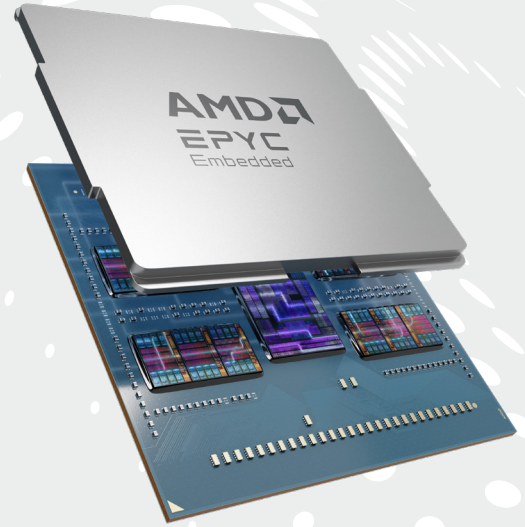


# AMD EPYC™ EMBEDDED 9004 AND 8004 SERIES PROCESSORS

4TH-GENERATION AMD EPYC™ EMBEDDED  
PROCESSORS DELIVER BREAKTHROUGH  
PERFORMANCE AND POWER EFFICIENCY  
FOR NETWORKING, SECURITY, STORAGE AND  
INDUSTRIAL SYSTEMS



## PRODUCT OVERVIEW

AMD EPYC™ Embedded 9004 and 8004 Series processors harness the performance and efficiency benefits of the “Zen 4” and “Zen 4c” core architecture (implemented with TSMC 5nm process technology) to achieve new levels of core density and performance-per-watt. Scalable up to 96 cores (9004 Series) with thermal design power (TDP) profiles starting at 70W (8004 Series), 4th-Generation AMD EPYC™ Embedded processors are designed to meet stringent performance and efficiency requirements for next-generation networking, security/firewall, storage and industrial systems.

Advanced reliability and security features available with AMD EPYC™ Embedded 9004 and 8004 Series processors make them ideally suited for applications with enterprise-class performance and protection needs. Supporting enterprise-grade reliability and planned availability up to seven years, AMD EPYC™ Embedded 9004 and 8004 Series processors are targeted for heavy workload, ‘always on’ embedded systems requiring exceptional compute performance and I/O agility in a power-optimized profile.

## EXCEPTIONAL PERFORMANCE-PER-WATT AND SCALABILITY

The performance and power scalability afforded with AMD EPYC™ Embedded 9004 and 8004 Series processors make them an ideal fit for embedded system OEMs expanding their product portfolios across a range of performance and power-optimized options. The onboard I/O provides ample connectivity for additional ASICs, networking cards, SSDs and/or controllers to help enable greater overall system design flexibility.

## AMD EPYC™ EMBEDDED 9004 SERIES PROCESSORS

AMD EPYC™ Embedded 9004 Series processors exploit the benefits of AMD “Zen 4” CPU cores to achieve new levels of performance. The series comprises ten processor models with performance options ranging from 16 to 96 cores (32 to 192 threads), and a thermal design power (TDP) profile ranging from 200W to 400W.

AMD EPYC™ Embedded 9004 Series processors integrate a broad set of high-speed interfaces with 128 I/O lanes capable of up to PCIe® Gen 5 speeds, up to 64 CXL lanes, 12 bonus PCIe® lanes, and support for up to 32 SATA devices. AMD EPYC™ Embedded 9004 Series processors are equipped with the latest and fastest DDR5 memory channels.

Each CPU model supports 12 DDR5 memory channels with transfer rates up to 4800 Mbps. Each channel has capability to support up to 2 DIMMs to yield 6TB (256GB DIMM size) of main memory capacity per socket. To help optimize for both small and large memory configurations, AMD EPYC™ Embedded 9004 Series processors support 2-,4-,6-,8-,10-, and 12-channel memory configurations and interleaving.

## AMD EPYC™ EMBEDDED 8004 SERIES PROCESSORS

For some workloads, highly optimized power efficiency is required, particularly in the challenging environmental and thermal constraints common to networking, storage and industrial applications. AMD EPYC™ Embedded 8004 Series processors leverage the benefits of “Zen 4c” cores to achieve new levels of core density and performance-per-watt, delivering excellent energy efficiency in a compact package.

Available in 1P configurations from 12 to 64 cores (24 to 128 threads) with up to 1.152TB DDR5 (2 DIMMs/channel with 96GB DIMM size) memory capacity, AMD EPYC™ Embedded 8004 Series processors support thermal design power (TDP) profiles ranging from 70W to 225W. AMD EPYC™ Embedded 8004 Series processors deliver the balanced performance and excellent energy efficiency needed for densely architected, space and power constrained systems.

The high-speed I/O connectivity provided with AMD EPYC™ Embedded 8004 Series processors (96 lanes PCIe® Gen 5 and CXL 1.1+ support) combined with expansive memory bandwidth (6 channels of DDR5-4800 supporting 2-, 4-, and 6- channel memory interleaving) are designed to support data-intensive workloads with ease.

