New series of TFT display driver in mobile phone application

Author: Kyna Wong
Title: Product Application Engineer
Company: Solomon Systech Limited
Website: www.solomon-systech.com

Introduction

Today, mobile phones tend to be multifunctional and are no longer simply for communication purposes. While surfing for mobile phones in consumer markets, you could easily pick up a smartphone with a QVGA TFT-LCD and a two-megapixel camera. Your mobile phone could be your MP3, DSC, PDA, PMP and even portable TV. Thus, the mobile phone's display screen plays an important role in supporting various functions.

Two major areas related to the display screen require enhancement during the development of mobile phone applications. First, the display unit must upgrade panel response and display performance to support video streaming. This explains why most mobile phone displays are TFT LCD—to take advantage of faster response times and better visual performance. Second, communication between the display unit and the mobile phone system is critical to the enhancement of the efficiency and performance of the overall display system.

To support such requirements, a new series of single chip TFT LCD driver controllers are being introduced into the market to enhance competitiveness and flexibility. These include platform solutions from Solomon Systech for QCIF+ (SSD1278 and SSD1288) and QVGA (SSD1279 and SSD1289) resolutions. These ICs are made to build compatible solutions utilizing the same panel for auxiliary video interface or system interface. Users have the flexibility to choose their effective solution for dedicated applications in the shortest development time.

Compatible Solutions for Utilizing the Same LCD Panel

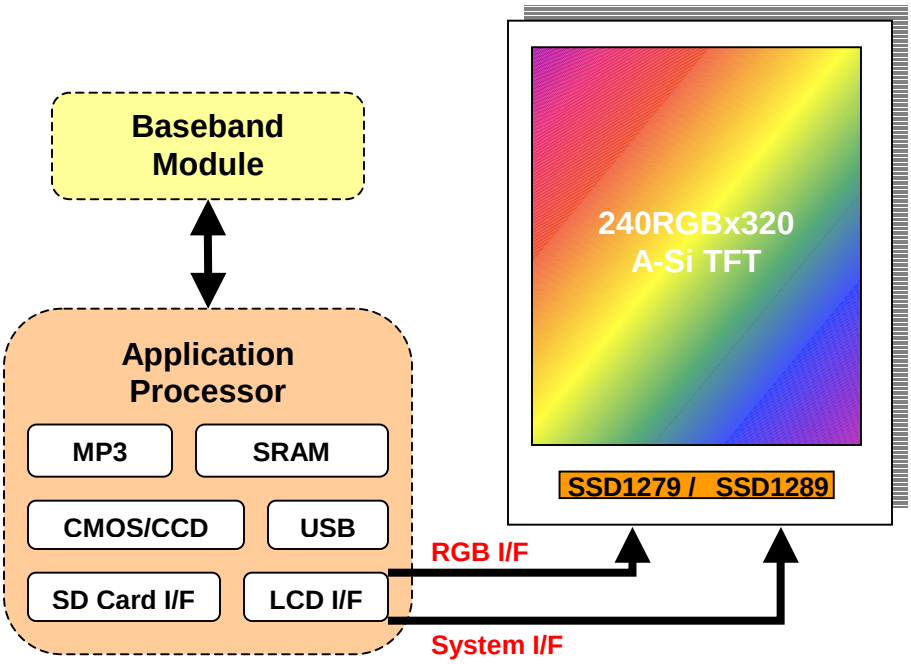


Figure 1: QVGA Application Block Diagram

In higher resolution displays such as the QCIF+ (176RGBx220) and QVGA (240RGBx320) or above, a powerful baseband system supports either a RGB parallel interface or CPU parallel interface for data transmission and command control. In the RGB parallel interface, the drivers are typically RAM-less and the display is real-time. For the traditional CPU parallel interface, the drivers have a built-in RAM and support graphics controls to display the image in some effects. To serve two kinds of communication, compatible solutions utilizing the same LCD panel are proposed to optimize the usage and cost of IC systems.

There are two ways to implement a compatible design: from either the IC pad layout design or from the panel layout design. With the IC pad layout design, such as the QCIF+ driver solutions from Solomon Systech, the new SSD1288 driver IC has a smaller die size than the existing SSD1278 driver IC, a result of finer fabrication technology. The IC design of the SSD1288 reuses the same pad locations as the SSD1278, such that the same panel may be applied for both ICs. This is accomplished through optimization of the bump size within the industrial standard while maintaining bonding quality. Ultimately, the SSD1288 and SSD1278 applications are interchangeable and transparent to module makers; module makers need only take care of alignment from differences in die sizes.

