# MPC8541E PowerQUICC™ III Processor

Key Features

Freescale's MPC8541E PowerQUICC™ III integrated communications processor incorporates a wide range of advanced Freescale technologies, modular cores and peripherals. Leveraging Freescale's system-on-chip (SoC) PowerQUICC III platform architecture, the MPC8541E combines the powerful e500 core, built on Power Architecture™ technology, and peripheral technology to balance processor performance with I/O system throughput.

The MPC8541E device's high level of integration helps simplify board design and enhances overall system-level bandwidth and performance. In addition to the e500 core and 256 KB of Level 2 (L2) cache memory, the MPC8541E features an integrated security engine, a double data rate (DDR) SDRAM memory controller, dual Gigabit Ethernet controllers, a four-channel DMA controller, dual asynchronous receiver/transmitters (DUART), local bus controller and a 64-bit PCI controller that can also serve as two 32-bit PCI ports. Dual on-chip PCI support provides a cost-effective alternative to separate, discrete PCI bridges and chipsets for I/O-intensive applications that require multiple PCI interfaces. The MPC8541E also supports Communications Processor Module (CPM) capabilities, such as dual 10/100 Fast Ethernet controllers, I2C controller and a serial peripheral interface (SPI).

MPC8541E Block Diagram
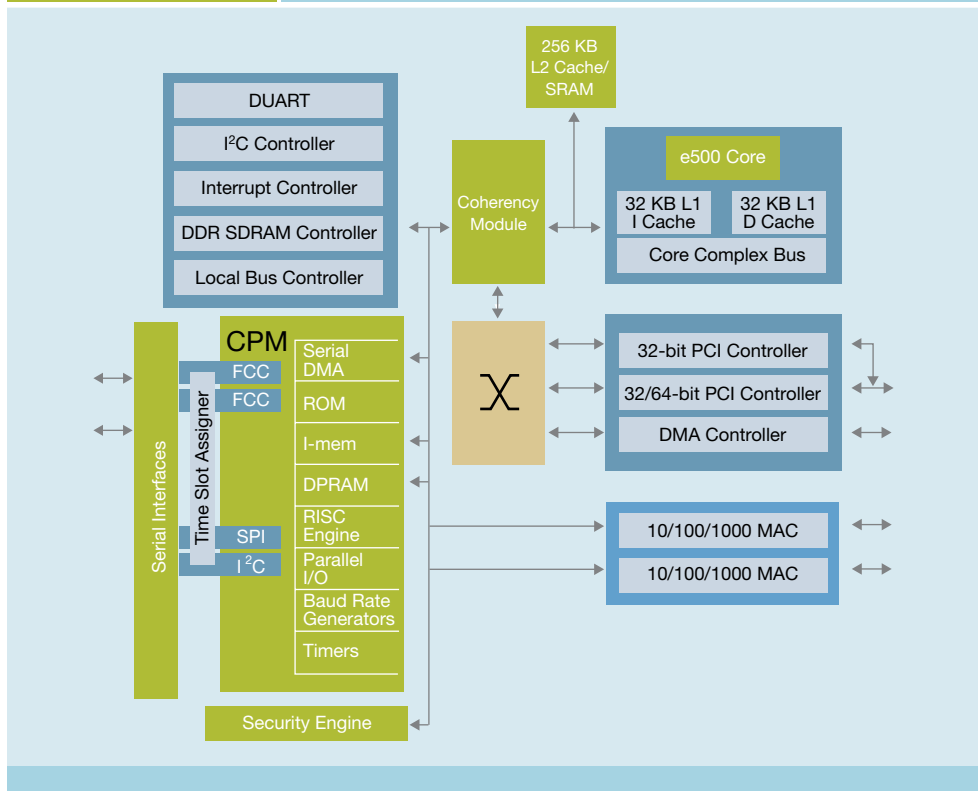
Integrated Security

The MPC8541E processor features a security engine that supports DES, 3DES, MD-5, SHA-1, AES and ARC-4 encryption algorithms and offers a public key accelerator and on-chip random number generator. This embedded security core is derived from Freescale's security coprocessor product line and offers the same direct memory access (DMA) and parallel processing capabilities, as well as the ability to perform single-pass encryption and authentication as required by widely used security protocols, such as IPsec and 802.11i. Integrated security makes the MPC8541E an optimal communications processor solution for applications that require security features in concert with high performance and low system-level cost.

