

LEADERSHIP ANSYS® CFX®, FLUENT®, & LS-DYNA® PERFORMANCE OUTPERFORMING 5TH GEN INTEL® XEON®

Powered by 4th Gen AMD EPYC™ Processors

October, 2024

AT A GLANCE

2P systems powered by 32- and 64-core 4th Gen AMD EPYC™ processors demonstrate outstanding per-core and top of stack competitive and generational performance uplifts on Ansys® CFX®, Ansys® Fluent®, and Ansys® LS-DYNA.

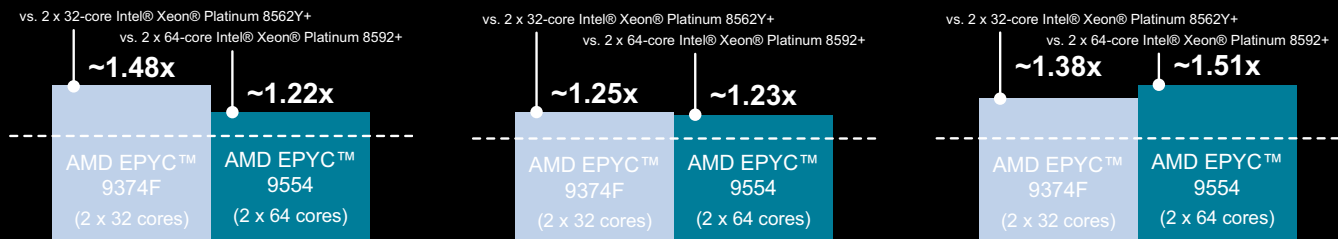
PERFORMANCE HIGHLIGHTS

A single 2P 32-core 4th Gen AMD EPYC 9374F system demonstrates composite average ~1.48x, ~1.25x, and ~1.51x uplifts vs. a single 2P Intel® Xeon® Platinum 8562Y+ system running Ansys CFX, Ansys Fluent, and Ansys LS-DYNA, respectively. A single 2P 64-core 4th Gen AMD EPYC 9554 system demonstrates composite average ~1.22x, ~1.23x, and ~1.38x uplifts vs. a single 2P Intel® Xeon® Platinum 8592+ system running Ansys CFX, Ansys Fluent, and Ansys LS-DYNA, respectively.

COMP. AVG. ANSYS CFX UPLIFTS

COMP. AVG. ANSYS FLUENT UPLIFTS

COMP. AVG. ANSYS LS-DYNA UPLIFTS



KEY TAKEAWAYS

Comparing 2P servers powered by 4th Gen 32-core AMD EPYC 9374F and 64-core AMD EPYC 9554 processors versus 2P servers powered by 5th Gen 32-core Intel Xeon Platinum 8562Y+ and 64-core Intel Xeon Platinum 8592+ processors delivered the strong composite average Ansys CFX, Ansys Fluent, and Ansys LS-DYNA competitive performance uplifts summarized above. Detailed per-benchmark results appear starting on Page 2 of this Performance Brief.

General purpose and high frequency 4th Gen AMD EPYC CPUs are available in 1P and 2P configurations and feature:

- Up to 96 cores (192 threads) per processor.
- Up to 384 MB L3 cache.
- Up to 4 Gen 3 Infinity Fabric™ links at up to 32 Gbps.
- Up to 12 memory channels per socket that support up to 6 TB of DDR5-4800 memory.
- Support for up to 128 (1P) and up to 160 (2P) PCIe® Gen 5 with up to 32 Gbps bandwidth.
- AVX-512 instruction support for enhanced HPC and ML performance.
- AMD Infinity Guard technology to defend your data.¹

IN THIS BRIEF

- Detailed Ansys CFX Performance Results **Page 2**
- Detailed Ansys Fluent Performance Results **Page 3**
- Detailed Ansys LS-DYNA Performance Results **Page 4**
- Test Methodology **Page 5**
- System Configuration **Page 5**
- References **Page 6**

DETAILED ANSYS CFX PERFORMANCE RESULTS

AMD tested Ansys CFX V231 as described in Test Methodology, below. Ansys CFX is a Computational Fluid Dynamics (CFD) software tool for designing and optimizing turbomachinery, including pumps, turbines, compressors, fans, and other rotating machinery that improves efficiency, safety, and durability. CFX has received extensive industry validation. Visit the [Ansys CFX website](#)* to learn more.

