



With speeds of up to 1.2 GHz, the **AppliedMicro PowerPC 460SX** embedded processor offers a powerful mix of high bandwidth, design flexibility and robust features. Boasting three Gen 2 PCI Express interfaces and available RAID 5 and RAID 6 acceleration hardware. It is ideally suited for RAID controllers, Storage Area Networking (SAN) equipment, iSCSI, NAS, and other embedded storage and networking applications.

## Features

- Delivers 833 MHz to 1.2 GHz performance for embedded I/O processor designs
- 32 KB-I / 32 KB-D L1 caches
- 512 KB L2 cache, may also be used as on-chip SRAM
- 32 KB on-chip SRAM
- High-speed Processor Local Bus (PLB) with 2-way crossbar, supports 12.8 GB/s peak bandwidth
- 2nd High Bandwidth (HB) bus with 6.4 GB/s bandwidth, accelerates RAID transactions
- Three Gen 2 PCI Express interfaces
- 32/64-bit SDRAM memory controller, interfaced to all three PLB slave segments, supporting memory speeds up to DDR2-800
- On-chip RAID 5 and RAID 6 acceleration (optional)
- On-chip storage and network encryption engines (optional)
- Three-channel DMA engine
- Integrated I2O messaging
- On-chip peripherals including four 10/100/1000 Ethernet MAC, UARTs, IIC
- NAND Flash controller supporting direct interfacing to discrete NAND Flash devices (up to four devices) and Smart-Media Card socket (22-pins)
- Low power dissipation and small form factor for high-density and power-conscious applications

## PowerPC 464 Core

The 464 core is an enhanced version of the 440 core. To enhance overall throughput, the PowerPC 464 super-scalar core incorporates a 7-stage pipeline and executes up to two instructions per cycle. Its large 32 KB data cache and 32 KB instruction cache are 64-way set-associative. For additional system performance, the PowerPC 464 core includes dynamic branch prediction and 24 digital signal processing (DSP) instructions, as well as non-blocking caches that can be managed in either write-through or write-back mode.

## High-Bandwidth Bus Architecture

For high bandwidth transactions, the PowerPC 460SX uses two independent buses. The primary bus is a CoreConnect 128-bit processor local bus (PLB), with a two-way crossbar configuration. It provides separate 128-bit read and 128-bit write data buses for each or the two ways. The four 128-bit data buses may operate concurrently, providing up to 12.8 GB/s of peak on-chip bandwidth. The secondary bus is a 128-bit bus with separate 128-bit read and 128-bit write data buses. These two 128-bit data buses may also operate concurrently, providing additional up to 6.4 GB/s of peak bandwidth. The aggregate on-chip bus bandwidth is 19.2 GB/s. The SDRAM is attached to three PLB slave ways to provide optimal access to memory from any other peripheral/core. Lower bandwidth I/O devices are supported by the on-chip peripheral bus (OPB).

## High Performance Memory Support

The PowerPC 460SX incorporates a high-performance DDR memory controller supporting DDR2 memory devices. The memory interface can operate at an effective rate of DDR800, for a maximum bandwidth of 6.4 GB/s. The interface can be configured for 64-bit or 32-bit memory implementations. Optional ECC. Industry standard DIMMS and discrete devices are supported for up to 16 GB of memory. For greater efficiency, the memory controller provides parallel paths from each of the three PLB slave segments and memory.



## On-Chip Memory

The PowerPC 460SX offers 32 KB of on-chip memory. It can be used to store boot code, security keys, or other user-specific functions.

## Gen 2 PCI Express Interfaces

The PowerPC 460SX offers three independent PCI Express interfaces compliant with PCI Express base specification 2.0 (5 GB/s per lane). The primary interface has eight lanes and supports x8, x4, or x1 configurations. The secondary two interfaces have four lanes each and can be configured as x4 or x1 ports, or be combined as a second 8-lane PCI-E port. All three interfaces can be configured as either root or end point ports.

## RAID Hardware (optional) and I2O Accelerate Storage Applications

The 460SX offers on-chip acceleration hardware for RAID 5 and RAID 6 parity generation and checking. This hardware, along with an internal high efficiency three-channel DMA engine, implements XOR and Galois Field P and Q parity operations in parallel at a high throughput rate.

I/O processing and other applications using multiple processors can benefit from the integrated messaging unit. Using I2O message frames, this messaging unit improves system performance by enabling the PPC460SX to communicate with a host system on the host-side PCI Express bus. This enables the PPC460SX to operate as an intelligent I/O adapter controller.

## Ethernet Ports, TCP/IP Acceleration, and QoS

For network connectivity options, the PowerPC 460SX supports four total 10/100/1000 Ethernet ports. This includes:

- Two integrated 10/100/1000 Ethernet ports with TCP/IP Acceleration Assist, QoS, and Jumbo Frame support
- Two additional 10/100/1000 Ethernet ports for a total of four Ethernet ports

All four Ethernet ports are configurable as RGMII or as two GMII interfaces.

