Special Report

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Will We See a New Interface Standard for LCD Displays?

by Bob Welch, Texas Instruments, Inc.

The trend toward higher and higher resolutions in flat panel displays is pushing the capabilities of conventional interfaces (Parallel CMOS) for display drivers to the limit. The aggregate bandwidth requirement for state-of-the-art displays (e.g. UXGA and QXGA) is already in the range of 5 Mbps, and will increase in the near future. This necessitates a large number of connections between the timing controller and the display drivers. Electromagnetic interference (EMI) is also a consideration in designing the interface between the panel timing controller and column drivers. Historically, this interface has been a major source of EMI and power dissipation inside a panel due to the common use of TTL-level signaling on the bus.

The Need for a New Interface

A new intra-panel interface for Thin-Film-Transistor (TFT) Liquid Crystal Display (LCD) panels is being developed. Widely used in notebook computer applications and LCD monitors, the parallel CMOS interface between the panel-timing controller (TCON) and column driver is now in the midst of change. With this new interface, panel-interface technology has made significant strides toward the next generation of flat-panel displays. A number of vendors are developing technology to enable customers to take advantage of this new interface because it offers many added advantages.

The CMOS interface between the TCON and the source drivers is designed with a parallel bus. Its successor, this new intra-panel solution, is designed to transmit data serially. By transmitting this RGB data serially, customers can now reduce the number of traces required on the PCB board by approximately 40 to 60 percent. In addition, because it uses a bus width approximately one-third that of conventional technology, customers are able to reduce the size of circuit boards and, in many cases, eliminate discrete components (i.e. ferrite beads) typically used in TFT LCD modules.

Through this new high-speed intra-panel interface implementation, higher resolutions, lower power consumption and significantly reduced EMI can be achieved by sending data at low amplitudes of 200 mV rather than the typical 0V -3.3 V. By reducing the cost of the PCB, eliminating the need for discrete components, overall system cost is reduced. The conventional parallel CMOS interface, which has served well for low-resolution displays in the past, is no longer a viable solution for today's displays. See Figure 1.

Conventional Architecture

Low Voltage Differential Signaling (LVDS) technology has redefined data transmission at the physical layer interface where many of the critical bottlenecks occur in applications that require high bandwidths. The LVDS standard utilizes multiple differential pairs to transmit clock and data signals between an LVDS Tx and an LVDS Rx. Noise induced on one of the lines will also be induced on the other. The receiver is only concerned with the difference between these two signals. Any noise coupled onto the two wires appears as either common- or differential-mode noise and is rejected. It is also true for noise from other noise sources as long as the common-mode voltage does not go beyond the common-mode range of the receiver.

The conventional TFT LCD module input is typically through an LVDS interface. Historically, this interface has

