

Product Brief

Intel® Xeon® 6 Processor Family



The Intel Xeon 6 Processor Family



The Intel Xeon 6 processor family introduces a robust computing platform that excels at both performance and efficiency, which are crucial for meeting the evolving demands of modern data centers. From powering compute-intensive workloads to enabling scalable cloud-native microservices, the processor family provides versatility for diverse operational requirements.

Bringing versatility to the data center

Businesses rely on performant data center infrastructure to drive innovation. But for IT leaders, that performance must be balanced with strong security, energy efficiency, and manageability—a daunting task, given today's increasingly diverse range of demanding workloads. Organizations need infrastructure with the performance and flexibility to handle everything from general storage and networking needs to high-performance computing (HPC), analytics, and AI. That's where the Intel Xeon 6 processor family excels.

With an innovative modular x86 architecture, the Intel Xeon 6 processor family allows data center architects to configure and deploy infrastructures that are purpose-built for unique needs and workloads across private, public, and hybrid clouds. To provide that versatility, Intel Xeon 6 processors allow for the choice of two different CPU microarchitectures: Performance-cores (P-cores) and Efficient-cores (E-cores). And with the latest product releases, the complete Intel Xeon 6 processor family is now available, with a full range of processor options that are built to meet a broad array of business needs, from high-density compute and scale-out workloads to AI-accelerated, high-performance multi-core computing, and everything in between.

Intel Xeon 6 processors with P-cores and E-cores

At one end of the workload spectrum, P-cores offer the best solution for compute-intensive, vector-based workloads such as AI and HPC, whereas E-cores are best for task-parallel, scalar-based workloads such as microservices. Between these ranges, the two microarchitectures combine to allow for highly versatile and complementary solutions. For example, systems powered by Intel Xeon 6 processors with E-cores can help consolidate a data center's footprint to make space for modern AI servers that make use of Intel Xeon 6 processors with P-cores. Data centers designed with a mix of Intel Xeon 6 processors with P-cores and with E-cores can take advantage of their platform commonality to transition workloads from one core type to the other depending on performance and power needs. The wide mix of options makes it easy for the data center to scale as the business grows.

As another example of the complementary nature of Intel Xeon 6 processors, a data center can easily mix servers with Intel Xeon 6 processors with P-cores and Intel Xeon 6 processors with E-cores to support business needs that require databases of different structures. Relational databases, which are characterized by complex data relationships, complex queries, joins, and aggregations, can benefit from the parallel data processing capabilities of Intel Xeon 6 processors with P-cores. Non-relational databases with numerous small, independent requests for data retrieval, such as key-value stores, can benefit from the task-parallel design of Intel Xeon 6 processors with E-cores.

Faster business results across the spectrum of workloads

Intel Xeon 6 processors deliver new degrees of performance with more cores, a choice of microarchitecture, additional memory bandwidth, and exceptional input/output (I/O) across a range of workloads. Features like Multiplexed Rank DIMM (MRDIMM) support, Compute Express Link (CXL) enhancements, [integrated accelerators](#), and more give an additional boost to targeted workloads for even greater performance and efficiency.

Performance and efficiency without compromise

Intel Xeon 6 processors are available in four series, offering tiered capabilities to take on entry-level and demanding workloads with options for an increased number of cores, a larger cache, faster and higher-capacity memory, and improved I/O over previous generations.

All Intel Xeon 6 processor families use a compatible x86 instruction set architecture (ISA) and a common hardware platform, including CPU socket type. Furthermore, Intel has teamed with industry partners to help ensure seamless use of both core types with common operating systems, compilers, libraries, and frameworks. With this shared software stack and a global ecosystem of hardware and software vendors, solutions can be matched to every business need.

Intel Xeon 6 processors with Performance-cores (P-cores)

Intel Xeon 6 processors with P-cores are optimized for high performance per core. With more cores, double the memory bandwidth, and AI acceleration in every core, Intel Xeon 6 processors with P-cores provide twice the performance for the widest range of workloads, including AI and HPC.^{1,2} Intel Xeon 6 processors with P-cores excel at a wide range of workloads, delivering better performance than any other general-purpose CPU for compute-intensive workloads like AI inference and machine learning (ML). Intel Xeon 6 processors with P-cores are great for public cloud workloads because they offer improved performance per vCPU for floating point operations, transactional databases, and HPC workloads.