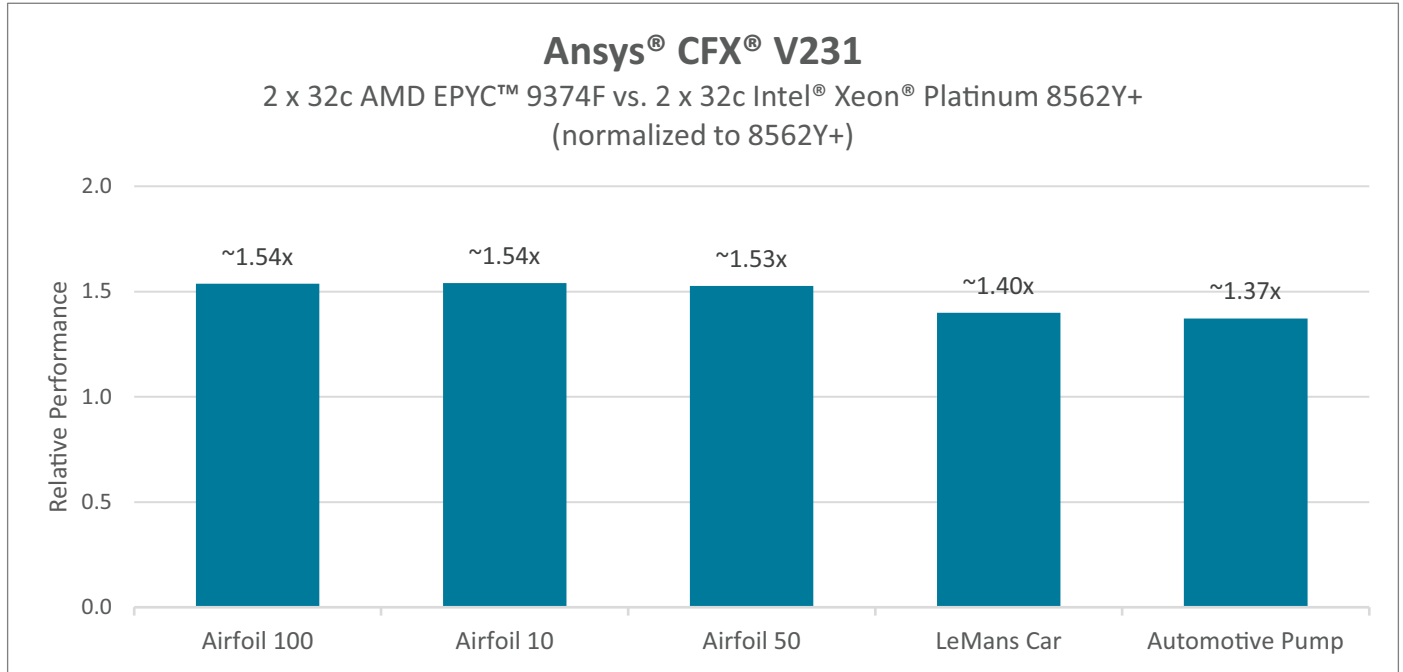


Figure 1: Detailed Ansys CFX performance, 2 x 32-core processors

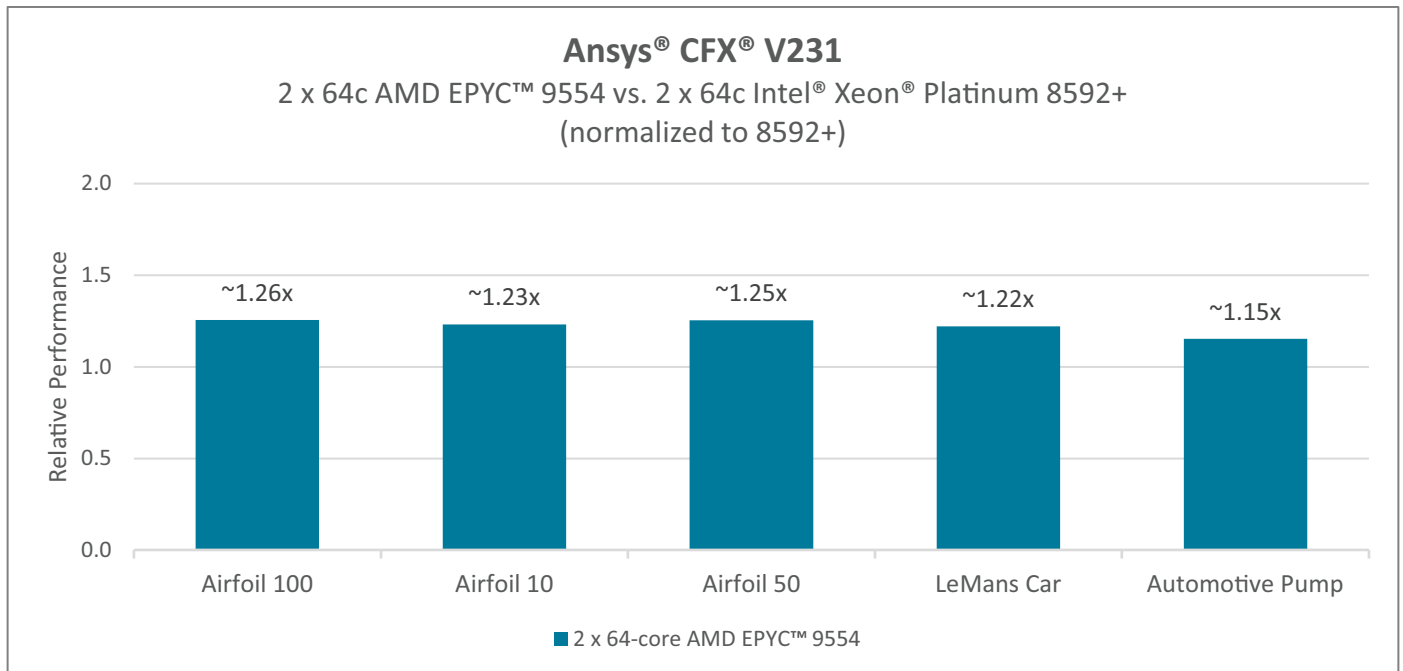


Figure 2: Detailed Ansys CFX performance, 2 x 64-core processors

DETAILED ANSYS FLUENT PERFORMANCE RESULTS

AMD tested Ansys Fluent V232 as described in Test Methodology, below. Ansys Fluent is a general-purpose CFD application that models fluid flow, heat and mass transfer, chemical reactions, and more via a modern user interface that streamlines the CFD process from pre- to post-processing within a single window workflow. Fluent is known for its advanced physics modeling capabilities. Some of these capabilities include turbulence modeling, single and multiphase flows, combustion, battery modeling, and fluid-structure interaction. Visit the [Ansys Fluent website](https://www.ansys.com/fluentsite)* to learn more.

