

## Embedded Memory Graphics LCD Controller

### ■ DESCRIPTIONS

The S1D13709 is a simple, multi-purpose Graphics/Text LCD Controller with 32KByte embedded SRAM display buffer which supports both TFT and STN panels. Designed as a functional replacement for the S1D13700, the S1D13709 has a TFT interface supported up to WVGA panel. Also from software point of view, a system using STN panel designed with the S1D13700 can be easily migrate to a TFT panel system with the S1D13709 because the register set of the S1D13709 is fully compatible with the S1D13700.

The S1D13709 allows layered text and graphics, scrolling of the display in any direction, and partitioning of the display into multiple screens. It includes 32K bytes of embedded SRAM display memory which is used to store text, character codes, and bit-mapped graphics. The S1D13709 handles display controller functions including: transferring data from the controlling microprocessor to the buffer memory, reading memory data, converting data to display pixels, and generating timing signals for the LCD panel.

The S1D13709 is designed with an internal character generator which supports 160, 5x7 pixel characters in internal mask ROM (CGROM) and 64, 8x8 pixel characters in character generator RAM (CGRAM). When the CGROM is not used, up to 256, 8x16 pixel characters are supported in CGRAM.

### ■ FEATURES

#### CPU Interface

- 8-bit CPU data bus interface
- Direct/Indirect address bus support

#### Display Support

- STN-LCD interface
  - Display mode:
    - 4-bit gray scale
  - Maximum support size:
    - 640x240 at 1 bpp
    - 320x240 at 2 bpp
    - 240x160 at 4 bpp
- TFT-LCD interface
  - Display mode:
    - 4-bit gray scale, 16 color palette
  - Resolutions up to:
    - 800x480 using up-scaler

#### Display Features

- Gray Shade Support for:
  - 1/2/4 bit-per-pixel (up to 16 gray shades)
- Text, graphics, and combined text/graphics display modes
- Three overlapping screens in graphics mode
- Programmable cursor control (Hardware Cursor)
- Smooth horizontal and vertical scrolling of all or part of the display
- Character ROM/RAM
  - 160, 5x7 pixel characters in embedded mask-programmed character generator ROM
  - Up to 256, 8x16 pixel characters in embedded character generator RAM
- Up-scaler for TFT interface

#### Pre-programmed setting for TFT typical resolution

- Software for S1D13700 can be used without re-design

#### Memory Interface

- Embedded 32K byte SRAM display buffer

#### Clock

- Two terminal crystal or Single Oscillator input
- Embedded PLL to generate TFT clock

#### Power

- Software initiated Power Save Mode
- Low power consumption
- Flexible Power Supply configuration:
  - CORE<sub>VDD</sub> 3.0 to 5.5 volts.
  - PLL<sub>VDD</sub> 3.0 to 5.5 volts.
  - NIO<sub>VDD</sub> 3.0 to 5.5 volts (LCD interface).
  - HIO<sub>VDD</sub> 3.0 to 5.5 volts (CPU interface).

#### Operating Temperature Range

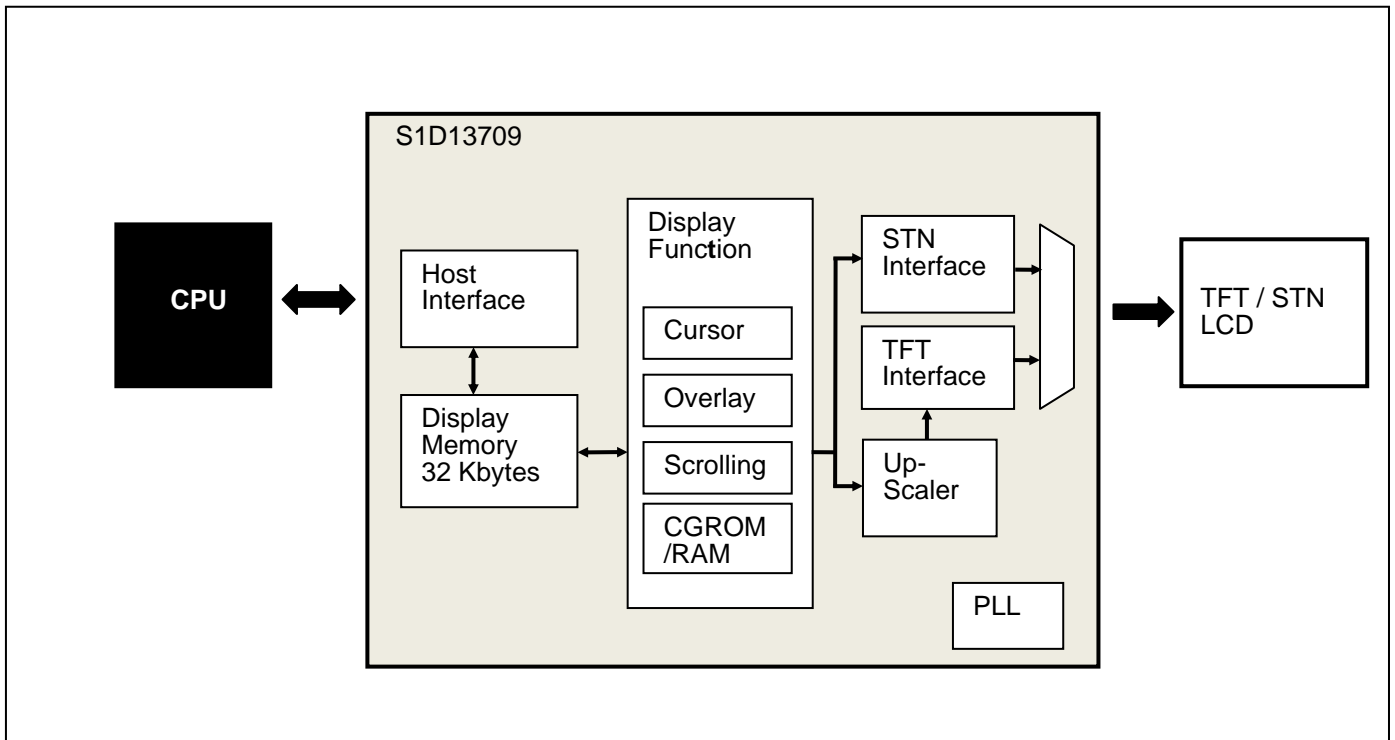
- -40 ~ 85°C

#### Package

- TQFP14- 80pin, 0.5mm pin pitch

# S1D13709

## FUNCTIONAL BLOCK DIAGRAM



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