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(54) **TOUCH SENSITIVE DEVICE**

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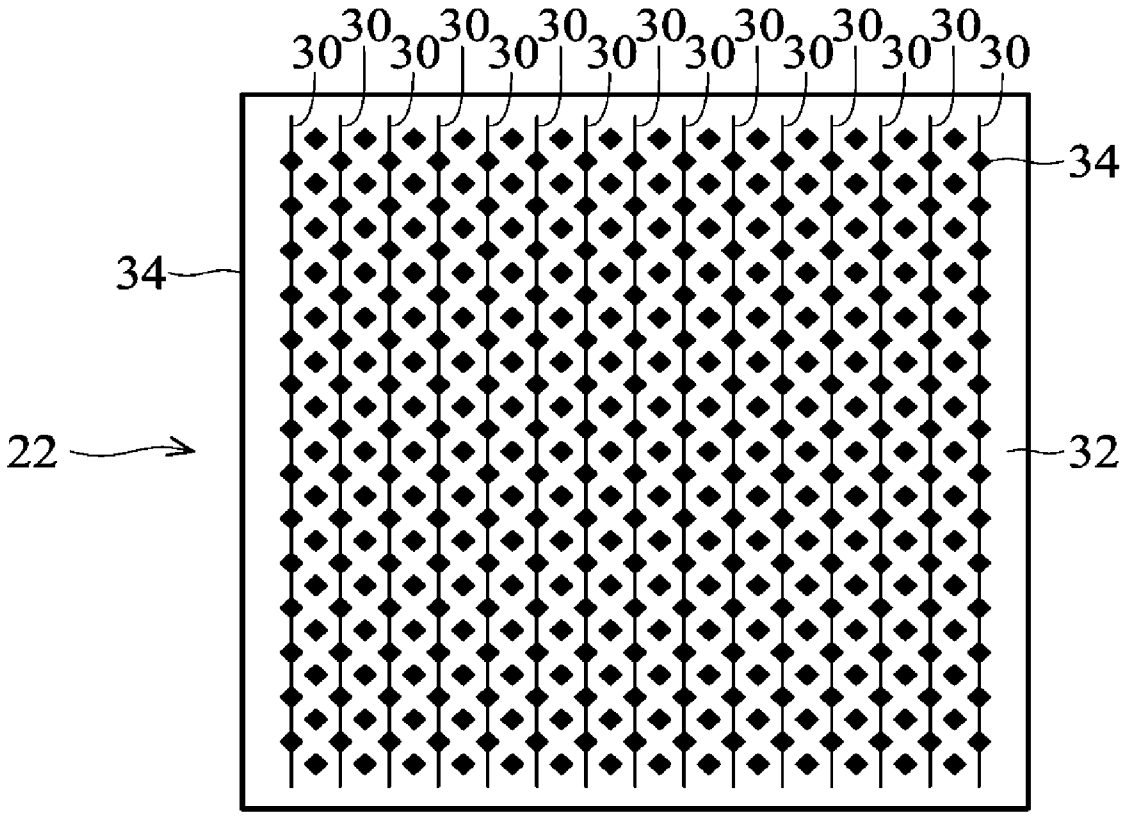
G06F 3/041 (2006.01)

(52) **U.S. Cl.** **345/173**

(57) **ABSTRACT**

A touch sensitive device is provided. The device includes a substrate; a plurality of first electrodes formed on the substrate and arranged along a first direction without overlapping one another; a first insulating layer formed on the substrate and covering the plurality of first electrodes; and a plurality of second electrodes formed on the first insulating layer and arranged along a second direction without overlapping one another, wherein the fist direction is vertical to the second direction.



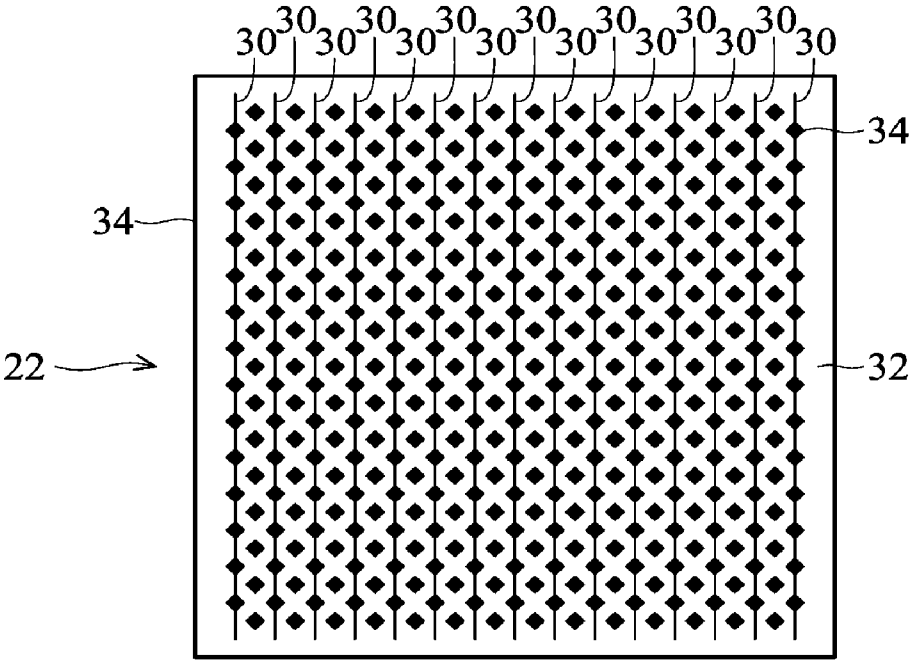

30
30
30
30
30
30
30
30
30
30
30
34
34
22
32

FIG. 1A

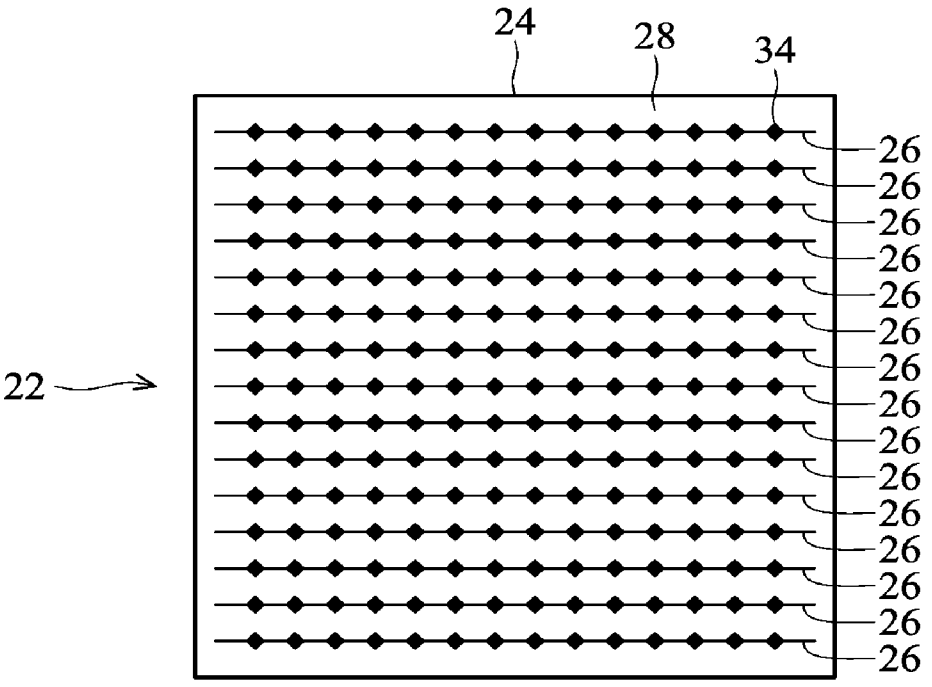

24
28
34
22
26
26
26
26
26
26
26
26
26
26
26
26
26
26

FIG. 1B

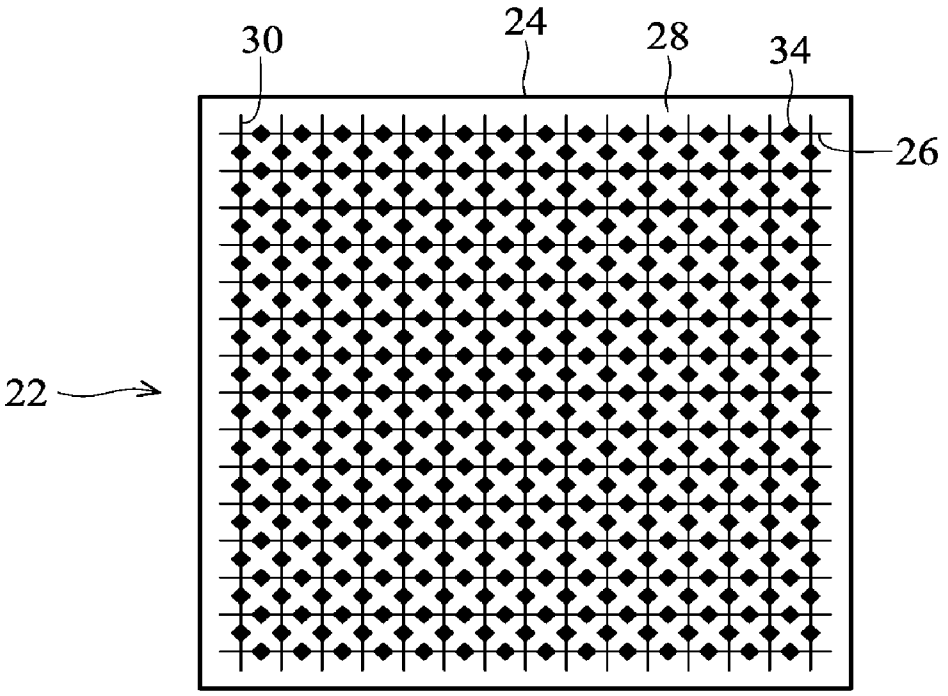


FIG. 1C

FIG. 1D

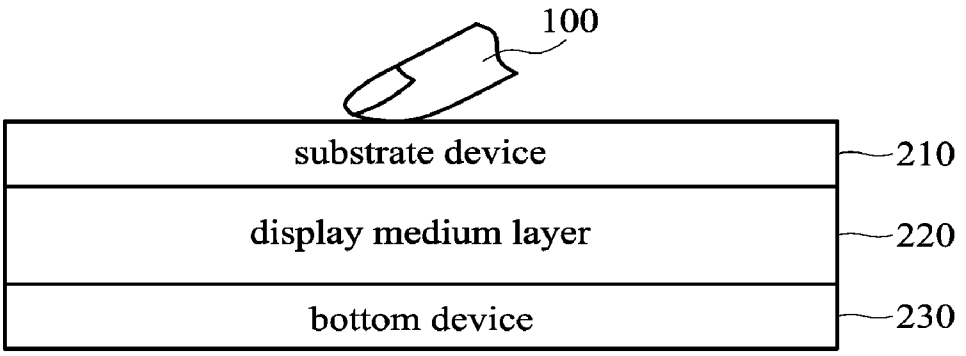

100
substrate device
210
display medium layer
220
bottom device
230

FIG. 2

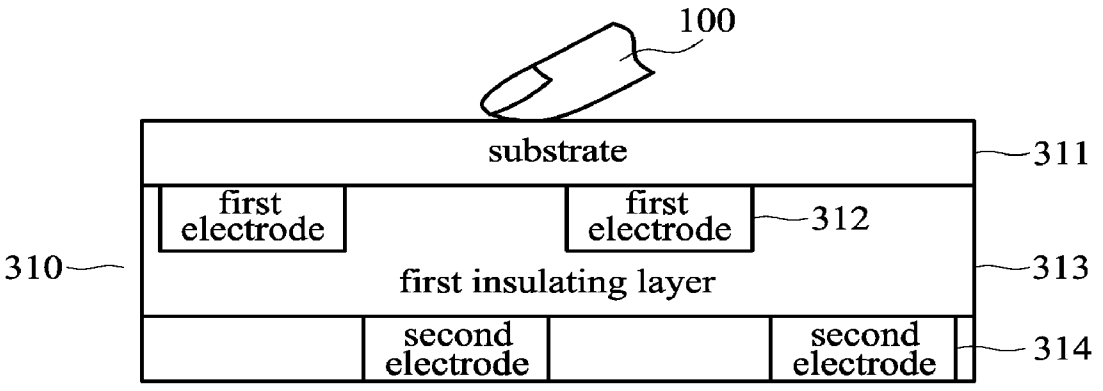

100
substrate
311
first electrode
first electrode
312
310
first insulating layer
313
second electrode
second electrode
314