Wide Range of Applications

With its high-performance core, I/O peripherals and integrated security engine, the MPC8541E processor offers a powerful control element for networking, communications and general-purpose embedded applications. The MPC8541E serves as an optimal host-processing solution for a multitude of compute-intensive applications, such as VPN and firewall routers, enterprise-class storage systems, Ethernet switching equipment, SOHO, enterprise router, business-class imaging equipment and general-purpose embedded applications.

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PowerQUICC™ III Processor Family	MPC8541E	MPC8540	MPC8555E	MPC8560
Core	e500	e500	e500	e500
Available Frequencies	533 MHz–1 GHz	667 MHz–1 GHz	533 MHz–1 GHz	667 MHz–1 GHz
I-Cache/D-Cache (KB)	32/32	32/32	32/32	32/32
Integrated L2 Cache (KB)	256	256	256	256
Integrated Security Engine	Yes	-	Yes	-
Fast Communications Controllers	2	-	2	3
Serial Communications Controllers	-	-	3	4
Ethernet (10/100 only)	2	1	Up to 2	Up to 3
Ethernet (10/100/1000)	2	2	2	2
I²C Controller	2	1	2	2
UTOPIA Level II Ports	-	-	2	2
Multi-Channel HDLC	-	-	Up to 64 (QMC)	Up to 256
PCI Interface	2x 32-bit or 1x 64-bit	1x 32/64-bit	2x 32-bit or 1x 64-bit	1x 32/64-bit
PCI-X Interface	-	Yes	-	Yes
RapidIO® Interface	-	Yes	-	Yes

Technical Specifications

- Embedded e500 core available from 533 MHz up to 1 GHz
  - 32-bit, dual-issue, superscalar, seven-stage pipeline
  - 2300 MIPS at 1 GHz (estimated Dhrystone 2.1)
  - 32 KB L1 data and 32 KB L1 instruction cache with line-locking support
  - 256 KB on-chip L2 cache with direct mapped capability
  - Enhanced hardware and software debug support
  - Memory management unit (MMU)
- Two TSECs supporting 10/100/1000 Mbps Ethernet (IEEE 802.3, 802.3u, 802.3x, 802.3z and 802.3ac-compliant) with two GMII/TBI/RGMII interfaces
- 166 MHz, 64-bit, 2.5V I/O, DDR SDRAM memory controller with full ECC support

- Integrated security engine supporting DES, 3DES, MD-5, SHA-1, AES, PKEU, RNG and RC-4 encryption algorithms
- Multiple PCI interface support
  - 64-bit PCI 2.2 bus controller (up to 66 MHz, 3.3V I/O)
  - Flexibility to configure two 32-bit PCI controllers
- 166 MHz, 32-bit, 3.3V I/O, local bus with memory controller
- Integrated four-channel DMA controller
- Dual I²C, DUART, SPI
- Two 10/100 Ethernet controllers
- Interrupt controller
- IEEE 1149.1 JTAG test access port
- 1.2V core power supply (1.3V for 1 GHz operation) with 3.3V and 2.5V I/O
- 783-pin FC-BGA package

Typical Applications

- VPN and firewall routers
- Branch office and enterprise routers
- Enterprise-class storage
- Ethernet switching equipment
- General purpose embedded applications
- Business-class imaging equipment

PowerQUICC Processors

With more than 5,500 design wins in communications processors, Freescale's PowerQUICC processors are the ideal choice for your embedded networking and communication system needs.

To learn more about Freescale's communications and networking embedded solutions, visit us on the web: **www.freescale.com/powerquicc**

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