

## S1D13A05 LCD/USB Companion Chip

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The S1D13A05 is an LCD/USB solution designed for seamless connection to a wide variety of microprocessors. The S1D13A05 integrates a USB slave controller and an LCD graphics controller with an embedded 256K byte SRAM display buffer. The LCD controller supports all standard panel types and multiple TFT types eliminating the need for an external timing control IC. The S1D13A05 includes a Hardware Acceleration Engine to greatly improve screen drawing functions and the built-in USB controller provides revision 1.1 compliance for applications requiring a USB client. This high level of integration provides a low cost, low power, single chip solution to meet the demands of embedded markets requiring USB client support, such as Mobile Communications devices and Palm-size PCs.

The S1D13A05 utilizes a guaranteed low-latency CPU architecture that provides support for microprocessors without READY/WAIT# handshaking signals. The 32-bit internal data path, write buffer and the Hardware Acceleration Engine provide high performance bandwidth into display memory allowing for fast display updates.

Additionally, products requiring a rotated display can take advantage of the SwivelView™ feature which provides hardware rotation of the display memory transparent to the software application. The S1D13A05 also provides support for “Picture-in-Picture Plus” (a variable size Overlay window).

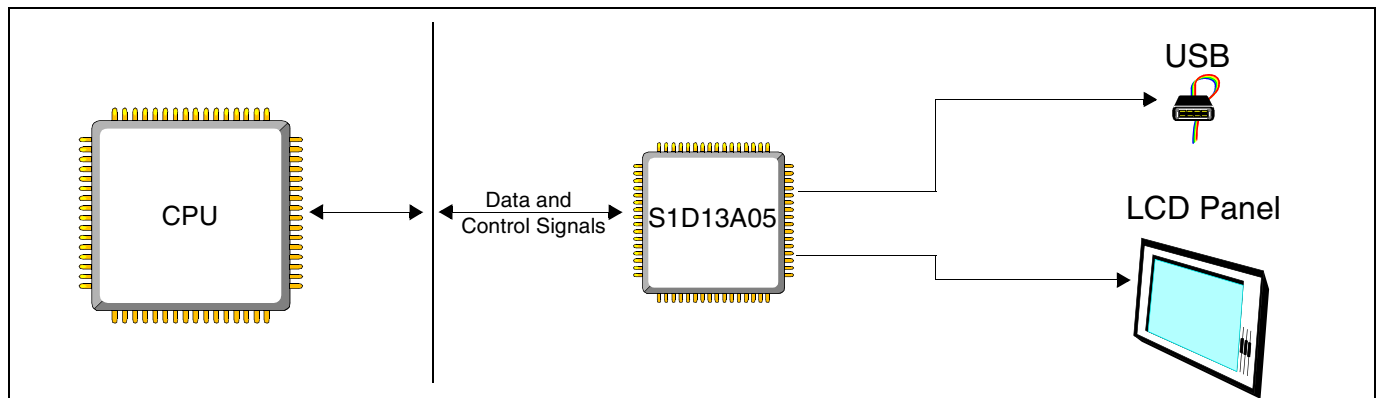
The S1D13A05, with its integrated USB client, provides impressive support for Palm OS® handhelds. However, its impartiality to CPU type or operating system makes it an ideal display solution for a wide variety of applications.

### ■ FEATURES

- Embedded 256KB Display Buffer.
- Low Operating Voltage.
- Low-latency CPU interface.
- Direct support for multiple CPU types.
- Programmable resolutions and color depths.
- Passive LCD support.
- Active Matrix LCD support.
- Extended TFT interfaces (Type 2, 3, 4).
- ‘Direct’ Sharp HR-TFT support (including Mode 2).
- ‘Direct’ Casio TFT support.
- USB Client, Revision 1.1 compliant.
- SwivelView™ (90°, 180°, 270° hardware rotation of displayed image).
  - (Patent # 5,734,875 - Patent # 5,956,049 - Patent #6,262,751)
- “Picture-in-Picture Plus”.
- Pixel Doubling.
- Hardware Acceleration Engine.
- Software Initiated Power Save Mode.
- 48MHz crystal for USBCLK.
- Software Video Invert.
- 121-pin PFBGA and 128-pin QFP5 packages.



### ■ SYSTEM BLOCK DIAGRAM



## S1D13A05

### DESCRIPTION

#### Memory Interface

- Embedded 256K byte SRAM display buffer.

#### CPU Interface

- 'Fixed' low-latency CPU access times.
- Direct support for:
  - Hitachi SH-4 / SH-3.
  - Motorola M68xxx (REDCAP2, DragonBall, ColdFire).
  - Motorola Dragonball SZ support (66MHz)
  - MPU bus interface with programmable READY.

#### Integrated USB Features

- USB Client, Revision 1.1 Compliant.

#### Power Down Modes

- Software Initiated Power Save Mode.

#### Operating Voltage

- $CORE_{VDD}$  2.0 ± 10% volts or 2.5 ± 10% volts.
- $IO_{VDD}$  3.3 ± 10% volts.

#### Clock Source

- Three independent clock inputs including dedicated USB clock (single clock possible if USB not required).
- 48MHz crystal oscillator for USBCLK.

#### Package

- 121-pin PFBGA
- 128-pin QFP5

#### Integrated LCD Controller Features

- 1/2/4/8/16 bit-per-pixel (bpp) support.
- Up to 64 gray shades on monochrome passive panels.
- Up to 64K colors on passive/active matrix panels.
- Single-panel, single-drive passive displays.
  - 4/8-bit monochrome and 4/8/16-bit color interfaces.
- 9/12/18-bit Active matrix TFT interface.
- 'Direct support for multiple TFT interfaces (Epson, Sharp, Type 2, 3, 4, external timing IC not required).
- SwivelView: hardware rotation by 90°, 180°, 270°.
- "Picture-in-Picture Plus": displays a variable size window overlaid over background image.
- Pixel Doubling: horizontal and vertical resolutions can be doubled without any additional memory.
- Software video invert.
- Typical resolutions supported:
  - 320x320 @ 16bpp
  - 160x160 @ 16bpp (2 pages)
  - 160x240 @ 16bpp
- 2D BitBLT Engine.
 

|                               |                       |
|-------------------------------|-----------------------|
| Write BLT                     | Transparent Write BLT |
| Move BLT                      | Transparent Move BLT  |
| Solid Fill BLT                | Read BLT              |
| Pattern Fill                  | Color Expansion BLT   |
| Move BLT with Color Expansion |                       |

### CONTACT YOUR SALES REPRESENTATIVE FOR THESE COMPREHENSIVE DESIGN TOOLS

- S1D13A05 Technical Manual
- Palm OS<sup>®</sup> Hardware Abstraction Layer
- S5U13A05 Evaluation Boards
- Windows<sup>®</sup> CE Display Driver
- CPU Independent Software Utilities
- VXWorks<sup>®</sup> Tornado<sup>™</sup> Display Driver

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