FIG. 3

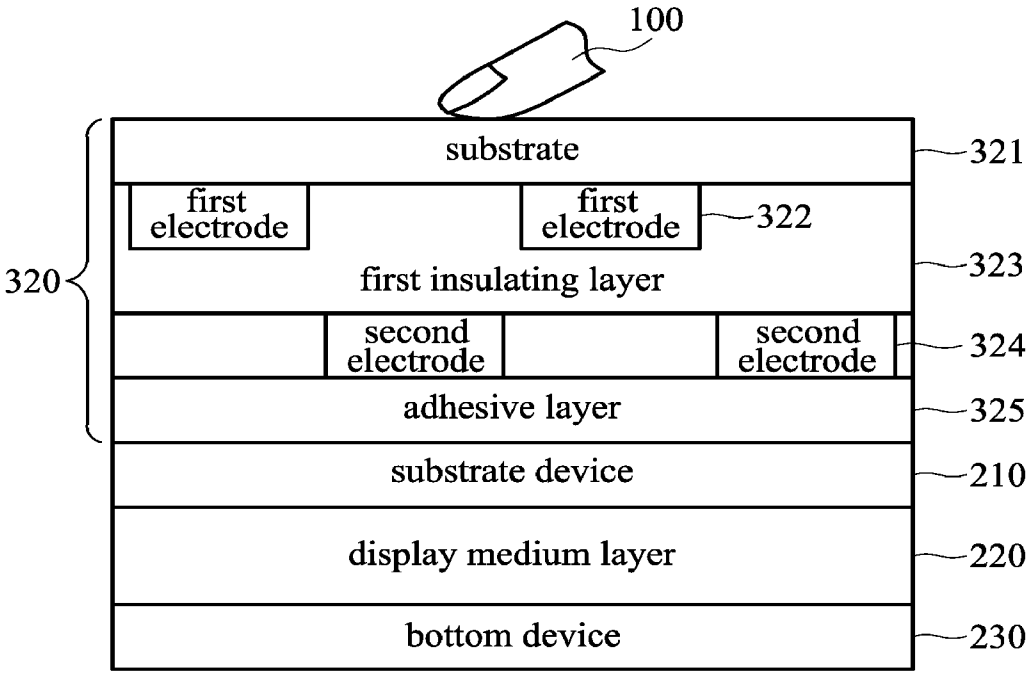

100
substrate
321
first electrode
first electrode
322
320
first insulating layer
323
second electrode
second electrode
324
adhesive layer
325
substrate device
210
display medium layer
220
bottom device
230

FIG. 4

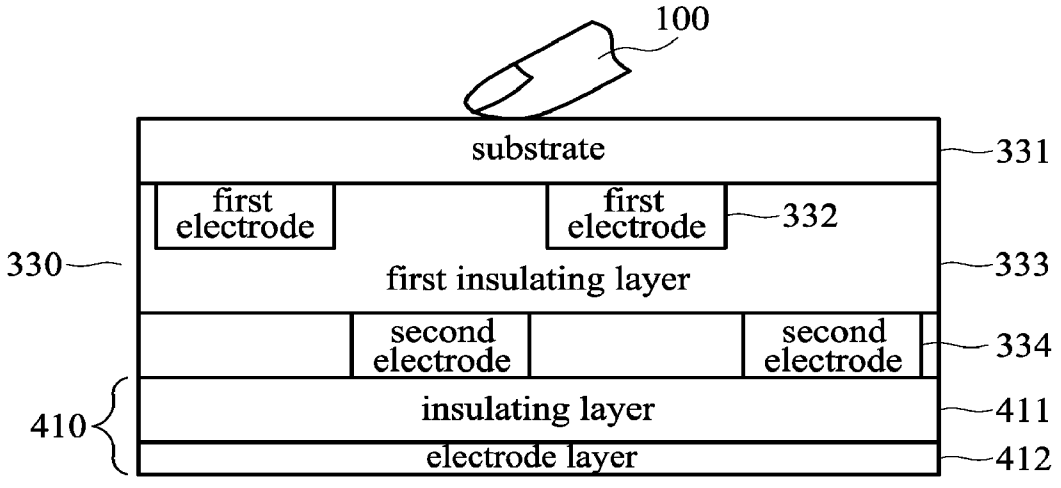

100
substrate
331
first electrode
first electrode
332
330
first insulating layer
333
second electrode
second electrode
334
410
insulating layer
411
electrode layer
412

FIG. 5

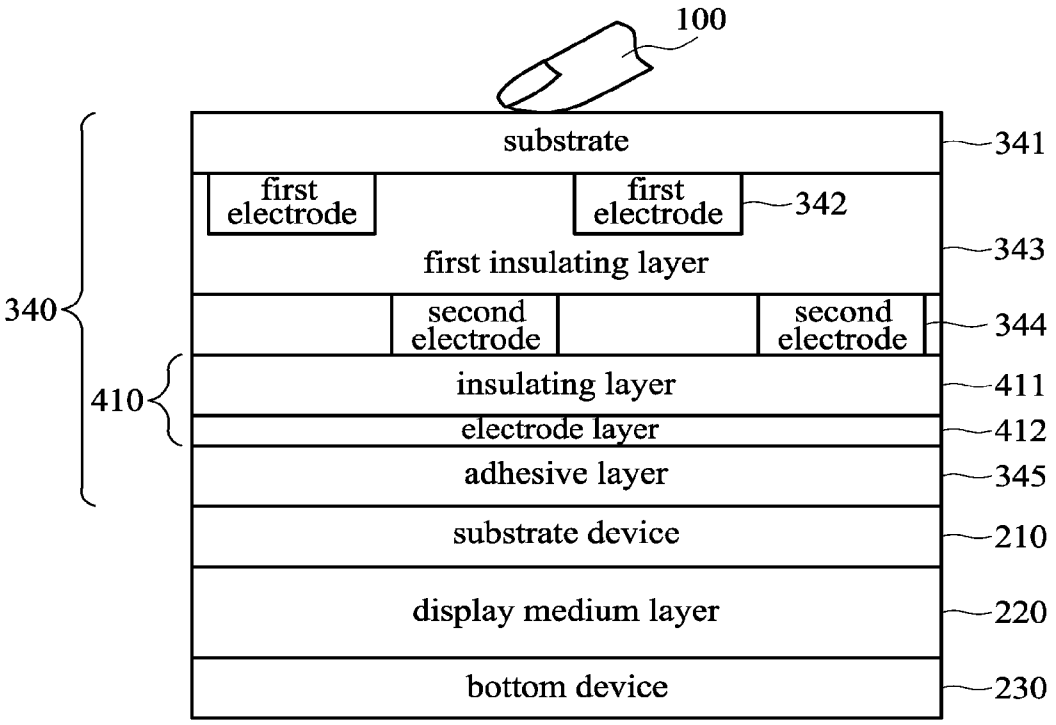

100
substrate
341
first electrode
first electrode
342
first insulating layer
343
340
second electrode
second electrode
344
410
insulating layer
411
electrode layer
412
adhesive layer
345
substrate device
210
display medium layer
220
bottom device
230

FIG. 6

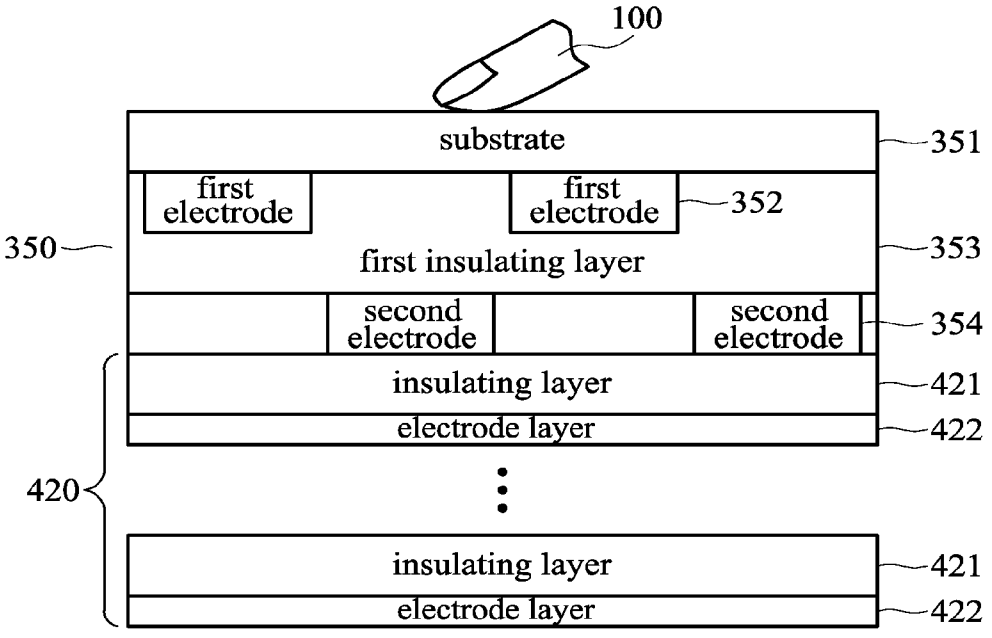

100
substrate
351
first electrode
first electrode
352
350
first insulating layer
353
second electrode
second electrode
354
insulating layer
421
electrode layer
422
420
insulating layer
421
electrode layer
422

FIG. 7

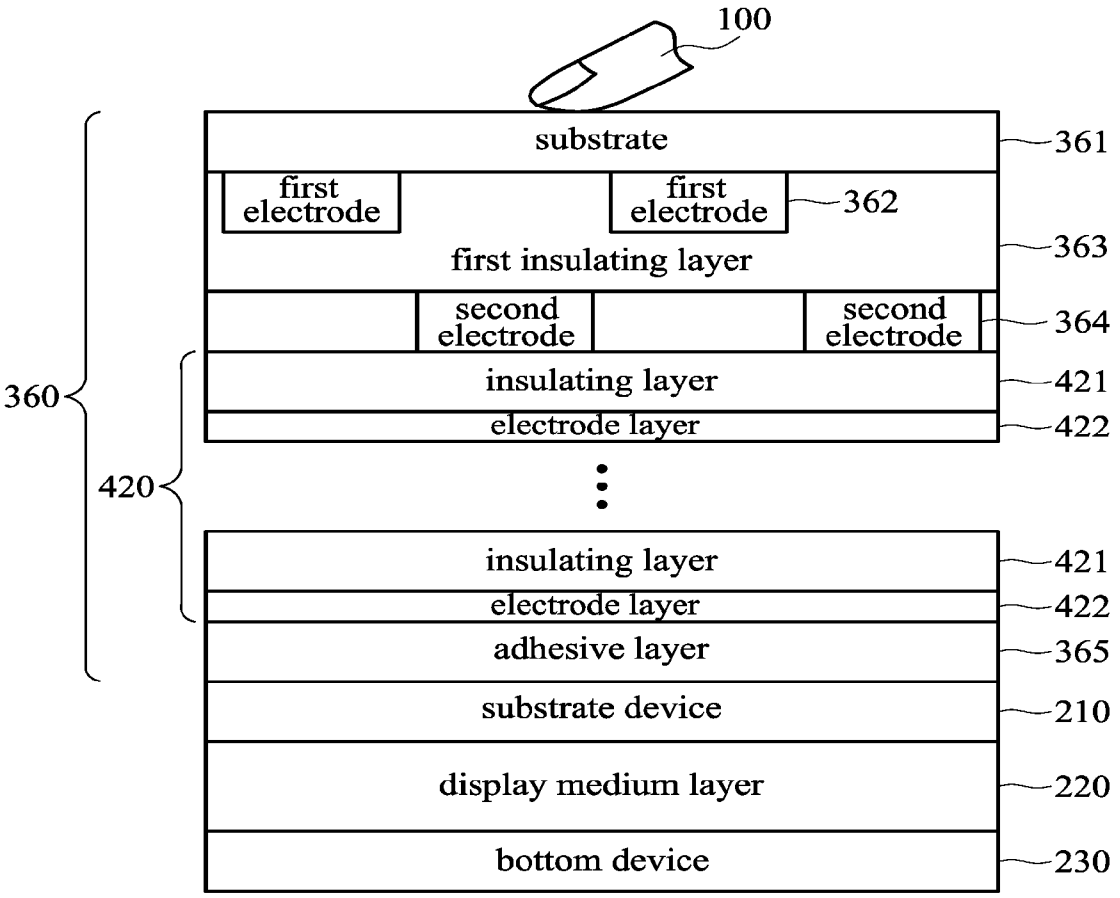

100
substrate
361
first electrode
first electrode
362
first insulating layer
363
second electrode
second electrode
364
360
insulating layer
421
electrode layer
422
420
insulating layer
421
electrode layer
422
adhesive layer
365
substrate device
210
display medium layer
220
bottom device
230

