

# PowerPC 405EXr

## Embedded Processor



### Benefits

- Superior Price/Performance for Cost Sensitive Wireless Access Applications
- Delivers 333 MHz to 533MHz performance (506 to 810 DMIPs)
- Single 1-lane PCI Express port
- Supports up to 2 GBytes of DDR 2/1 DRAM
- High performance Security Engine (optional) supports IPsec, SSL, DTLS and SRTP
- One 10/100/1000 Ethernet MAC
- On-the-Go USB 2.0 port
- 8/16/32-bit External Peripheral Bus Controller
- Two UARTs (UART0 with full hardware modem flow control),
- 32 General Purpose I/Os
- Low power dissipation, small form factor for high-density, power-conscious applications

The PPC405EXr offers the performance of the market leading PPC405 processor together with a high performance suite of peripheral and memory interfaces, including PCI Express, USB2.0 On-the-Go, DDR 2/1 and Gigabit Ethernet. The PPC405EXr also incorporates an advanced security engine, featuring header/trailer processing capability and support for the broadest range of security protocols, including IPsec, SSL, and DTLS. The PPC405EXr delivers exceptional performance and is ideally suited for cost sensitive next generation Residential Gateway and IP-STB applications.

The PPC405EXr also incorporates an advanced security engine, featuring header/trailer processing capability and support for the broadest range of security protocols, including IPsec, SSL, and DTLS. The PPC405EXr delivers exceptional performance and is ideally suited for cost sensitive next generation Residential Gateway and IP-STB applications.

### The PowerPC 405 Core

The PowerPC 405 core has been optimized for system on a chip designs requiring solid performance, low cost, and low power consumption. Performance is enhanced through the use of separate instruction and data cache units. A 5-stage pipeline further boosts performance by offering single cycle execution of most instructions, including loads and stores.

### Security

The PPC405EXr integrates the advanced EIP-94 security engine from SafeNet. This security engine attaches directly to the PLB4 bus for the fastest possible throughput between the PPC405 processor, memory, and the security engine itself. The engine supports DES, 3DES, AES, and ARC-4 encryption, MD-5, SHA-1 and SHA-256 hashing. The packet engine includes a pseudo random number generator. The header/trailer protocol processor eliminates any need for security protocol processing by the PPC405 processor, freeing it to handle application-based operations, while improving overall security performance. The engine 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.

### Ethernet Interface MAC

To ensure that the system level throughput to the wired infrastructure can keep pace with the much faster 802.11n data rates, the PowerPC405EXr is equipped with a single gigabit Ethernet MAC that is compliant with ANSI/IEEE std. 802.3 and IEEE 802.3u supplement. The gigabit MAC is compliant with IEEE standard 802.3z. (Gigabit Ethernet), and supports both half Duplex and Full Duplex operations, as well as Wake On LAN support. In addition, it supports 9KB Jumbo frames, GMII, MII, and RGMII interfaces.

### USB2.0 On-the-Go

Able to support either device or host modes, with data rates of up to 480Mbps.

### External Bus Controller (EBC)

EBC operates at up to 100MHz. It provides 8-, 16- or 32-bit data bus, 27-bit address bus, 4 chip selects, and bus arbitration for ample space and flexibility for large amounts of RAM, nonvolatile memory, and external peripherals/ASICs. Both simple and multi-master configuration systems can be built.

### Standard Peripherals

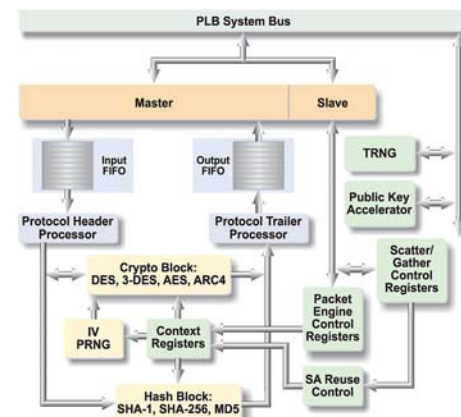
The PowerPC405EXr offers an array of standard on-chip peripherals. Two UARTs (one with full hardware modem flow control), watchdog timer, and a 4-channel DMA controller capable of transferring data to/from any PLB and OPB slave, and external bus.

### Development Tools Support

PowerPC embedded processors are supported by AMCC and 100+ third-party vendors through the PowerPC Embedded Tools program. This program provides compilers, debuggers, real-time operating systems, emulators, and a full range of tools to help manufacturers develop products more quickly. A PowerPC405EXr evaluation board kit is available to help expedite product evaluation and project development.

### PCI Express

To be ready for the next generation of 802.11n wireless access devices, the 405EXr features a 1-lane PCI Express port. With greater bandwidth, PCI Express is the preferred choice for high throughput WLAN access Points, Gateways and IP Set Top Boxes. The PCI Express port can support 2.5 Gb/s per lane (2Gb/s data due to 8b/10b coding).



