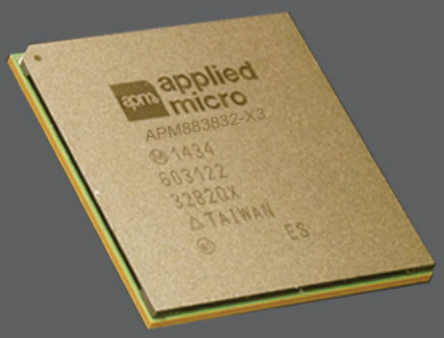
APM883832-X3 | X-Gene® 3 Multi-Core 64-bit Processor



The AppliedMicro® APM883832-X3 X-Gene® 3 is the third generation 64-bit ARM server class processor within the X-Gene family. It combines 32 ARMv8-compatible CPU cores to deliver 500 SPECint_rate at a very good power efficiency (performance per watt) and cost-effectiveness. With eight DDR4 memory channels, APM883832-X3 is well suited to hyperscale workloads, such as in-memory databases, big data, machine learning, web search, and high-performance computing (HPC). X-Gene 3 also enhances the non-CPU subsystem through greatly increased PCI Express connectivity. The X-Gene 3 CPU cores are custom designed by AppliedMicro in 16nm FinFET process technology under architectural license from ARM. It is fully compliant with ARMv8 architecture as well as ARM's Server Base System Architecture (SBSA) Level 3 standard.

Features

Processor Subsystem

- Thirty-two X-Gene 3 CPU cores operating at up to 3.0 GHz
  - ARM v8-compliant 64-bit cores
  - 32 KB L1 data cache, 32 KB L1 instruction cache per core
- Shared 256 KB L2 cache per each pair of cores
- ECC protection on caches
- Floating Point and SIMD Unit
  - Separate FP/SIMD renamer
  - Out of order scheduler
  - Full frequency scalar FPU
  - Full frequency Integer/FP SIMD unit
  - Fully pipelined operations

Memory

- Shared 32 MB L3 cache
- Eight DDR4-2667 channels
- ECC, Symbol-based ECC, and DDR4 RAS features
- Up to 16 DIMMs and 1TB/socket

System Resources

- ARM Generic Interrupt Controller (GICv3)
- Full IO Virtualization (SMMUv2)
- Enterprise server-class RAS
  - End-to-end data poisoning
  - Error containment and isolation
  - Background L3 and DRAM scrubbing

Connectivity

- 42 lanes of PCIe Gen 3, with 8 controllers
  - x16 or two x8/x4
  - x16 or two x8/x4
  - x8 or two x4
  - Two x1
- 4 x SATA Gen 3 ports
- 2 x USB 2.0 ports
- 1 x RGMII port

Functionality

- ARM SBSA Level 3
  - EL3, secure memory, and secure boot support
- Advanced Power Management
  - Dynamic estimation, Turbo, Voltage droop mitigation

Performance and Power

- SPECint_rate: ~500
- TDP: 110-125W

The X-Gene 3 Multi-Core Processor

At the heart of the APM883832-X3 are 32 X-Gene 3 CPU cores based on the ARM v8 architecture with full SMP support and individual Floating Point and SIMD units. With eight DDR4 memory channels, APM883832-X3 is well suited to hyperscale workloads, such as in-memory databases, big data, machine learning, web search, and HPC. X-Gene 3 builds upon the foundation of two generations of server products, which have been proven in a variety of data center, storage and HPC applications, and delivers the level of performance needed to address mainstream workloads and general purpose computing.

APM883832-X3 has enhanced reliability features to support enterprise class servers. For example, the memory controllers support advanced ECC options to detect and correct errors even if a complete DRAM chip fails. The processor is designed for end-to-end data poisoning; instead of terminating a process upon an uncorrectable memory or I/O error, it tags the bad data and allows it to pass through the system, only causing a terminal error if the CPU actually attempts to use the bad data. The large L3 cache also includes ECC, and the processor can conduct background scrubbing of the L3 cache and DRAM to locate and correct single-bit errors before they accumulate into uncorrectable errors.

Flexible I/O System

The I/O capabilities of X-Gene 3 have been comprehensively overhauled. Instead of dedicated Ethernet MACs, the APM883832-X3 simplifies system design by providing 42 lanes of PCI Express 3.0 that can connect to external Ethernet controllers. This approach also allows designers the flexibility of choosing any combination of Ethernet speeds and links; they can even use in-house NICs. Unlike the previous generation X-Gene 1 and X-Gene 2 devices, the APM883832-X3 does not include any specific offload engines. Instead, X-Gene 3 allows customers to connect external accelerators such as FPGAs, ASICs, and GPUs using PCIe.

Similarly, the PCIe links can connect to external storage controllers of the customer's preference. X-Gene 3 also includes four SATA3 links to directly support traditional hard drives.

PMPro and SMPro – Power and System Management

The X-Gene 3 integrates two dedicated 32-bit Cortex-M3 processors (with 128 KB I/D cache and debug port), PMPro and SMPro for power and system management respectively. The PMPro processor provides advanced power management capabilities such as Dynamic Frequency Scaling (DFS), Advanced Configuration Power Interface (ACPI) power management states, on-die thermal monitoring, and active power management including turbo mode operation. The SMPro provides system management capabilities including Platform Management, Secure Boot, and BMC communication.