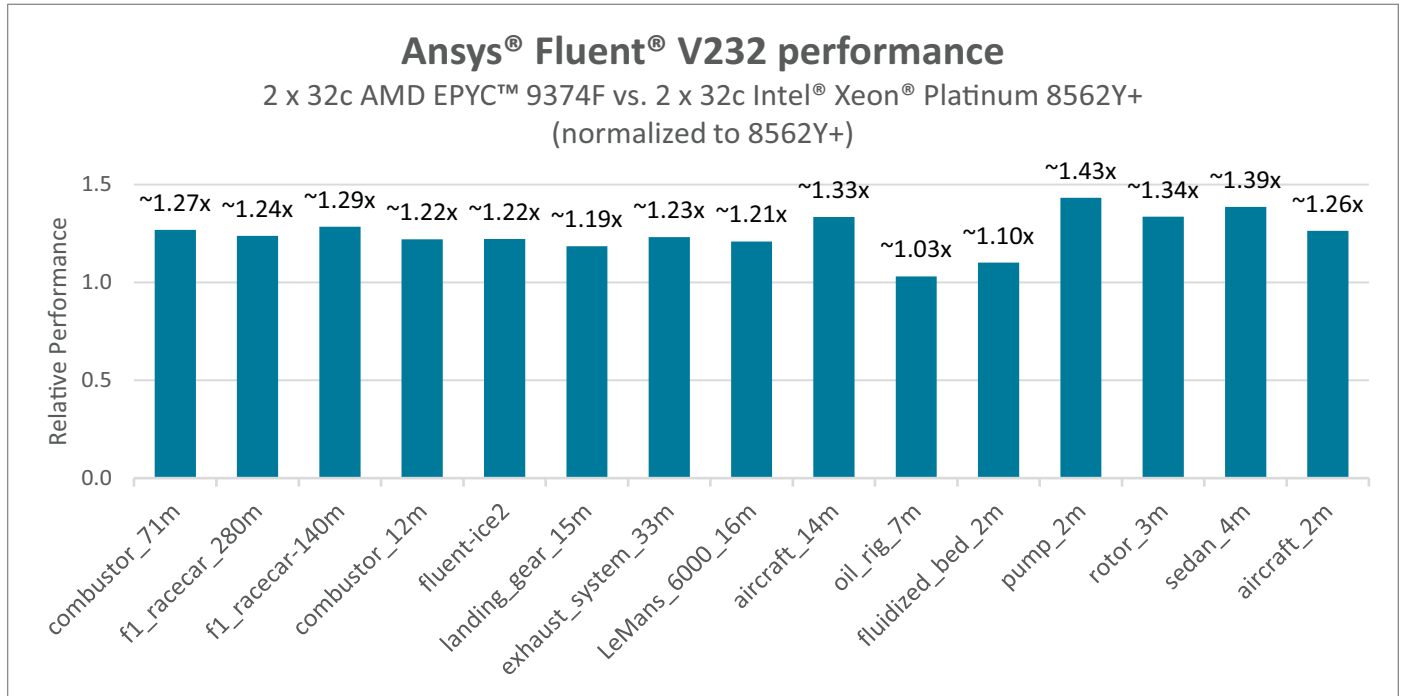


Figure 3: Detailed Ansys Fluent performance, 2 x 32-core processors

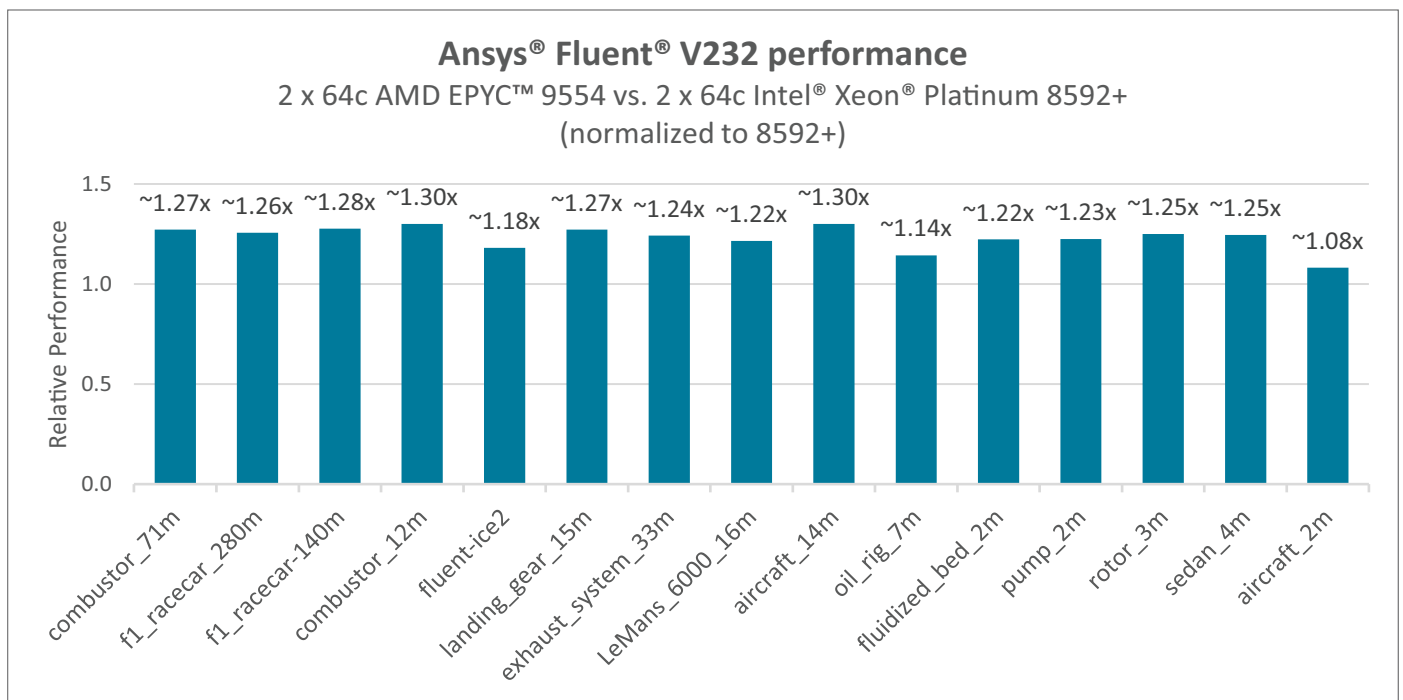


Figure 4: Detailed Ansys Fluent performance, 2 x 64-core processors

DETAILED ANSYS LS-DYNA PERFORMANCE RESULTS

AMD tested Ansys LS-DYNA R13_1_1 as described in Test Methodology, below. Ansys LS-DYNA is a widely-used explicit simulation program that simulates how materials respond to short periods of severe loading. Its many elements, contact formulations, material models and other controls can be used to simulate complex models with finely detailed controls. Some of the many Ansys LS-DYNA use cases include crash/impact behavior and safety, plasticity, failure (including fracture and fragmentation), manufacturing methods (such as stamping and drawing), and the behaviors of compressible and incompressible fluids. Visit the [Ansys LS-DYNA website](#)* to learn more.

