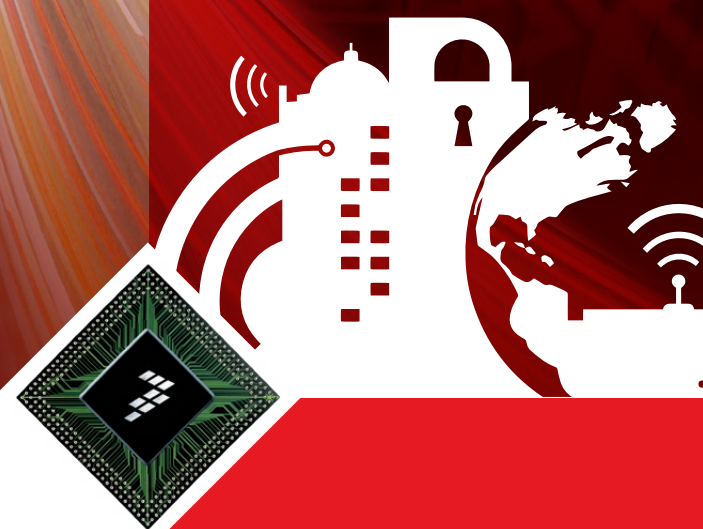
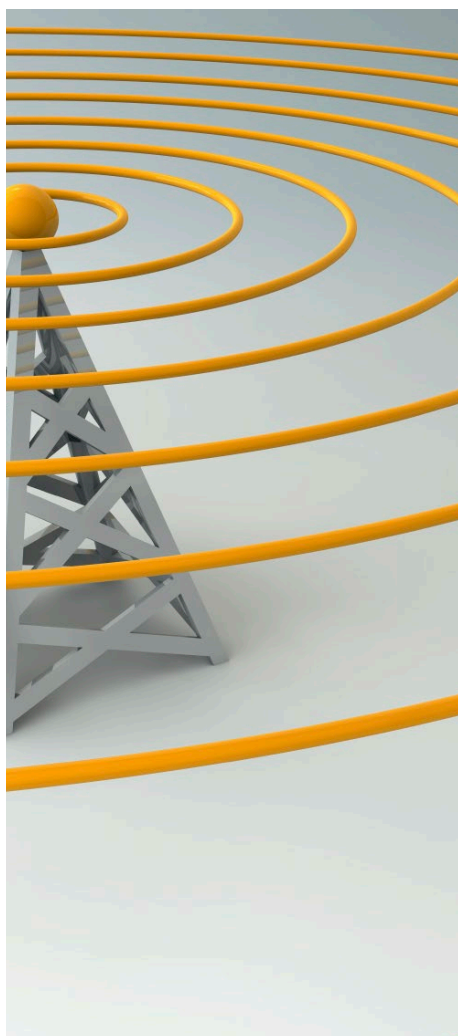


QorIQ T4 Family of Processors

Our highest performance
processor family





QorIQ Communications Platform: Scalable Processing Performance

Overview

The QorIQ communications processors portfolio delivers a smarter approach to multicore—providing a coherent migration path from single core to multicore, and from 32-bit to 64-bit. Now over 25 products strong, the QorIQ platform is the industry’s broadest portfolio of communications processors, which enables customers to address opportunities and deploy solutions across a wide range of performance, energy dissipation and cost points, from power-constrained devices to the highest performance multicore devices.

Featuring 24 virtual cores, and based on our dual-threaded e6500 Power Architecture® core, the T4240 processor, along with its 16-virtual-core variant T4160 processor, offers frequencies up to 1.8 GHz, large caches, hardware acceleration and advanced system peripherals. Both devices target applications that benefit from consolidation of control and data plane processing in a single SoC. In addition, each e6500 core implements the Freescale AltiVec technology SIMD engine, dramatically boosting the performance of math-intensive algorithms without using additional DSP components on the board.

A wide variety of applications can benefit from the processing, I/O integration and power management offered by T4 series processors. Like other QorIQ devices, T4240 processors’ high level of integration offers significant space, weight and power benefits compared to multiple discrete devices.

