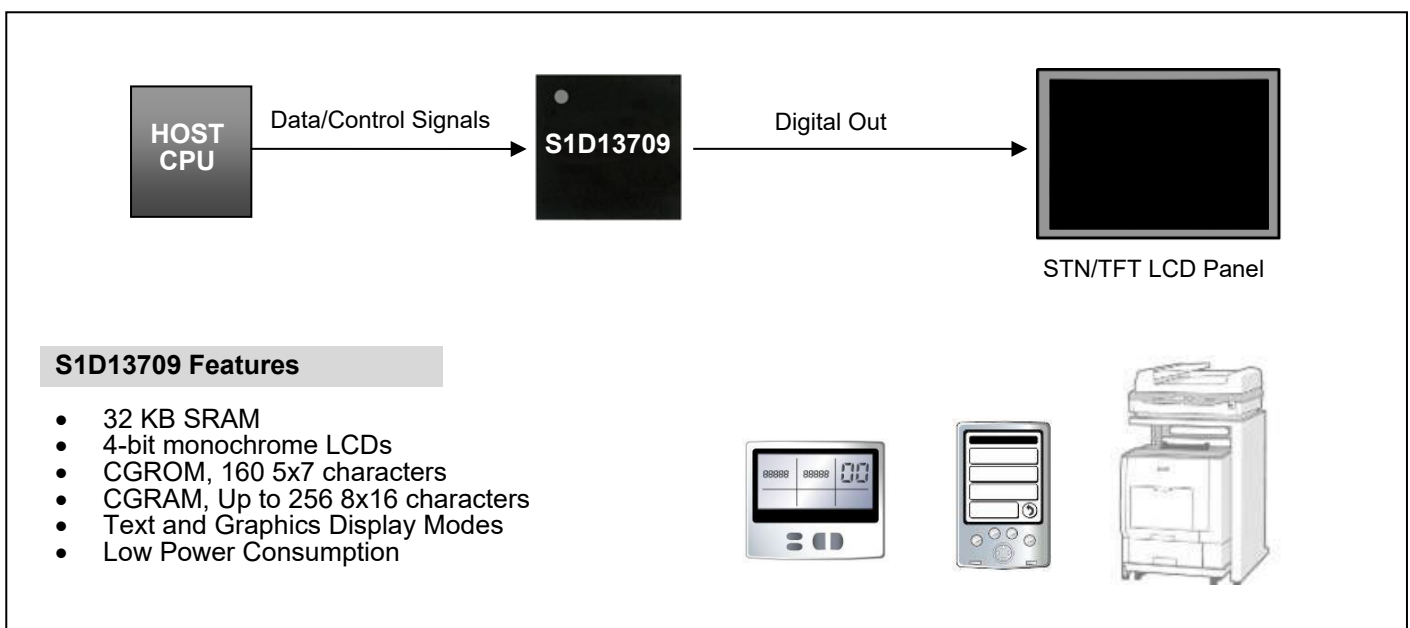# EPSON

S1D13709

Graphics LCD Controller w/ CGROM

The S1D13709 is a simple, multi-purpose graphics/text LCD controller with 32 KB embedded SRAM display buffer which supports both TFT and STN panels. The S1D13709 has a TFT interface supporting up to WVGA panels. The register set of the S1D13709 is fully compatible with the S1D13700. Designed as a functional replacement for the S1D13700, from a software point of view, a system using an STN panel designed with the S1D13700 can be easily migrated to a TFT panel system with the S1D13709.

The S1D13709 allows layered text and graphics, scrolling of the display in any direction, and partitioning of the display into multiple screens. The 32 KB of embedded SRAM display memory is used to store text, character codes, and bit-mapped graphics. The S1D13709 handles display controller functions such as: 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

- Embedded 32 KB display buffer
- Direct and indirect CPU interfaces
- 8-bit data bus width
- Supports 4-bit STN/TFT LCDs
- Example Resolutions:
- 640x240@1bpp
- 320x240@2bpp
- 240x160@4bpp
- Low power consumption

- Color / Gray shade support for 1/2/4 bpp
- Text, graphics, and combined text/graphics display mode
- 160, 5x7 pixel characters in embedded CGROM
- Up to 256, 8x16 pixel characters in CGRAM
- Overlapping Screens (up to 3)
- Programmable Cursor
- Temperature range: -40° ~ 85°
- Package: QFP14-80pin

■ SYSTEM BLOCK DIAGRAM

| HOST CPU | Data/Control Signals → | S1D13709 | Digital Out → | STN/TFT LCD Panel |

S1D13709 Features

- 32 KB SRAM
- 4-bit monochrome LCDs
- CGROM, 160 5x7 characters
- CGRAM, Up to 256 8x16 characters
- Text and Graphics Display Modes
- Low Power Consumption

S1D13709

■ DESCRIPTION

Display Memory
- Embedded 32 KB SRAM display buffer

CPU Interface
- 8-bit CPU data bus interface
- Direct/indirect address bus support

Pre-programmed Setting for TFT Typical Resolution
- Software for S1D13700 can be used without re-design

Clock
- Two terminal crystal or single oscillator input
- Embedded PLL to generate TFT clock

Display Support
- STN-LCD interface
  - 4-bit gray scale
  - Maximum support size:
    - 640x240@1bpp
    - 320x240@2bpp
    - 240x160@4bpp
- TFT-LCD interface
  - 1/2/4 bpp color depths
  - Resolutions up to 800x480 using up-scaler

Display Features
- Color / Gray shade support for 1/2/4 bpp
- Text, graphics, and combined text
- 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

Miscellaneous
- Software initiated power save mode
- Lower power consumption
- Flexible power supply configuration:
  - COREVDD 3.0 to 5.5 volts
  - PLLVDD 3.0 to 5.5 volts
  - NIOVDD 3.0 to 5.5 volts (LCD interface)
  - HIOVDD 3.0 to 5.5 volts (CPU interface)
- Operating Temperature Range: -40° ~ 85°C
- QFP14 80-pin, 0.5mm pin pitch

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Seiko Epson Corporation

Sales & Marketing Division

EPSON semiconductor website

global.epson.com/products_and_drivers/semicon/

MD Sales & Marketing Department
JR Shinjuku Miraina Tower, 4-1-6 Shinjuku,
Shinjuku-ku, Tokyo 160-8801, Japan

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