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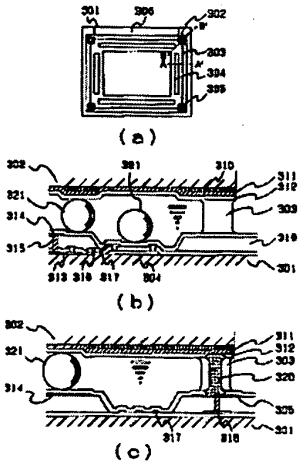
[54] [Title of Invention]

Liquid crystal display device

[57] [Summary]

[Purpose] To provide a small liquid crystal display device of high yield with little liquid-crystal deterioration.

[Structure] The present invention is characterized by covering the entire device substrate with transparent organic insulating film, followed by mounting drivers inside of the sealing area and peeling aforementioned organic film over the drivers.



[Scope of Patent Claim]

[Claim 1]

A liquid crystal display device with liquid crystal retained between a pair of substrates on the inside of the sealing area, said device provided with a transistor, pixel electrodes mounted via organic film on aforementioned transistor, and a drive circuit that drives aforementioned transistor on the inside of aforementioned sealing area of one substrate of aforementioned pair of substrates, wherein aforementioned organic film is mounted in the region facing aforementioned sealing area on one of aforementioned substrates and aforementioned organic film is not mounted over aforementioned drive circuit.

[Claim 2] The liquid crystal display device of Claim 1 wherein aforementioned organic film is within the sealing area.

[Claim 3] The liquid crystal display device of Claim 2 wherein driver circuits are mounted between the sealing area and the pixel section.

[Claim 4] The liquid crystal display device of Claim 3 wherein an electrode having a common and uniform potential is situated above the driver circuits in the same layer as that of aforementioned pixel electrode.

[Detailed Description of the Invention]

[0001]

[Field of Industrial Utilization] The present invention concerns an active-matrix liquid crystal display device.

[0002]

[Related Art] One example of a conventional liquid crystal display device is explained using Figure 1.

[0003] This diagram is an outer view of a liquid crystal display device.

[0004] A pixel area 105 is mounted as shown in Figure 1(a) over device substrate 101 of glass, quartz, etc., and driver circuits 103, 104 comprising integrated circuits of a thin-film transistor are mounted about the periphery of this pixel section. Opposing substrate 102 is fastened to device substrate 101 by sealant 106 of ultraviolet-cured resin, etc., so that the edge of opposing substrate 102 is situated between pixel area 105 and driver circuits 103, 104. In addition, the potential of the transparent electrode of the opposing substrate is set to the common potential through pad 107 on the substrate side via electroconductive adhesive.

[0005] This is to avoid the entry of moisture, etc., into the liquid crystal that is incorporated between device substrate 101 and opposing substrate 102 to the extent possible.

[0006] A structural cutaway drawing of the A-A' section of Figure 1 is shown in Figure 1(b). Thin-film transistor 113 of polycrystalline silicon, etc., is formed on device substrate 101. The thin-film transistor, source wiring, and pixel electrode 114 are covered by second inter-layer insulating film 120, but holes are opened above pixel electrode 114. The gate electrode of this transistor ultimately is connected to wiring 117 via contact holes at the terminal edge 116, and wiring 117 is connected to driver circuit 103 comprising integrated circuits of a transistor that are formed outside of the edge of the opposing substrate.

[0007] Transparent electrode 111 is formed over the entire opposing substrate 102, and is fastened to the substrate by sealant 106 of ultraviolet-cured resin, etc. Device substrate 101 and opposing substrate 102 are covered by alignment film 112 of polyimide, etc.