FIG. 8

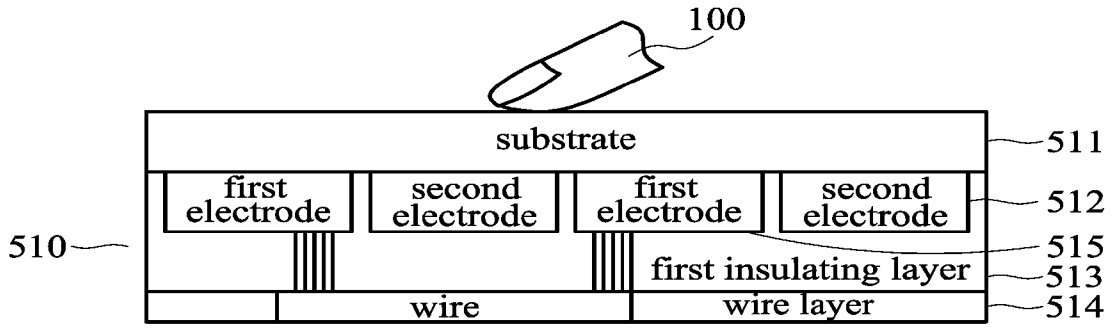

100
substrate
511
first electrode
second electrode
first electrode
second electrode
512
510
515
first insulating layer
513
wire
wire layer
514

FIG. 9

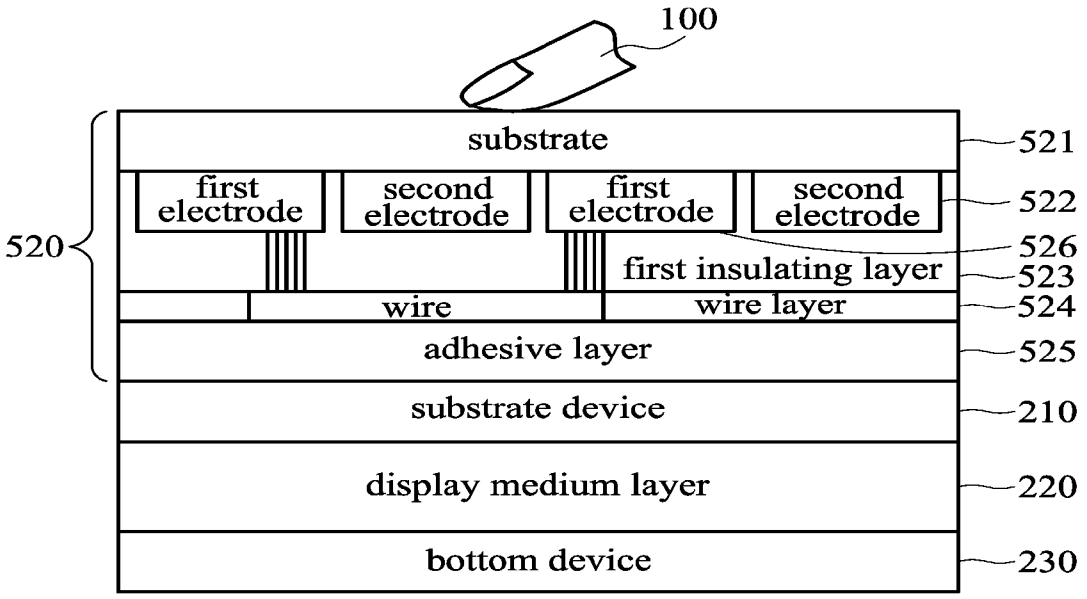

100
substrate
521
first electrode
second electrode
first electrode
second electrode
522
520
526
first insulating layer
523
wire
wire layer
524
adhesive layer
525
substrate device
210
display medium layer
220
bottom device
230

FIG. 10

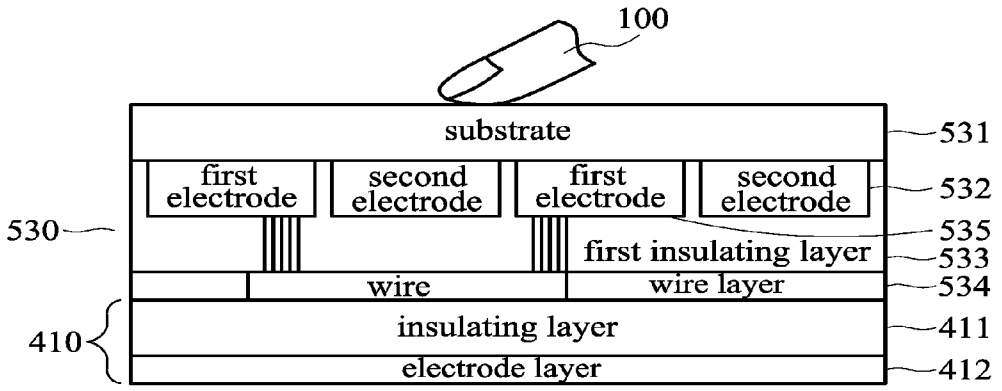

100
substrate
531
first electrode
second electrode
first electrode
second electrode
532
530
535
first insulating layer
533
wire
wire layer
534
410
insulating layer
411
electrode layer
412

FIG. 11

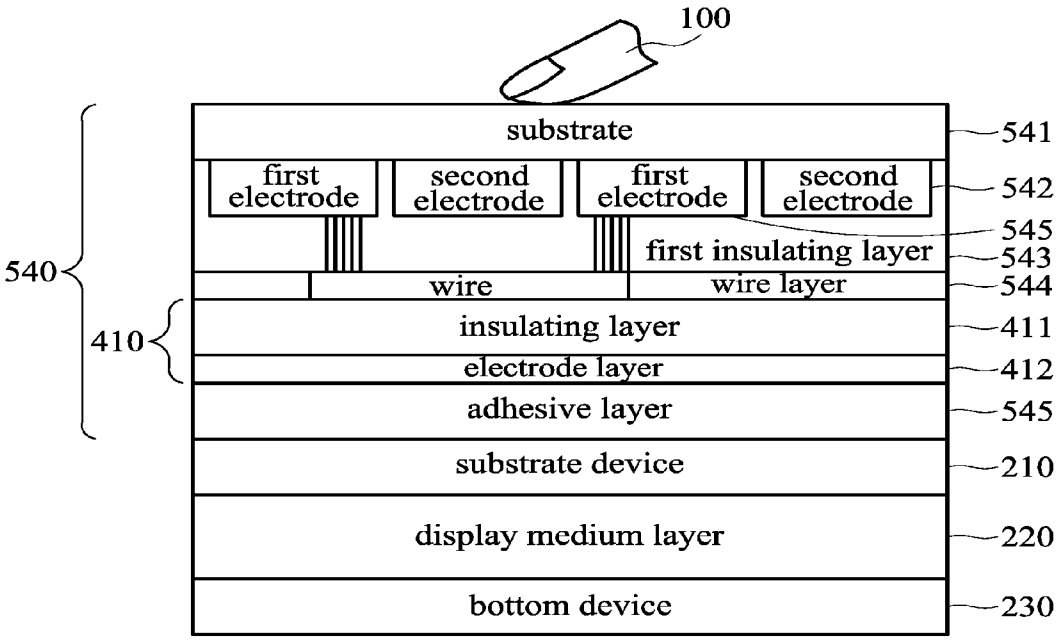

100
substrate
541
first electrode
second electrode
first electrode
second electrode
542
545
first insulating layer
543
540
wire
wire layer
544
410
insulating layer
411
electrode layer
412
adhesive layer
545
substrate device
210
display medium layer
220
bottom device
230

FIG. 12

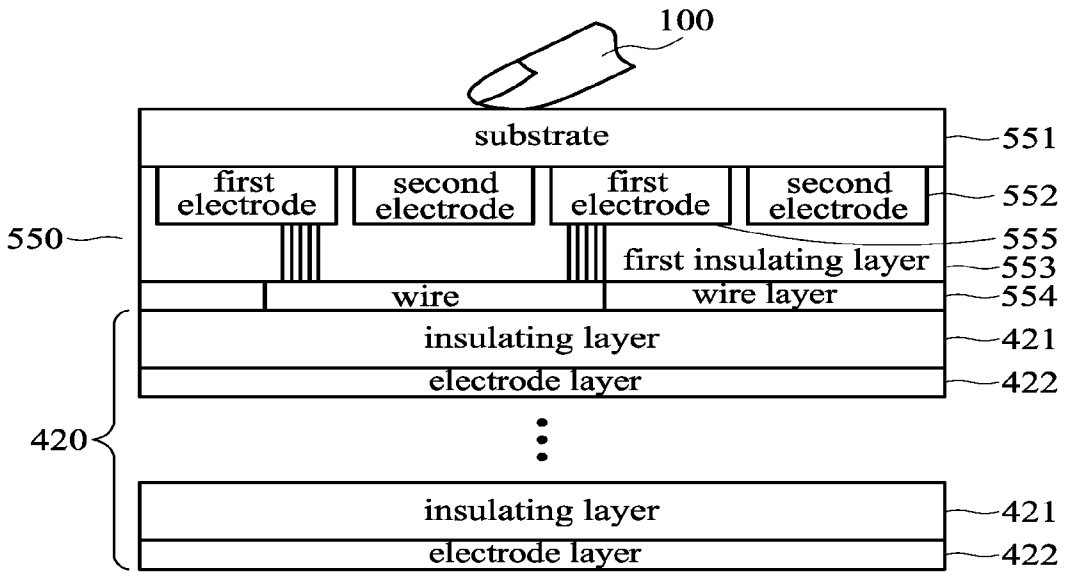

100
substrate
551
first electrode
second electrode
first electrode
second electrode
552
550
555
first insulating layer
553
wire
wire layer
554
insulating layer
421
electrode layer
422
420
insulating layer
421
electrode layer
422

