A High-Image-Quality Data Driver IC for Flat Panel Displays

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The uniformity of the data driver for flat panel display cannot be overemphasized since it determines the display quality. The random offset voltage at the buffer amplifiers in the data driver degrades the uniformity of data driver. To reduce the offset voltage, autozeroing [1] and offset averaging [2], [3] can be used, but these methods increase the circuit area since they require additional devices and signals. To resolve these problems, we propose a high uniformity data driver IC using a digital calibration method without channel area increase. Fig. 1 shows the proposed data driver. In the offset measurement phase, ADC measures the offset of buffer amplifier and stores the measured offset data in memory. In the calibration and driving phase, the calibration logic can provide offset-calibrated data by subtracting the offset voltage from original RGB data. With this operation, the proposed data driver can achieve high uniformity. The proposed data driver was fabricated in 0.35 μm CMOS process. The proposed data driver IC is basically based on the traditional data driver structure, but a 10-bit resolution, 6-bit window range SAR-ADC is implemented to measure the offset voltage. The calibration logic and offset memory is not included in this IC since it can be located in timing-controller and external EEPROM which are already used for display systems. The measured offset voltage with the proposed method is drastically reduced from over 20 mV to under 5 mV which means the error is under 0.5 LSB of DAC. Therefore, we can conclude that the proposed data driver can provide very high uniformity.

Fig. 1. Proposed data driver with offset calibration method (a) block diagram and (b) layout