[0008] A structural cutaway drawing of the B-B' section of Figure 1 is shown in Figure 1(c). Wirings 306 are formed on the upper layer of first inter-layer insulating film 119 over device substrate 101, and these are covered by second inter-layer insulating film 120 of silicon oxide, but holes are opened over pad 107. This is coated with alignment film 112 of polyimide, etc. Since pad 107 is wired so as to have a common potential, electroconductive adhesive 118 is applied to this section, and when opposing substrate 102 is contact bonded, the facing electrode 111 of the opposing substrate adopts the common potential as a result. Reference numeral 121 denotes a gap agent.

[0009] In addition, Figure 2 is an oblique view of this liquid crystal display device.

[0010] The number of wires traversing seal 205 is equal to the number of gate wires and source wires at the bottom.

[0011]

[Problems Solved by the Invention] However, in conventional technology, since driver circuits are mounted outside of the opposing substrate, driver circuits are broken during panel assembly, which reduces the yield. Furthermore, the overall device size is increased because driver circuits are mounted

outside of the sealing area.

[0012] Furthermore, since driver circuits are mounted outside of the sealing area, the number of wires traversing the sealing area increases to more than double the pixel number, which increases the possibility of moisture entry which causes deterioration of liquid crystal.

[0013]

[Means of Solving the Problems] In the present invention, liquid crystal is retained between a pair of substrates on the inside of the sealing area. The device is provided with a transistor, pixel electrodes mounted via organic film on aforementioned transistor, and a drive circuit that drives aforementioned transistor on the inside of aforementioned sealing area of one substrate of aforementioned pair of substrates. Aforementioned organic film is mounted in the region facing aforementioned sealing area on one of aforementioned substrates, and aforementioned organic film is not mounted over aforementioned drive circuit.

[0014]

[Embodiments] The present invention is explained in detail below based on an embodiment.

[0015] Figure 3(a) is a frontal outer view of one example of the liquid crystal display device pursuant to the present invention. Opposing substrate 302 is fastened to device substrate 301 by sealant 303 of ultraviolet-cured resin, etc., so as to incorporate the liquid crystal. Driver circuit 304 is mounted inside of the sealing area and aforementioned organic film thereover is peeled. The purpose of electrode 306 having oblique lines in the four corners is for conduction in order to provide potential of the opposing substrate to the facing electrode. That potential is set to the potential that is provided from external connection terminal 307 of the device substrate using electroconductive adhesive, etc.

[0016] Figure 3(b) is a structural cutaway drawing from the pixel area to the sealing area. Pixel drive transistor 313 is formed over device substrate 301. Driver circuit 304 comprising an integrated circuit of transistors is mounted midway between the sealing area and the pixel area. The entire device substrate is covered by transparent organic insulating film of polyimide, etc. A pixel electrode such as ITO 314 is formed over this transparent organic insulating film and is connected via contact hole 315 to the drain electrode of the pixel transistor. In addition, transparent organic insulating film 319 over the driver circuit is peeled so that no electrode is present over the circuit. Whether a facing electrode is present over the driver circuit or not is irrelevant.

[0017] Figure 3(c) is a structural cutaway drawing from the pixel area to the sealing area.

[0018] Opposing substrate 302 is connected to electrode 306 such as ITO over transparent organic insulating film via electroconductive adhesive 320, and this electrode is connected to wiring 318 below having common potential so that the potential of opposing substrate 302 is set at the common potential.

[0019] The cell thickness of the liquid crystal display device is determined by gap agent 321 that is spread over the pixel area having little unevenness since the driver circuits are mounted within the sealing area and aforementioned organic film is peeled from the top of the circuits. Consequently, a uniform cell thickness is readily attained.

[0020] The overall display device in this case is smaller than a conventional display device by widths D1 and D2 of the driver circuits, as shown in Figure 4(a), since the driver circuits are mounted within the sealing area.

[0021] In addition, Figure 4(b) shows an oblique view of this liquid crystal display device.

[0022] The number of wires traversing the sealing area is markedly reduced to signal wires and power wires since driver circuit 404 is mounted within sealing area 405.

[0023]

[Effects of Invention] The following effects are realized by a liquid crystal display device that adopts the structure of the present invention.

