S1D/S2D13515 LCD Controller   April 2009

The S1D/S2D13515 is a highly integrated LCD Controller targeted at the embedded and automotive markets. It advances on the successes of other Epson LCD controllers by embedding a proprietary 32-bit RISC CPU and associated accelerator blocks to achieve an increase in flexibility and functionality over previous designs. Routines are provided allowing for audio playback, 2D BitBLT operations, warp and filtering operations, and the ability to offer OpenGL-ES 1.1 support. In particular, the Warp Logic functions make this an ideal solution for the automotive Heads-Up Display (HUD) market, or pseudo 3D navigation displays.

The S1D/S2D13515 is an affordable, low power device which uses a flexible external SDRAM memory interface to provide its frame buffer. It supports a wide variety of CPU interfaces and LCD panel outputs, including Double Display panels, which makes it an excellent choice for instrumentation or center cluster applications.

■ FEATURES

- Indirect and Direct CPU interfaces
- SPI or I2C Host interface
- External SDRAM Memory interface
- Can display 2 RGB panels simultaneously (some restrictions apply)
- Support for Double Display panels
- Programmable resolutions and color depths up to 32 bpp
- Video Input / Camera Port supporting flexible configurations of 8-bit Cameras and RGB input streams
- Sprite Engine with up to 8 sprites
- Multiple windows supporting Alpha Blending, Double Buffering, and Horizontal Flip
- Warp logic for HUD projection correction or other distortion compensation

- 32-bit embedded RISC processor with accelerator blocks
  - Audio playback (WAV, Ogg Vorbis, etc.)
  - OpenGL-ES 1.1 compliant
  - 2D BitBLT Acceleration with API
  - Programmable startup sequence without Host
- 2 channel PWM
- I2S and I2C outputs
- SPI Flash Memory Interface
- Keypad interface (5x5 matrix support)
- Temperature range:
  - S1D13515: -40 to +85 °C
  - S2D13515: -40 to +105 °C
- Package: QFP22-256 and PBGA1U-256