QorIQ Features and Benefits

T4 Key Features	Benefits
64-bit e6500 Power Architecture core	<ul style="list-style-type: none"> • Twelve/eight dual-threaded cores up to 1.8 GHz, enables control and dataplane functions in a single processor • T series enables new levels of performance through intelligent integration balanced with a focus on power efficiency • Recorded 188 K CoreMark benchmark performance score
Energy Efficiency	<ul style="list-style-type: none"> • Increases system power efficiency by 2x using advanced 28 nm process technology • Energy efficiency with cascading power management • 1.4 to 3 times more power efficient than the nearest competition
Application-Specific Accelerators	<ul style="list-style-type: none"> • Offloads the cores from the need to perform common packet-handling tasks • Efficiently manages high-speed interfaces, quality of service (QoS), security (to 40 GB/s), data compression (to 20 GB/s) and pattern matching/ deep packet inspection (to 10 Gb/s)
Embedded Hypervisor	<ul style="list-style-type: none"> • Enables safe and autonomous operation of multiple individual operating systems • Facilitates resource sharing and partitioning • Virtualization at core, platform and I/O levels
AltiVec Engine	<ul style="list-style-type: none"> • Delivers DSP functionality for compute-intensive processing tasks such as radar, sonar and image processing • 10x performance improvements on image processing applications with AltiVec technology • 250+ Mentor Graphics AltiVec libraries
Trust Architecture	<ul style="list-style-type: none"> • Ensures only trusted code is booted • Identifies if the system is being tampered with and takes appropriate action • Protects secrets and intellectual property in the form of software
Complete Solutions	<ul style="list-style-type: none"> • Complete development environment including SDK, multicore debug, optimization tools and third-party production hardware and software solutions to enable you to design, develop and deliver your next solution to the market

Service Provider Networking

Networks are moving into a new era. Overall bandwidth needs and operational connectivity continue to grow across all businesses and organizations as vertical-specific requirements and bandwidth-intensive applications, such as video streaming, data storage and general Internet services, are on the rise. However, many technical challenges remain in designing robust networks that deliver the performance necessary to support these emerging applications. With the #1 position* for wired and wireless markets and over 300 million communications processors shipped, Freescale is leading innovation in next generation networking infrastructure and mobile networks. With Power Architecture technology including PowerQUICC and QorIQ processing platforms and recently announced ARM®-based devices, DSPs and RF devices, our networking portfolio is unmatched in breadth. Combined with our enablement ecosystem and Freescale Connect partners, we can help you build full system solutions to accelerate your network's IQ.

Some of the more demanding packet-processing applications in the service provider networking market are found in the realm of wireless infrastructure. These systems have to interwork between wireless link layer protocols and IP networking protocols. Wireless protocol complexity is high, and includes scheduling, retransmission and encryption with algorithms specific to cellular wireless access networks.

Connecting to the IP network offers wireless infrastructure tremendous cost savings, but introduces all the security threats found in the IP world. The T4240 processor and peripheral interfaces provide the flexibility to connect to DSPs, and to wireless link layer framing ASICs/FPGAs. While Data Path Acceleration Architecture (DPAA) offers encryption acceleration for both wireless and IP networking protocols, in addition to packet filtering capability on the IP networking side, multiple virtual CPUs may be dedicated to data path processing in each direction.

Applications

- Radio node controller
- Metro networking
- Core router
- Edge router

Features for the Market

- Data Path Acceleration Architecture (DPAA) offers encryption acceleration for both wireless and IP networking protocols
- Packet filtering capability on the IP networking side
- Multiple virtual CPUs may be dedicated to data path processing in each direction (wireless and IP)
- The 24 Power Architecture threads offer a major leap in total available computing performance
- Support of dominant DDR3/3L memory
- Integrated SerDes reduces system interconnection costs
- Dual Serial RapidIO® (SRIO) ports (up to 5 GHz) for redundancy or multiple connections
- Type 9 and 11 messaging in the SRIO interfaces for DSP connectivity





Industrial and Aerospace

In today's industrial market, new technology provides many opportunities for system developers to successfully address ever-evolving challenges. Freescale control and network processor solutions are engineered to meet the challenging safety, security and reliability requirements of manufacturing, processing and critical infrastructure facilities. We are fulfilling our industrial customers' needs to meet the growing requirements for more intelligent and cost-effective industrial solutions for the control and networking, defense and aerospace, power protection and medical imaging markets.