[0024] The overall device is miniaturized and the productivity is enhanced by mounting the driver circuits on the inside of the opposing substrate.

[0025] Furthermore, the entry of moisture into the liquid crystal that is incorporated under the sealing area where there is little unevenness can be reduced by mounting the driver circuits on the inside of the sealing area, which provides a display device of higher reliability.

[0026] A cell of uniform thickness can easily be attained by peeling the transparent organic insulating film over the driver section and the display quality can be enhanced.

[Brief Description of Drawings]

[Figure 1] An outer view showing the structure of a liquid crystal display device based on conventional technology.

[Figure 2] An oblique view showing the structure of a liquid crystal display device based on conventional technology.

[Figure 3] A cutaway drawing showing the structure of a liquid crystal display device pursuant to the present invention.

[Figure 4] An oblique view showing the structure of a liquid crystal display device pursuant to the present invention.

[Explanation of Notations]

101, 201, 301, 401.. device substrate
102, 202, 302, 402.. opposing substrate
113, 207, 313, 407.. pixel drive transistor
116, 316.. gate electrodes of pixel drive transistor and gate wiring
106, 205, 303, 405.. sealing area
103, 104, 203, 204, 304, 403, 404.. driver circuits
117, 317.. wiring
105.. pixel area
114, 314.. pixel electrodes
111, 311.. facing electrodes
318.. wiring having common potential
107, 305.. pad with a common potential
110, 310.. black matrix
115, 315.. contact hole with pixel electrode
118, 320.. electroconductive adhesive
319.. transparent organic insulating film
112, 312.. alignment film
119.. first inter-layer insulating film
120.. second inter-layer insulating film
108, 206, 306, 405.. external connection terminal
121, 321.. gap agent

Figure 1

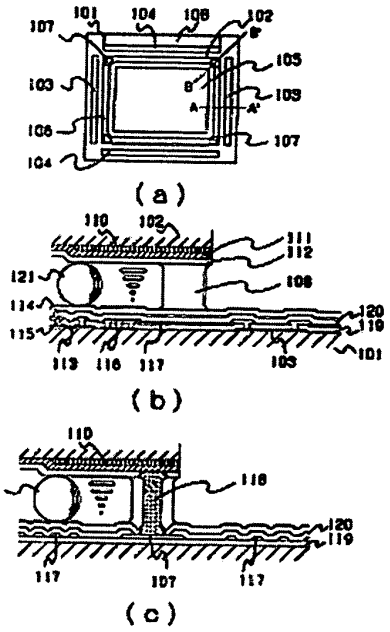


Figure 2

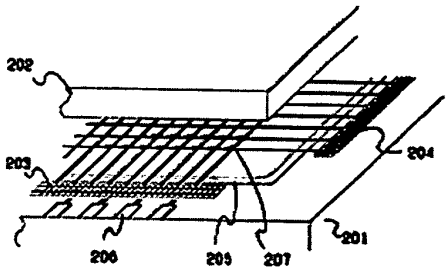
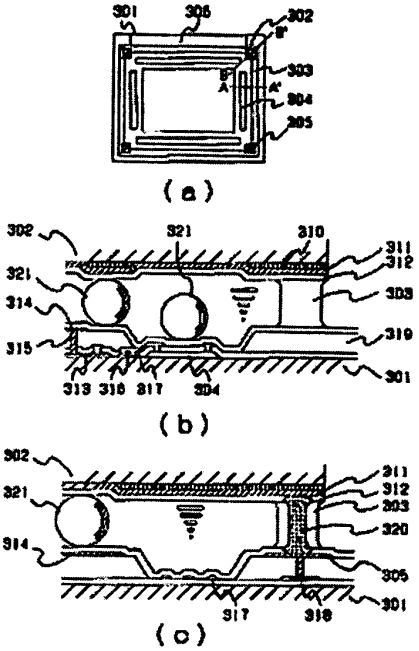


Figure 3



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