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A REVIEW COMPACT HIGH-QUALITY DISPLAYS FOR LCD APPLICATIONS

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ABSTRACT: Recently, ‘Liquid crystal display (LCD) vs. organic light-emitting diode (OLED) display who wins has become a topic of heated debate. In this review, we perform a systematic and comparative study of these two flat panel display technologies. First, we review recent advances in LCDs and OLEDs, including material development, device configuration and system integration. Next we analyze and compare their performances by six key display metrics: response time, contrast ratio, color gamut, lifetime, power efficiency, and panel flexibility.

Index Terms— *Liquid crystal display, contrast ratio, backlight, panel performances.*

INTRODUCTION

Display technology has gradually but profoundly shaped the lifestyle of human beings, which is widely recognized as an indispensable part of the modern world Presently, liquid crystal displays (LCDs) are the dominant technology, with applications spanning smart phones, tablets, computer monitors, televisions (TVs), to data projectors However, in recent years, the market for organic light-emitting diode (OLED) displays has grown rapidly and has started to challenge LCDs in all applications, especially in the small-sized display market Lately, ‘LCD vs. OLED: who wins?’ has become a topic of heated debate.LCDs are non-emissive, and their invention can be traced back to the 1960s and early With extensive material research and development, device innovation and heavy investment on advanced manufacturing technologies, thin-film transistor (TFT) LCD technology has gradually matured in all aspects; some key hurdles, such as the viewing angle, response time and color gamut, have been overcome Compared with OLEDs, LCDs have advantages in lifetime, cost, resolution density and peak brightness On the other hand, OLEDs are emissive; their inherent advantages are obvious, such as true black state, fast response time and an ultra-thin profile, which enables flexible displays As for color performance, OLEDs have a wider color gamut over LCDs employing a white light-emitting diode (WLED) as a backlight. Nevertheless, LCD with a quantum dot (QD) backlight has been developed and promoted the full width at half maximum (FWHM) of green and red QDs is only 25 nm. As a result, a QD-enhanced LCD has a wider color gamut than an OLED. Generally speaking, both technologies have their own pros and cons.

The competition is getting fierce; therefore, an objective systematic analysis and comparison on these two superb technologies is in great demand. In this review paper, we present recent progress on LCDs and OLEDs regarding materials, device structures to final panel performances. We briefly describe the device configurations and operation principles of these two technologies. Then, we choose six key metrics: response time, contrast ratio, color gamut, lifetime, power efficiency, and panel flexibility, to evaluate LCDs and OLEDs. Their future perspectives are discussed in, including high dynamic range (HDR), virtual reality/augmented reality (VR/AR) and smart displays with versatile functions. In line with the contemporary evolution of high-quality liquid-crystal displays (LCDs), the realization of compact low-power high-performance output drivers is being given an increasingly rising emphasis in recent years. The column drivers of an LCD driving system hold the most significant role in achieving fast speed capabilities, high resolution and low power dissipation, as they distribute the pixel information into the display active matrix. Among the key building blocks of which an LCD column driver is composed, the output buffer amplifiers determine the speed, resolution, voltage swing and power consumption of the whole driver.

These are the most challenging design requirements for the output buffers of an LCD driver. Since several column drivers must be used to achieve the required number of outputs, the total number of output drivers should be minimized to reduce system costs and increase reliability; hence, due to the thousands of output buffers built in a single chip, each buffer amplifier should occupy a small die area, allowing more output drivers to be integrated on the same chip. Furthermore, as °at-panel displays are commonly employed in battery-powered portable systems, the static power consumption of the output buffers should be minimized to extend the battery lifetime. Besides, as the display pixels are always updated row by row, the output buffers must be all driven by a step-wise function; consequently, their output voltage should be settled within a horizontal scanning time dictated by the frame frequency and depending on the total number of rows. The LCD output buffers are mostly realized by operational transconductance amplifiers in unity-gain conjuration, and are typically used to drive the highly capacitive column lines of the display panel. Moreover, as a high open-loop gain is required to obtain a low-valued systematic offset voltage, two-stage amplifier architecture is traditionally employed in the LCD driver. As the additional Miller capacitance required for frequency compensation would involve sensible silicon area consumption, most recently proposed buffers achieve stability by exploiting dominant-pole compensation at the high-capacitive-impedance output node.