FIG. 13

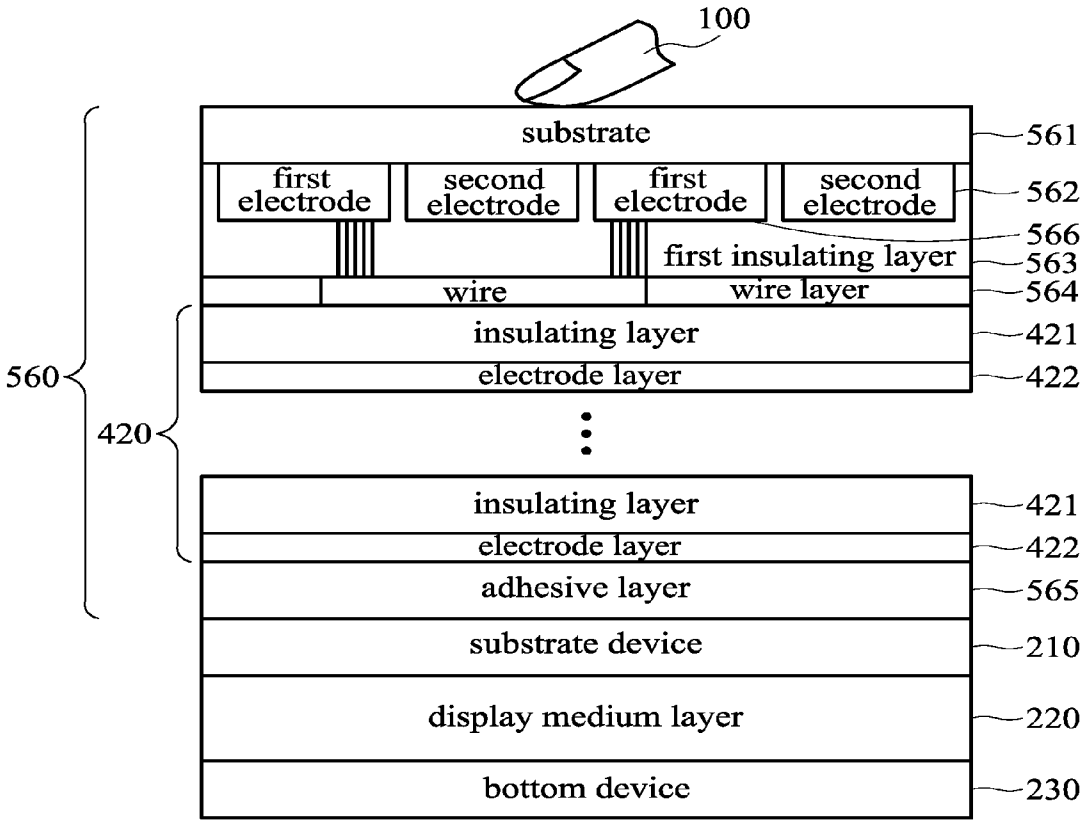

100
substrate
561
first electrode
second electrode
first electrode
second electrode
562
566
first insulating layer
563
wire
wire layer
564
insulating layer
421
electrode layer
422
560
420
insulating layer
421
electrode layer
422
adhesive layer
565
substrate device
210
display medium layer
220
bottom device
230

FIG. 14

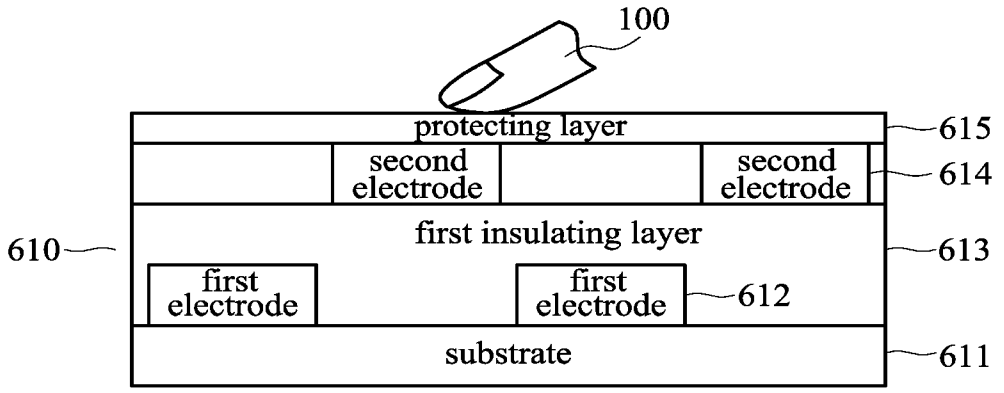

100
protecting layer
615
second electrode
second electrode
614
first insulating layer
610
613
first electrode
first electrode
612
substrate
611

FIG. 15

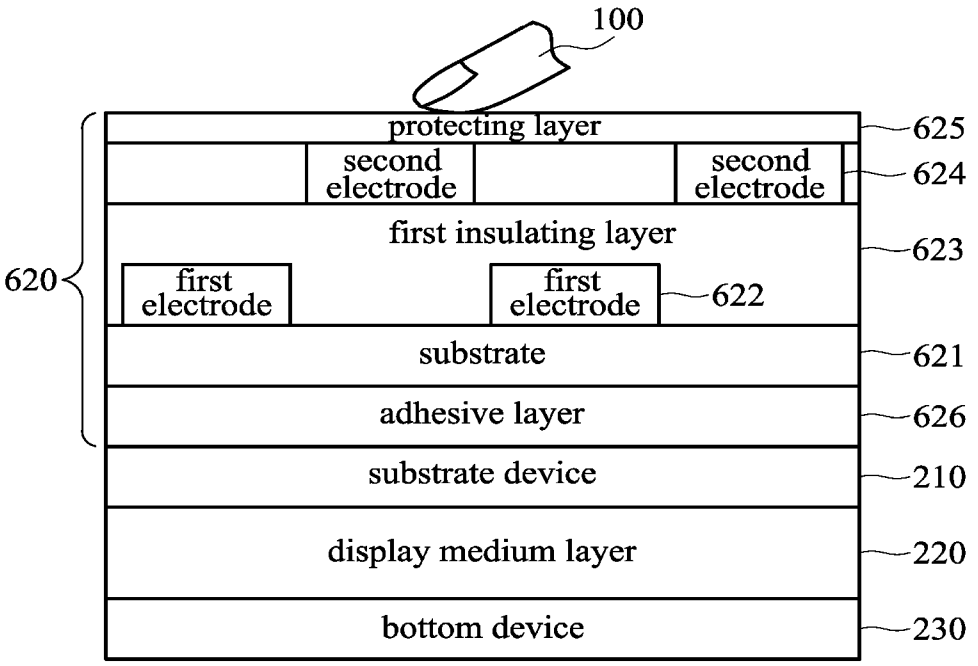

100
protecting layer
625
second electrode
second electrode
624
first insulating layer
623
620
first electrode
first electrode
622
substrate
621
adhesive layer
626
substrate device
210
display medium layer
220
bottom device
230

FIG. 16

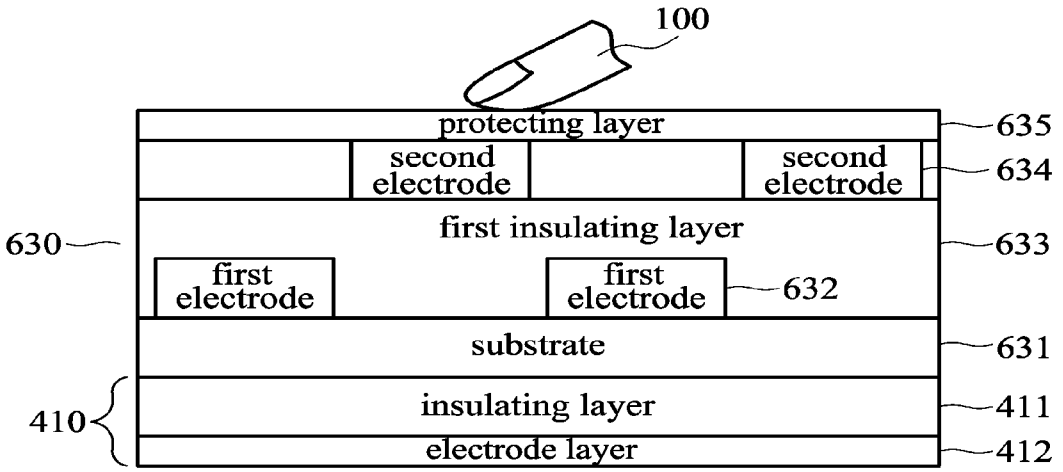

100
protecting layer
635
second electrode
second electrode
634
first insulating layer
630
633
first electrode
first electrode
632
substrate
631
410
insulating layer
411
electrode layer
412

FIG. 17

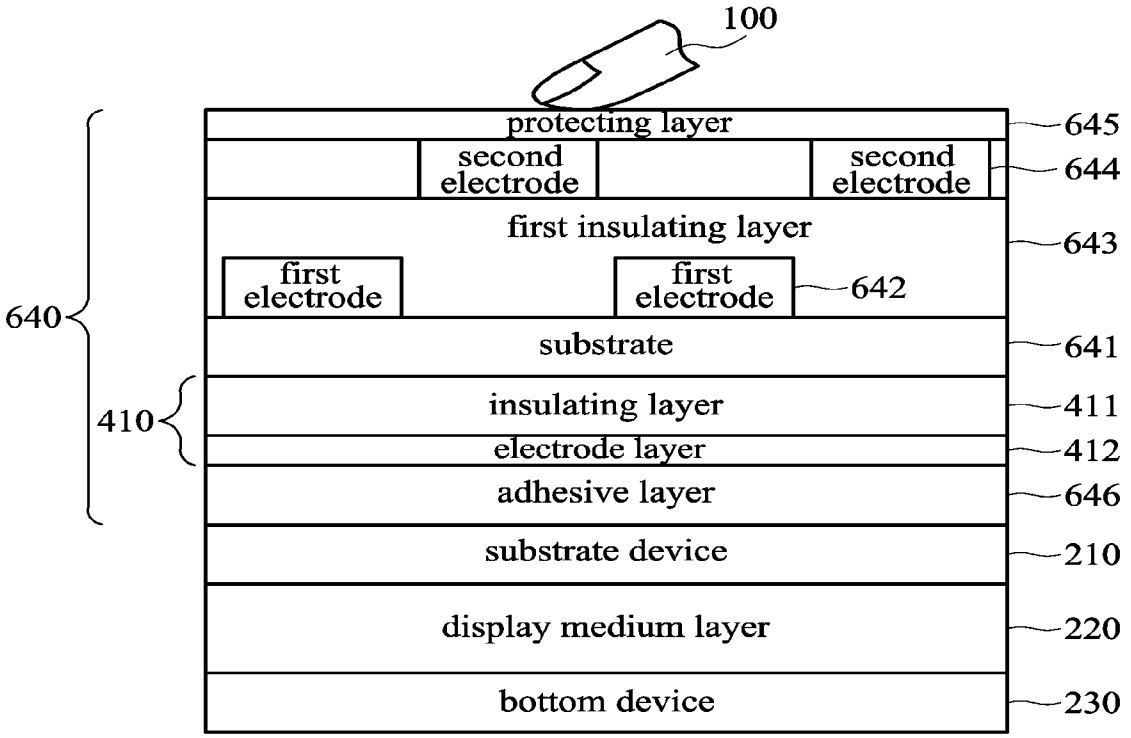

100
protecting layer
645
second electrode
second electrode
644
first insulating layer
643
640
first electrode
first electrode
642
substrate
641
410
insulating layer
411
electrode layer
412
adhesive layer
646
substrate device
210
display medium layer
220
bottom device
230

FIG. 18

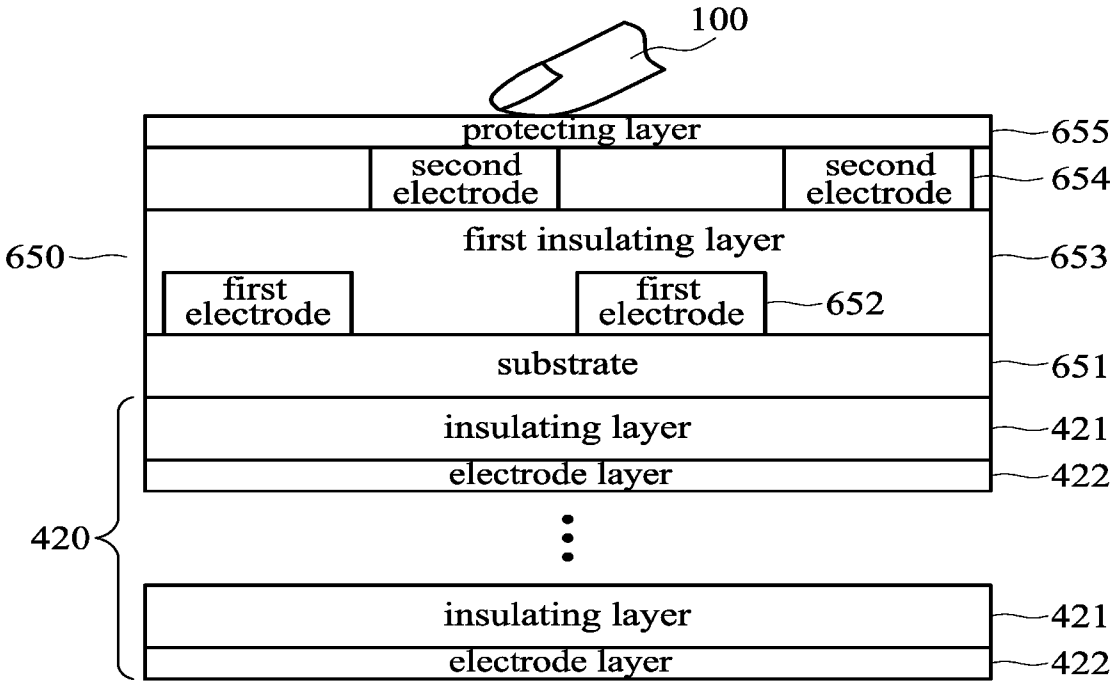

100
protecting layer
655
second electrode
second electrode
654
650
first insulating layer
653
first electrode
first electrode
652
substrate
651
insulating layer
421
electrode layer
422
420
insulating layer
421
electrode layer
422

