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Intel® StrongARM* SA-1111 Microprocessor Companion Chip

Brief Datasheet

Product Features

The Intel® StrongARM* SA-1111 Microprocessor Companion Chip (SA-1111), when coupled with the Intel® StrongARM* SA-1110 Microprocessor (SA-1110), adds a variety of functions for use in high-performance handheld computer systems. This companion chip brings a new level of integration to small systems and enables complete systems to be built with greatly reduced chip count, low power, and high performance.

- n PLL clock generator
  - —3.6863-MHz clock generated by the StrongARM* processor

- n Three modes of operation
  - —Normal
  - —Doze
  - —Sleep

- n System Bus Interface (SBI)
  - —Shared Memory Controller (SMC)
  - —Register Access Bus (RAB)
  - —DMA Bus

- n AC-Link/I^2S Serial Port for Audio that supports:
  - —AC'97 codecs that are compliant with AC-Link standard 1.03
  - — I^2S-format codecs

- n PCMCIA and Compact Flash (CF) Interface
  - — Two sockets (one for PCMCIA and one for CF)
  - — Full card-detection and PCMCIA voltage control supporting 3.3-V and 5-V PCMCIA cards
  - —Full on-chip buffering so no external devices are required

- n USB Host Controller
  - —USB-Rev 1.1 compatible
  - —Supports 1.5 Mbits/s and 12 Mbits/s speeds of operation

- n Two PS/2 ports for use with keyboards, mice, trackpads, or other PS/2-compliant devices

- n SSP* Serial Data Port
  - —Supports National Microwire protocol, TI Synchronous Serial Protocol (SSP), and Motorola Serial Peripheral Interface (SPI)* protocol

- n Two Pulse-Width-Modulated (PWM) outputs
  - —8-bit digital-to-analog (D-to-A) converters

- n 256 mini-ball grid array (mBGA)

Description

The SA-1111 is an integrated circuit incorporating a Universal Serial Bus (USB) controller, two PS/2 ports (mouse and trackpad), a PCMCIA and Compact Flash (CF) interface, AC-Link/I^{2}S serial audio port, two pulse-width-modulated (PWM) outputs, and a versatile serial port. These functional blocks are connected via a fast internal synchronous bus. The System Bus Interface (SBI) connects the internal bus to the SA-1111's memory/system bus and transfers all data and control information between the SA-1111 and the SA-1110 system processor.

Intel® StrongARM* SA-1111 Architecture

Figure 1 shows the functional blocks of the SA-1111.

Figure 1. SA-1111 Block Diagram
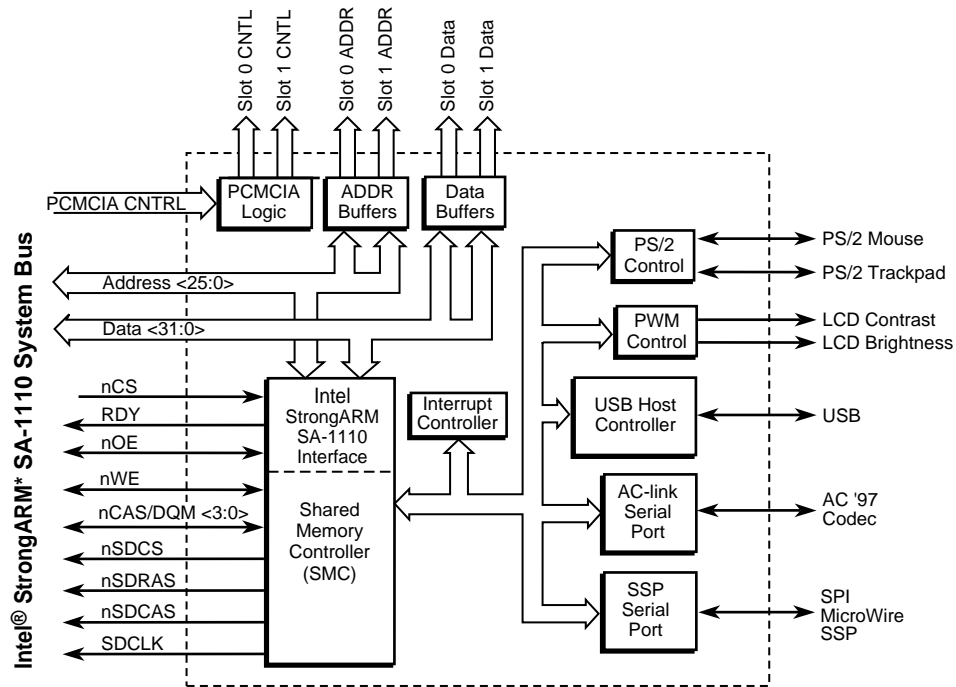
* Other brands and names are the property of their respective owners.

