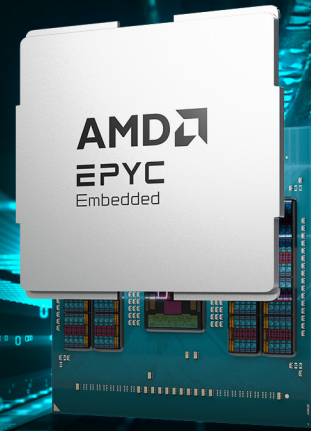# AMD EPYC™ EMBEDDED 9005 SERIES PROCESSORS

FIFTH-GENERATION "ZEN" ARCHITECTURE BREAKS PERFORMANCE AND EFFICIENCY BARRIERS WHILE ENHANCING RESILIENCY FOR NETWORKING, STORAGE, AND INDUSTRIAL SYSTEMS

AMD

The AMD EPYC™ Embedded 9005 Series processors bring server-grade performance to embedded applications. Built on "Zen 5" architecture, they offer exceptional core density, power efficiency, and compute throughput to deliver next-level performance for networking, security, storage, and industrial solutions.

Scalable up to 192 cores with 160 PCIe® Gen5 lanes in dual-socket configurations, AMD EPYC™ Embedded 9005 series processors provide exceptional I/O agility and workload flexibility. Advanced security and reliability features ensure mission-critical performance, with planned availability extending up to seven years for long-lifecycle embedded deployments. Fully compatible with previous-generation platforms, these processors offer a seamless upgrade path while equipping OEMs with scalable, power-efficient solutions for demanding embedded systems.

High performance, reliability, and optimized power efficiency are essential for networking, storage, and industrial applications, and the EPYC Embedded 9005 Series processors deliver these capabilities:

- In networking, these processors enhance enterprise and edge routers, security appliances, and firewalls by providing efficient CPU core performance for packet forwarding and processing, with high-core density for scalable, balanced networking.

- For enterprise and cloud storage, the series offers robust media connectivity across PCIe® Gen5, SATA, and Compute Express Link (CXL®) 2.0, along with features that protect data availability and retention during power loss.

- In industrial applications, EPYC 9005 Series processors enable real-time data processing with optimized power consumption, while its built-in security features enhance protection across both physical and virtual layers.

PURPOSE-BUILT ENHANCEMENTS FOR EMBEDDED REQUIREMENTS

AMD EPYC Embedded 9005 Series processors offer embedded-specific features to enhance platform longevity and system resiliency, including:

- **Non-Transparent Bridging (NTB)** for high availability in fault tolerant multi-host configurations. NTB enhances system redundancy and failover capabilities for networking and storage systems by enabling data exchange between two CPUs in active-active configurations via PCI Express (PCIe®) to allow continued operation in case of a failure
- **Dual Serial Peripheral Interface (SPI)** functionality enables two off-chip ROMs to be supported for secure boot. The first ROM contains the BIOS image, and the second ROM contains a proprietary bootloader from the customer to validate and load the BIOS image.
- **Direct Memory Access features** improve system efficiency and performance by minimizing CPU involvement in data transfers. By delegating data transfer to the DMA engine, CPU cores can better support critical application-related compute tasks.
- **DRAM Flush to NVMe**, in the event of a power loss, data is flushed from DRAM to NVMe SSD to ensure critical data is retained.
- **Yocto Project® framework support** enables customized Linux distribution builds, empowering customers to create a lightweight, optimized OS with a smaller footprint, ideal for embedded systems.

EXCEPTIONAL PERFORMANCE AND SCALABILITY

AMD EPYC™ Embedded 9005 series processors power compute-intensive embedded systems with core counts from 8 to 192 in a single socket. Leadership core density boosts throughput by up to 1.3x, compared to the competition, making these devices ideal for networking, security firewalls, storage, and industrial control applications. With up to 160 PCIe® Gen5 lanes[3] and CXL® 2.0 support, they enable high-speed data transfer for networking and storage. DDR5-6000 memory and efficient power management enhance workload responsiveness, delivering up to 1.3x power-per-watt than the competition.

