One-chip Driver for 262K-Color QCIF+ Passive-Matrix OLED Displays

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Abstract

A single-chip driver for 262K-Color QCIF+ (176RGB×240) passive matrix OLED (PMOLED) displays is presented. This driver chip consists of a scan driver, a data driver, a digital controller, 3(R/G/B) reference current generators, and two interface circuits. The gray level is controlled by pulse width modulation (PWM) of data currents. Gradient in pre-charge levels between data lines is applied to remove the effect of scan line resistance and 120Hz of the frame frequency is applied to reduce the flickering effect. By using 0.35 μm 18V CMOS process, 19300 μm×2800 μm of the chip size is obtained.

Chip Architecture

Figure 1 shows the symbolic block diagram of the proposed one-chip driver. RGB interface circuit receives 18-bit (6-bit for each R/G/B) digital graphic data from the external. RGB look-up table circuit modifies the received 6-bit data to 8-bit data for enhancing contrast ratio. Timing controller (TCON) generates control signals for scan driver, data driver and pre-charge circuit. Scan driver controls the cathode voltage of display panels with 3-steps for swift turn-on and turn-off operation. Data driver provides pulse width modulated data currents to the display panel with a constant amplitude. The pre-charge control circuit generates data line pre-charge voltage levels for compensating scan line resistance effects and accurate gray level controls.

Implementation and Measurement

0.35 μm 18V CMOS process is used for fabricating the proposed one-chip driver. Die photo of the chip is shown in figure 6. 19300 μm×2800 μm of the chip size is obtained. The complete display module is shown in figure 2. Chip-On-Film (COF) is used for compact and flexible connection to the display panel. Figure 2 shows the display with well-controlled gray scales and a still image.
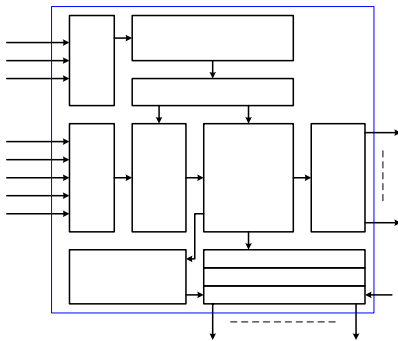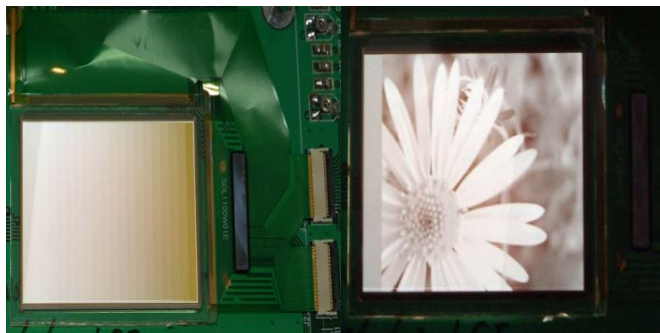

Figure 1. The proposed one-chip driver architecture

(a) Gray pattern   (b) Still image

Figure 2. 2.0-inch PMOLED display module (Gray Pattern)