transmitting region is less than a thickness of the gate insulating layer disposed in the light-shielding region; and wherein the common electrode and the pixel electrode are insulated from each other by the gate insulating layer under the first opening.
2. The display panel according to claim 1, wherein an orthographic projection of the light-shielding electrode on the first substrate covers an orthographic projection of the data line on the first substrate.
3. The display panel according to claim 2, wherein the light-shielding electrode is electrically connected to the common electrode.
4. The display panel according to claim 1, further comprising a gate metal layer disposed between the first electrode layer and the source-drain electrode layer; wherein the gate metal layer comprises a gate scanning line formed in the light-shielding region, and the first electrode layer further comprises a first conductive part formed in the light-shielding region and covering the gate scanning line.
5. The display panel according to claim 4, further comprising a semiconductor layer disposed on the gate insulating layer; wherein the source-drain electrode layer is covered on the semiconductor layer, the semiconductor layer comprises a first semiconductor part formed in the light-shielding region, and the data line is covered on the first semiconductor part.
6. The display panel according to claim 5, wherein the gate scanning line extends along a first direction, the data line extends along a second direction, the gate scanning line and the data line adjacent to each other define the light-transmitting region, and the first direction differs from the second direction.
7. The display panel according to claim 1, further comprising a light-shielding layer and a color filter layer disposed on a side of the second electrode layer away from the first substrate, the light-shielding layer being provided with a second opening corresponding to the light-transmitting region, and the color filter layer being disposed in the second opening.
8. A manufacturing method of a display panel, comprising: providing a first substrate defined with a light-transmitting region and a light-shielding region disposed at a periphery of the light-transmitting region; forming a first electrode layer disposed on the first substrate, wherein the first electrode layer comprises a pixel electrode formed in the light-transmitting region; covering the

first electrode layer and the first substrate with a gate insulating layer; forming a source-drain electrode layer disposed on the gate insulating layer, wherein the source-drain electrode layer comprises a data line formed in the light-shielding region; covering the source-drain electrode layer and the gate insulating layer with a passivation layer; forming a first opening in the light-transmitting region, wherein the first opening goes through the passivation layer and further extends into the gate insulating layer; and forming a second electrode layer, wherein the second electrode layer comprises a light-shielding electrode formed in the light-shielding region and a common electrode formed in the light-transmitting region; the light-shielding electrode is disposed corresponding to the data line and on the passivation layer, and the common electrode is disposed in the first opening and being in direct contact with the gate insulating layer; wherein a thickness of the gate insulating layer disposed between the pixel electrode and the common electrode in the light-transmitting region is less than a thickness of the gate insulating layer disposed in the light-shielding region; and wherein the common electrode and the pixel electrode are insulated from each other by the gate insulating layer under the first opening.

9. An electronic device, comprising a house and a display panel disposed in the house, wherein the display panel comprises a light-transmitting region and a light-shielding region disposed at a periphery of the light-transmitting region, and the display panel further comprises: a first substrate; a first electrode layer disposed on the first substrate and comprising a pixel electrode formed in the light-transmitting region; a gate insulating layer covering the first electrode layer and the first substrate; a source-drain electrode layer disposed on the gate insulating layer and comprising a data line formed in the light-shielding region; a passivation layer covering the source-drain electrode layer and the gate insulating layer; a first opening in the light-transmitting region, wherein the first opening goes through the passivation layer and further extends into the gate insulating layer; and a second electrode layer comprising a light-shielding electrode formed in the light-shielding region and a common electrode formed in the light-transmitting region, the light-shielding electrode being disposed corresponding to the data line and on the passivation layer, and the common electrode being disposed in the first opening and being in direct contact with the gate insulating layer; wherein a thickness of the gate insulating layer disposed between the pixel electrode and the common electrode in the light-transmitting region is less than a thickness of the gate insulating layer disposed in the light-shielding region; and wherein the common electrode and the pixel electrode are insulated from each other by the gate insulating layer under the first opening.

10. The electronic device according to claim 9, wherein an orthographic projection of the light-shielding electrode on the first substrate covers an orthographic projection of the data line on the first substrate.

11. The electronic device according to claim 10, wherein the light-shielding electrode is electrically connected to the common electrode.

12. The electronic device according to claim 9, wherein the display panel further comprises a gate metal layer disposed between the first electrode layer and the source-drain electrode layer; and the gate metal layer comprises a gate scanning line formed in the light-shielding region, and the first electrode layer further comprises a first conductive part formed in the light-shielding region and covering the gate scanning line.

13. The electronic device according to claim 12, wherein the display panel further comprises a semiconductor layer disposed on the gate insulating layer; wherein the source-drain electrode layer is covered on the semiconductor layer, the semiconductor layer comprises a first semiconductor part formed in the light-shielding region, and the data line is covered on the first semiconductor part.

14. The electronic device according to claim 13, wherein the gate scanning line extends along a first direction, the data line extends along a second direction, the gate scanning line and the data line adjacent to each other define the light-transmitting region, and the first direction differs from the second direction.

15. The electronic device according to claim 9, wherein the display panel further comprises a light-shielding layer and a color filter layer disposed on a side of the second electrode layer away from the first substrate, the light-shielding layer is provided with a second opening corresponding to the light-transmitting region, and the color filter layer is disposed in the second opening.