BUILT-IN SECURITY

EPYC Embedded 9005 series support all confidential computing features from our previous-generation product, including Secure Memory Encryption-SME, Secure Encrypted Virtualization-SEV, SEV-Encrypted State, SEV-Secure Nested Pages, and hardware-validated boot. Added to the fifth-generation product is AMD Trusted I/O. This feature establishes a framework for securing virtualized I/O paths. It supports the PCI-SIG TDISP standard that mutually authenticates the VM and the device, then establishes an encrypted connection. AMD trusted I/O provides the framework for ensuring mutual trust and security of data in flight.

ENTERPRISE-CLASS RELIABILITY, AVAILABILITY, AND SERVICEABILITY (RAS)

AMD EPYC™ Embedded 9005 series processors offer seamless, 24/7 performance for storage, networking, and security workloads. Key RAS features include:

- **DRAM ECC with Advanced Memory Device Correction:** Detects and corrects single DRAM device failures, enhancing system uptime.
- **Crash Dump and MCA Over APML:** Allows the processor to report both fatal and runtime errors out-of-band to the platform without halting the x86 cores.
- **DRAM Runtime Post-Package Repair:** Reconfigures faulty DIMM rows in real time, maintaining reliability without system reboots.

EXTENDED LONGEVITY

To meet the longer product lifecycle and operational requirements of embedded markets, AMD EPYC Embedded 9005 Series CPUs provide extended 7-year product manufacturing support, helping system designers ensure long-term product availability, reducing redesign and qualification efforts. Additionally, AMD plans to extend design lifetime operation targets from 5 years on currently sampling AMD EPYC Embedded 9005 Series CPUs, to 7 years for production SKUs, ensuring long-term product stability for embedded systems. These extended design lifetime operation targets are critical for embedded systems running mission-critical applications in harsh conditions, minimizing unplanned downtime, repairs, and costly system replacements.

ADDITIONAL KEY FEATURES

64-BIT X86 "ZEN 5" AND "ZEN 5c" ARCHITECTURE:

- Supports classic (4nm) and dense (3nm) cores
- "Zen 5": Up to 16 core complex die (CCDs) / 128 cores / 256 threads
- "Zen 5c": Up to 12 CCDs / 192 cores / 384 threads
- Gen 3 AMD Infinity Fabric™ architecture with up to 32 Gbps die-to-die bandwidth
- 1 MB L2 cache per core, up to 32 MB L3 per CCD

MEMORY:

- RDIMM and 3DS RDIMM support
- 12-channel DDR5 with ECC up to 6000 MT/s
- Option for 2, 4, 6, 8, 10, and 12-channel memory interleaving
- Up to two DIMMs per channel capacity of 9 TB/socket (384 GB 3DS RDIMMs)

I/O:

- 160 lanes (2P) or 128 (1P) lanes of PCIe Gen5
- Speeds up to 32 Gbps with bifurcation supported down to x1
- PCIe link encryption and PCIe Hotplug port reconfiguration
- CXL 2.0, four x16 capable "P" links; Type 3, Type 1 and 2
- Up to 32 I/O lanes for SATA
- SDCI (Smart Data Cache Injection)
- Four USB 3.2 Gen2x1 ports, including support for legacy USB speeds

RAS (RELIABILITY, AVAILABILITY, AND SERVICEABILITY)

- Advanced Memory Device Correction
- Dynamic PPR (Post Package Repair) to repair faulty DIMMs
- BMC MCA crash-dump
- Out-of-band error polling over APML

ADDITIONAL FUNCTIONALITY:

- NTB (Non-Transparent Bridging)
- DRAM flush
- Non-Volatile CXL Memory Module (NV-CMM)
- Dual SPI
- Yocto Project® board support package for custom Linux distributions
- Seven-year product availability