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Universal Serial Bus (USB) Host Controller

The USB Host Controller is Open HCI-compatible, Windows95* USBD-compatible, and USB-Rev 1.1 compatible. It supports both low- (1.5 Mbits/s) and high-speed (12 Mbits/s) USB devices. The USB controls the transfer of data between USB peripherals (attached to the USB) and system memory. The USB uses DMA to transfer data.

PS/2 Ports

The two PS/2 ports can be used with keyboards, mice, trackpads or other PS/2-compliant devices. The PS/2 pins behave like open-drain I/Os when used in PS/2 mode. When not used for PS/2 attachment, the pins may be used as General-Purpose Input/Output (GPIO).

PCMCIA and Compact Flash Interface

The PCMCIA and Compact Flash (CF) Interface drives all signals for two sockets (one for PCMCIA and one for CF), without external buffering. The I/O buffers can drive signals at 3.3 V and 5.0 V, or they can be turned off. The control logic and built-in buffers eliminate numerous external "glue" and buffer/transceiver components, providing a highly integrated and low-power solution for the creation of complete systems.

Pulse-Width-Modulated (PWM) Interface

Two PWM outputs provide brightness and contrast control suitable for an LCD display. These function as 8-bit digital-to-analog (D-to-A) converters, with the addition of inexpensive external filter components. When not used for PWM output, the pins may be used for GPIO.

AC-Link/I^{2}S Serial Port for Audio

The full-duplex serial port for audio transfers serialized audio data to and from external devices using AC-Link, I^{2}S or "MSB-Justified" formats. The AC-Link fully supports AC'97 codec that are compliant with AC-Link standard 1.03—some features added to later revision AC'97 codecs may not be supported. For AC'97 codecs, digitized audio can pass in both directions simultaneously using sample sizes up to 16 bits. For AC'97 codecs, the playback or audio out (SA-1111 to codec) is fixed at 48 KHz. Variable-rate sampling for playback, which is not defined in AC-Link standard 1.03, is not supported in hardware. The serial audio port supports variable sample rates for incoming audio (codec to SA-1111). Codecs compliant with AC-Link standard 1.03 or later can select the incoming audio sample rate by software control.

The audio serial port also supports I^{2}S or "MSB-Justified" mode requirements. Sample rates for I^{2}S may be 8, 11.025, 16, 22.05, 32, or 44.1 KHz.

SSP* Serial Data Port

A full-duplex synchronous serial interface provides attachment to modem, telecom, and other devices using serial protocols for data transfer. It supports National Microwire[*], TI Synchronous Serial Protocol (SSP)[*], and Motorola Serial Peripheral Interface (SPI)[*] serial protocols. The SSP Serial Data Port data FIFOs can be accessed by system-initiated transfers that use SRAM-like block data moves by the system processor.

System Bus Interface

The SBI is the primary interface between the SA-1111 and the SA-1110 processor. Its connection to the full SA-1110 system memory bus is used for transferring data between the host processor and the SA-1111 internal functional blocks. The SBI is used for three types of transfer:

- Register READs and WRITEs
  SRAM-like single word transfers, initiated by the SA-1110 system processor.

- Block-data READs and WRITEs
  SRAM-like bursts across the system bus, initiated by the SA-1110 system processor. Block-data transfers are used to fill or empty SRAM buffers serving the serial-port subsystems.