Thanks to optimized processing performance, Intel Xeon 6 processors with P-cores continue to be the [host CPU of choice](#) for the world's most powerful AI accelerator platforms.

- **Take advantage of up to 128 cores per socket** with up to 504 MB L3 cache and exceptionally low latency at large L3 access sizes. Intel® Advanced Vector Extensions 512 (Intel® AVX-512) is only supported on Intel Xeon 6 processors with P-cores, and it can be used out of the box, boosting the speed of vector math common to HPC and classical AI workloads.
- **Improve memory throughput with the fastest DDR5 memory available, MRDIMMs.** MRDIMMs can deliver more than 37 percent greater memory bandwidth than RDIMMs,³ with an expected data transfer rate of up to 8,800 megatransfers per second (MT/s). Intel Xeon 6 processors (both with P-cores and with E-cores) also support DDR5-6400 high-speed memory, providing memory bandwidth gains.
- **Enable AI everywhere with AI acceleration in every core.** Intel® Advanced Matrix Extensions (Intel® AMX) speeds up inferencing for INT8 and BF16, and it offers support for FP16-trained models, with up to 2,048 floating point operations per cycle per core for INT8 and 1,024 floating point operations per cycle per core for BF16/FP16.
- **Consolidate servers to reduce total cost of ownership (TCO).** Achieve 5:1 average server consolidation at maintained performance with an average TCO gain of 40 percent, compared to 2nd Gen Intel Xeon Scalable processors.⁴
- **Enhance privacy and control over your data with increased confidentiality at the virtual machine (VM) level.** With Intel® Trust Domain Extensions (Intel® TDX) confidential VMs, the guest operating system (OS) and VM applications are isolated from access by the cloud host, hypervisor, and other VMs on the platform. And with Intel TDX version 2.0, support is extended to the trusted execution environment (TEE) for device I/O, enabling encrypted communications with connected PCIe devices via Intel TDX Connect. Intel is actively collaborating with a broad ecosystem of partners to expand adoption of this invaluable security technology.

In addition, Intel Xeon 6 processors with P-cores include an efficient single-socket offering with 136 PCIe lanes per socket and high I/O performance, making these processors ideal for use with peripherals and software devices like storage drivers. These efficient processors also provide significant flexibility for rack power and density configurations, enabling cost optimizations that can help lower TCO.

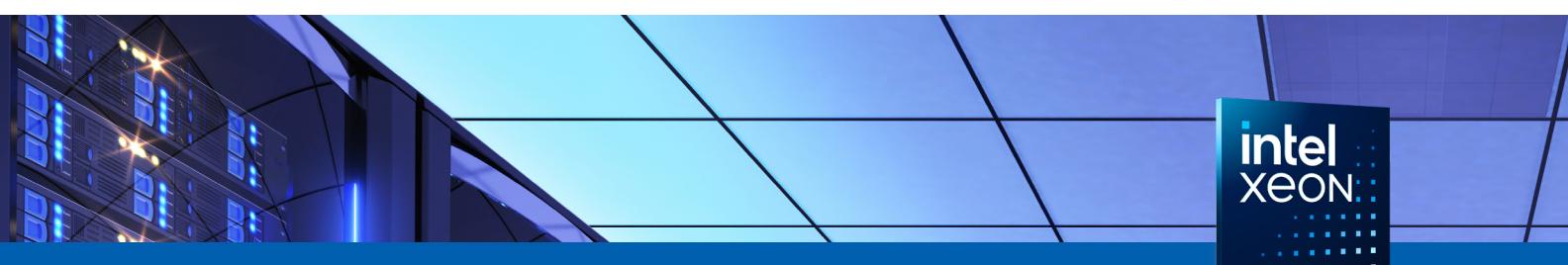
Intel Xeon 6 processors with Efficient-cores (E-cores)