FIG. 19

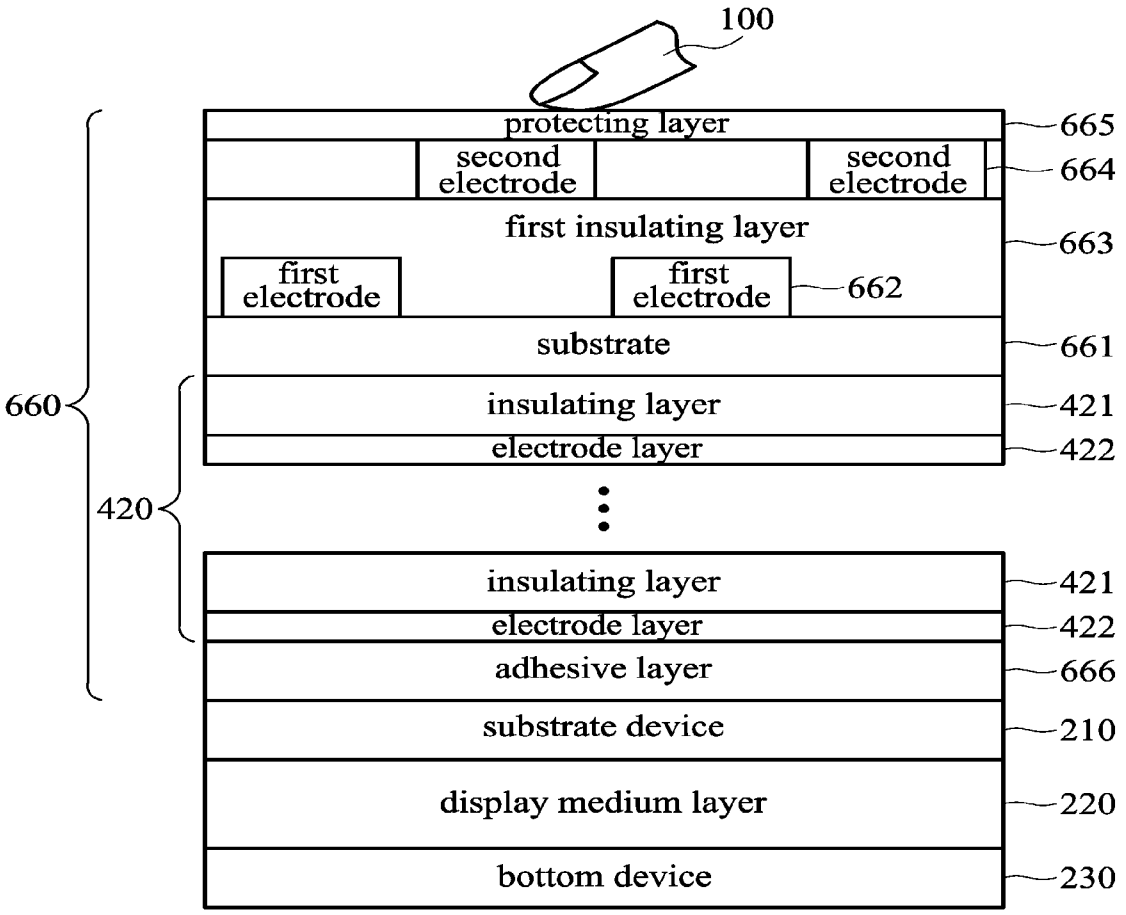

100
protecting layer
665
second electrode
second electrode
664
first insulating layer
663
first electrode
first electrode
662
substrate
661
660
insulating layer
421
electrode layer
422
420
insulating layer
421
electrode layer
422
adhesive layer
666
substrate device
210
display medium layer
220
bottom device
230

FIG. 20

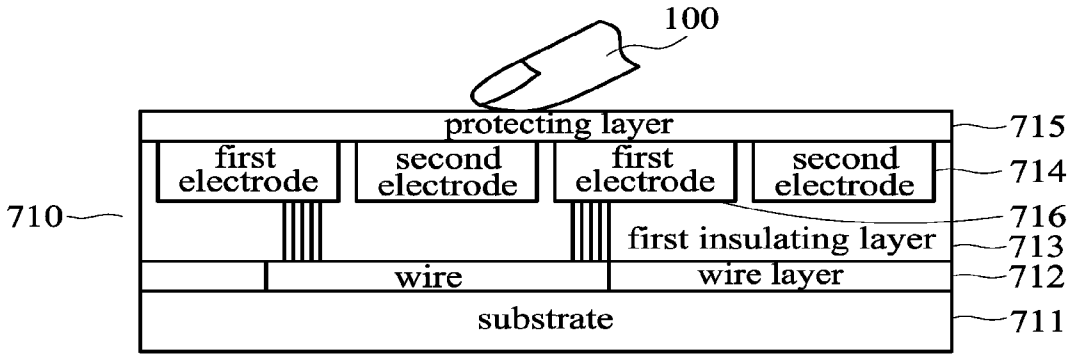

100
protecting layer
715
first electrode
second electrode
first electrode
second electrode
714
710
716
first insulating layer
713
wire
wire layer
712
substrate
711

FIG. 21

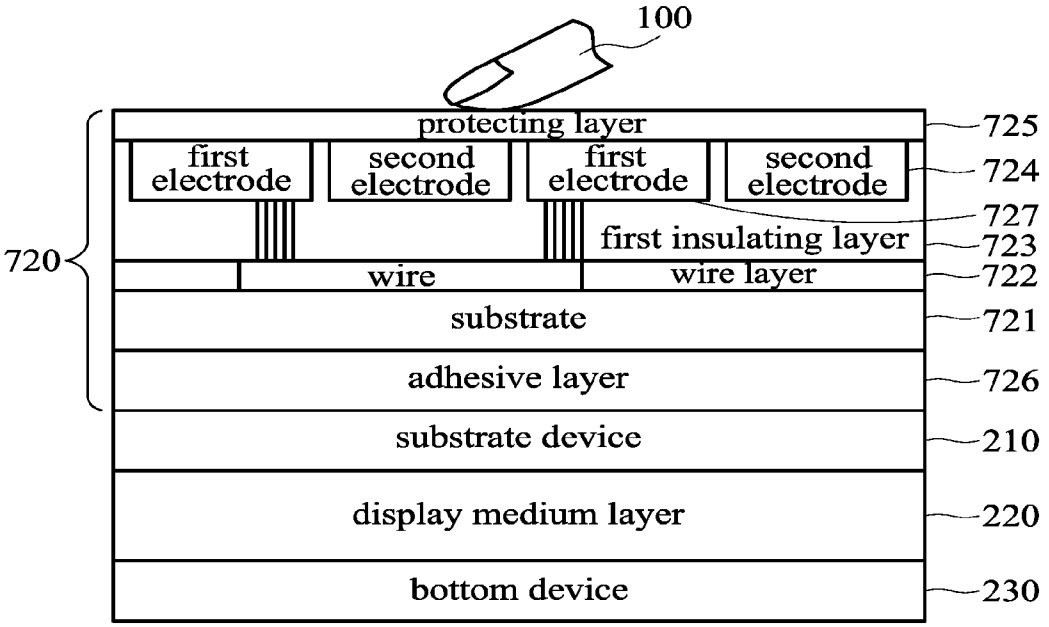

100
protecting layer
725
first electrode
second electrode
first electrode
second electrode
724
727
first insulating layer
723
720
wire
wire layer
722
substrate
721
adhesive layer
726
substrate device
210
display medium layer
220
bottom device
230

FIG. 22

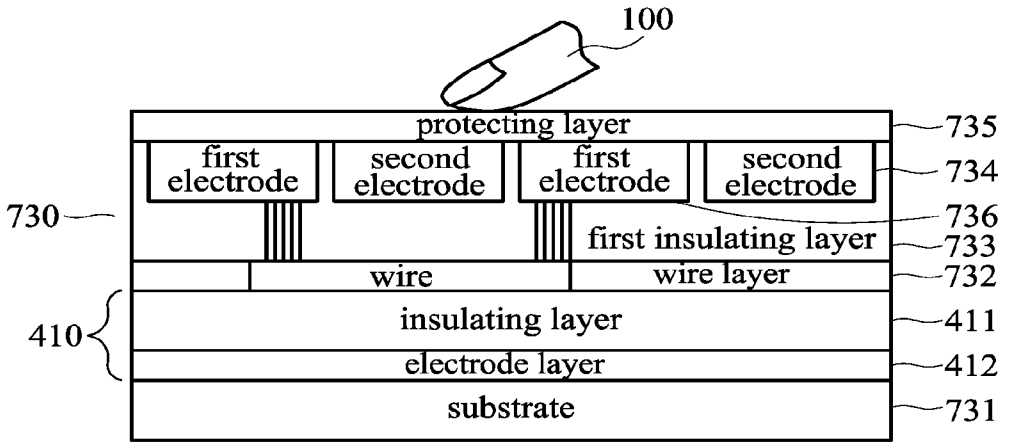

100
protecting layer
735
first electrode
second electrode
first electrode
second electrode
734
730
736
first insulating layer
733
wire
wire layer
732
410
insulating layer
411
electrode layer
412
substrate
731

FIG. 23

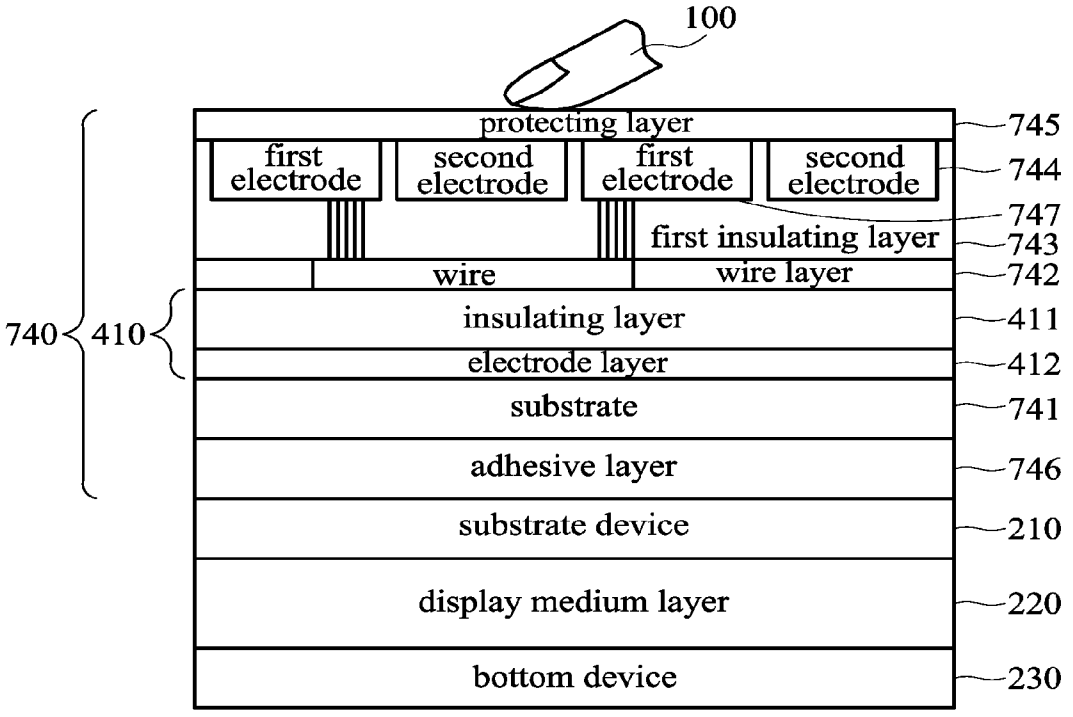

100
protecting layer
745
first electrode
second electrode
first electrode
second electrode
744
747
first insulating layer
743
wire
wire layer
742
740
410
insulating layer
411
electrode layer
412
substrate
741
adhesive layer
746
substrate device
210
display medium layer
220
bottom device
230