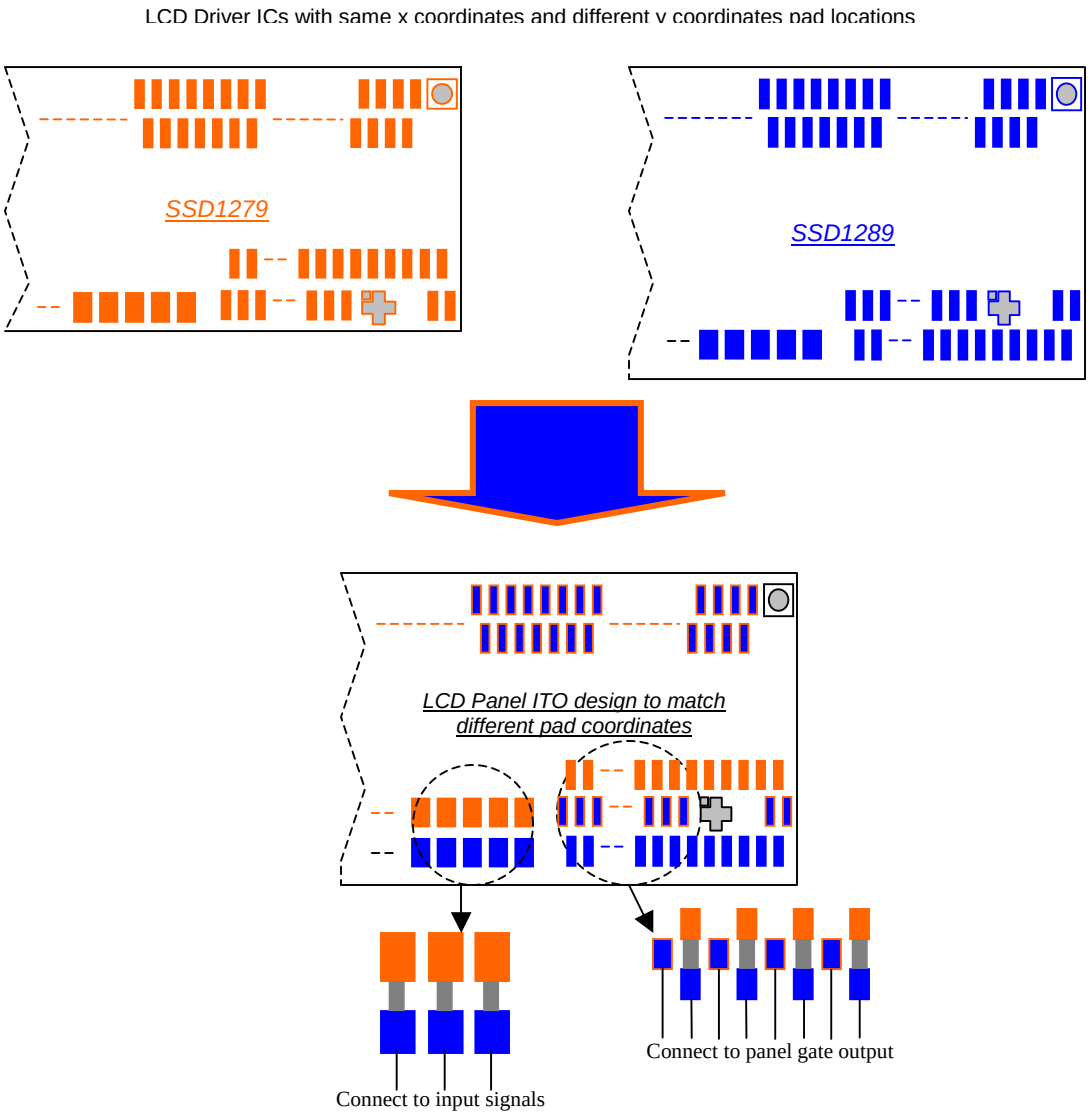


Figure 2: LCD panel ITO layout example to match IC pad coordinates design for compatibility

For the panel layout design technique for compatibility, such as the QVGA solutions from Solomon Systech, the input signals and certain gate output signals of the SSD1279 and SSD1289 driver ICs are positioned at the same X coordinates but at different Y coordinates. The ITO pad layout on panel can then be arranged as shown in Figure 2. This accommodates the applications of the two different ICs in one single panel design through the ITO linkage. It is worth noted that both SSD1279 and SSD1289 are designed with the same alignment marks also for compatibility during assembly.

Thus, panel layout may be designed for SSD127X and SSD128X as a platform. SSD127X supports the 18-bit RGB interface with SPI, while SSD128X supports both 18/16/9/8-bit system interfaces and 18/16/6-bit RGB interfaces. SSD128X consists of a

built-in RAM and requires higher technology to optimize the die size. Customers may now choose either the without-RAM solution for purely RGB interface applications to achieve higher cost effectiveness, or the build-in RAM solution for graphic control functions.