Intel Xeon processors with E-cores are optimized for high core density and exceptional performance per watt, delivering distinct advantages for cloud-scale workloads that demand high task-parallel throughput. In comparison to 2nd Gen Intel Xeon Scalable processors, which are excellent candidates for performance-per-watt upgrades in competitive data centers, Intel Xeon 6 processors with E-cores can deliver more than 2.66x better results.⁵ This efficient performance is also ideal where power, space, and cooling are limited. Intel Xeon 6 processors with E-cores can:

- Significantly improve rack density by up to 2.7x over prior-generation Intel Xeon processors.⁶ Consolidate three racks of 2nd Gen Intel Xeon Scalable processor-based systems into a single rack, which can lead to a 1 megawatt power reduction.⁷
- Accommodate AI inferencing and vector-oriented operations with Intel® Advanced Vector Extensions 2 (Intel® AVX2) and enhancements such as Vector Neural Network Instructions (VNNI) and fast-convert for BF16 and FP16.
- Offer up to 288 cores per socket, with as much as 216 MB L3 cache, and with exceptionally low latency at large L3 access sizes.
- Strengthen security with Intel TDX 2.0. With Intel TDX confidential VMs, the guest OS and VM applications are isolated from access by the cloud host, hypervisor, and other VMs on the platform.

The efficiency of Intel Xeon 6 processors with P-cores and Intel Xeon 6 processors with E-cores is highlighted by these processors' ability to provide scalable performance per watt as server utilization increases, delivering nearly linear power-performance consumption across the load line. For performance-demanding workloads, this means power is efficiently utilized at high loads to finish jobs faster. For a scalable implementation, common to cloud or shared computing environments, this level of efficiency means that servers only consume the power they need when under load, reducing costs when instances are not fully utilized.

The sustainability of these processors is further enhanced through system-wide power-management and telemetry capabilities. These capabilities allow for increased performance per watt on a per-application basis to help with lowering overall energy consumption.



Overview of the Intel Xeon 6 processor family

Intel Xeon 6900-series processors are delivered in a new class of Intel server platform design, offering customers the high performance, high memory bandwidth, and high throughput ideal for cloud, HPC, and AI environments. These processors feature higher core counts, more memory channels, and I/O lanes with thermal design points that are higher than the other series.

The Intel Xeon 6 SoC with P-cores provides up to 72 P-cores and better performance per watt in a single-socket platform. Built for edge and networking applications, this SoC offers PCIe 5.0 lanes, integrated Ethernet, higher memory bandwidth compared to the prior generation, and key enhancements to built-in Intel® Accelerator Engines for virtualized radio access networks (vRANs), media, AI, and more.

Intel Xeon 6700-series processors and Intel Xeon 6500-series processors are delivered in an updated server platform design featuring high performance with cost- and power-efficient solutions ideal for a wide array of data center environments. These processors come in one-socket to eight-socket options with enhanced I/O and memory within established data center power and cooling footprints.

Intel Xeon 6300-series processors deliver essential, business-ready performance, expandability, and reliability for entry-level server solutions. These power- and cost-efficient processors feature support for two channels of DDR5 memory, the ability to deliver speeds up to 4,800 MT/s, and 16-lane PCIe 5.0 for fast networking and storage.



Highlight technologies

The innovative microarchitectures of Intel Xeon 6 processors with P-cores and Intel Xeon 6 processors with E-cores deliver the following advanced features and benefits:

Intel Xeon 6 processors with P-cores

Up to 128 cores per socket

One-, two-, four-, or eight-socket servers, with a rich one-socket SKU delivering significantly more I/O per socket

Intel AMX provides up to 16x more multiply accumulate operations than Intel AVX-512, now supporting FP16 models for enhanced AI performance.

Intel AVX-512 encompasses unique instructions and two 512-bit fused-multiply add (FMA) units per core, boosting the speed of vector mathematics common to AI, HPC, and database workloads.

MRDIMMs deliver up to 8,800 MT/s and are capable of providing more than 37 percent additional memory bandwidth compared to standard DDR5 DIMMs, supporting bandwidth-constrained use cases found in AI and HPC.³

DDR5-6400 high-speed memory provides memory bandwidth gains.

Up to 12 memory channels

Intel® Ultra Path Interconnect (Intel® UPI) 2.0 provides up to 24 gigatransfers per second (GT/s) of inter-socket bandwidth—a 20 percent increase over the prior generation.

