TI Designs: TIDA-00169
Automotive TFT LCD Display Solution

System Description

This design implements a video over LVDS solution for automotive infotainment applications.It highlights the support of multi-touch with haptic feedback, LCD backlight control, and ambient light sensing, without the introduction of dedicated support lines back to the host processor. This design is implemented using two boards. The main electronics board, SAT0059 is where the deserializer, microProcessor, backlight controller, haptics drivers and power supply are located. The LCD interface board, SAT0096, is a physical and electrical interface to a specific LCD panel. It connects to the SAT0059 through a Samtec board to board connector and provides connection points for the LCD panel, touchscreen, backlight connections and haptic drivers. The SAT0096 is designed for a Microtips UMSH-8596MD-20T display. If a different display is to be used, a new LCD Interface board would likely need to be designed.

Featured Applications

- Front Seat Infotainment Systems
- Rear Seat Entertainment Systems

Design Resources

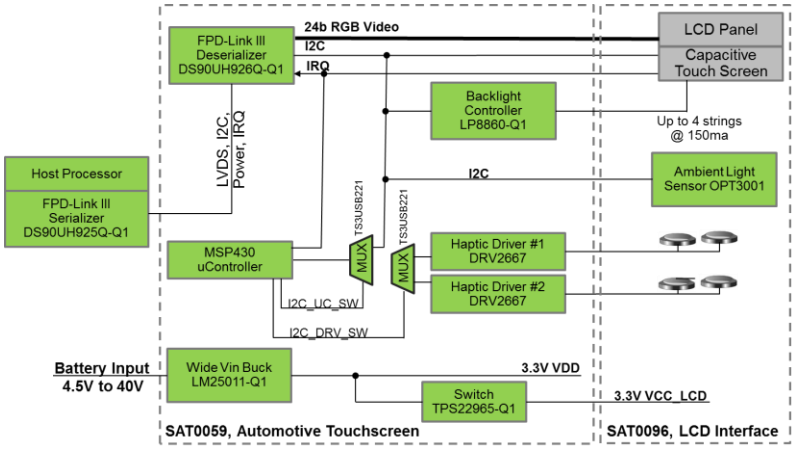
- Block Diagram and Schematic
- Test Data
- Gerber Files
- Design Files
- Bill of Materials and design considerations
- Wiki Page

Design Features

- Wide input voltage range: off battery 4.5V to 40V power supply
- All video and support communications through LVDS
  - Supporting 24 bit RGB Video
  - 400kbit back channel I2C connection for multi-touch input
- Multi-touch input supported via 400Kbit back channel I2C connection
- Haptic feedback
- State of art I2C/SPI interface LED backlighting controller with dimming ratio of >10,000:1, switching frequency ~2.2MHz, hybrid dimming and saftey and fault tolerances/functions
- Backlight adjustable to inputs
  - Ambient light sensor
  - Thermistor inputs on the LCD and the back light to enable thermal protection

Board Photo

Block Diagram



Jump start system design and speed time to market

Comprehensive designs include schematics or block diagrams, BOMs, design files and test reports by experts with deep system and product knowledge. Designs span TI's portfolio of analog, embedded processor and connectivity products and supports a board range of applications including industrial, automotive, medical, consumer, and more. To explore the designs, go to http://www.ti.com/tidesigns

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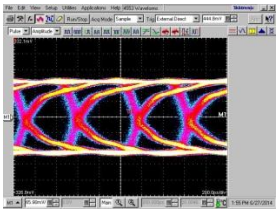
Associated Part Numbers

Part Number	Part Description	EVM
DS90UH925Q-Q1	Automotive FPD-LINK III Multi-Channel Digital Video Serializer	EVM
DS90UH926Q-Q1	Automotive FPD-LINK III Multi-Channel Digital Video Deserializer	EVM
DRV2667	Piezo Haptic Driver with Boost and Digital Front End	EVM
TPS22965-Q1	Automotive 4A, 5.5V, 16mΩ on resistance load switch	EVM
LM25011-Q1	Automotive Wide Vin Non-sync Buck Regulator	EVM
LP8860-Q1	LED Backlighting Controller	EVM

Design Considerations:

1. In the SAT0059 reference board:
    a. First stage asynchronous buck converter LM25011-Q1 was selected based on its wide VIN range off battery 6V to 40V, 2A output current capability, and switching frequency set to 2MHz to avoid the AM band interference and duty cycle close to 100%.
    b. TPS22965-Q1 load switch is used to quickly isolated the one 3.3V versus the other because 3.3V supply to MSP430 needs to be on for standby.
    c. MSP430 on the roadmap for automotive qualification was chosen with the ability to implement I2C capability.
    d. State of art I2C/SPI interface LED LP8860 backlighting controller with dimming ratio of >10,000:1, switching frequency ~2.2MHz can easily supports up 12-14" LCD screen due to the fact that it can drive 4 LED strings with each string up to 150mA. It also has the capability to do hybrid dimming to better light efficient and to have saftey and fault diagonotics which is important for automotive applications.
    e. DRV2667 haptics driver on the roadmap for automotive qualification was selected to have the capability to drive piezo haptic actuator and vibrate the screen to let the user know where they are on the screen and keep the driver eyes on the road.
    f. DS90UH925Q-Q1 and DS90UH926Q-Q1 FPD-LINK III serializer and deserializer are chosen to support 720P with content protection, two I2S audio channel, 24bit RGB video and 400kbit I2C. It also can have adaptive equalizer, dithering, and white patterns function to have more vivid video.
2. In the SAT0085 reference board:
    a. LCD Panel has an integrated LCD bias with a capacitor touch screen to support multi-touch.
    b. Ambient light sensor OPT3001 on the roadmap for automotive qualification is to sense the ambient light and send an I2C to control the brightness of LP8860.
    c. Piezo haptic actuators are placed haptics driver to vibrate the LCD screen.
3. Below is a graph to show the eye diagram captured when LED backlighting and Haptics Driver are on with FPD-LINK III with 3m of STP cable.



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