S1D13709

EPSON

Graphics LCD Controller w/ CGROM

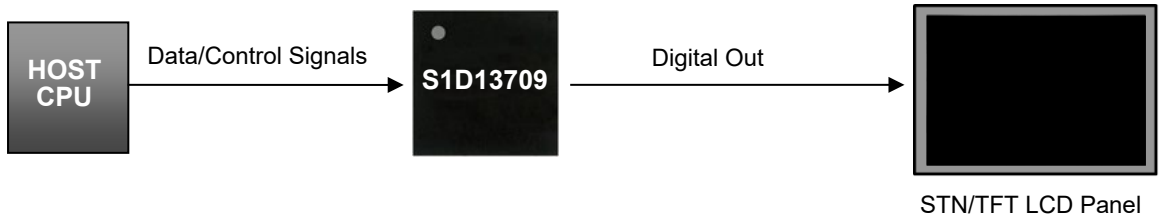
The S1D13709 is a simple, multi-purpose graphics/text LCD controller with 32 KB embedded SRAM display buffer which supports both TFT and STN panels. The S1D13709 has a TFT interface supporting up to WVGA panels. The register set of the S1D13709 is fully compatible with the S1D13700. Designed as a functional 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



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

■ 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

NOTICE: PLEASE READ THE FOLLOWING NOTICE CAREFULLY BEFORE USING THIS DOCUMENT

The contents of this document are subject to change without notice.

1. This document may not be copied, reproduced, or used for any other purpose, in whole or in part, without the consent of the Seiko Epson Corporation (“Epson”).
2. Before purchasing or using Epson products, please contact our sales representative for the latest information and always be sure to check the latest information published on Epson’s official web sites and other sources.
3. Information provided in this document such as application circuits, programs, usage, etc., are for reference purposes only. Using the application circuits, programs, usage, etc. in the design of your equipment or systems is your own responsibility. Epson makes no guarantees against any infringements or damages to any third parties’ intellectual property rights or any other rights resulting from the information. This document does not grant you any licenses, intellectual property rights or any other rights with respect to Epson products owned by Epson or any third parties.
4. Epson is committed to constantly improving quality and reliability, but semiconductor products in general are subject to malfunction and failure. By using Epson products, you shall be responsible for your hardware. Software and systems must be designed well enough to prevent death or injury as well as any property damage even if any of the malfunctions or failures might be caused by Epson products. When designing your products using Epson products, please be sure to check and comply with the latest information regarding Epson products (this document, specifications, data sheets, manuals, Epson’s web site, etc.). When using the information included above materials such as product data, charts, technical contents, programs, algorithms and application circuit examples, you shall evaluate your products both on a stand-alone basis as well as within your overall systems. You shall be solely responsible for deciding whether or not to adopt and use Epson products.
5. Epson has prepared this document and programs provided in this document carefully to be accurate and dependable, but Epson does not guarantee that the information and the programs are always accurate and complete. Epson assumes no responsibility for any damages which you incur due to misinformation in this document and the programs.
6. No dismantling, analysis, reverse engineering, modification, alteration, adaptation, reproduction, etc., of Epson products is allowed.
7. Epson products have been designed, developed and manufactured to be used in general electronic applications (office equipment, communications equipment, measuring instruments, home electronics, etc.) (“General Purpose”) and applications which is individually listed in this document or designated by Epson (“Designated Purpose”). Epson products are NOT intended for any use beyond the General Purpose and Designated Purpose uses that requires particular/higher quality or reliability in order to refrain from causing any malfunction or failure leading to death, injury, serious property damage or severe impact on society, including, but not limited to those listed below (“Particular Purpose”). Therefore, you are advised to use Epson products only for General Purpose and Designated Purpose uses. Should you desire to buy and use Epson products for a Particular Purpose, Epson makes no warranty and disclaims with respect to Epson products, whether express or implied, including without limitation any implied warranty of merchantability or fitness for any Particular Purpose. Please be sure to contact our sales representative and obtain approval in advance.

   [Examples of Particular Purpose]
   Space equipment (artificial satellites, rockets, etc.) /
   Transportation vehicles and their control equipment (automobiles, aircraft, trains, ships, etc.) /
   Medical equipment / Relay equipment to be placed on ocean floor /
   Power station control equipment / Disaster or crime prevention equipment / Traffic control equipment / Financial equipment

   Other applications requiring similar levels of reliability as those listed above. Please be sure to contact our sales representative for details of the other applications.
8. Epson products listed in this document and our associated technologies shall not be used in any equipment or systems that laws and regulations in Japan or any other countries prohibit to manufacture, use or sell. Furthermore, Epson products and our associated technologies shall not be used for developing weapons of mass destruction, or any other military purposes or applications. If exporting Epson products or our associated technologies, you shall comply with the Foreign Exchange and Foreign Trade Control Act in Japan, Export Administration Regulations in the U.S.A. (EAR) and other export-related laws and regulations in Japan and any other countries and follow the required procedures as provided by the relevant laws and regulations.
9. Epson assumes no responsibility for any damages (whether direct or indirect) caused by or in relation with your non-compliance with the terms and conditions in this document.
10. Epson assumes no responsibility for any damages (whether direct or indirect) incurred by any third party that you assign, transfer, loan, etc., Epson products to.
11. For more details or other concerns about this document, please contact our sales representative.
12. Company names and product names listed in this document are trademarks or registered trademarks of their respective companies.

Rev. e1.4, 2023. 4

Seiko Epson Corporation

Sales & Marketing Division

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

EPSON semiconductor website

global.epson.com/products_and_drivers/semicon/

Document code: XA8A-C-001-01.3
First issue August 2013
Revised September 2023