Up to 192 lanes of PCIe 5.0 for two-socket servers

Options of up to 136 lanes for one-socket server designs, allowing I/O add-in components including accelerators, network adapters, storage controllers, and storage

Up to 500 W thermal design power (TDP) per CPU

Intel Xeon 6 processors with E-cores

Up to 288 cores per socket

One- or two-socket servers

Intel AVX2 with VNNI and fast up/down convert for BF16 and FP16 enables better AI compatibility.

DDR5-6400 high-speed memory provides memory bandwidth gains.

Up to 12 memory channels

Intel UPI 2.0 provides up to 24 GT/s of inter-socket bandwidth—a 20 percent increase over the prior generation.

Up to 192 lanes of PCIe 5.0 for two-socket servers

Up to 500 W TDP per CPU

Intel Xeon 6 processors with P-cores

Up to 64 lanes of CXL 2.0 with data transfer rates up to 32 GT/s per lane, supporting CXL capabilities such as memory expansion and sharing, including Type 1, 2, and 3 devices

Intel TDX enhances privacy and control over data with increased confidentiality at the VM level. Intel TDX upgrades with AES-256 and 2,048 encryption keys enhance confidential computing for the protection of sensitive business data.

New support for Intel TDX Connect enables encrypted communications with connected PCIe devices.

Intel® Flat Memory Mode helps expand system memory and improve TCO when using lower-cost memory, such as DDR4 with CXL 2.0.

Intel® QuickAssist Technology (Intel® QAT) enables offload of bulk cryptography and compression.

Enhanced Intel® Data Streaming Accelerator (Intel® DSA) 2.0 enables offload of data movement and transform operations such as move, fill, compare, cyclic redundancy checking (CRC), data integrity field (DIF), delta, and flush.

Enhanced Intel® In-Memory Analytics Accelerator (Intel® IAA) 2.0 enables offloading of memory compression and decompression, scan and filter functions, and CRC.

Intel Xeon 6 processors with E-cores

Up to 64 lanes of CXL 2.0 with data transfer rates up to 32 GT/s per lane, supporting CXL capabilities such as memory expansion and sharing, including Type 1, 2, and 3 devices

Intel TDX enhances privacy and control over data with increased confidentiality at the VM level. Intel TDX upgrades with AES-256 and 2,048 encryption keys enhance confidential computing for the protection of sensitive business data.

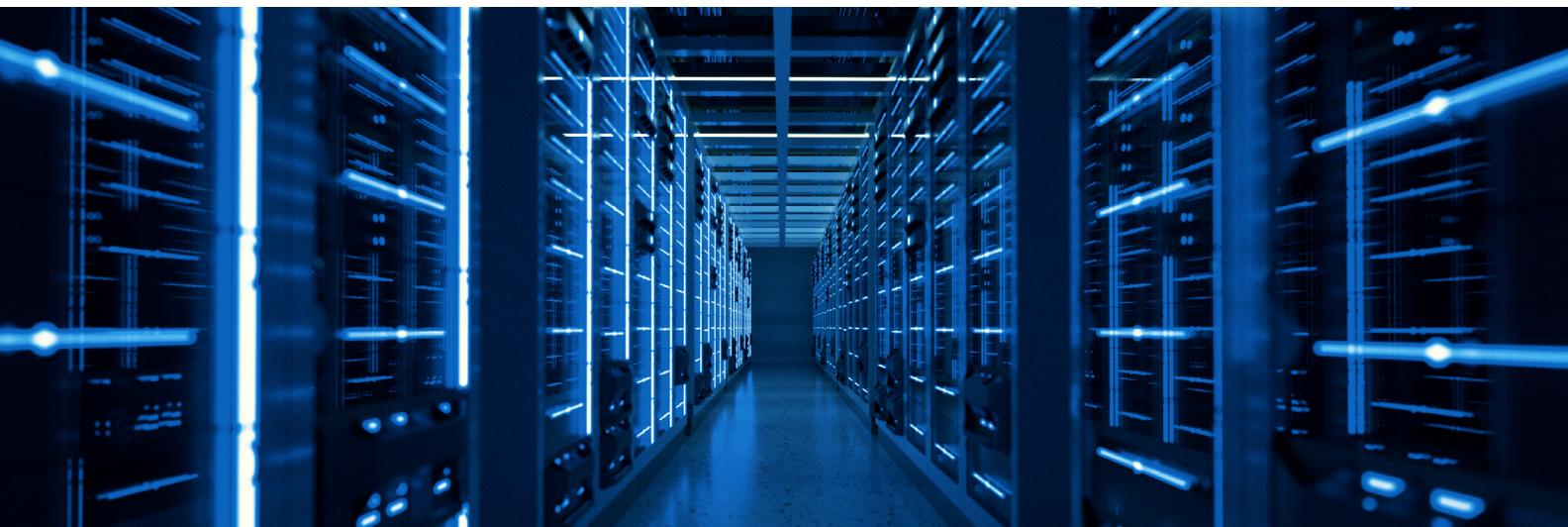
Intel Flat Memory Mode helps expand system memory and improve TCO when using lower-cost memory, such as DDR4 with CXL 2.0.

