



Intel® StrongARM® SA-1111 Microprocessor Companion Chip

ADVANCE INFORMATION 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/I²S Serial Port for Audio
 - Supports AC'97 and I²S-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)

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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/I²S 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.

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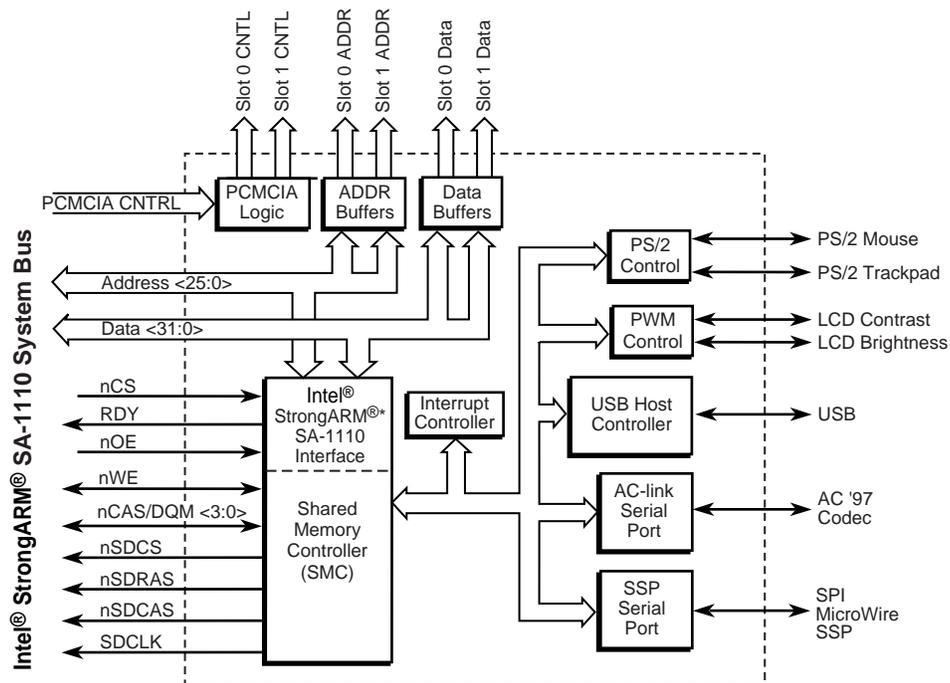
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Figure 1. SA-1111 Block Diagram



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Universal Serial Bus (USB) Host Controller

The USB Host Controller is Open HCI-compatible, Windows95* USB-D-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/I²S Serial Port for Audio

A full-duplex serial port for audio, compliant with AC-Link (for attachment to AC'97 codecs) or I²S specification. It transfers serialized audio data to and from external devices using AC-Link, I²S or "MSB-Justified" formats. This interface connects to any external codec meeting AC'97 or I²S format requirements. The audio serial port can also operate in "MSB-Justified" mode of operation. The AC-Link can be accessed using either DMA transfers initiated by the audio serial port, or block-data transfers initiated by the SA-1110 system processor.

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:

- SSP-initiated transfers that use the DMA capability of the System Bus Interface (SBI) to transfer SSP data directly to or from system memory
- 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/I²S serial audio port.