Freescale also offers industrial control and networking solutions for many wired and wireless communications protocols and human machine interfaces. Our safe and secure systems withstand hacking, cloning, tampering and soft errors in harsh environments typical of manufacturing or processing facilities.

For the aerospace market, the QorIQ T4240 processor meets the performance, safety and security criteria mandated for aerospace and defense applications. Freescale's T4 family delivers highly integrated solutions that combine high-speed I/O, multiple memory controllers and secure boot options as well as a sophisticated security engine to help designers reduce space, weight and power while ensuring security within their application.

Freescale understands that time in market is as important as time to market. Through our Product Longevity Program, QorIQ processors provide the 10+ year lifetime required for these applications. Freescale is committed to continuing technology advancements, providing cost-effective, reliable, field-proven solutions for the defense and commercial aerospace markets.

Built using high-performance Power Architecture cores, Freescale's T4240/T4160 processors are well suited for computationally intensive industrial and aerospace applications.

Applications

- Factory and building automation
- Machine to machine communications
- Power protection
- Medical imaging and networks
- Aerospace communications, instrumentation, radar, sonar

Features for the Market

- High-frequency, seven-stage pipeline
- Multicore device with hardware-based virtualization for multi-function integration
- DPAA to offload packet processing and to help with higher level switching capabilities
- Energy efficiency: 1.4 to 3x more power efficient than the competition
- Efficient core: 6.0 DMIPS/MHz means less processor to get the work done
- Secure boot and trust architecture ensures communication link and device integrity
- AltiVec engine enables vector processing in imaging applications
- Long product life cycles
- Broad range of third-party embedded OS support

Data Centers/Enterprise Equipment

The rapid increase of Internet-connected devices and the shift to cloud-based services are creating an explosive data tsunami that needs to be serviced by data centers. The traffic aggregation entering the data center must be load-balanced and time shared across servers, and can even bypass the servers through a content caching mechanism to ensure the best delivery of the services. In addition, applications and web content is typically not optimized for the most efficient delivery and can further be compressed before delivery to the client.

Today's data centers are dominated by servers that are both costly and power hungry. Never before has there been such a need for technology to not only reduce the carbon footprint but also the total cost of ownership (TCO). Freescale, in cooperation with partners and standardization bodies, is designing products to meet these data center challenges with best-in-class performance per watt, per dollar solutions.

To help meet today's demanding requirements, data centers and enterprise equipment solutions must provide greater intelligence, higher bandwidth, wide connectivity, hardware-accelerated solutions and faster time to market. The QorIQ T4240 processor integrates the features and performance required to meet the needs of data centers and enterprise equipment applications, including Data Path Acceleration Architecture for offload packet processing. The Freescale T4240 processor offers 24 virtual cores based on our dual-threaded e6500 Power Architecture core, providing the processing horsepower for compute-intensive and power conscious applications. In addition, T4240 processor's massive integration significantly reduces system BOM cost. These capabilities, with industry-leading performance per watt metrics, truly deliver the best-in-class solution for the data center.

Applications

- Application delivery controller (ADC)
- WAN optimization controller (WOC)
- Server appliance
- Router

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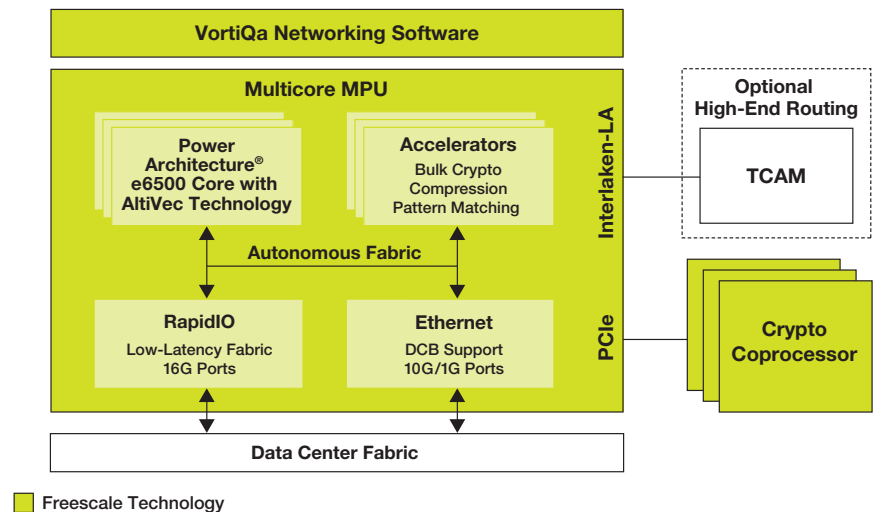
- Switch services
- Unified threat management (UTM)
- SDN and NFV

