Real-time threshold voltage and mobility compensation for large-size AMOLED displays

Dongwei Li[1,2], Yufeng Jin[2], Hailong Jiao[1], Gary Chaw[2]
[1] Peking University Shenzhen Graduate School, Shenzhen 518055, China
[2]Shenzhen China Star Optoelectronics Technology Co., LTD, Shenzhen, China

Abstract
A new real-time compensation method of Vth and μ for large size AMOLED display named linear charging sensing (LCS) has been developed. This compensation method can accomplish the Vth and u sensing within tens or hundreds microseconds which can realize the sensing for all the pixels of FHD (1920× 1080) AMOLED display within one frame time in theory. By simulation analysis, LCS compensation method has very high accuracy for Vth sensing with a tiny error of 0.07V for ΔVth=0.5V and no error for ΔVth=-0.5V. Further verified in FHD AMOLED panel, the method can make a great improvement for image sticking and luminance uniformity.

2. Introduction

The Active Matrix Organic Light Emitting Diode (AMOLED) display technology have developed rapidly in the past decades. However, the image sticking and luminance unifromity resulted from the TFT V_{th} and μ shift are still problems. The main approach to solve the problems is V_{th} and μ compensation at present [1][2]. In this work, we studied a real-time compensation method for large size AMOLED display, named linear charging sensing. The theory of this method is that charge the stray capacitance of the sensing line by the current I_{DS} of driving TFT and ensure the voltage change of sensing line is linear. And then quickly sense the V_{th} and μ. The sensing time of LCS compensation method is 10^3 magnitudes shorter than source follow method. It can sense the V_{th} for all the pixels of FHD display within the blank time of one frame in theory, which meets the needs for real time compensation.

3. Experiment And Discussion

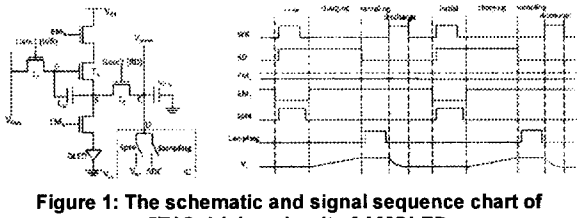

Figure 1: The schematic and signal sequence chart of a 5T1C driving circuit of AMOLED

The sensing process can be divided into three stages. In the first stage (called initial stage), the V_{data} and V_{cm} are written into the G and S spot of driving TFT, respectively and which sets the $V_{GS}=V_{data}-V_{cm}$. In the second stage (charging stage), the stray capacitance of sensing line stars to charge. In this stage, the V_{GS} remains stable because of the C_{st} so that the I_{DS} unchanged. Therefore, the boosting of the V_S and V_C is proportional to time only. In the third stage (sampling stage), the Sam switch opens and the driving system senses the voltage. After the voltages are sensed twice by the same method, we can calculate the V_{th} of driving TFT. The method of sensing μ is similar to that of V_{th}. After sensing V_{th} and μ, we can compensate ΔV_{th} and μ by external driving IC in a very short time.

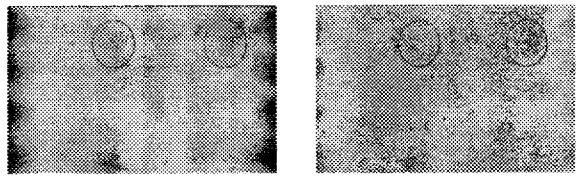

Figure 2: The performance of LCS compensation method in FHD AMOLED panel

We further analyzed the slight error of the accuracy for V_{th} sensing by simulation. The simulation result illustrates that the error of LCS method is mainly caused by the change of μ and the RC loading of gate signal. The optimum proposal is proposed to realize more accurate compensation. We also verified the performance of LCS compensation method on a FHD AMOLED display which shows good luminance umiformity and without image sticking.

4. Conclusion

The LCS compensation method shows a very good performance for the improvement of image sticking and display uniformity.

5. Acknowledgements

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6. References

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