■ SYSTEM BLOCK DIAGRAM
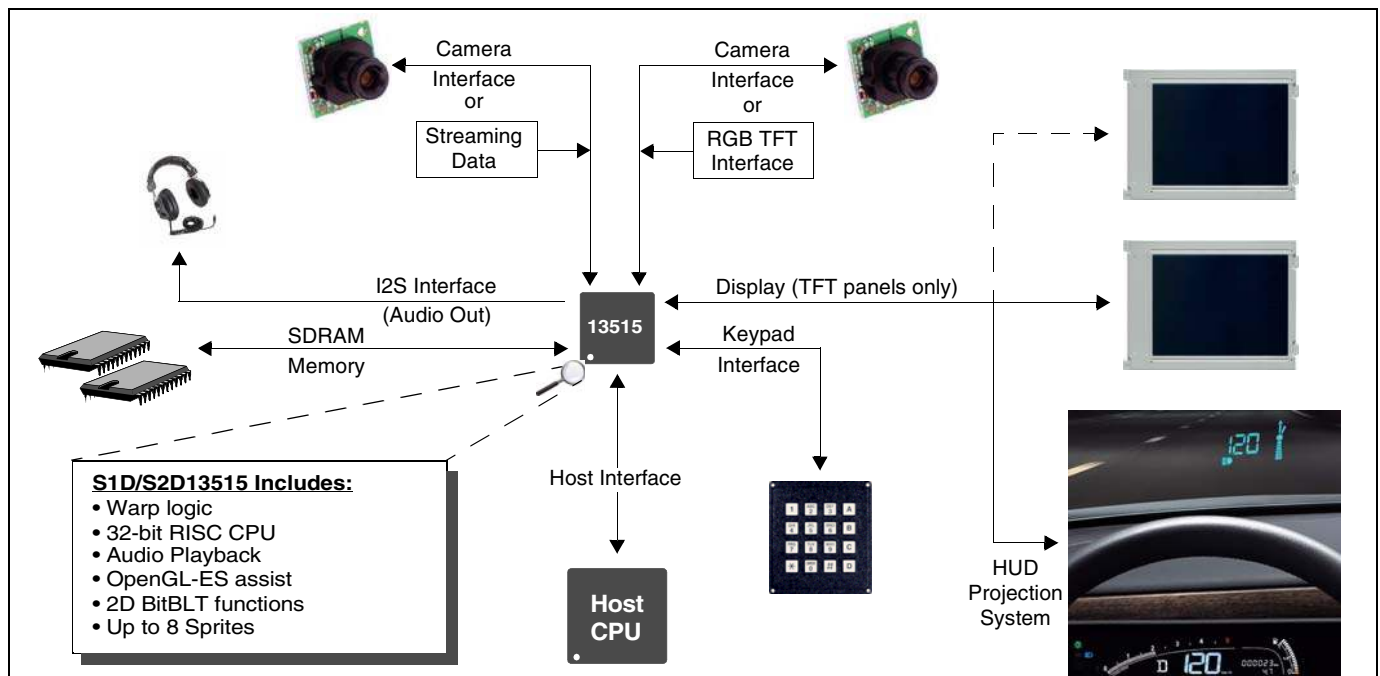
■ DESCRIPTION

External Display Buffer

- Uses external SDRAM as display buffer
- Supports x32 SDRAM interface (Size: 16/32/64M byte)
- SDRAM clock: 100MHz
- External memory is accessible by the internal and Host CPUs
- Provides configurable linear access to memory in 4M byte paging windows

CPU Interface

- Direct/indirect interface support for most popular CPU interfaces
- SPI or I2C Host Interface
- Supports 25MHz Host bus clock

Display Support

- Single or Dual panel implementations (Dual can have independent images)
- Color TFT Panel with optional serial command interface
- EID and Sharp Double Display Panels
- NTSC/PAL TV Output can be realized by using an external video encoder such as the Epson S1D13746
- Color Depths: 8/16/24 bpp
- Target resolutions / Color Depths:
    - 800x480 + 320x240 simultaneous @ 24 bpp, 60Hz
    - 1024x768, 24 bpp, 60Hz

Display Features

- Warp logic corrects projection anomalies on HUD
- Multiple Windows (Layers) support:
    - Horizontal Flip
    - Double Buffering
    - Alpha Blending
- Sprite Engine supports up to 8 sprite layers with Alpha blending and transparency
- Interrupts available
    - Supports maskable non-display (Vsync) interrupt
    - Supports delayed version of Vsync Interrupt

Embedded CPU

- Embedded CPU Speed: 50MHz (typical)
- 32-bit RISC CPU can be used for:
    - Audio decode (Supported Codecs: MP3, AAC, WAV, ADPCM, Ogg Vorbis)
    - 2D BitBLT Acceleration with API
    - OpenGL-ES assist (OpenGL-ES v1.1 compliant)
    - OEM defined functions

Digital Video

- Video Input / Camera port supporting either 1x 8-bit camera, 2x 8-bit cameras, 1x RGB data stream, 2x RGB data streams, simultaneous 1x 8-bit and 1x RGB data stream input (when second camera input is used only single panel is available)
    - Supports ITU-R BT.656 YUV format
    - Supports down-scaling of the video input stream
    - Captures YUV data into SDRAM as RGB format

Miscellaneous

- Internal System Speed: 50MHz typical
- 2 channel PWM for backlight control
- I2C Interface (typically used for Camera)
- I2S Interface (typically used for audio output)
- SPI Flash Memory Interface
- Keypad Interface with 5 x 5 matrix support
- General Purpose IO pins available
- Flexible Clock Structure:
    - Two embedded PLLs
    - Built-in crystal input
    - Digital clock input
    - Clocks dynamically turned off for power saving
- Operating Temperature Range:
    - S1D13515: -40 to +85 °C
    - S2D13515: -40 to +105 °C
- CORE$_{VDD}$ 1.8 volts and IO$_{VDD}$ 3.3 volts
- Package: QFP22-256 and PBGA1U-256
- S1D13515 also available (non-automotive specification)

CONTACT YOUR SALES REPRESENTATIVE FOR THESE COMPREHENSIVE DESIGN TOOLS

- Technical Documentation
- CPU Independent Software Utilities
- Evaluation Boards
- Royalty Free source level driver code

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