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Specifications

X-Gene 3 Core Frequency
- Up to 3.0 GHz

Operating Junction Temperature Range
- 0 ºC to + 90 ºC

Power Supply
- CPU/SoC logic: 0.85 V
- DDR4: 1.2 V
- I/O: 3.3 V/1.8 V
- SerDes PLL: 1.5 V/1.8 V

Packaging
- 50mm x 50mm, 3211-pin Heat Spreader Flip Chip Ball Grid Array (HFCBGA)

Process Technology
- 16 nm FinFET

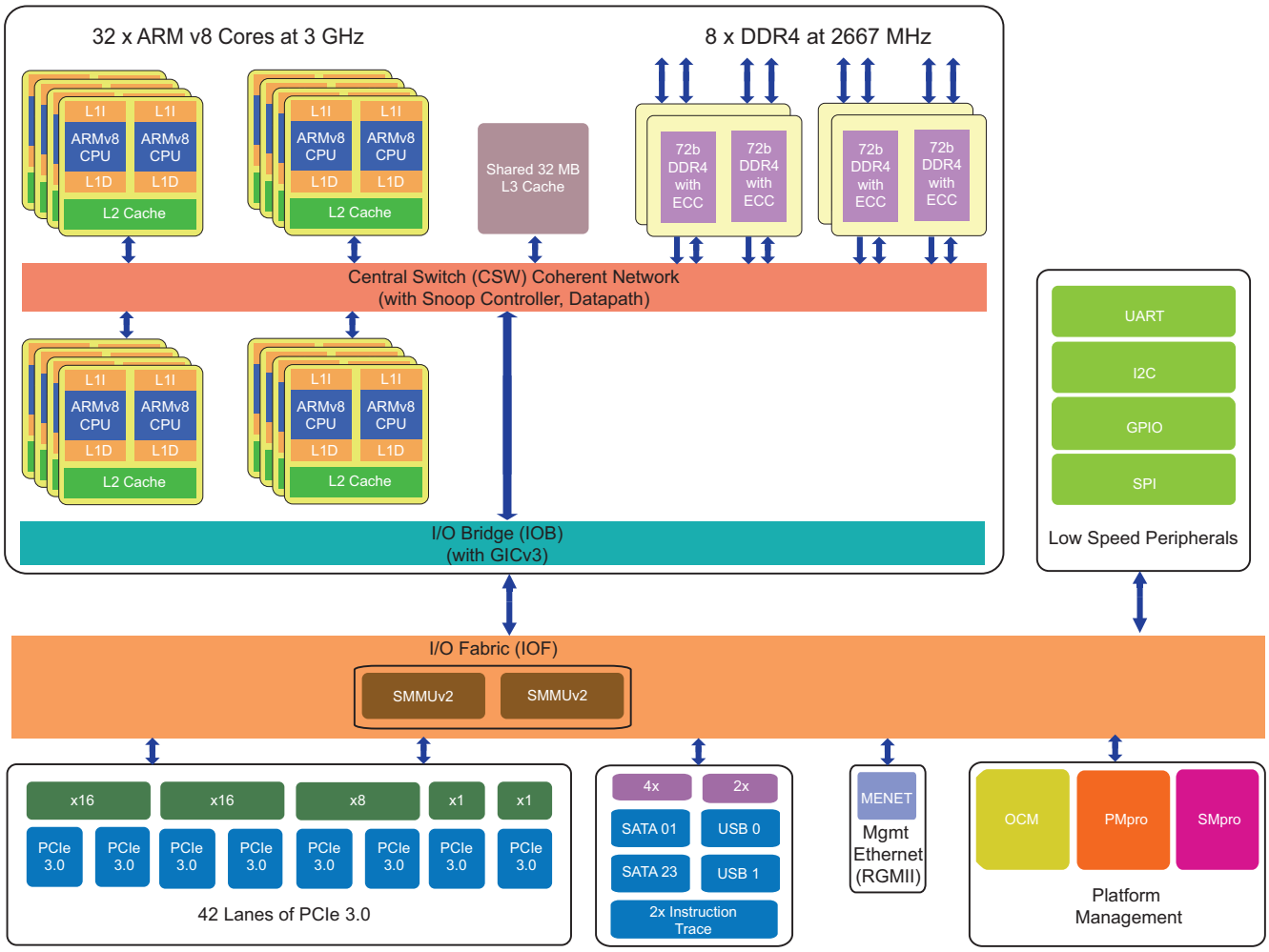
AppliedMicro's X-Gene 3 Partner Ecosystem

AppliedMicro's X-Gene 3 processors are supported by an extensive Partner ecosystem of products and services from a wide range of leading suppliers, including industry standard providers of:

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

AppliedMicro offers an evaluation kit (EV883832-X3-OC3-1) for product evaluation and for early software development.

X-Gene 3 Block Diagram



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