FIG. 24

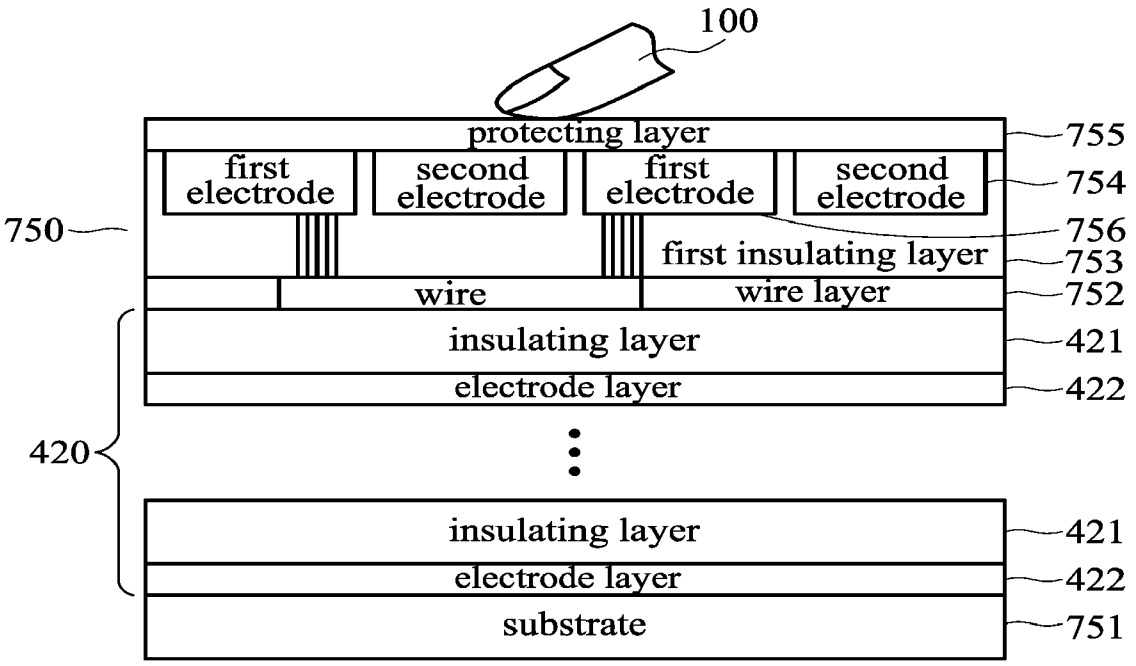

100
protecting layer
755
first electrode
second electrode
first electrode
second electrode
754
750
756
first insulating layer
753
wire
wire layer
752
insulating layer
421
electrode layer
422
420
insulating layer
421
electrode layer
422
substrate
751

FIG. 25

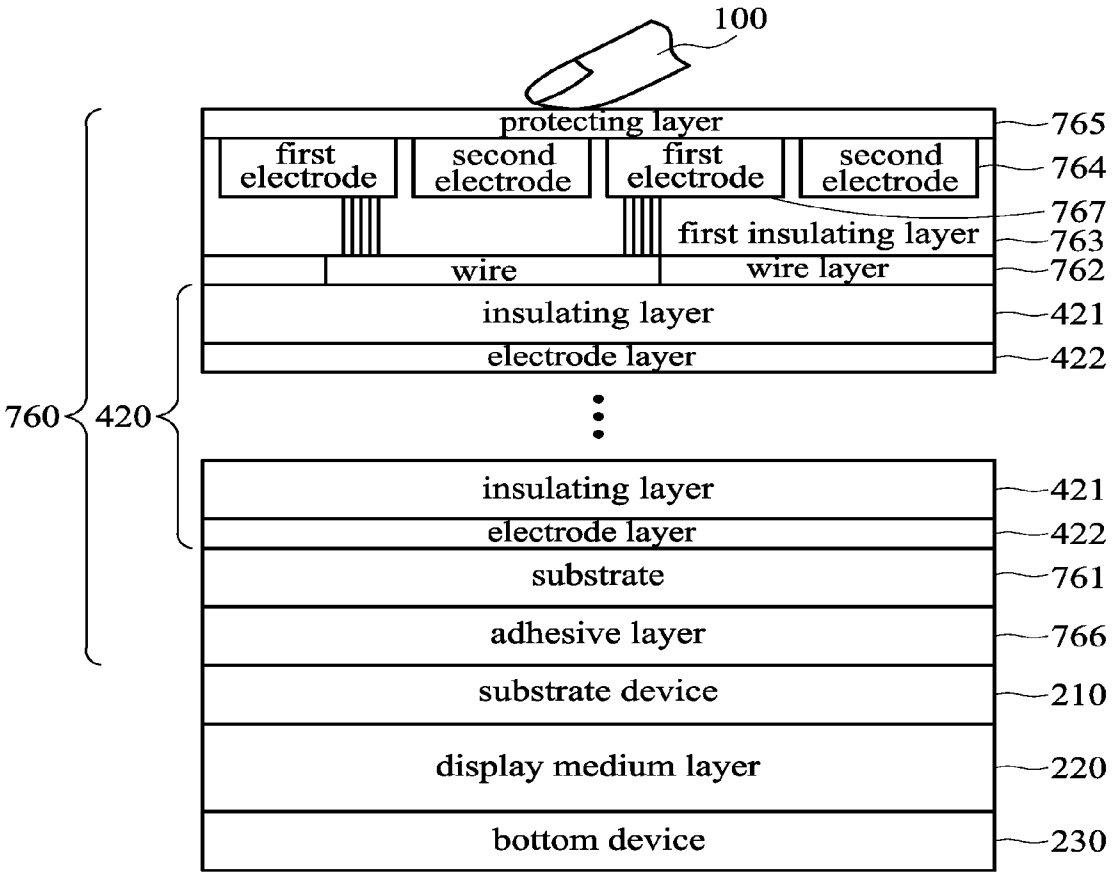

100
protecting layer
765
first electrode
second electrode
first electrode
second electrode
764
767
first insulating layer
763
wire
wire layer
762
insulating layer
421
electrode layer
422
760
420
insulating layer
421
electrode layer
422
substrate
761
adhesive layer
766
substrate device
210
display medium layer
220
bottom device
230

FIG. 26

TOUCH SENSITIVE DEVICE

CROSS REFERENCE TO RELATED APPLICATION

[0001] This Application claims priority of Taiwan Patent Application No. 98112461, filed on Apr. 15, 2009, the entirety of which is incorporated by reference herein.

BACKGROUND

[0002] 1. Technique Field

[0003] The disclosure relates to a touch sensitive device.

[0004] 2. Description of the Related Art

[0005] The conventional capacitive touch sensing display is formed by externally bonding one or two touch sensing panels to a display panel. The substrate material of the touch sensing panels may be a patterned ITO 0.7 mm or 0.5 mm glass, or a single layer patterned 175 um or 150 um PET/ITO substrate. While the glass substrate is formed at higher temperatures, beneficial for forming low resistance ITO electrode for fabrication of a stacked structure and large area manufacturing, the fabricated glass substrate is not flexible and has low capacitance sensitivity due to the thickness of the glass substrate, hindering applicability. Meanwhile, the PET/ITO substrate is formed at lower temperatures, forming high resistance ITO electrodes, hindering fabrication of a stacked structure and large area manufacturing.

[0006] U.S. Pat. No. 7,109,978 discloses a sense plane. The sense plane includes a touch sensor array **22**, wherein top, bottom, composite and cross-sectional views are respectively shown in FIG. **1**A-**1**D. The touch sensor array **22** includes a substrate **24** having a first set of conductive traces **26** disposed on a top surface **28** thereof and in a first direction to comprise row positions of the touch sensor array **22**. A second set of conductive traces **30** are disposed on a bottom surface **32** thereof and in a second direction orthogonal to the first direction to form the column positions of the touch sensor array **22**. The first and second set of conductive traces **26** and **30** alternately contact with the sense pads **34**. An insulating layer **36** is disposed over the sense pads **34** on top surface **28** to insulate a human finger or other object therefrom. The substrate disclosed in the U.S. Pat. No. 7,109,978 may be a Print Circuit Board (PCB) or a flexible PCB or any other useable circuit connection structure. The insulating layer **36** is a thin layer (i.e. Mylar). Therefore, in the manufacturing of the sense panel and the display panel, an assembly process for externally bonding is needed.

[0007] Thus, it provides a touch sensitive device, formed with low resistance ITO electrodes, having high capacitance sensitivity, flexibility and no external bonding assembly process.

SUMMARY

[0008] A detailed description is given in the following embodiments with reference to the accompanying drawings.

[0009] In one embodiment, the present invention provides a touch sensitive device. The touch sensitive device includes: a non-conductor soft or hard substrate, or a soft or hard compound substrate comprising gas-water-proof material, anti-reflection optical material, electrode-adhesion-enhanced material, planarization material, or scrape-proof material; a plurality of first electrodes formed on the substrate and arranged along a first direction without overlapping one another; a first insulating layer formed on the substrate and covering the plurality of first electrodes; and a plurality of second electrodes formed on the first insulating layer and arranged along a second direction without overlapping one another, wherein the fist direction is orthogonal to the second direction. An isolating layer is formed on the second electrodes to improve waterproofing, optical, planarization or anti-interference performance.

[0010] In another embodiment, the present invention provides a touch sensitive device. The touch sensitive device includes: a non-conductor soft or hard substrate, or a soft or hard compound substrate comprising gas-water-proof material, anti-reflection optical material, electrode-adhesion-enhanced material, planarization material, or scrape-proof material; a plurality of first electrodes and a plurality of second electrodes formed on the substrate and arranged along a first direction and a second direction without overlapping one another; a first insulating layer formed on the substrate and covering the plurality of first electrodes and second electrodes, and a plurality of cavities are formed on the first insulating layer; a wire layer comprising a plurality of wires formed on the first insulating layer, and the first electrodes are connected by the plurality of wires, wherein the first direction is orthogonal to the second direction. An isolating layer is formed on the wire layer to improve waterproofing, optical, planarization or anti-interference performance.

[0011] In another embodiment, the present invention provides a touch sensitive device. The touch sensitive device includes: a soft or hard substrate, or a soft or hard compound substrate comprising gas-water-proof material, anti-reflection optical material, electrode-adhesion-enhanced material, planarization material, or scrape-proof material; a plurality of first electrodes formed on the substrate and arranged along a first direction without overlapping one another; and a first insulating layer formed on the substrate and covering the plurality of first electrodes; a plurality of second electrodes formed on the first insulating layer and arranged along a second direction without overlapping one another; a preventing layer formed on the first insulating layer and covering the second electrodes, wherein the fist direction is orthogonal to the second direction. An isolating layer is formed under the isolating layer to improve waterproof, optical, planarization or anti-interference performance.

[0012] In another embodiment, the present invention provides a structure of a touch sensitive device. The touch sensitive device includes: a soft or hard substrate, or a soft or hard compound substrate comprising gas-water-proof material, anti-reflection optical material, electrode-adhesion-enhanced material, planarization material, or scrape-proof material; a wire layer comprising a plurality of wires formed on the substrate; a first insulating layer formed on the wire layer and a plurality of cavities are formed in the first insulating layer; a plurality of first electrodes and a plurality of second electrodes formed on the substrate and arranged along a first direction and a second direction without overlapping one another, and the first electrodes are connected by the plurality of wires via the plurality of cavities; and a preventing layer formed on the first insulating layer and covering the plurality of first electrodes and the second electrodes, wherein the first direction is orthogonal to the second direction. An isolating layer is formed between the wire layer and the substrate to improve waterproofing, optical, planarization or anti-interference performance.

[0013] The above-mentioned touch sensitive structure provides display devices (e.g. Electrophoresis Display, LCD, OLED Display etc.) with a substrate basis.

