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Kubota et al.

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(54) **DISPLAY DEVICE**

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(73) Assignees: **Semiconductor Energy Laboratory Co., Ltd.**, Kanagawa-ken; **Sharp Kabushiki Kaisha**, Osaka, both of (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(30) **Foreign Application Priority Data**

Sep. 20, 1996 (JP) 8-271614

(51) **Int. Cl.⁷** **G09G 3/36**

(52) **U.S. Cl.** **345/92; 345/98; 345/100; 345/206**

(58) **Field of Search** **345/92, 98, 100, 345/80, 206; 257/57, 59; 438/157**

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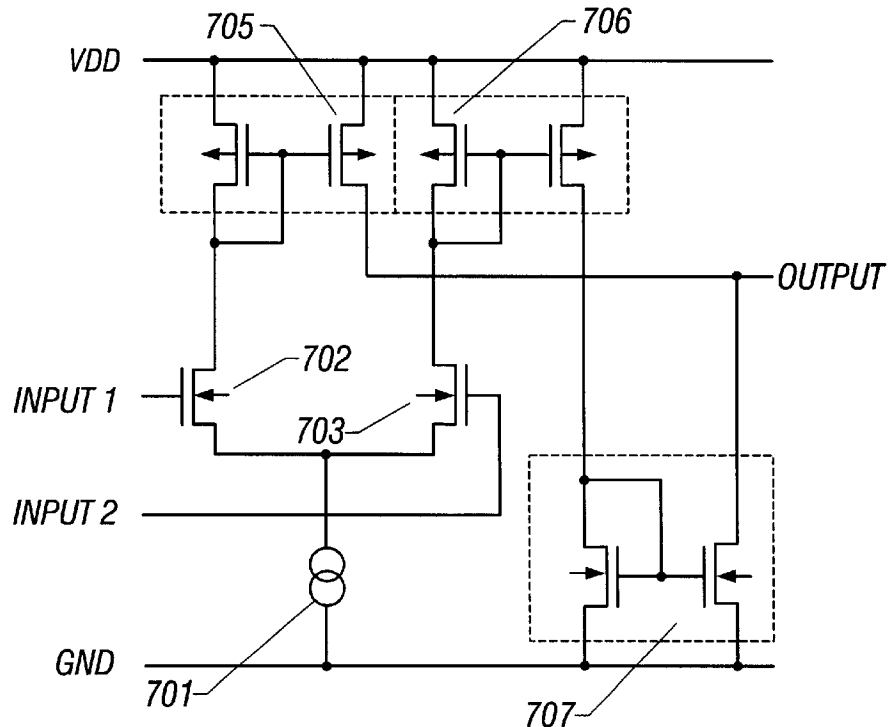
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(57) **ABSTRACT**

There is disclosed an active matrix liquid crystal display that receives input signals having small amplitudes and needs no externally attached level-shifting circuit. The active matrix liquid crystal display has a level-shifting circuit for amplifying various input signals, such as control signals, a clock signal, and a start pulse signal, and supplying the amplified signals to peripheral driver circuits. These peripheral driver circuits drive an active matrix circuit. The level-shifting circuit is made of a differential amplifier consisting of polysilicon TFTs. This amplifier is an analog amplifier. This level-shifting circuit is fabricated on the same substrate as the active matrix circuit and the peripheral driver circuits. If the amplitudes of the input signals are small, level-shifting operations can be performed well. Since any externally attached level-shifting circuit is dispensed with, the cost can be curtailed.