SECURITY:

- Hardware root-of-trust
- Secure I/O (SEV-TIO)
- SME, SEV-ES, SEV-SNP, SMKE

PRODUCT SKUS

MODEL	CORES	CCD ("ZEN5" / "ZEN5c")	CORES (UP TO GHZ)	DEFAULT TDP (W)	L3 CACHE (MB)
AMD EPYC™ Embedded 9965	192	"Zen 5c"	2.25 / 3.7	500W	384
AMD EPYC™ Embedded 9845	160	"Zen 5c"	2.1 / 3.7	390W	320
AMD EPYC™ Embedded 9755	128	"Zen 5"	2.7 /4.1	500W	512
AMD EPYC™ Embedded 9745		"Zen 5c"	2.4 / 3.7	400W	256
AMD EPYC™ Embedded 9655	96	"Zen 5"	2.6 /4.5	400W	384
AMD EPYC™ Embedded 9655p		"Zen 5"	2.6 /4.5	400W	384
AMD EPYC™ Embedded 9555	64	"Zen 5"	3.2 / 4.4	400W	256
AMD EPYC™ Embedded 9555p		"Zen 5"	3.2 / 4.4	360W	256
AMD EPYC™ Embedded 9535		"Zen 5"	2.4 / 4.3	360W	256
AMD EPYC™ Embedded 9455	48	"Zen 5"	3.15 / 4.4	300W	256
AMD EPYC™ Embedded 9455p		"Zen 5"	3.15 / 4.4	300W	256
AMD EPYC™ Embedded 9355	32	"Zen 5"	3.55 / 4.4	280W	256
AMD EPYC™ Embedded 9355P		"Zen 5"	3.55 / 4.4	280W	256
AMD EPYC™ Embedded 9355		"Zen5"	3.0 / 4.4	210W	128
AMD EPYC™ Embedded 9255	24	"Zen 5"	3.25 / 4.3	200W	128
AMD EPYC™ Embedded 9135	16	"Zen 5"	3.65 / 4.3	200W	64
AMD EPYC™ Embedded 9015	8	"Zen 5"	3.6 / 4.1	125W	64

FOOTNOTES

The information contained herein is for informational purposes only and is subject to change without notice. Timelines, roadmaps, and/or product release dates mentioned herein are plans only and subject to change. "Zen", "Zen 5," and "Zen 5c" are code names for AMD architectures and are not product names (GD-122).

1. Estimated integer throughput uplift is based on 5th Gen AMD EPYC 9965 processor test results compared to 6th Gen Intel Xeon 6980P processor test results, on the SPECrate®2017_int_base benchmark. Scores published on Spec.org in December 2024. Results may vary based on settings, configuration, usage, and other factors. SPEC® and SPECrate are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information. AMD EPYC 9965 CPU Scores: https://www.spec.org/cpu2017/results/res2024q4/cpu2017-20241004-44979.html. INTEL XEON 6980P CPU Scores: https://spec.org/cpu2017/results/res2025q1/cpu2017-20241230-45863.html. (EEB-005).

2. Estimated results based on 5th Gen EPYC Embedded 9965 processor test results compared to 6th Gen Intel Xeon 6980 processor test results, on the SPECrate®2017_int_base benchmark. Scores published on Spec.org in December 2024. Results may vary based on settings, configuration, usage, and other factors. SPEC® and SPECrate are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information. AMD EPYC Embedded 9965 CPU Scores (performance score 3100 @ 1000W- Perf/W-3.1): https://www.spec.org/cpu2017/results/res2024q4/cpu2017-20241004-44979.html. INTEL XEON 6980P CPU Scores (performance score 2420 @ 1000W- Perf/W- 2.4): https://www.spec.org/cpu2017/results/res2025q1/cpu2017-20241230-45863.html. (EEB-010).

3. 160 PCIe Gen 5 lanes is based on a 2P configuration.