Mini-RGB Interface

In addition to compatibility design, an intermediate platform solution exists for mobile phone APIs (application program interfaces). Many High Speed Serial Interface (HSSI) standards exist in the industry. However, not all of them are well defined in the mobile phone system at this moment. To solve the adhoc demand for simplifying connections between the baseband system and the display module, a mini-RGB interface from Solomon Systech has been developed to support flexible connections in mobile phone systems. The first solution consists of SSD1270, a mini-RGB controller, and SSD1276, a single chip QCIF+ TFT driver with a mini-RGB interface.

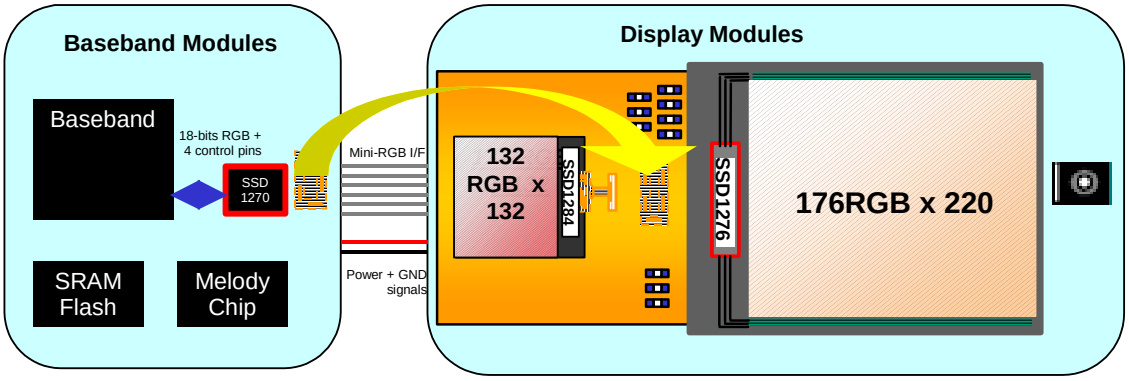


Figure 3: Mini-RGB Interface System Block Diagram

SSD1270 is a mini-RGB bridge chip, which provides an effective transmission solution enabling short-range communication with a display device using a TTL interface. SSD1270 is used to simplify the connections between a host processor and the display to reduce the cost of these connections, and simultaneously supports dual display panels with up to 262k colors. The controller directly communicates with a main display using SSD1276 and a sub-display in TFT/STN/OLED using a serial interface; data transmission can be used only in **6 WIRES**. SSD1270 embeds a DC-DC converter and voltage generator to provide the necessary voltage required by the display driver with minimum external components. The interface operates in the 1.4V to 3.0V range. A low-power standby mode is supported in the SSD1270 for extra power savings.

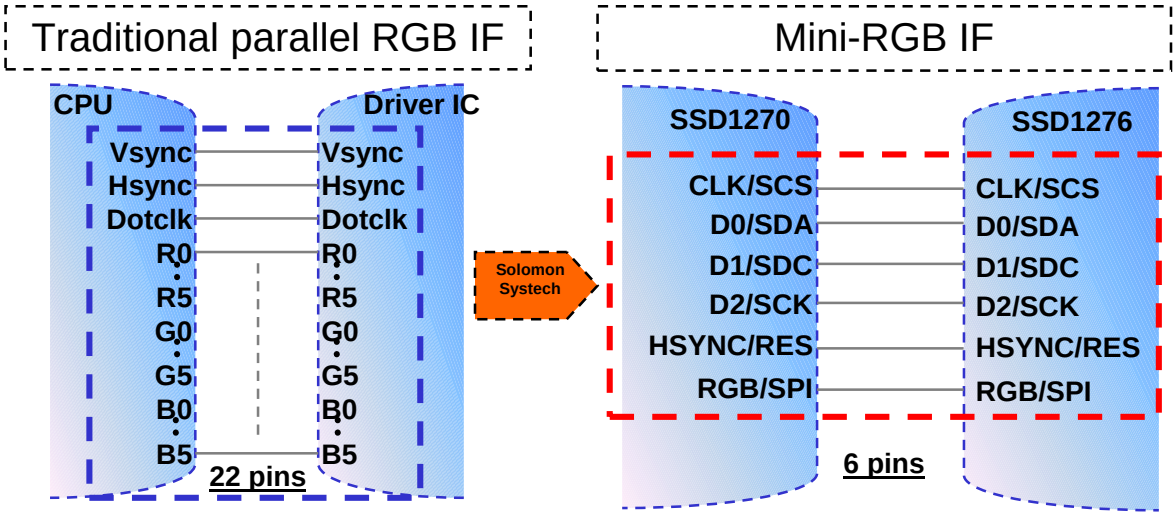
SSD1276 is a shrink and enhanced QCIF+ driver, supporting the traditional 18-bit RGB parallel interface with SPI and additionally, a mini-RGB interface. The SSD1276 integrates the power circuits, gate driver and source driver into a single chip and drives a 262k color a-TFT panel with resolution of 176 RGB x 220. SSD1276 embeds a DC-DC converter and voltage generator to provide the necessary voltage required by the driver