22 Claims, 7 Drawing Sheets



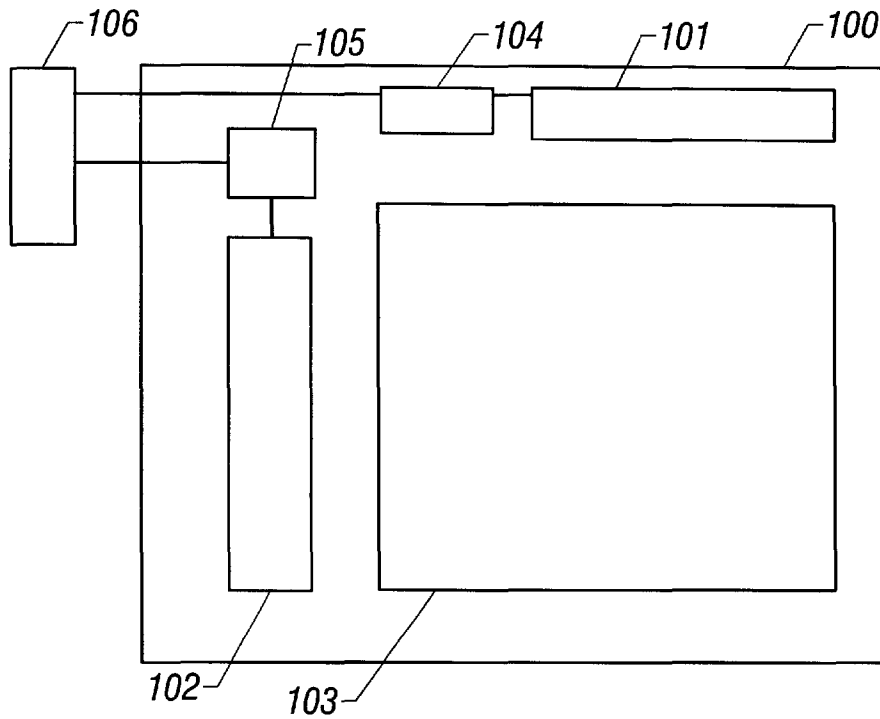


FIG. 1

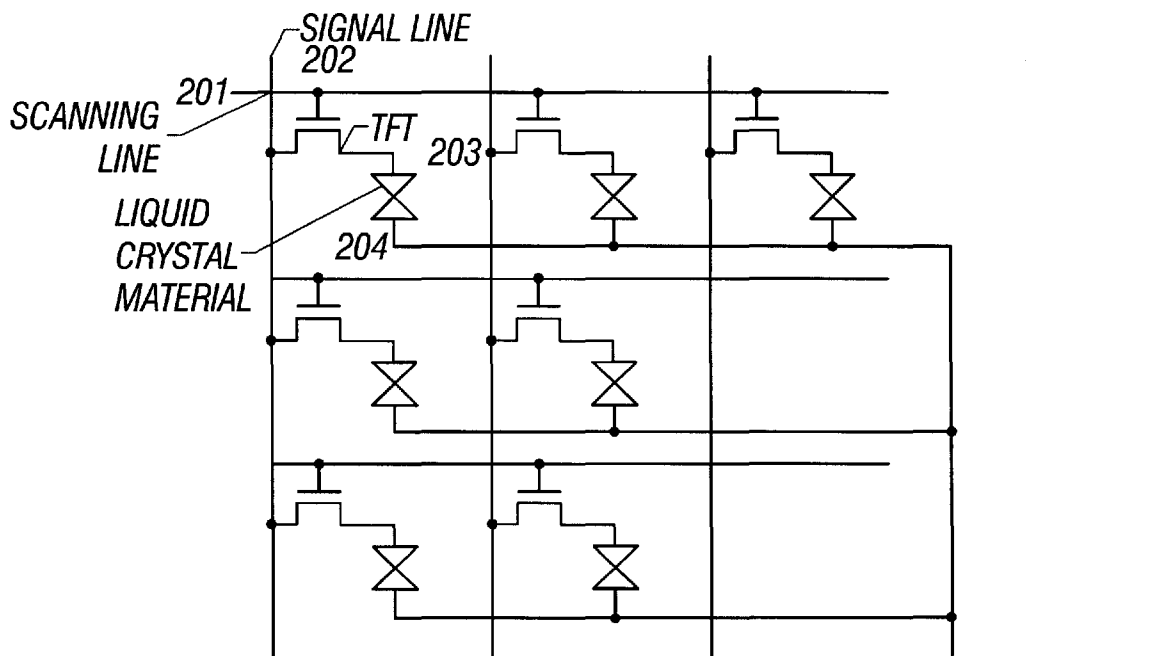


FIG. 2
(Prior Art)

