A 12-Bit Mobile OLED/μLED Display Driver IC with Cascaded Loading-Free Capacitive Interpolation DAC and 6.24V/μs-Slew-Rate Buffer Amplifier

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Abstract

This paper presents an OLED/μLED display driver IC with cascaded loading-free capacitive interpolation (LFCI) DAC and a high-slew buffer amplifier. The 12-bit color-depth is realized by a combination of 7-bit R-DAC and proposed 5-bit LFCI DAC while occupying only 295×17μm², which is <2 reduction compared to the state-of-the-art. 5V amplifier offers a slew-rate of 6.24V/μs at 80pF with a static current of 2μA. The chip fabricated in 180-nm achieved the measured 0.43LSB (DNL), 0.95LSB (INL), and 7.9mV (DVO).

Proposed 12-bit Mobile OLED/μLED Display Driver IC

5-bit Cascaded Loading-Free Interpolation DAC: Compact size (2N × C), High accuracy interpolation.

High-Slew Buffer: Dynamically boosted tail current, Smooth transition from slow to linear region.

In-Pixel MSB-Conversion: Driver channel size reduction for CMOS-based μLED pixel array.

Measured Performances and Demonstration Results

Prototype chip fabricated in 180-nm CMOS process/5mm x 5mm active area.

DAC Performance: 0.43LSB (DNL), 0.95LSB (INL), 7.9mV (Deviation of voltage outputs among 192 channels from 5 chips).

Conclusion

The proposed 12-bit OLED/μLED display driver IC achieved 0.43LSB (DNL), 0.95LSB (INL), and 7.9mV DVO. Thanks to the LFCI DAC and simple structure of tail current boosting circuit, the proposed IC occupies only 295×17μm² offers a slew-rate of 6.24V/μs at 80pF with a static current of 2μA.

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