with minimum external components. A Common Voltage Generation Circuit is included to drive the TFT-display counter electrode. Also included is an Integrated Gamma Control Circuit that can be adjusted by software commands to provide maximum flexibility and optimal display quality, and provides a serial output interface to control the sub-display driver.

Advantages of the Mini-RGB Interface

Reduces the number of data transmission lines

The SSD1270 supports a higher transfer rate for communication data in only a few signal lines, at the same time controlling power consumption. Its design is implemented in 6 wires to achieve a flexible module design especially in twisted mobile phone applications which connection is made in a flip type.

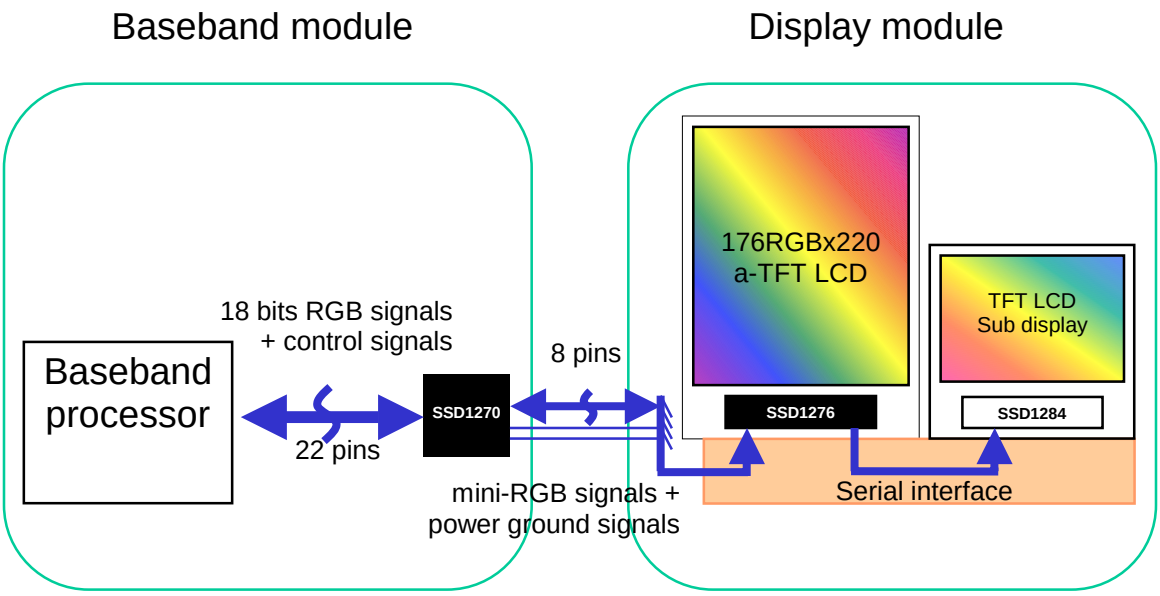


Low power consumption and EMI noise

Mini-RGB enables low power consumption communications via the company's original serial transfer technology, and achieves lower EMI noise by implementing a reduced data switching and double data rate (DDR) scheme. In addition, mini-RGB applies lower voltage in the transmission line with strew rate control to resolve EMI problems in TTL interface design. It is suitable for high LCD resolutions and a simplified EMI design in mobile phone applications.

Control main and sub display through single interface

SSD1270 can be a single interface referring the Baseband processor but controls the display module with main and sub displays. A RGB/SPI pin controls the interface passing RGB data or command control data. The device toggles to the main driver or the sub display through software settings and hardware pin selection. This is an effective way to control the display module with fewer signal lines and is the simplest interface control.



Conclusion

Trends in mobile TFT LCD technology will go towards higher resolution, quality and physically larger panel sizes. To catch up to the requirements, a newly developed series of single chip mobile display drivers with advanced features from Solomon Systech accomplishes these different applications. The mobile display drivers also adopt innovative technologies, such as a mini-RGB interface. They are introduced to the display industry whilst contributing to the phone design house that will optimize module communication.