POTENTIAL AT
COUNTER ELECTRODE

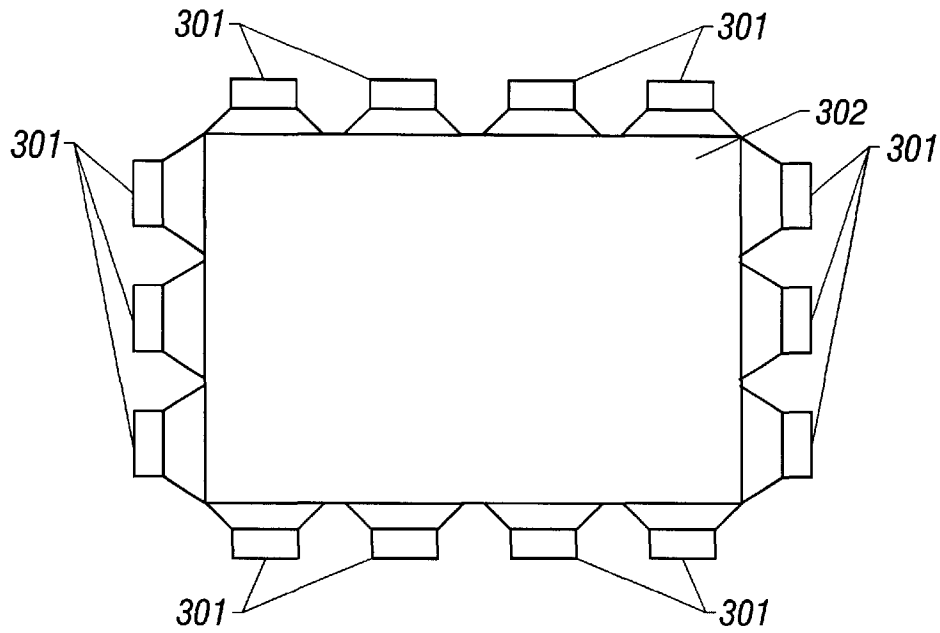


FIG. 3A
(Prior Art)

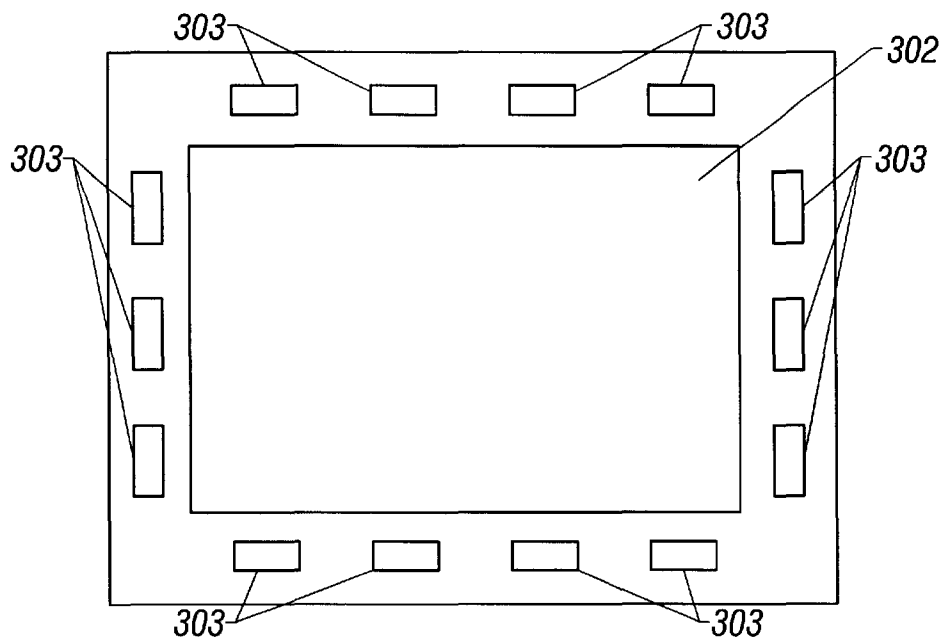


FIG. 3B
(Prior Art)