## Technology

- 90 nm CMOS

## Performance (est.)

- 2400 Dhrystone MIPS @ 1200 MHz

## Memory

- 32-bit width: up to 3.2 GB/s (DDR800)
- 64-bit width: up to 6.4 GB/s (DDR800)

## PCI Express

- One 8-lane @ 5.0 Gb/s per lane/ direction
- Two 4-lane @ 5.0 Gb/s per lane/ direction (can be combined as one 8-lane PCI-E)

## Typical Power Dissipation

- < 12W @ 1000 MHz

## Case Temperature Range

- 0° C to +95° C (case temperature)

## Power Supply

- 1.25 V (logic), 1.8 V (DDR2), 3.3 V (peripherals), 2.5 V (Ethernet, other I/O)

## Signal I/Os

- 431

## Packaging

- 783 FC-PBGA, 29mm x 29mm with 1.0mm pad pitch

## Storage Security Engine (optional)

For storage applications, the PowerPC 460SX offers an optional on-chip high speed hardware acceleration engine for IEEE1619 encryption/decryption for data at rest. It supports:

- Galois counter mode and XTS-AES and LRW-AES
- Hashing for SHA-1 and SHA-2 (SHA-224, SHA-256, SHA-384, SHA-512)
- Hash Message Authentication (HMAC)

## Network Turbo Security (optional)

The optional Turbo Security engine attaches directly to the PLB bus for the fastest possible throughput between the processor core, memory, and the security engine itself. The Turbo Security engine supports:

- DES, 3DES, AES, ARC-4 encryption
- MD-5, SHA-1 and SHA-2 (SHA-256, SHA-384, SHA-512) hashing

The security engine includes a pseudo random number generator as well as header and trailer protocol processor. The engine also incorporates an on-chip true random number generator and a public key accelerator. The algorithms are compliant with FIPS-140-2 and ANSI X9.17 Annex C.

## External Bus Interface

To accommodate connectivity with other devices, the PowerPC 460SX offers a 32-bit bus supporting up to four ROM, EPROM, SRAM, flash memory or slave peripheral I/O devices and speeds up to 100 MHz. The 4-Channel DMA is also supported.

## Standard Peripherals

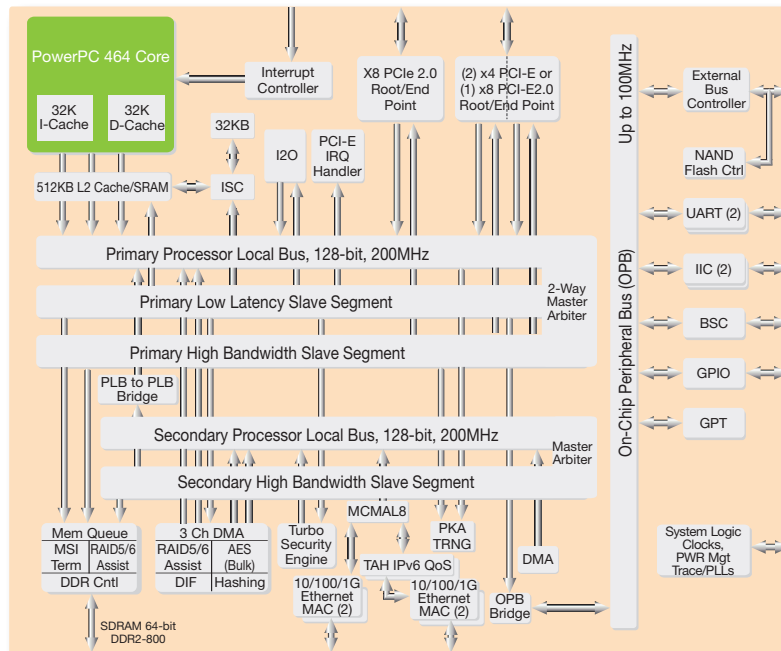
Two IIC controllers operate at 100/400 KHz. Both support master mode with multi-master and reset and target mode, and one supports serial boot ROM. The peripheral set also includes two UARTs, up to 32 general-purpose I/Os (GPIO) and general-purpose timers.

## AppliedMicro Partners Ecosystem

AppliedMicro's embedded PowerPC processors are supported by an extensive ecosystem of products and services from a wide range of leading suppliers. The AppliedMicro Partners program includes industry-standard providers of:

- Embedded operating systems
- Hardware and software development tools
- Embedded software products and services
- Board-level products
- System design services
- Technical training

For full details of the products and services available through the AppliedMicro Partners program, or to browse support available for a specific processor, please visit [www.appliedmicro.com/Embedded/Partners/](http://www.appliedmicro.com/Embedded/Partners/).



460SX Embedded Processor Block Diagram

For technical support, please call 1-800-840-6055 or 858-535-6517, or email [support@amcc.com](mailto:support@amcc.com).

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