However, to provide high-speed driving capabilities to the output stage, additional output stages are usually included in the basic two-stage amplifier topology, therefore requiring some extra quiescent current from the power supply. In addition, to allow the buffer amplifier to be capable of driving a wide range of load capacitance, phase compensation is additionally performed by introducing a series resistor connected between the amplifier output and the load capa. As Liquid-crystal displays (LCDs) are recently installed in notebook type personal computers and compact desktop personal computers and monitors are becoming larger and higher definition, there is a big demand of developing low power dissipation, high resolution, small settling time and high-speed LCD driver [1-6]. An LCD driver is generally composed of column drivers, gate drivers, a timing controller, and a reference source. The column drivers are especially important to achieving high-speed driving, high resolution and low-power dissipation [1-3]. A column driver generallyincludes registers, data latches, digital-to-analog converters (DAC’s) and output buffers. Among those, the output buffers determine the speed, resolution, voltage swing and power dissipation of the column drivers

[2, 5]. Due to the thousands of output buffer amplifiers built into a single chip, the buffer should occupy a small die area, and its static power consumption should be small. The output buffer should offer an almost rail-to-rail voltage driving which can accommodate higher gray levels. Also, the settling time should be smaller than the horizontal scanning time. Some output buffers were proposed and demonstrated to reduce the power consumption in recent years. For examples, [4] proposed a class-B output buffer for flat-panel display column driver, for which a comparator was used in the negative feedback path to eliminate the quiescent current in the output stage.

Weng et al. [5] proposed a compact, low-power, and rail-to-rail class-B output buffer for driving the large column line capacitance of LCDs, where a nonlinear element in feedback path is modified from the current-mirror amplifier to obtain the area and power advantages. Lu [2] proposed a high-speed driving scheme and a compact high-speed low power rail-to-rail class-B buffer amplifier, which are suitable for both of the small- and large-size liquid crystal display applications. This buffer amplifier employs a double cascade current mirror as the load of the rail-to-rail differential pairs. Since the cascode current mirror is a self-bias configuration, it cannot be operated under a wide range of power supply. An LCD driver should applicable to different power supplies [7]. In this work, a buffer amplifier, which can be operated under a wide range of power supply, is proposed. With increasing demand of high-speed high quality liquid crystal display and market in recent years we have to match with these requirements to fulfill the market demand and LCD driver generally contains shift registers, input register's, data latch, level shifter , digital to analog converter, Pre-Emphasis, and analog buffers the output buffer amplifier is strongly affects the speed, resolution, voltage swing and power dissipation For each pixel we need a buffer amplifier so as the number of pixel increases the number of buffers to drive to drive the panel increases, nowadays battery operated portable devices are used to increase the performance and to extend the battery life we need low-power high-speed buffer amplifier.

LCD output buffer amplifier are realized by operational amplifier in unity gain configuration generally RAIL TO RAIL operational amplifiers are used to get full output swing RAIL TO RAIL operation amplifiers are consist of complimentary differential amplifiers at first stage and a summing current source at second is stage with generally known as folded cascaded architecture then the output is stage which are this work in class B and class AB configurations inverting and non-inverting. These configurations place different requirements on the common-mode input range. The required range varies from almost zero to a full rail to rail. The differential amplifier is used as the input stage for operational amplifiers. The problem is that it will behave as a differential amplifier only over a limited range of common-mode input. Therefore, to make the operational amplifier versatile, its input stage should work for rail to rail.

CONCLUSION

This paper describes a new compact low-power high-speed buffer amplifier which is suitable for large-size LCD panel applications. The proposed output buffer can obtain fast driving capabilities with a limited quiescent current consumption by exploiting a slew detector which monitors the output voltage of the input differential.

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