UNIVERSITY OF CAMBRIDGE

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A Novel High-Precision Voltage-Programmed Pixel Circuit for AMOLED Displays

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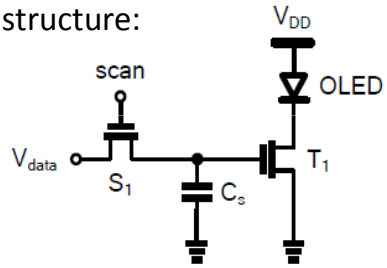
Introduction

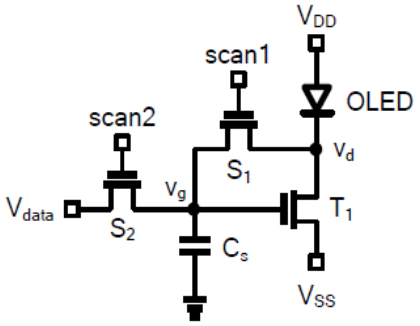
- A new accurate voltage-programmed pixel circuit for active matrix organic light-emitting diode (AMOLED) displays is presented.
- The proposed pixel circuit is implemented both in a-Si and a-IGZO TFT technologies with the same size of the pixel for a fair comparison.

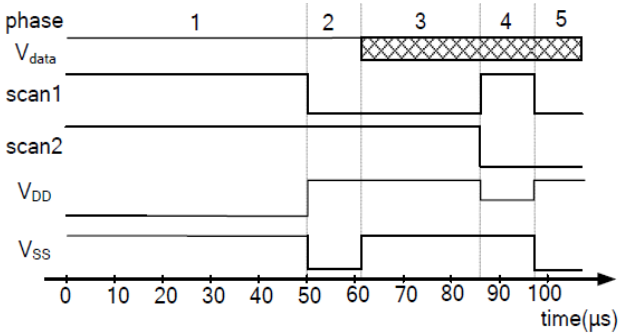
- A simple AMOLED pixel structure:

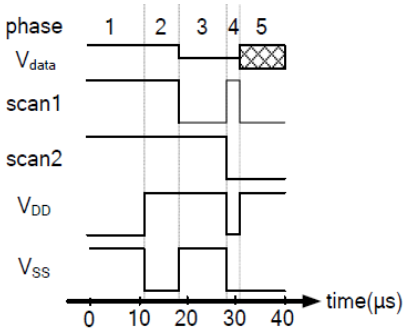


Results and Discussions

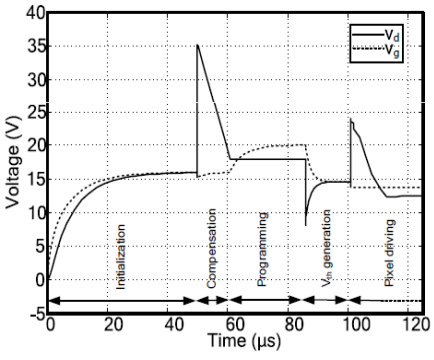
- Proposed pixel circuit for V_{th} compensation and timing diagrams for a-Si and IGZO circuits:



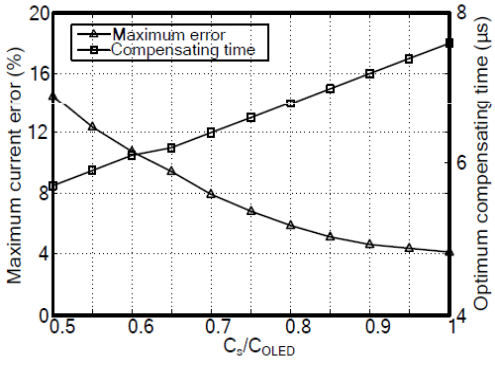




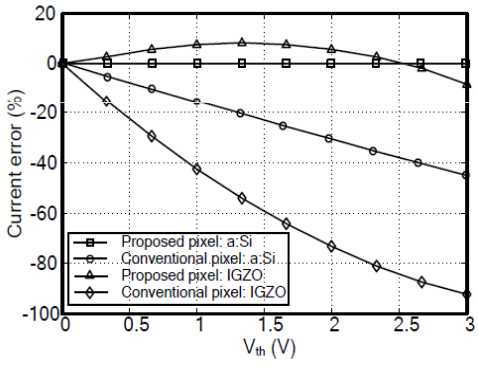
- Transient waveform of gate and drain voltages:



- Profile of the optimum compensation time and maximum current error:



- Measured current error as a function of V_{TH} shift:



$$V_{error,max} = \frac{(3-2\sqrt{2})\Delta V_{th,max}^2}{K\left[V_{data2} - V_{th0} - (\sqrt{2}-1)\Delta V_{th,max}\right]}$$

$$t_{comp,opt} = \frac{C_s + C_{OLED}}{K\left[V_{data2} - V_{th0} - (\sqrt{2}-1)\Delta V_{th,max}\right]}$$

Conclusion

- The simulation result for the a-Si-based design shows that, during a programming time of 90s, the pixel circuit was able to compensate for a 3V threshold voltage (V_{th}) shift of the drive TFT with almost no error.
- The a-IGZO-based circuit proves to be more than three times faster while having a larger current error of around 8%.

Related Publication: • Mojtaba Bagheri *et al.*, ***IEEE Journal of Display Technology***, 2016.