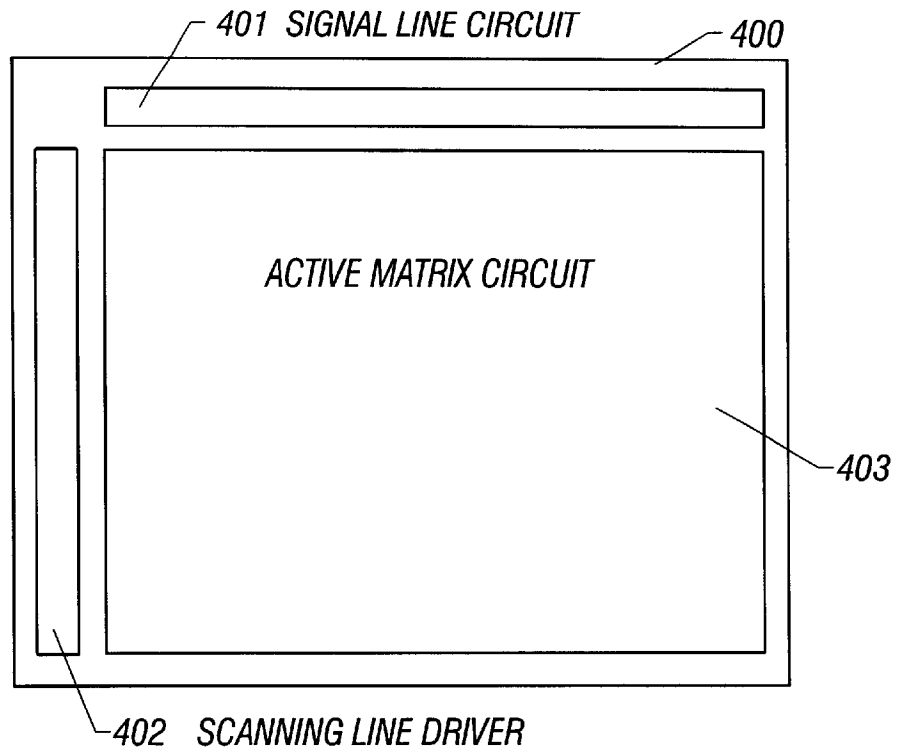


FIG. 4
(Prior Art)

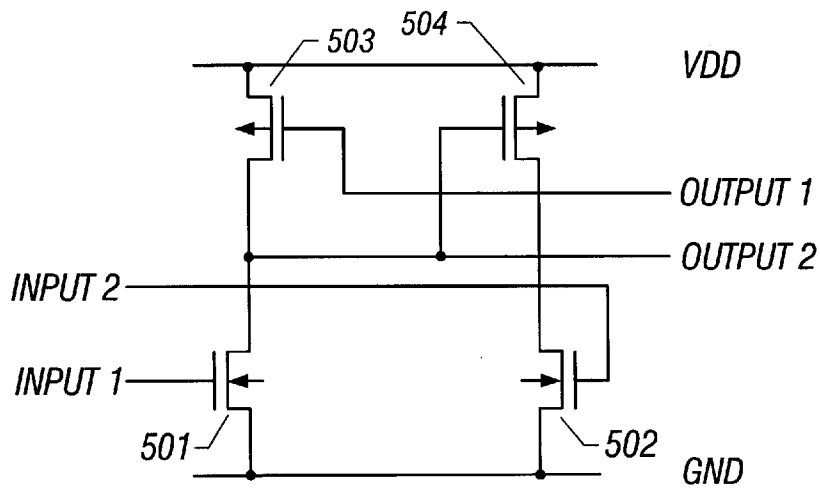


FIG. 5
(Prior Art)