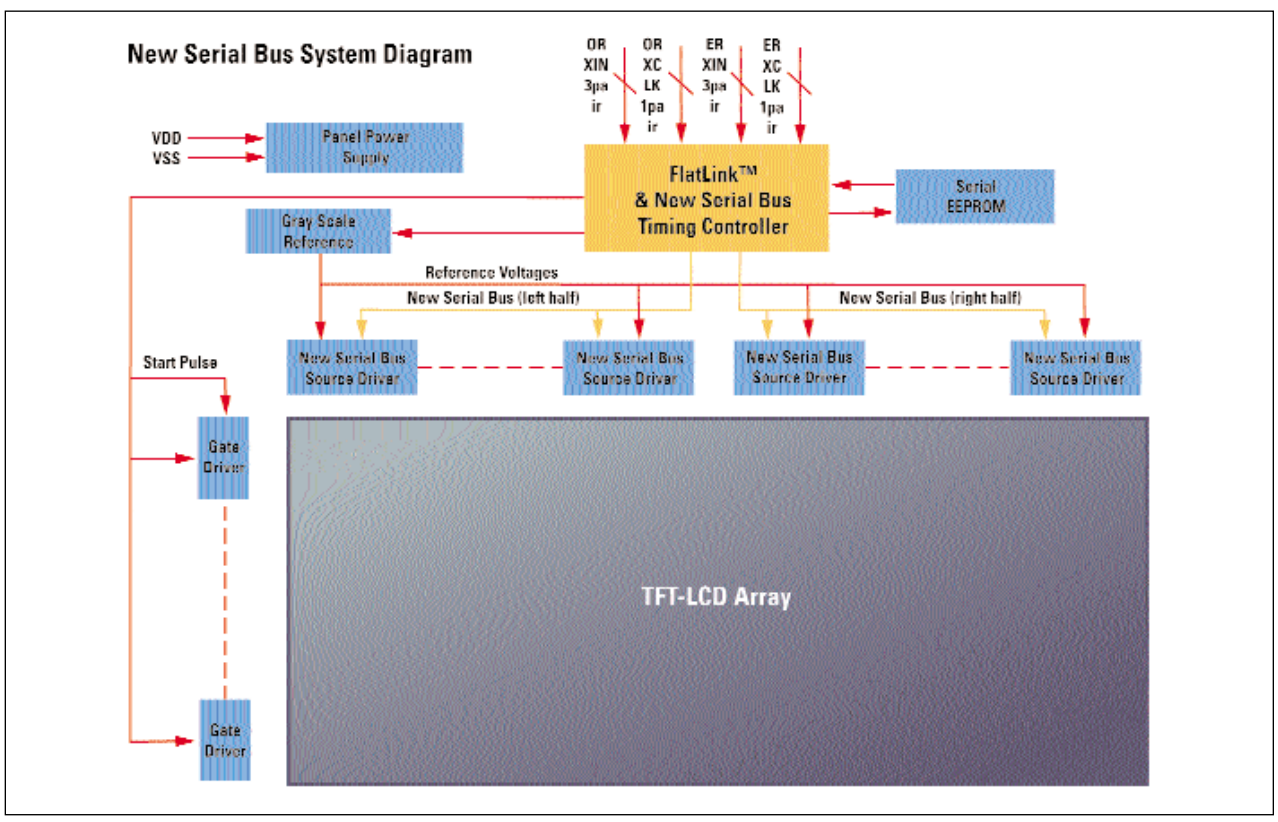

Figure 1. New Serial Bus System Diagram.

been implemented through a discrete LVDS receiver that interprets the incoming LVDS RGB data, clock and control signals from a graphics controller into a CMOS signal to the on-board panel TCON. (It is now common to find the LVDS Rx integrated with the TCON). Control signals inherent to the TFT LCD are then generated, which is normally produced based on custom-core logic within the TCON. Data from the TCON to the column drivers is routed via a parallel CMOS bus. The bus can be a dual-pixel bus or quad-pixel bus of 18 or 24 wires each, depending on the display architecture and color depth. Since this bus utilizes CMOS signals, data transfer rates for EMI and power consumption reasons have been limited to 65 MHz or less.

Standards as Cost Controllers

Data transmission standards evolved to meet two main needs: to transmit data reliably over long distances and to provide a standard interface to facilitate communication between equipment from different suppliers (i.e. to ensure interoperability). Semiconductor manufacturers must know the specifications and how to integrate the specifications into silicon to make catalog devices fully compatible with the standard and enable devices to communicate. Users then will achieve much more cost-effective methods of configuring the system so the equipment can communicate (cable lengths, signaling rates, etc.).

As an example, efforts to define and standardize a digital interface for video monitors, projectors and display support systems began in earnest in 1996. But the process moved rather slowly in ensuing years, causing concern among manufacturers desperate for a standard. One of the earliest widely used digital display interfaces is LVDS, a low speed, low voltage protocol optimized for the ultra-short cable lengths and stingy power requirements of laptop PC systems.

Efforts to transition LVDS to external desktop displays floundered when various chipmakers developed different, incompatible flavors of the technology. As a result, none achieved widespread acceptance. There are currently several industry standards that define LVDS including ANSI/TIA/EIA-644 (EIA-644) and IEEE 1596.3 which is used primarily for communication between processors and for grouping workstations into clusters. EIA-644 is more general purpose and application independent, and it provides a high bandwidth for higher transmission speeds with low noise and power consumption. EIA-644 is particularly well suited for interfacing high performance TFT LCD panels.

Choosing a Supplier

There is likely to be more than one standard. Inevitably the consumer will be the winner, gaining higher resolutions at a lower cost. To make that happen, many original equipment manufacturers are requiring more than one source for their ICs. But how does an OEM choose?

To make it easy for designers to work with them, a vendor should be breaking down barriers wherever possible, such as working with major players in the business of producing LCDs; providing a solution that is without licensing costs and is royalty-free, thereby making their technology available to other vendors; consulting with panel makers to ensure that solutions meet their needs; providing more choices of integration.

For example, the TFP74x3 mini-LVDS family is offered without licensing cost and is royalty-free. Features include resolutions from XGA up to QXGA; spread spectrum clocking; 6-bit and 8-bit video supports; reduced EMI; and reduced power consumption. Texas Instruments is currently working with IBM on this open standard.

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