- DMA to System Memory
  The Shared Memory Controller (SMC) performs DMA transfers in response to requests from the USB Host Controller or the AC-Link/I^2S serial audio port.
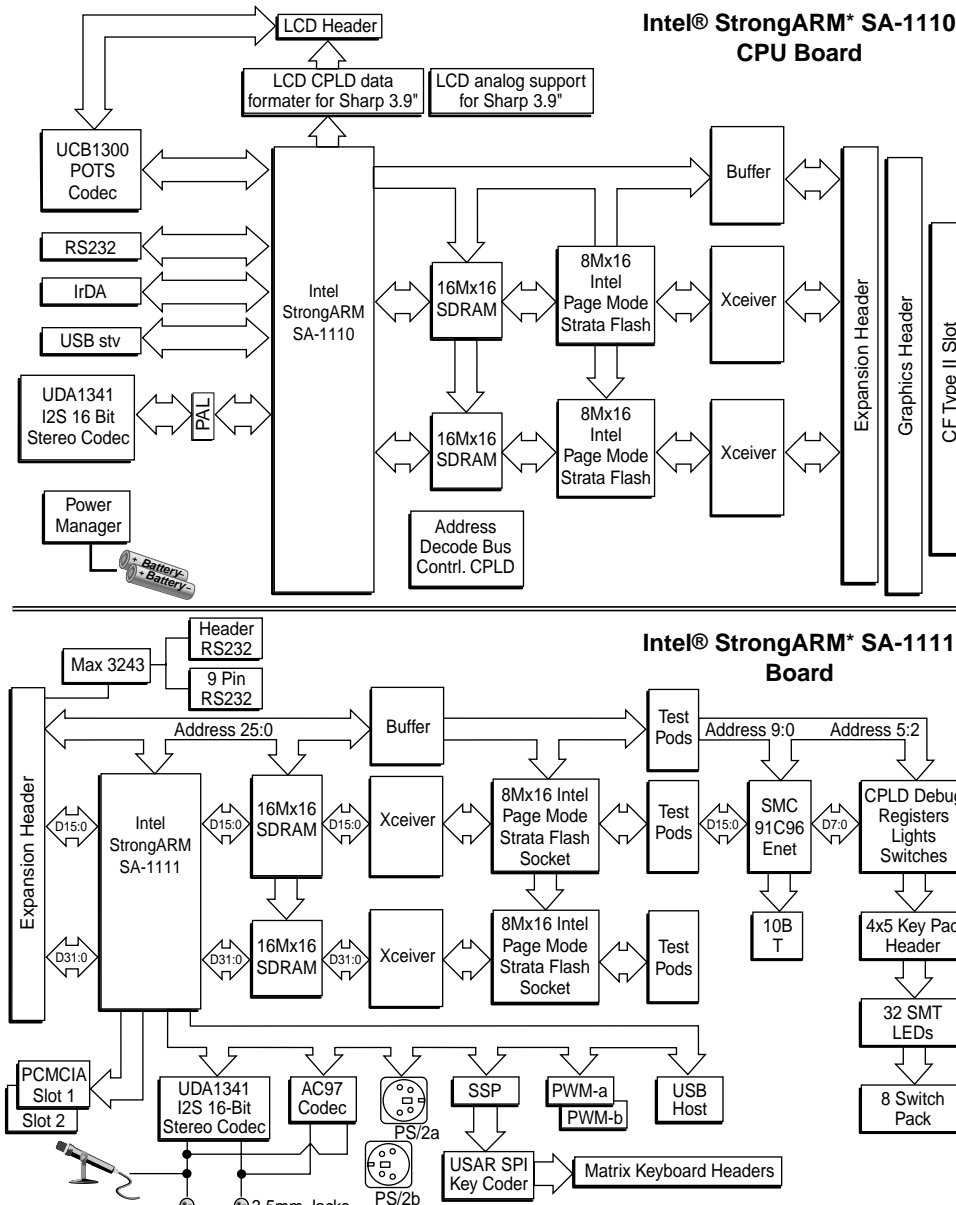
Shared Memory Controller

The SMC is a sub-unit of the SBI and responds to data transfer requests from the USB Host Controller, or the AC-Link/I^2S serial port for audio. The SMC translates these data read or write cycles into DRAM cycles, supporting up to 128 Mbytes of EDO DRAM or SDRAM, with peak bandwidth of 192 Mbytes/s.

System Overview

The SA-1111 provides a variety of I/O functions that enable complete systems to be built with very little "glue" logic. Figure 2 shows how the SA-1111 can be used with the SA-1110 in a handheld computing device. The external display controller/graphics accelerator is optional, for higher performance with an LCD display, or to enable simultaneous display to a video monitor.

For power parameters and physical characteristics, see the SA-1111 Linecard on Intel's website for developers.

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Figure 2. System Block Diagram

Intel® StrongARM* SA-1110 CPU Board

Intel® StrongARM* SA-1111 Board

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