Overview

The QorIQ AMP series represents a new direction for QorIQ communications platforms with a number of firsts for Freescale, including the new e6500 64-bit multithreaded core, new decompress/compress engine and cascading power management, all built in 28 nm process technology. The e6500 core reintroduces our highly popular AltiVec technology processing engine. Along with the addition of new features to the AMP series, we have made significant performance enhancements to the data path and acceleration engines. These high-performance QorIQ products will span 2-24 virtual cores, providing 4x application performance improvement over our highest performance QorIQ P4 platform.

The QorIQ AMP series adds to a portfolio of almost one hundred Freescale code-compatible processors built on Power Architecture® technology that have provided solutions to a broad base of customers over the last fifteen years. The AMP series will build on Freescale’s industry-leading position in networking, telecom/datacom, wireless infrastructure, aerospace/defense and industrial end equipment markets.

QorIQ AMP Series Architecture
Performance

When gauging multicore performance levels, it’s important to not only consider the total aggregate frequency of the cores, but also the full system-on-chip (SoC) application processing performance. Freescale intelligently integrates the right number of high-performance programmable cores, multiple acceleration engines (when fixed functionality is needed), and combines features like hardware virtualization and extensive debug hooks designed to ease multicore programming. The resulting AMP series of products will provide customers with a scalable platform of processors with more than four times the performance of Freescale’s previous highest performance QorIQ P4080 processor.

New e6500 Core

The 64-bit e6500 core is a high-performance, power-efficient, dual-threaded embedded core. It enables more than twice the performance improvement as well as twice the power efficiency over Freescale’s previous generation e500mc core through enhancements to the core itself, the move to 28 nm process technology, as well as dual-threading capability.

- The addition of the improved AltiVec 128-bit SIMD engine enables an additional 240 GFLOPS of programmable processing performance.
- The e6500 core can execute two threads via a combination of shared and dedicated resources. It was designed to deliver exceptional high-performance, general-purpose thread throughput at a given power budget. From a software point of view, each core appears as two fully capable, independent cores.

Acceleration Engines

- Performance on demand is delivered through multiple enhanced acceleration engines on the AMP series of products, allowing for power-efficient, high fixed-function performance. Combined with an enhanced implementation of the QorIQ data path acceleration architecture (DPAA), multiple improvements have been made to core QorIQ acceleration engines like frame manager, security engine (SEC), Serial RapidIO® manager (RMAn) and the pattern matching engine.

AMP Series Performance Improvement over QorIQ P4080 Processor

<table>
<thead>
<tr>
<th>Improvement of DMIPs per Thread</th>
<th>Dual Thread Efficiency</th>
<th>Frequency Improvements</th>
<th>Multicore</th>
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- 64-bit architecture
- AltiVec Technology: 240 GFLOPS
- 1 TB physical address
- Accelerate Hypervisor
- Dual Thread
- Each with separate front end, branch unit and LSU
- Larger amount of on-board cache per core
- New process and e6500 core, allowing increased frequency
- Up to 24 virtual cores
- Large 2 MB shared L2 cache within a cluster of 1–4 cores
- CoreNet Cache-coherent fabric with multiple clusters to scale 1–8 clusters
- Virtualization

The AMP series also introduces the decompress/compress engine (DCE) to the QorIQ portfolio. The DCE is a high-performance accelerator compatible with DPAA, providing lossless data decompression and compression ideal for data center applications. It supports the raw DEFLATE algorithm (RFC1951), GZIP format (RFC1952) and ZLIB format (RFC1950). The DCE also supports Base64 encoding and decoding (RFC4648).

Power Efficiency

Power efficiency is a critical design characteristic of the AMP series. The new Freescale proprietary cascading power management enables the programmer to scale the performance needed for the workload. This new power management technology consists of two core power-saving modes:

- **Day mode**
  Multiple cores always running to process packets. Data path constantly distributes packets across cores.
- **Night mode**
  Data path delivers packets to only as many cores as required to process them. Remaining cores enter low power mode. Cores are automatically brought out of low power mode as traffic increases.

These core power saving techniques, combined with the ability to turn on and off the different acceleration engines, as well as the move to 28 nm process technology, enable more than twice the power efficiency versus our existing highest performing QorIQ product, the eight-core P4080 processor.

Platform

AMP Series Acceleration Improvements over P Series Platforms

- 2x SEC performance
- 3x DPAA throughput
- 2x more CoreNet throughput
- 2x more OCEAN bandwidth
The AMP series of products will consist of T1–T5 platforms with products at varying levels of performance and integration. The first product planned for release is the T4240 processor, which can be used for combined control, data path and application layer processing in routers, switches, gateways and general-purpose embedded computing systems. Its high level of integration offers significant performance benefits compared to multiple discrete devices, while also greatly simplifying board design.

Software Complement

Focusing on the developer’s experience and making multicore programming easy, Freescale has invested heavily on technologies such as virtualization and debugging tools to allow ease of programming and extensive visibility into the system. We provide a broad suite of software tools, including the QorIQ software development kit (SDK) and CodeWarrior, which embed deep introspection debug for extensive visibility and provide access into our QorIQ AMP series, allowing developers to fully utilize the cores and resources, and debug complex on-chip interactions. VortiQa software application solutions are designed to complement our customers’ offerings and help ease multicore software development.

We continue to collaborate closely with leading software and tools companies in the embedded industry to help ensure comprehensive solutions that take advantage of the QorIQ architecture. Choose from our strategic alliance partners, including ENEA, Green Hills, QNX and Mentor Graphics, that provide integrated solutions optimized for maximum performance on QorIQ platforms. Or, you may leverage the strengths of a broad array of partners including 6Wind, Critical Blue and Wind River to help accelerate migration to multicore and help reduce time to market.

Freescale offers a comprehensive roadmap with the necessary stepping stones that enable you to access the level of performance and capabilities needed for your next-generation applications.

To learn more about the QorIQ AMP series, visit freescale.com/QorIQAMPseries