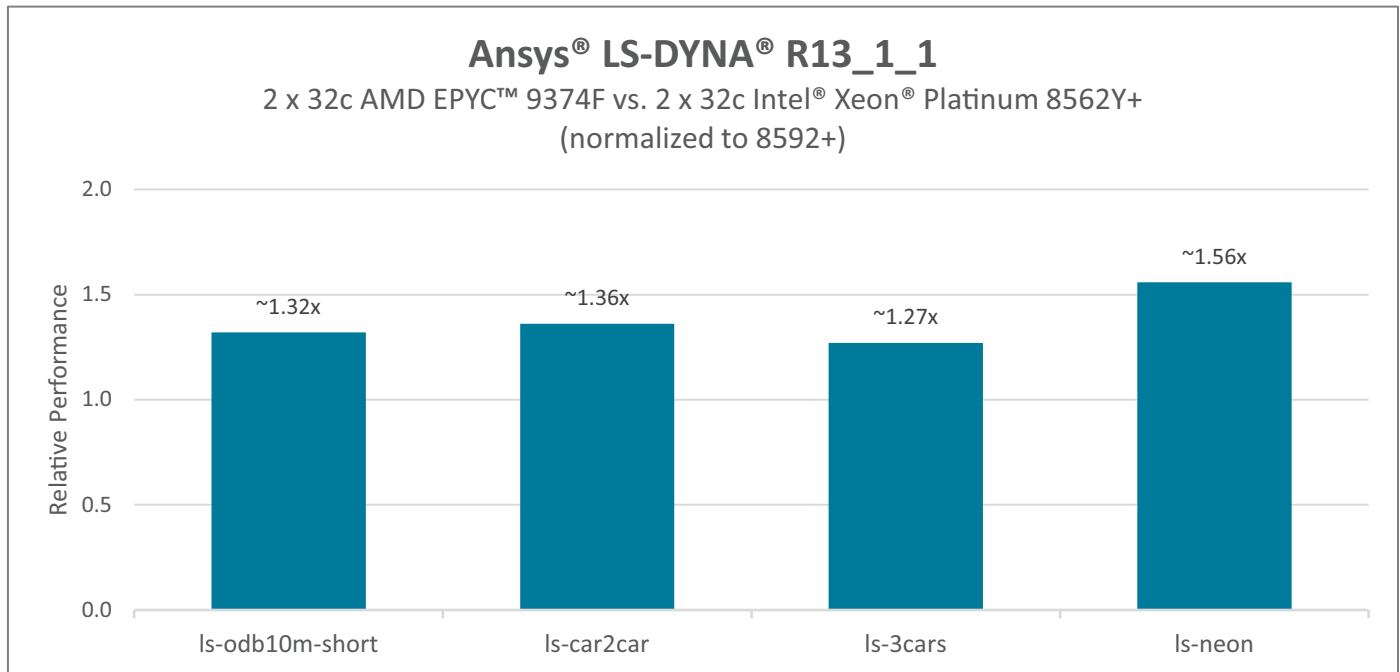


Figure 5: Detailed Ansys Fluent performance, 2 x 32-core processors

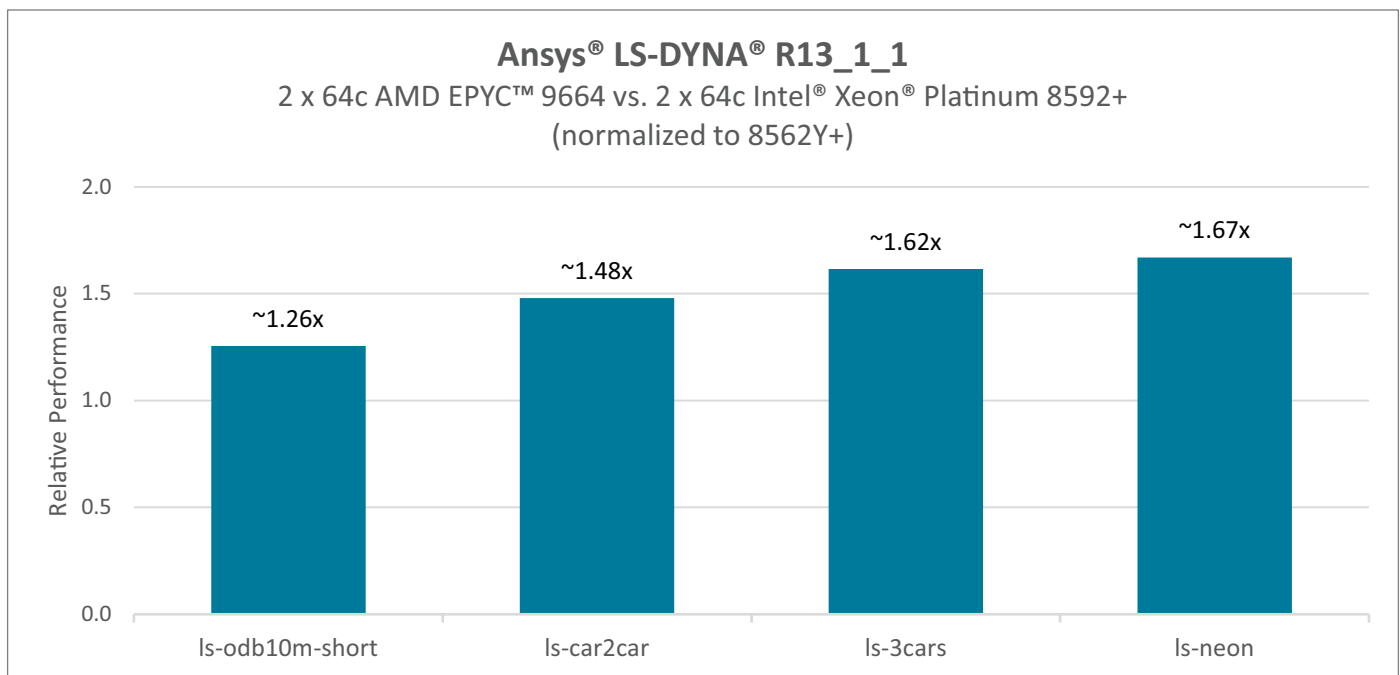


Figure 6: Detailed Ansys Fluent performance, 2 x 64-core processors

TEST METHODOLOGY

Ansys provides a standard set of benchmarks that evaluate the performance of different platforms running Ansys applications. These benchmark cases represent typical usage and cover a range of sizes. Each of the systems described in Tables 1 and 2 ran each of the benchmarks listed in each of the Detailed Results sections of this Performance Brief three times. The total amount of variability between individual runs was <2%. The average from each three-run set was used to calculate the performance uplift for that benchmark. The uplift is calculated as the ratio of the systems under test (*sut*) to the reference systems (*ref*). In this Performance Brief, the Intel Xeon Platinum 8562Y+ and Intel Xeon Platinum 8592+ processors are the *ref* systems, and 4th Gen AMD EPYC processors are the *sut*. The 4th Generation AMD EPYC processors tested included the high frequency AMD EPYC 9374F and general purpose AMD EPYC 9554 models.

SYSTEM CONFIGURATION

AMD SYSTEM CONFIGURATION		
CPUs	2 x AMD EPYC 9374F	2 x AMD EPYC 9554