Features for the Market

- High-frequency, dual-threaded, seven-stage pipeline; a tightly coupled cache hierarchy for low latency and integrated hardware acceleration processors for compute-intensive, power-conscious applications
- 64-bit ISA support to increase performance for computational-intensive applications with large data sets
- Broad range of third-party embedded OS
- Security engine to perform high throughput encryption/decryption
- PCI Express® interfaces enable multiple flexible I/O options including single root I/O virtualization (SR-IOV) to give virtual machines a private view of their hardware
- Long product life cycles
- Hypervisor support for safe partitioning of control and data plane
- DPAA to offload packet processing



Application Delivery Controller (ADC) Block Diagram





QorIQ High-Performance Tier

	P4080	P5040	T4160	T4240
CPU Frequency Range	1200–1500 MHz	1600–2200 MHz	1500–1800 MHz	1500–1800 MHz
Cores (Physical/Virtual)	8/-	4/-	8/16	12/24
DMIPS	30,000	26,400	73,000	117,000
Cache (I/D)	32 KB/32 KB	32 KB/32 KB	32 KB/32 KB	32 KB/32 KB
Cache L2	128 KB/core	512 KB/core	256 KB/thread	256 KB/thread
Cache L3	2 MB	2 MB	1 MB	1.5 MB
DDR Controller	Dual 64-bit DDR2/3	Dual 64-bit DDR3/3L	Dual 64-bit DDR3/3L	Three 64-bit DDR3/3L
DDR Data Rate (GHz)	1.3 GHz	1.6 GHz	1.867 GHz	1.867 GHz
PCI Express®	3 gen 2.0	3 gen 2.0/3.0	4 gen 2.0/3.0	4 gen 2.0/3.0
USB 2.0	2	2	2	2
SATA	N/A	2	2	2
Serial RapidIO®	2	N/A	2	2
GbE	8 x GbE, 2 x 10GbE	10 x GbE, 2 x 10GbE	Up to 13 x GbE, Up to 2 x 10GbE	Up to 16 x GbE, Up to 4 x 10GbE
Interlaken	N/A	N/A	Look-aside	Look-aside
SerDes	18 lanes @ 5 GHz	20 lanes @ 5 GHz	24 lanes @ 10 GHz	32 lanes @ 10 GHz
FPU	Double precision	Double precision	Double precision	Double precision
Accelerators	Data path: SEC 4.0, PME 2.0	Data path: SEC 5.0, RAID 5/6	Data path: SEC 5.0, PME 2.0, DCE 1.0, RMAN 1.0	Data path: SEC 5.0, PME 2.0, DCE 1.0, RMAN 1.0
Package	1295 FCPBGA	1295 FCPBGA	1932 BGA	1932 BGA
Process Technology	45 nm SOI	45 nm SOI	TSMC 28 HPM	TSMC 28 HPM
Typical Power	~23 W	25 W	~31 W	~37 W
Other Features	SPI, 4 x I ² C, 2 x DUART, CoreNet, SD/MMC, DMA, Hardware Hypervisor, Trust Architecture	SPI, 4 x I ² C, 2 x DUART, CoreNet, SD/MMC, DMA, Hardware Hypervisor, IFC, Trust Architecture	eSPI, 4 x I ² C, 2 x DUART, CoreNet, SD/MMC, DMA, Hardware Hypervisor, IFC, Trust Architecture	eSPI, 4 x I ² C, 2 x DUART, CoreNet, SD/MMC, DMA, Hardware Hypervisor, IFC, Trust Architecture, Altivec



For more information, please visit freescale.com/T4240

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