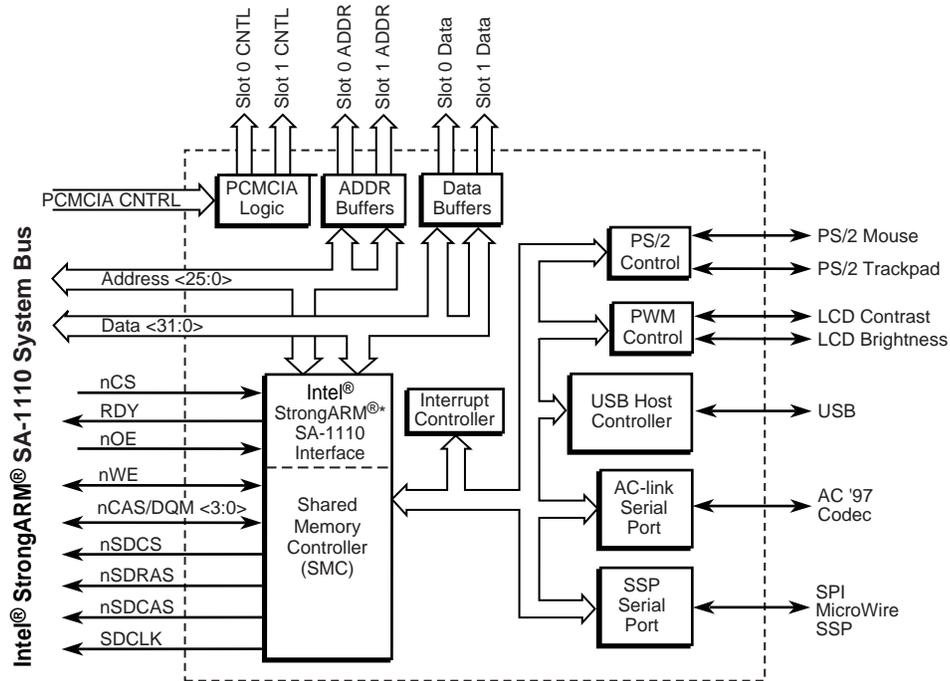
Shared Memory Controller

The SMC is a sub-unit of the SBI and responds to data transfer requests from the USB Host Controller, or the AC-Link/I²S 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.

Figure 2. System Block Diagram



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Table 1. SA-1111 Tool Chains and Operating Systems

Manufacturer	Operating System	Tool Chain
Accelerated Technology Incorporated	Nucleus PLUS*	Nucleus UDB*; ARM™ SDT* (ARM Limited); C, C++, MULTI* (Green Hills Software, Inc.); C/C++* compilers (MetaWare Incorporated)
Express Logic, Inc.	ThreadX*	ARM SDT (ARM Limited); C, C++, MULTI (Green Hills Software, Inc.); C/C++* compilers (MetaWare Incorporated)
Freewear	μCOS*	ARM SDT (ARM Limited); C, C++, MULTI (Green Hills Software, Inc.); C/C++ compilers (MetaWare Incorporated)
Integrated Systems, Inc.	pSOS*	pRISM+*; ARM SDT (ARM Limited); C, C++, MULTI (Green Hills Software, Inc.); C/C++* compilers (MetaWare Incorporated)
JMI Software Systems, Inc.	C EXECUTIVE*	ARM SDT (ARM Limited); C, C++, MULTI (Green Hills Software, Inc.); C/C++ compilers (MetaWare Incorporated)
KADAK Products Ltd.	AMX*	ARM SDT (ARM Limited); C, C++, MULTI (Green Hills Software, Inc.); C/C++ compilers (MetaWare Incorporated)
Lucent Technologies, Inc.	Inferno*	Inferno Toolkit*
Microsoft Corporation	Windows CE*	Platform Builder*
Microware Systems Corporation	OS-9*	FasTrac*
Precise Software Technologies, Inc.	Precise/MQX*	ARM SDT (ARM Limited); C, C++, MULTI (Green Hills Software, Inc.); C/C++ compilers (MetaWare Incorporated)
Sun Microsystems, Inc.	Chorus OS*	Sun Embedded Workshop Toolset*
Sun Microsystems, Inc.	Java OS for Consumer*	Java Development Tools*
Symbian	EPOC32*	C++ SDK
Wind River Systems, Inc.	VxWorks/Tornado*	Tornado*

Table 2. SA-1111 Characteristics

USB OHCI Performance	High speed = 12.0 Mbits/s Slow speed = 1.5 Mbits/s
Power supply	Core and CMOS I/O = 3.3 V \pm 10% PCMCIA buffers = 0 V to 5 V \pm 10% CF buffers = 0 V to 3.3 V \pm 10%
Typical power dissipation	Run = <165 mW Doze = <33 mW Sleep = <66 μ W
Ambient operating temperature	0°C (32°F) to 70°C (158°F)
Storage temperature	-20°C (-4°F) to +125°C (257°F)
Packaging	256 mBGA
Process technology	0.35 μ m, 3-layer metal
Transistor count	400,000
Order number	GDS1111AA



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