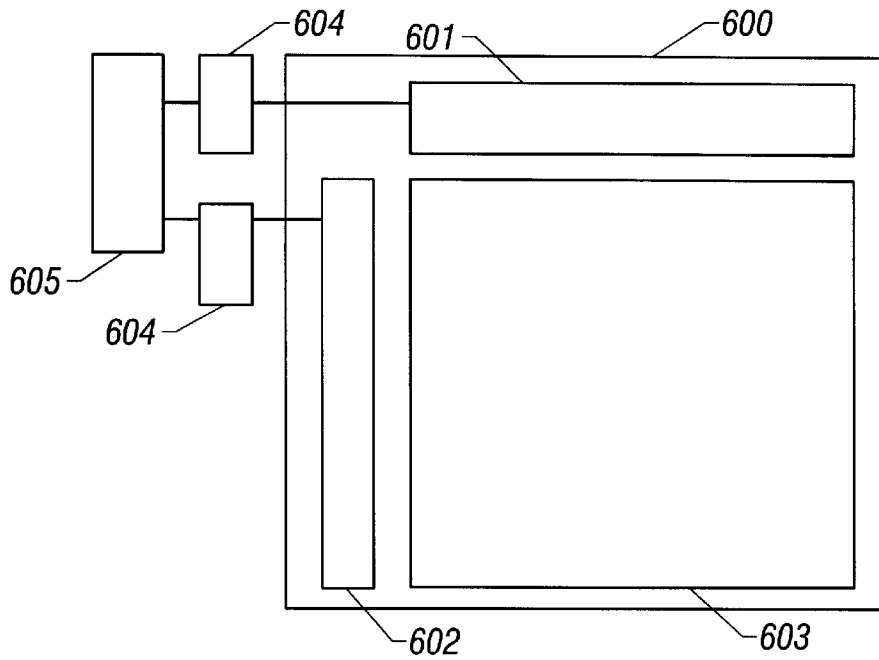


FIG. 6
(Prior Art)

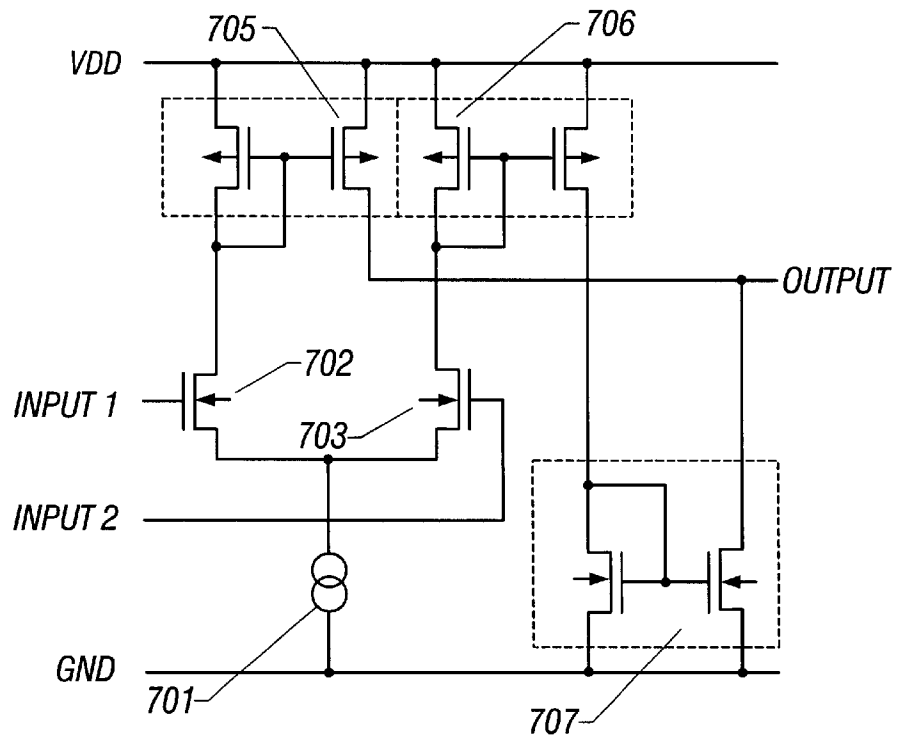


FIG. 7

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