### DDR Memory Support

To ensure design flexibility, both DDR1 and DDR2 memory are supported at a maximum data rate of 400Mbps for DDR2.



## PowerPC 405EXr

### Dual Bus Architecture

The 405EXr features two on-chip buses: a processor local bus (PLB) as well as an on-chip peripheral bus (OPB). High speed peripheral, such as PCI Express, DDR2 and the Security Engine connect directly to the 128-bit, PLB4 bus up to 200MHz. Less demanding devices are connected to the 32-bit OPB Bus up to 100MHz. An external peripheral controller supports the NAND and NOR flash memory as well as slave peripheral devices.

### PowerPC Partners Ecosystem

AMCC's embedded PowerPC processors are supported by an extensive ecosystem of products and services from a wide range of leading suppliers. AMCC's PowerPC 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 PowerPC Partners program, or to browse support available for a specific processor, visit <http://www.amcc.com/Embedded/Partners>

AMCC also provides an evaluation kit for this PowerPC processor, including an optimized evaluation board, sample applications, and other software.

### Features

- Processor Speed (frequency): From 333 to 533MHz
- Performance: 1.52 DMIPS/MHz (810 DMIPS @ 533 MHz peak)
- Single 1-lane PCI Express port
- Supports up to 2 GBytes of DDR 1/2 DRAM
- High performance Security Engine (optional) supports IPSec, SSL, DTLS and SRTP
- DMA Controller with four independent channels
- One 10/100/1000 Ethernet MAC with MAL DMA support
- 8/16/32-bit External Peripheral Bus Controller
- External Bus Master Interface (EBMI)
- 2 UARTs (one with full hardware modem flow control)
- 32 GPIOs
- NAND Flash Controller
- Universal Interrupt Controller: 10 external interrupts
- On-the-Go USB 2.0 port
- JTAG and realtime trace support in processor core
- RoHS compliant (lead-free) version available

For more information, please visit <http://www.amcc.com>.

### Specifications

#### Technology

- 90nm CMOS Process

#### Performance (estimated)

- 506 Dhrystone 2.1 MIPS @ 333 MHz
- 810 Dhrystone 2.1 MIPS @ 533MHz

#### Frequency

- CPU: 533 MHz Maximum
- PLB: 200 MHz Maximum
- OPB: 100 MHz Maximum
- External Bus: 100 MHz Maximum

#### Power Dissipation

- 1.5W typical

#### Case Temperature Range

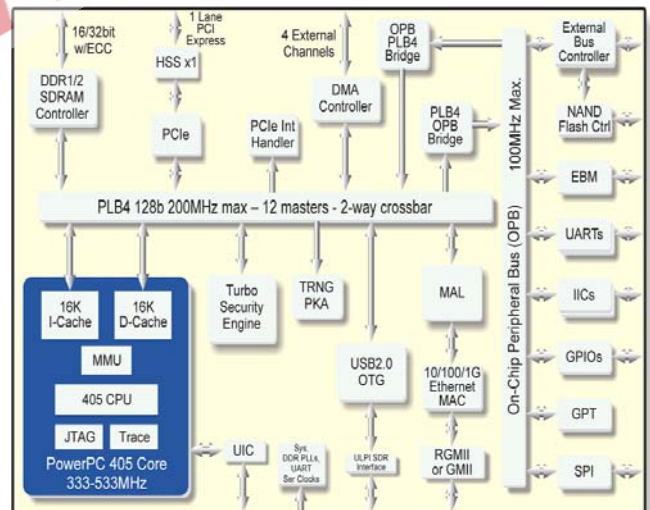
- -40°C to + 85°C

#### Power Supply

- 1.2V (internal logic), 1.8V (DDR2), 2.5V (DDR1, Ethernet), 3.3V (1/0)

#### Packaging

- 388-pin E-PBGA 27mm x 27mm (with 1mm ball pitch)



215 Moffett Park Drive  
Sunnyvale, CA 94089  
P +1 408 542 8600  
F +1 408 542 8601  
[www.amcc.com](http://www.amcc.com)

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

AMCC reserves the right to make changes to its products, its datasheets, or related documentation, without notice and warrants its products solely pursuant to its terms and conditions of sale, only to substantially comply with the latest available datasheet. Please consult AMCC's Term and Conditions of Sale for its warranties and other terms, conditions and limitations. AMCC may discontinue any semiconductor product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information is current. AMCC does not assume any liability arising out of the application or use of any product or circuit described herein, neither does it convey any license under its patent rights nor the rights of others. AMCC reserves the right to ship devices of higher grade in place of those of lower grade.

AMCC SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS.

AMCC is a registered trademark of Applied Micro Circuits Corporation. PowerPC and the PowerPC logo are registered trademarks of IBM Corporation. All other trademarks are the property of their respective holders. Copyright © 2007 Applied Micro Circuits Corporation. All Rights Reserved.

POWERPC405EXr\_PB\_v1.00\_06\_05\_2007