Intel QAT enables offload of bulk cryptography and compression.

Enhanced Intel DSA 2.0 enables offload of data movement and transform operations such as move, fill, compare, CRC, DIF, delta, and flush.

Enhanced Intel IAA 2.0 enables offloading of memory compression and decompression, scan and filter functions, and CRC.

To learn more about Intel Xeon 6 processors, including the features listed above, visit intel.com/xeon.



Addressing unique workload requirements

Workload	Best for	Intel Xeon 6 processor benefits	Claim
AI	P-cores	Scale AI everywhere with AI acceleration in every core. Industry-leading P-cores are architected for compute-intensive AI workloads, which benefit from multiple data elements being processed in parallel. Intel AMX accelerates inferencing time for INT8 and BF16 and provides support for FP16-trained models.	<p>Up to 2x higher BERT-Large training and inference performance⁸ compared to 5th Gen Intel Xeon processors</p> <p>Up to 2x higher average AI performance⁹ compared to AMD EPYC processors</p>
HPC	P-cores	Speed time to insights with accelerated HPC, featuring 504 MB of L3 cache and faster memory with MRDIMM technology. Intel Xeon 6 processors with P-cores offer advanced I/O with PCIe 5.0 and CXL. Code and models can take advantage of powerful Intel AVX-512 with two FMA units per core for the most demanding computational workloads.	<p>Up to 2.5x better performance for the HPCG benchmark with MRDIMMs¹⁰ compared to 5th Gen Intel Xeon processors</p> <p>Up to 1.52x higher HPCG performance¹¹ compared to AMD EPYC processors</p>
Web and microservices	E-cores	Lower costs with excellent performance per watt for search, social, e-commerce, media, and other digital services. Deliver fast web experiences that keep visitors engaged, and accelerate data movement through and within cloud platforms. Intel Xeon 6 processors with E-cores improve throughput on microservices while addressing key challenges, such as quality of service (QoS) and infrastructure overhead.	Up to 1.5x better performance for server-side Java throughput¹² compared to 5th Gen Intel Xeon processors
Database and analytics	P-cores and E-cores	Boost performance for database and analytics workloads. Relational databases, which are characterized by complex data relationships, complex queries, joins, and aggregations, can benefit from the parallel data processing capabilities of Intel Xeon 6 processors with P-cores. Non-relational databases with numerous small requests for data retrieval, such as key-value stores, can benefit from the task-parallel design of Intel Xeon 6 processors with E-cores.	<p>Up to 2.14x higher performance for MySQL¹³ compared to 5th Gen Intel Xeon processors</p> <p>Up to 1.42x higher MongoDB performance¹⁴ compared to 5th Gen Intel Xeon processors</p>
Infrastructure and storage	P-cores	Achieve high performance and low latency for virtualization, hyperconverged infrastructure (HCI), and storage with Intel Xeon 6 processors with P-cores. A rich one-socket platform option can deliver greater I/O per socket and performance per watt than dual-socket platforms.	<p>Up to 1.43x higher socket-level performance¹⁵ compared to 5th Gen Intel Xeon processors</p> <p>Up to 1.62x higher performance/watt¹⁵ compared to 5th Gen Intel Xeon processors</p>

Addressing unique workload requirements (cont.)