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

Reliable, consistent processing performance is critical in heavy workload, 24x7 operating environments for delivering seamless compute, storage, networking and security protections without compromise. Key RAS features available with AMD EPYC™ Embedded 9004 and 8004 Series processors include:

- **DRAM ECC (Error Correction Code) with AMDC (Advanced Memory Device Correction)** provides the ability to correct and recover from errors, even in the case where an entire DRAM device fails. This feature helps to improve system uptime.
- **PCIe® System Firmware Intermediary (SFI)** capability isolates PCIe® hot-plug events from OS and applications, adding a firmware layer between OS and devices to enhance robustness, security and traceability of hot-plug events.
- **DRAM runtime post-package repair** capability allows DIMMs with problem DRAM rows to be reconfigured and kept in service with the same level of reliability as before, maximizing uptime and eliminating the need to reboot the system on soft repair.<sup>1,2</sup>

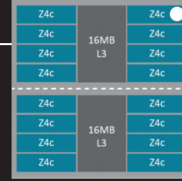
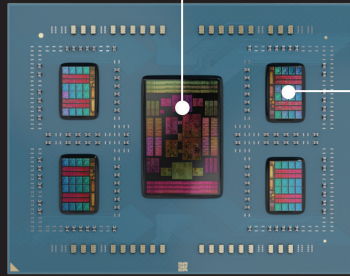
## UNIQUE EMBEDDED FEATURES

AMD EPYC™ Embedded 9004 and 8004 Series processors offer additional embedded-specific features:

- **Direct Memory Access (AMD EPYC 4th Gen DMA):** Designed to improve system efficiency and performance by offloading data transfers from the CPU, allowing cores to focus on critical application tasks.
- **Non-Transparent Bridging (NTB):** Enhances system reliability by enabling data exchange between two CPUs in active-active configurations via PCI Express (PCIe®), enabling continued operation in case of a failure.
- **DRAM Flush to NVMe:** Helps ensure critical data is preserved by flushing it from DRAM to nonvolatile memory in the event of a power loss (available with EPYC Embedded 8004 processors only).
- **Dual SPI Support:** Enables the use of two SPI ROMs, one for the BIOS image and another for a secure bootloader, providing an added layer of security.
- **Device Identity Attestation:** Helps protect against unauthorized CPU upgrades by allowing cryptographic authentication of the processors.
- **Yocto Project™ Framework Support:** Empowers customers to create a lightweight, optimized Linux® OS for embedded systems.

AMD EPYC™ EMBEDDED 8004 SERIES ARCHITECTURE

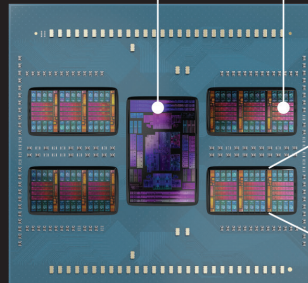
I/O die  
6 memory controllers  
and 96 PCIe lanes  
connected to  
SP6 package pins



'Zen 4c' CPU die  
Up to 4 dies  
per processor

AMD EPYC™ EMBEDDED 9004 SERIES ARCHITECTURE

I/O die  
12 memory controllers  
PCIe® Gen 5 controllers  
Infinity Fabric™ controllers  
SATA controllers  
CXL™ controllers  
AMD Secure Processor



CPU die  
8 cores per die  
Up to 12 dies per processor



CPU die detail  
8 'Zen 4' cores  
1 MB L2 cache per core  
Shared 32 MB L3 cache

MODEL	OPN	2P/1P	CORES	NOMINAL TDP (W)	CTDP (W)	IRM GROUP	L3 CACHE	BASE FREQ (GHZ)	MAX FREQ* (GHZ)
9654	100-000000921	2P	96	360	320-400	E	384	2.4	3.7
9554	100-000000912	2P	64	360	320-400	E	256	3.1	3.75
9454	100-000000913	2P	48	290	240-300	A	256	2.75	3.8
9354	100-000000914	2P	32	280	240-300	A	256	3.25	3.8
9254	100-000000915	2P	24	200	200-240	B	128	2.9	4.15
9124	100-000000916	2P	16	200	200-240	B	64	3.0	3.7
9654P	100-000000917	1P	96	360	320-400	E	384	2.4	3.7
9554P	100-000000918	1P	64	360	320-400	E	256	3.1	3.75
9454P	100-000000919	1P	48	290	240-300	A	256	2.75	3.8
9354P	100-000000920	1P	32	280	240-300	A	256	3.25	3.8
8534P	100-000001415	1P	64	200	155-225	A	123	2.3	3.1
8434P	100-000001416	1P	48	200	155-225	A	12B	2.5	3.1
8324P	100-000001417	1P	32	180	755-225	A	123	2.65	3.0
8224P	100-000001418	1P	24	100	155-225	A	54	2.55	3.0
8124P	100-000001419	1P	16	125	120-150	B	64	2.45	3.0
8C24P <sup>3</sup>	100-000001546	1P	12	100	70-100	C	32	2.45	3.0

\*Max Freq is the maximum frequency achievable by any single core on the processor under normal operating conditions.

FOOTNOTES

<sup>1</sup>Socket SP5/SP6 Platform RAS Specification and Implementation Guide for Family 19h Model 10-1Fh

<sup>2</sup>JEDEC Publishes Update to DDR5 SDRAM Standard Used in High-Performance Computing Applications

<sup>3</sup>Engineering projections by AMD as of 9/30/2024. Projections are based on internal designs and are not a guarantee of final performance. Actual performance and specifications will vary. This data is provided as a basis for discussion for informational purposes to provide general directional guidance in advance of final product configuration. CD-218

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