Frequency: Base Boost ²	3.85 GHz 4.3 GHz	3.1 GHz 3.75 GHz
Cores	32 cores/socket (64 threads)	64 cores/socket (128 threads)
L3 Cache	256 MB per CPU	256 MB per CPU
Memory	1.5 TB (24 x 64 GB DDR5-4800)	
Storage	SAMSUNG MZQL21T9HCJR-00A07	
BIOS Version	RTI1009C	
BIOS Settings	SMT=Off, NPS=4, Determinism=Power	
OS	RHEL 9.3 (kernel Linux 5.14.0-362.8.1.el9_3.x86_64)	
Kernel CMDLINE	amd_iommu=on, iommu=pt, mitigations=off	
Runtime Tunings	Clear caches, NUMA Balancing 0, randomize_va_space 0, THP ON, CPU Governor=Performance, Disable C2 States	

Table 1: AMD system configurations

INTEL SYSTEM CONFIGURATION		
CPUs	2 x Intel® Xeon® Platinum 8562Y+	2 x Intel® Xeon® Platinum 8592+
Frequency: Base Boost	2.80 GHz 4.10 GHz	1.90 GHz 3.90 GHz
Cores	32 cores/socket (64 threads)	64 cores/socket (128 threads)
L3 Cache	60 MB per CPU	320 MB per CPU
Memory	1.0 TB (16 x 64 GB DDR5-5600)	
Storage	KIOXIA KCMYXRUG3T84	
BIOS Version	ESE122V-3.10	
BIOS Settings	Hyperthreading=Off, Profile=Maximum Performance Profile	
OS	RHEL 9.3 (kernel Linux 5.14.0-362.8.1.el9_3.x86_64)	
Kernel CMDLINE	processor.max_cstate=1, Intel_idle.max_cstate=0, iommu=pt, mitigations=off	
Runtime Tunings	Clear caches, NUMA Balancing 0, randomize_va_space 0, THP ON, CPU Governor=Performance	