BRIEF DESCRIPTION OF DRAWINGS

[0014] Embodiment can be more fully understood by reading the subsequent detailed description and examples with references made to the accompanying drawings, wherein:

[0015] FIG. **1**A is a top view of a conventional touch sensitive device;

[0016] FIG. **1**B is a bottom view of a conventional touch sensitive device;

[0017] FIG. **1**C is a composite view of a conventional touch sensitive device;

[0018] FIG. **1**D is a cross-sectional view of a conventional touch sensitive device;

[0019] FIG. **2** is a diagram showing a display device;

[0020] FIG. **3** is a diagram showing a touch sensitive device of an embodiment;

[0021] FIG. **4** is a diagram showing a touch sensitive display device of an embodiment;

[0022] FIG. **5** is a diagram showing a touch sensitive device of another embodiment;

[0023] FIG. **6** is a diagram showing a touch sensitive display device of another embodiment;

[0024] FIG. **7** is a diagram showing a touch sensitive device of another embodiment;

[0025] FIG. **8** is a diagram showing a touch sensitive display device of another embodiment;

[0026] FIG. **9** is a diagram showing a touch sensitive device of another embodiment;

[0027] FIG. **10** is a diagram showing a touch sensitive display device of another embodiment;

[0028] FIG. **11** is a diagram showing a touch sensitive device of another embodiment;

[0029] FIG. **12** is a diagram showing a touch sensitive display device of another embodiment;

[0030] FIG. **13** is a diagram showing a touch sensitive device of another embodiment;

[0031] FIG. **14** is a diagram showing a touch sensitive display device of another embodiment;

[0032] FIG. **15** is a diagram showing a touch sensitive device of another embodiment;

[0033] FIG. **16** is a diagram showing a touch sensitive display device of another embodiment;

[0034] FIG. **17** is a diagram showing a touch sensitive device of another embodiment;

[0035] FIG. **18** is a diagram showing a touch sensitive display device of another embodiment;

[0036] FIG. **19** is a diagram showing a touch sensitive device of another embodiment;

[0037] FIG. **20** is a diagram showing a touch sensitive display device of another embodiment;

[0038] FIG. **21** is a diagram showing a touch sensitive device of another embodiment;

[0039] FIG. **22** is a diagram showing a touch sensitive display device of another embodiment;

[0040] FIG. **23** is a diagram showing a touch sensitive device of another embodiment;

[0041] FIG. **24** is a diagram showing a touch sensitive display device of another embodiment;

[0042] FIG. **25** is a diagram showing a touch sensitive device of another embodiment;

[0043] FIG. **26** is a diagram showing a touch sensitive display device of another embodiment;

DETAILED DESCRIPTION

[0044] In the following detailed description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the disclosed embodiments. It will be apparent, however, that one or more embodiments may be practiced without these specific details. In other instances, well-known structures and devices are schematically shown in order to simplify the drawing.

[0045] FIG. **2** is a diagram showing a display device which includes a substrate device **210**, a display medium **220** and a bottom device **230**. Generally, a touch sensing panel (not showed) is externally bonded to the substrate device **210** and executed by conductors or fingers.

[0046] FIG. **3** is a diagram showing a touch sensitive device of an embodiment of the invention. The touch sensitive device **310** includes a substrate **311**, a plurality of first electrodes **312**, a first insulating layer **313** and a plurality of second electrodes **314**.

[0047] The touch sensitive device **310** includes the substrate **311** such as glass or plastics (PET-polyethylene terephthalate, PI, PES etc.) or functional material such as organic matter (e.g. SiO_2, SiNx, etc) or an inorganic matter (Parylene) material stack which are used to increase hardness, water-tolerance, transmittance, and rub-proofing. The plurality of first electrodes **312** which are separated within an interval are formed on the substrate **311** and arranged along a first direction (e.g. x axial) in 2D space. The first electrodes **312** which are connected to one another by conductive wires (not showed) are used to sense total capacitance variation according to the conductor **100** (or a finger) indirectly touches the first electrodes **312** in the x axial. The first insulating layer **313** comprising material such as SiO2 or SiNx is formed on the substrate **311** and covers the plurality of first electrodes **312**. The plurality of second electrodes **314** such as transparent electrodes (e.g. ITO, AZO, IZO etc.) are formed on the first insulating layer **313**. The plurality of second electrodes **314** are separated within an interval and arranged along a second direction (e.g. y axial) in 2D space. The second electrodes **314** which are connected to one another by conductive wires (not showed) are used to sense total capacitance variation according to the conductor **100** (or a finger) indirectly touches the first electrodes **312** in the y axial. The touch sensitive device **310** can be a substrate base of a substrate device **210** in a display device. A color filter or co-plane electrodes can be added. The touch sensitive device **310** also can be a substrate base of a bottom device **230** in the display device. Film transistors or co-plane electrodes can be added. The sequential processes are well known by those who are skilled in the art, so it's not detailed herein.

[0048] In another embodiment, as shown in FIG. **4**, a touch sensitive device **320** includes a substrate **321**, a plurality of first electrodes **322**, a first insulating layer **323**, a plurality of second electrodes **324** and an adhesive layer **325**.

[0049] The difference between the foregoing touch sensitive device **310** and the touch sensitive device **320** is the insulating layer **325**. The touch sensitive device **320** can be externally bonded to the substrate device **210** in the display device through the insulating layer **325** which may be an OCA tape.

[0050] In another embodiment, as shown in FIG. **5**, a touch sensitive device **330** includes a substrate **331**, a plurality of

first electrodes **332**, a first insulating layer **333**, a plurality of second electrodes **334** and an isolating layer **410**. The difference between the foregoing touch sensitive device **310** and the touch sensitive device **330** is the isolating layer **410** having an insulating layer **411** and an electrode layer **412**. The insulating layer **411** is formed on the second electrodes and the electrode layer **412** is formed on the insulating layer **411**. The insulating layer **411** may be SiNx, SiO2, photo-resistor, plastics etc. The electrode layer **412** may be a transparent conductor such as an ITO, IZO, AZO etc. The isolating layer **410** is used to prevent interference from the display terminal. The touch sensitive device **330** can be a substrate base of the substrate device **210** in a display. For an LCD as an example, a color filter and co-planar electrode process would be performed on the substrate device **210**. The display medium layer **220** would be liquid crystal and the bottom device **230** would be a film transistor substrate.

[0051] The touch sensitive device **340** as shown in FIG. **6** includes a substrate **341**, a plurality of first electrodes **342**, a first insulating layer **343**, a plurality of second electrodes **344**, an adhesive layer **345** and an isolating layer **410** having an insulating layer **411** and an electrode layer **412**. The touch sensitive device **340** can be bonded to the substrate device **210** through the adhesive layer **345**.

[0052] In another embodiment as shown in FIG. **7**, the touch sensitive device **350** has a compound isolating layer **420** consisting of multi-insulating layers **421** and a multi-electrode layer **422** for raising interference-proofing, water-proofing and optical performance. The touch sensitive device **350** can be a substrate base of the substrate device **210** in a display.

[0053] The touch sensitive device **360** further includes an adhesive layer **365** as shown in FIG. **8**. The touch sensitive device **360** can be bonded to the substrate device **210** through the adhesive layer **365** as shown in FIG. **8** to form a touch sensitive display device.

[0054] In another embodiment as shown in FIG. **9**, the touch sensitive device **510** includes a substrate **511** such as glass or plastics (PET-polyethylene terephthalate, PI, PES etc.) or functional material such as organic matter (e.g. SiO_2, SiNx, etc) or an inorganic matter (Parylene) material stack which are used to increase hardness, water-tolerance, transmittance, and rub-proofing. A plurality of first electrodes **515** and a plurality of second **512** are formed on the substrate **511** and arranged along a first direction and a second direction without overlapping one another. The plurality of first electrodes and second electrodes are respectively along the first direction x axial and the second direction y axial formed on the surface of the substrate **511** and the electrodes are separated within an interval. The first electrodes **515** and the second electrodes **512** (e.g. ITO, IZO, AZO etc) are formed on the substrate **511** with a sputter method. The second electrodes **512** are connected by conductive wires (not showed) to sense total capacitance variation along a y axial according to the conductor **100** (or a finger) indirectly touches the first electrodes **312**. A patterned first insulating layer **513** comprising material such as SiO2, SiNx or other organic matter is manufactured by evaporation or other film processes to be formed on the substrate **511** and cover the plurality of first electrodes **515** and second electrodes **512**. Furthermore, a plurality of cavities as passages are formed inside the first insulating layer **513**. A wire layer **514** having a plurality of wires is formed by a film process, wherein the first electrodes **515** are connected by the wires through the cavities and the wire layer **514**. Wire material may be transparent electrodes (e.g. ITO, IZO, AZO etc.) or metal electrodes (e.g. Ti—Al—Ti, Al, Cu, MoW etc.). The touch sensitive device **510** can be a substrate base of a substrate device **210** in a display device. A color filter or co-planer electrodes can be added. The touch sensitive device can also be a substrate basis of a bottom device **230** in the display device. Film transistors or co-planer electrodes can be added by manufacturing processes. The sequential processes are well known by those who are skilled in the art. So it's not detailed herein.

[0055] In another embodiment as shown in FIG. **10**, the difference between the foregoing touch sensitive device **510** and the touch sensitive device **520** is the adhesive layer **525**. The touch sensitive device **520** can be externally bonded to the substrate device **510** in the display device through the adhesive layer **525** which may be an OCA tape.

[0056] In another embodiment, as shown in FIG. **11**, the difference between the forgoing touch sensitive device **510** and the touch sensitive device **530** is the isolating layer **410** having an insulating layer **411** and an electrode layer **412**. The insulating layer **411** is formed on the wire layer **534**, and the electrode layer **412** is formed on the insulating layer **411**. The insulating layer **411** may be SiNx, SiO2, photo-resistor, plastics etc. The electrode layer **412** may be a transparent conductor such as ITO, IZO, AZO etc. The isolating layer **410** is used to prevent interference from the display terminal. The touch sensitive device **530** can be a substrate base of the substrate device **210** in the display. For an LCD as an example, a color filter and co-planar electrode process would be performed on the substrate device **210**. The display medium layer **220** would be liquid crystal. The bottom device **230** may be a film transistor substrate.

[0057] The touch sensitive device **540** can be bonded to the substrate device **210** as shown in FIG. **12**. The touch sensitive device **540** includes a substrate **541**, a plurality of first electrodes **545** and a plurality of second electrodes **542** and a first insulating layer. The plurality of first electrodes **545** and the plurality of second electrodes **542** are respectively formed on the substrate **511** and arranged along a first direction x axial and a second direction y axial in 2D space. The first and second electrodes are separated with an interval. A plurality of cavities is formed inside the first insulting layer **543** as passages. The touch sensitive device **530** can be bonded to the substrate device **210** through the adhesive layer **545** to form a touch sensitive display device.

[0058] In another embodiment as shown in FIG. **13**, the touch sensitive device **550** has a compound isolating layer **420** consisting of multi-insulating layers **421** and a multi-electrode layer **422** for raising interference-proofing, water-proofing and optical performance. The touch sensitive device **550** can be a substrate base of the substrate device **210** in the display.

[0059] The touch sensitive device **560** further includes an adhesive layer **565** as shown in FIG. **14**. The touch sensitive device **560** can be bonded to the substrate device **210** through the adhesive layer **565** as shown in FIG. **14**.

[0060] In another embodiment as shown in FIG. **15**. The touch sensitive device **610** includes a soft or a hard substrate **611** such as glass or plastics (PET-polyethylene terephthalate, PI, PES etc.) or functional material such as organic matter (e.g. SiO_2, SiNx, etc) or an inorganic matter (Parylene) material stack which are used to increase hardness, water-tolerance, transmittance, and rub-proofing. The plurality of first electrodes **612** (e.g. ITO, AZO, IZO etc.) which are separated

within an interval are formed on the substrate **611** and arranged along a first direction (e.g. x axial). The first insulating layer **613** (e.g. Parylene or SiNx, SiO_2) is formed on the substrate **611** with a film process (e.g. evaporation or print coating) and covers the first electrodes **612**. The plurality of second electrodes **314** which are separated within an interval are formed on the first insulating layer **313** and arranged along a second direction (i.e. y axial) in 2D space. A preventing layer **615** such as a functional film such as a scrape-proof layer or anti-reflection layer or water-proof layer or gas-proof layer is coated on the first insulating layer **613** and covers the second electrodes **614**. The touch sensitive device **610** can be a substrate base of a substrate device **210** in a display device. A color filter or co-plane electrodes can be added. The touch sensitive device also can be a substrate base of a bottom device **230** in the display device. Film transistors or co-planer electrodes can be added. The sequential processes are well known by those who are skilled in the art. So it's not detailed herein.

