An AMOLED Pixel Structure Using Poly-Si TFTs for Compensating Threshold Voltage and Mobility Variations

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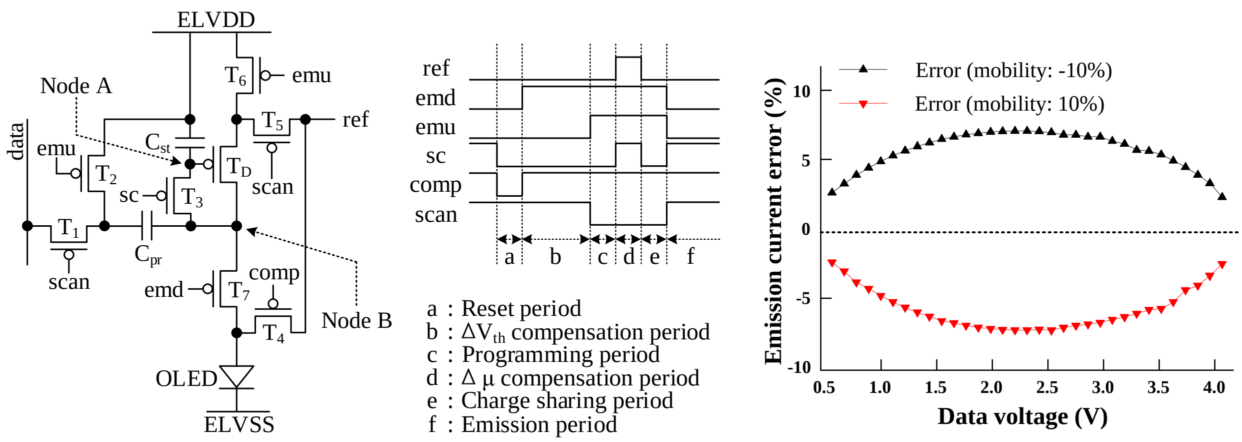
In active matrix organic light emitting diode (AMOLED) displays, the image quality is mainly degraded due to variations in threshold voltage (V_{th}) and mobility (μ) of the driving TFT which is fabricated on poly-crystalline silicon (poly-Si) backplane. To improve the image quatlity of the AMOLED displays, several compensation methods for variations in V_{th} and mobility have been researched [1-3]. The V_{th} variation is compensated for every gray level by using a diode connection method [1-2], whereas the mobility variation is compensated for only a specific gray level [3]. In this paper, we propose a pixel structure to compensate mobility variations for every gray level.

Fig. 1(a) and (b) show the schematic and timing diagram of the proposed pixel structure, respectively. It operates in the sequence of the reset, ΔV_{th} compensation, programming, $\Delta\mu$ compensation, charge sharing, and emission periods. In the reset period, the voltage at node A (V_A) is reset to a low signal of “ref” to turn on T_D. In the ΔV_{th} compensation period, T_D is diode-connected by T_3, and then V_A becomes ELVDD-$|V_{th,TD}|$, where $V_{th,TD}$ is V_{th} of T_D. In the programming period, a data voltage is programmed to node A by using the capacitive coupling of C_{pr} and then the current flowing through T_D varies according to mobility of T_D and a programmed data voltage. In the $\Delta\mu$ compensation period, T_D generates the current to compensate for the mobility variation of T_D ($I_{D,\mu}$) and the generated $I_{D,\mu}$ charges C_{pr}. At the end of this period, the voltage at node B is increased proportionally to mobility of T_D because $I_{D,\mu}$ is proportional to mobility of T_D. In the charge sharing period, the information of V_{th} and mobility of T_D is transferred from node B to node A by the charge sharing between the node A and B. Then, V_A compensates for the mobility variation of T_D since V_A increases as mobility of T_D increases. In the emission period, the emission current of T_D is determined by V_A which compensates for variations in threshold voltage and mobility of T_D.

The proposed pixel structure is verified using the SmartSpice [4] simulation. As shown in Fig. 1(c), the simulation results of the proposed pixel structure show that the emission current error is less than ±7% for every gray level when the mobility variation of T_D is ±10%.



(a) **(b)** **(c)**

Fig. 1. (a) Schematic, (b) timing diagram, and (c) simulation results of proposed pixel structure

References

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