Workload	Best for	Intel Xeon 6 processor benefits	Claim
Networking	P-cores and E-cores	Add capacity to your networks and achieve low latency by speeding up data movement, encryption, and compression with Intel Xeon 6 processors, delivering greater performance per watt, core density, and overall rack density performance gains. Enable better 5G experiences with excellent system performance for the user plane function (UPF), and increase control plane compute cycles to address the security and additional capacity needed from the service mesh.	<p>Up to 4.17x higher 5G UPF performance with up to 2.66 better performance/watt¹⁶ compared to prior-generation Intel Xeon processors</p> <p>Up to 2.45x better performance and up to 1.88x better performance/watt for CDN video on demand (VOD)¹⁷ versus prior-generation Intel Xeon processors</p>
Edge	P-cores	Achieve exceptional performance per watt and low TCO for demanding edge workloads. Use video to enhance your operations, marketing, and customer experiences. Extract insights and metadata—such as scene changes, objects, faces, speech, and more—with video structurization servers powered by Intel Xeon 6 processors with P-cores.	<p>Up to 1.5x better NGINX handshake-only test with OpenSSL 3.3.2 for cipher ECDHE-X25519-ECDSA-P256 with up to 1.55x better performance/watt¹⁸ compared to 5th Gen Intel Xeon processors</p>

Exemplary user experience

Intel Xeon 6 processors provide a high level of quality and reliability that customers appreciate. Maintaining continuous operations and minimizing the time needed to service a system are fundamental to managing your business's service-level agreements (SLAs) and overall TCO. Intel reliability, availability, and serviceability (RAS) features encompass a suite of capabilities that help increase system uptime, reduce unplanned interruptions, and maintain data integrity. Intel Xeon 6 processors are the first Intel Xeon processors without platform controller hub (PCH) technology, enabling the CPU to self-boot without an assist from PCH. By removing PCH technology, this update supports lifecycle optimization and sustainability and is beneficial for system designers.

Security is important for both the user experience and customer satisfaction. IT teams must protect against a growing number of security threats and remain compliant with privacy regulations, whether on-premises or in the cloud. To protect data in use, Intel Xeon processors allow you to pick the Intel® confidential computing solutions that best meet your business and regulatory requirements. Intel TDX offers isolation and confidentiality at the VM level, while Intel® Software Guard Extensions (Intel® SGX) provides application-level isolation.

Addressing the needs of today's data center

The Intel Xeon 6 processor family delivers new degrees of performance and efficiency that can help businesses meet their growing demands with strong security, energy efficiency, and manageability.

Access the [Intel Xeon Processor Advisor Suite](#) to explore different Intel Xeon 6 processor options, get product and solutions recommendations, and even calculate TCO and return on investment (ROI) for different data center solutions.

[Visit the "Developer Tools for Intel® Xeon® 6 Processors" site to explore tools for Intel Xeon 6 processors.](#)



- ¹See [9A2] at intel.com/processorclaims: Intel Xeon 6. Results may vary.
- ²See [9D1] at intel.com/processorclaims: Intel Xeon 6. Results may vary.
- ³In comparison to DDR5 6,400 RDIMMs.
- ⁴Workload geometric. See intel.com/processorclaims: Intel Xeon 6. Results may vary.
- ⁵See [7N1] at intel.com/processorclaims: Intel Xeon 6. Results may vary.
- ⁶AMAX. "[The New Intel Xeon 6 Processor: P-cores and E-cores Explained](#)." June 2024.
- ⁷Based on architectural projections as of February 2023. Results may vary.
- ⁸See [9A6] and [9A3] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary.
- ⁹See [9A220] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary.
- ¹⁰See [9H10] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary.
- ¹¹See [9H221] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary.
- ¹²See [7W5] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary.
- ¹³See [9D1] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary.
- ¹⁴See [7D21] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary.
- ¹⁵See [7N20] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary.
- ¹⁶See [7N1] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary.
- ¹⁷See [7N24] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary.
- ¹⁸See [7N25] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary.

Performance varies by use, configuration and other factors. Learn more at www.intel.com/PerformanceIndex.

Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates. See configuration disclosure for additional details.

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