[0061] In another embodiment as shown in FIG. **16**, the difference between the forgoing touch sensitive device **610** and the touch sensitive device **620** is the adhesive layer **626**. The touch sensitive device **620** can be externally bonded to the substrate device **610** in the display device through the adhesive layer **626** which may be an OCA tape.

[0062] In another embodiment as shown in FIG. **17**, the difference between the forgoing touch sensitive device **610** and the touch sensitive device **630** is the isolating layer **410** having an insulating layer **411** and an electrode layer **412**. The insulating layer **411** such as organic insulating layer or inorganic layer (e.g. photoresist, plastics, Parylene, SIO_2, SiNx etc.) is formed on the other side of the substrate **631** by a coating process or an evaporation process. After that, the electrode layer **412** (e.g. ITO, IZO, AZO etc.) is formed on the insulating layer **411**. The touch sensitive device **630** can be a substrate base of the substrate device **210** in the display. For an LCD as an example, a color filter and co-planar electrode process would be performed on the substrate device **210**. The display medium layer **220** would be liquid crystal. The bottom device **230** may be film transistor substrate.

[0063] The touch sensitive device **640** further includes an adhesive layer **646** as shown in FIG. **18**. The touch sensitive device **640** can be bonded to the substrate device **210** through the adhesive layer **646** as shown in FIG. **18**.

[0064] In another embodiment as shown in FIG. **19**, the touch sensitive device **650** has a compound isolating layer **420** consisting of multi-insulating layers **421** and a multi-electrode layer **422** for raising interference-proofing, water-proofing and optical performance. The touch sensitive device **650** can be a substrate base of the substrate device **210** in the display.

[0065] The touch sensitive device **660** further includes an adhesive layer **666** as shown in FIG. **20**. The touch sensitive device **660** can be bonded to the substrate device **210** through the adhesive layer **666** as shown in FIG. **20** to form a touch sensitive display device.

[0066] In another embodiment as shown in FIG. **21**. The touch sensitive device **710** includes a soft or a hard substrate **711** such as glass or plastics (PET-polyethylene terephthalate, PI, PES etc.) or functional materials such as organic matter (e.g. SiO_2, SiNx, etc) or an inorganic matter (Parylene) material stack which are used to increase hardness, water-tolerance, transmittance, and rub-proofing. A wire layer **712** having conductive wires manufactured from transparent conductive oxide electrode (e.g. ITO, IZO, AZO etc.) or metal (e.g. Ti—Al—Ti, Al, MoW etc.) with sputter method is formed on the substrate **711**. A first insulating layer **713** such as inorganic matter (e.g. SiNx, SiO_2, etc.) or organic matter (e.g. photoresist, Parylene, plastics etc.) is formed on the wire layer **712**. A plurality of first electrodes **716** and second electrodes **714** (i.e. ITO, AZO, IGZO etc.) are formed on the first insulating layer **713** and arranged respectively along an x axial and a y axial. Pluralities of cavities as passages are formed inside the first insulating layer **713** by an etching or laser process. The first electrodes are connected by the wires in the wire layer **712** through the first insulating layer **713** and the cavities. A preventing layer **715** such as functional film such as a scrape-proof layer or anti-reflection layer or water-proof layer or gas-proof layer is coated on the first insulating layer **714**, and covers the first electrodes **716** and the second electrodes **714**. The touch sensitive device **710** can be a substrate base of a substrate device **210** in a display device. A color filter or co-planer electrodes can be added. The touch sensitive device can also be a substrate base of a bottom device **230** in the display device. Film transistors or co-planer electrodes can be added by manufacturing processes. The sequential processes are well known by those who are skilled in the art. So it's not detailed herein.

[0067] In another embodiment as shown in FIG. **22**, the difference between the foregoing touch sensitive device **710** and the touch sensitive device **720** is the adhesive layer **726**. The touch sensitive device **720** can be externally bonded to the substrate device **210** in the display device through the adhesive layer **726** which may be an OCA tape.

[0068] In another embodiment, as shown in FIG. **23**, the difference between the forgoing touch sensitive device **710** and the touch sensitive device **730** is the isolating layer **410** having an insulating layer **411** and an electrode layer **412**. The electrode layer **412** (e.g. ITO, IZO, AZO etc.) is firstly formed on the substrate **731**. After that, the insulating layer **411** such as organic insulating layer or inorganic layer (e.g. photoresist, plastics, Parylene, SIO_2, SiNx etc.) is formed on the insulating layer **411** by a coating process or an evaporation process before the wire layer **732** is formed. The touch sensitive device **730** can be a substrate base of the substrate device **210** in the display. For the LCD as an example, a color filter and co-planar electrode process would be formed on the substrate device **210**. The display medium layer **220** would be liquid crystal. The bottom device **230** may be film transistor substrate.

[0069] The touch sensitive device **740** further includes an adhesive layer **746** as shown in FIG. **24**. The touch sensitive device **740** can be bonded to the substrate device **210** through the adhesive layer **746** as shown in FIG. **24**.

[0070] In another embodiment as shown in FIG. **25**, the touch sensitive device **750** has a compound isolating layer **420** consisting of multi-insulating layers **421** and a multi-electrode layer **422** for raising interference-proofing, water-proofing and optical performance. The touch sense device **750** can be a substrate base of the substrate device **210** in the display.

[0071] The touch sensitive device **760** further includes an adhesive layer **766** as shown in FIG. **26**. The touch sensitive device **760** can be bonded to the substrate device **210** through the adhesive layer **766** as shown in FIG. **26** to form a touch sensitive display device.

[0072] The display devices are manufactured by semiconductor process without externally bonding process to increase

product stability and decrease cost. The touch sensitive devices can also be assembled to electronic product display surfaces by adhesion.

[0073] While the invention has been described by way of example and in terms of the preferred embodiments, it is to be understood that the invention is not limited to the disclosed embodiments. To the contrary, it is intended to cover various modifications and similar arrangements (as would be apparent to those skilled in the art). Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.

What is claimed is:

1. A touch sensitive device, comprising:
a substrate;
a plurality of first electrodes formed on the substrate and arranged along a first direction without overlapping one another;
a first insulating layer formed on the substrate and covering the plurality of first electrodes; and
a plurality of second electrodes formed on the first insulating layer and arranged along a second direction without overlapping one another,
wherein the fist direction is vertical to the second direction.

2. The touch sensitive device as claimed in claim **1**, further comprising:
an isolating layer formed on the first insulating layer and covering the plurality of second electrodes.

3. The touch sensitive device as claimed in claim **2**, wherein the isolating layer further comprises:
an or a plurality of insulating layers and an or a plurality of electrode layers.

4. The touch sensitive device as claimed in claim **3**, wherein the insulating layers are formed between the second electrodes and the electrode layers, between the first insulating layers and the electrode layers, between the electrode layers or on the electrode layers.

5. The touch sensitive device as claimed in claim **3**, wherein the electrode layers are formed between the insulating layers or on the insulating layers.

6. The touch sensitive device as claimed in claim **1**, further comprising an adhesive layer formed on the second electrodes.

7. The touch sensitive device as claimed in claim **2**, further comprising an adhesive layer formed on the isolating layer.

8. A touch sensitive device, comprising:
a substrate;
a plurality of first electrodes and a plurality of second electrodes formed on the substrate and arranged along a first direction and a second direction without overlapping one another;
a first insulating layer formed on the substrate and covering the plurality of first electrodes and second electrodes, and a plurality of cavities are formed on the first insulating layer; and
a wire layer comprising a plurality of wires formed on the first insulating layer, and the first electrodes are connected with the plurality of wires;
wherein the first direction is vertical to the second direction.

9. The touch sensitive device as claimed in claim **8**, further comprising:
an isolating layer formed on the wire layer.

10. The touch sensitive device as claimed in claim **9**, wherein the isolating layer further comprises:
an or a plurality of insulating layers and an or a plurality of electrode layers.

11. The touch sensitive device as claimed in claim **10**, wherein the insulating layers are formed between the wire layer and the electrode layers, between the electrode layers, or on the electrode layers.

12. The touch sensitive device as claimed in claim **10**, wherein the electrode layers are formed between the insulating layers or on the insulating layers.

13. The touch sensitive device as claimed in claim **8**, further comprising an adhesive layer formed on the wire layer.

14. The touch sensitive device as claimed in claim **8**, further comprising an adhesive layer formed on the isolating layer.

15. A touch sensitive device, comprising:
a substrate;
a plurality of first electrodes formed on the substrate and arranged along a first direction without overlapping one another;
a first insulating layer formed on the substrate and covering the plurality of first electrodes;
a plurality of second electrodes formed on the first insulating layer and arranged along a second direction without overlapping one another;
a preventing layer formed on the first insulating layer and covering the second electrodes;
wherein the fist direction is vertical to the second direction.

16. The touch sensitive device as claimed in claim **15**, further comprising:
a isolating layer formed on the substrate and the isolating layer and the substrate are formed as a compound layer.

17. The touch sensitive device as claimed in claim **16**, wherein the isolating layer further comprises:
an or a plurality of insulating layers and an or a plurality of electrode layers.

18. The touch sensitive device as claimed in claim **17**, wherein the insulating layers are formed between electrode layers or between the substrate and the electrode layers.

19. The touch sensitive device as claimed in claim **17**, wherein the electrode layers are formed between the insulating layers or between the insulating layers and the substrate.

20. The touch sensitive device as claimed in claim **15**, further comprising:
a isolating layer formed under the substrate and the isolating layer and the substrate are formed as a compound substrate.

21. The touch sensitive device as claimed in claim **20**, wherein the isolating layer further comprises:
an or a plurality of insulating layers and an or a plurality of electrodes layers.

22. The touch sensitive device as claimed in claim **21**, wherein the insulating layers are formed between the substrate and the electrode layers, between the electrode layers or on the electrode layer.

23. The touch sensitive device as claimed in claim **21**, wherein the electrode layers are formed between the insulating layers, between the insulating layer and the substrate or on the insulating layer.

24. A touch sensitive device, comprising:
a substrate;
a wire layer comprising a plurality of wires formed on the substrate;

a first insulating layer formed on the wire layer and a plurality of cavities are formed on the first insulating layer;

a plurality of first electrodes and a plurality of second electrodes formed on the substrate and arranged along a first direction and a second direction without overlapping one another, and the first electrodes are connected by the plurality of wires via the plurality of cavities; and

a preventing layer formed on the first insulating layer and covering the plurality of first electrodes and the second electrodes;

wherein the first direction is vertical to the second direction.

25. The touch sensitive device as claimed in claim **24**, further comprising:

an isolating layer formed on the substrate, and the isolating layer and the substrate are formed as a compound substrate.

26. The touch sensitive device as claimed in claim **25**, wherein the isolating layer further comprises:

an or a plurality of insulating layers and an or a plurality of electrode layers.

27. The touch sensitive device as claimed in claim **26**, wherein the insulating layers are formed between the wire layer and the electrode layers, between the electrode layers, or between the substrate and the electrode layers.

28. The touch sensitive device as claimed in claim **26**, wherein the electrode layers are formed between the insulating layers or between the insulating layers and the substrate.

29. The touch sensitive device as claimed in claim **31**, further comprising:

an isolating layer formed under the substrate and the isolating layer and the substrate are formed as a compound substrate.

30. The touch sensitive device as claimed in claim **24**, wherein the isolating layer further comprises:

an or a plurality of insulating layers and an or a plurality of electrodes layers.

31. The touch sensitive device as claimed in claim **30**, wherein the insulating layers are formed between the substrate and the electrode layers, between the electrode layers or on the electrode layer.

32. The touch sensitive device as claimed in claim **37**, wherein the electrode layers are formed between the insulating layers, between the insulating layer and the substrate or on the insulating layer.

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