Table 2: Intel system configurations

FOR ADDITIONAL INFORMATION

Please see the following additional resources for more information about 4th Gen AMD EPYC features, architecture, and available models:

- [AMD EPYC™ 9004 Series Processors](#)
- [AMD Documentation Hub](#)

REFERENCES

1. AMD Infinity Guard features vary by EPYC™ Processor generations and/or series. Infinity Guard security features must be enabled by server OEMs and/or Cloud Service Providers to operate. Check with your OEM or provider to confirm support of these features. Learn more about Infinity Guard at <https://www.amd.com/en/technologies/infinity-guard>. GD-183A
2. Maximum boost for AMD EPYC processors is the maximum frequency achievable by any single core on the processor under normal operating conditions for server systems. EPYC-18

AUTHOR

Michael Senizaiz contributed to this Performance Brief.

RELATED LINKS

- [Ansys*](#)
- [Ansys CFX*](#)
- [Ansys Fluent*](#)
- [Ansys LS-DYNA*](#)
- [Ansys and AMD*](#)
- [Ansys HPC*](#)

**Links to third party sites are provided for convenience and unless explicitly stated, AMD is not responsible for the contents of such linked sites and no endorsement is implied.*

AMD EPYC 9004 FOR CFD

4th Gen AMD EPYC CPUs deliver excellent per-core performance by taking advantage of fast CPU frequencies, low latency memory, and a unified cache structure. Design engineers can use AMD EPYC processors to perform complex computational fluid design tasks with ground-breaking high-performance computing and robust security features to deliver excellent results.

“ZEN 4” CORE & SECURITY FEATURES

General-purpose support for up to:

- 96 physical cores, 192 threads
- 1152 MB of L3 cache per CPU
- 96 MB of L3 cache per CCD
- 6 TB of DDR5-4800 memory
- Up to 128 1P, up to 160 2P PCIe® Gen 5 lanes

Infinity Guard security features¹

- Secure Boot
- Encrypted memory with SME

ANSYS

Ansys offers a broad portfolio of engineering simulation software that enables customers to solve complex design challenges, rapidly innovate and easily validate design ideas, and predict the performance of future products.

DISCLAIMERS

The information contained herein is for informational purposes only and is subject to change without notice. While every precaution has been taken in the preparation of this document, it may contain technical inaccuracies, omissions and typographical errors, and AMD is under no obligation to update or otherwise correct this information. Advanced Micro Devices, Inc. makes no representations or warranties with respect to the accuracy or completeness of the contents of this document, and assumes no liability of any kind, including the implied warranties of noninfringement, merchantability or fitness for particular purposes, with respect to the operation or use of AMD hardware, software or other products described herein. No license, including implied or arising by estoppel, to any intellectual property rights is granted by this document. Terms and limitations applicable to the purchase or use of AMD products are as set forth in a signed agreement between the parties or in AMD's Standard Terms and Conditions of Sale. GD-18u.

COPYRIGHT NOTICE

©2024 Advanced Micro Devices, Inc. All rights reserved. AMD, the AMD logo, EPYC, and combinations thereof are trademarks of Advanced Micro Devices. Microsoft and SQL Server are trademarks or registered trademarks of Microsoft Corporation in the US and other countries. Ansys, CFX, Fluent, LS-DYNA, Mechanical, RedHawk, and any and all Ansys, Inc. brand, product, service and feature names, logos and slogans are registered trademarks or trademarks of Ansys, Inc. or its subsidiaries in the United States or other countries under license. Linux is the registered trademark of Linus Torvalds in the U.S. and other countries. Red Hat is a trademark or registered trademark of Red Hat, Inc. PCIe is a registered trademark of PCI-SIG Corporation. Other product names used in this publication are for identification purposes only and may be trademarks of their respective owners. Certain AMD technologies may require third-party enablement or activation. Supported features may vary by operating system. Please confirm with the system manufacturer for specific features. No technology or product can be completely secure.