Innovative Platforms with Performance Hybrid Architecture, AI, and Media at the Edge

Drive more value for IoT deployments with 12th Gen Intel® Core™ mobile processors, featuring new performance hybrid architecture for dramatic increases to single- and multithreaded performance combined with graphics density and AI acceleration in high-performance and small form factor designs.

What’s new

- Performance hybrid architecture with up to 14 cores and 20 threads on Intel® 7 process technology
- Increased L2 cache and L3 shared Intel® Smart Cache
- Up to DDR5-4800 and LPDDR5-5200 memory and up to 16 lanes of PCIe 4.0 on the CPU
- Four display pipes, support for Pipelock for Windows, graphics and display virtualization
- Support for Windows 10 IoT Enterprise 2021 Long-Term Servicing Channel (LTSC)

12th Gen Intel® Core™ mobile processors offer differentiated capabilities and value for mobile hardware targets in key IoT use cases. Media accelerators and up to 96 graphics execution units (EUs), driven by Intel® Iris® Xe Graphics, deliver high-performance graphics and fast video processing for immersive experiences or highly parallel AI workloads. 12th Gen Intel Core mobile processors are highly versatile, offering a balance of performance and power with up to 14 cores and 20 threads, a processor base power range of 15W to 45W, and high-bandwidth DDR5 and LPDDR5 memory. All IoT SKUs support long-life availability and long-term software support for lasting value from IT/OT investments.

The first Intel® Core™ processor to feature performance hybrid architecture

12th Gen Intel Core mobile processors are the first Intel® Core™ processors to feature performance hybrid architecture with Intel® Thread Director. This innovative new chip design combines Performance-cores (or P-cores) that focus on primary workloads with Efficient-cores (or E-cores) that are built for multitasking. Intel Thread Director intelligently directs the OS to match the appropriate workload to the right core. This is the biggest leap in Intel Core processor technology in years, with up to 1.04x faster single-thread performance and up to 1.18x faster multithread performance vs. 11th Gen Intel® Core™ processors.

Exceptional graphics density for video at the edge

12th Gen Intel Core mobile processors deliver up to 2.29x faster graphics performance vs. 11th Gen Intel Core processors. With Intel Iris Xe Graphics, the mobile platform features up to 96 graphics EUs to drive eye-catching visuals across IoT deployments, opening the door to potential cost savings in the bill of materials (BOM). 12th Gen Intel Core mobile processors also provide up to four display pipes to support up to four concurrent 4K60 HDR displays or up to one 8K display. For video wall deployments, the inclusion of support for Pipelock video synchronization for Windows helps deliver a smooth playback experience across multiple displays.

Fast AI with hardware acceleration and Intel Iris Xe® Graphics

AI inference also benefits from the high number of graphics EUs, allowing for greater parallelization of mathematical operations that are common to AI workloads. The platform also features hardware-enabled AI acceleration with Intel® Deep Learning Boost (Intel® DL Boost) and VNNI instructions, enabling robust AI performance through int8 quantization. Support for the Intel® Distribution of OpenVINO™ toolkit also delivers optimized performance while helping developers speed time to market with pretrained AI models for common use cases.

For workloads and configurations, visit intel.com/PerformanceIndex. Results may vary.
Small footprint with durability built in
12th Gen Intel Core mobile processors feature a soldered-down BGA package in a low z-height package that contributes to device durability and form factor flexibility. Deployments are inherently resistant to shock and vibration, and these processors are well suited for space-constrained IoT applications.

More connectivity and DDR5/LPDDR5 memory
Up to 16 lanes of PCIe 4.0 provide a fast data pipeline directly to the CPU for accelerators and expansion cards. The high memory bandwidth of DDR5-4800 and LPDDR5-5200 enables IoT deployments to move a high volume of data fast, so solution providers can run more simultaneous applications on fewer devices.

Easier manageability for long-term deployments
12th Gen Intel Core mobile processors bring support for Windows 10 IoT Enterprise 2021 LTSC and long-term Linux kernel, providing a stable, prolonged period between OS update cycles to ensure consistent performance for devices in the field.
Retail, banking, hospitality, and education: Consolidate workloads on converged infrastructure

**Applications:** Small-format retail for POS, digital security, digital signage, and video walls

- Up to 96 graphics execution units provide improved graphics rendering for rich immersive visuals or AI enablement for accelerated inference in machine vision deployments.
- Four display pipes allow customers to build video walls of 2x2 displays at 4K/60 fps or up to four discrete digital signs or menu boards. Pipelock support on Windows helps ensure a smooth video wall experience across synchronized screens.
- Up to 8K resolution for high-end displays in signage and kiosk applications.
- More cores and more threads combined with efficient 15W to 45W processor base power for sleek form factor point of sale.

Healthcare: Fast data processing and hardware-enabled AI to support medical imaging

**Applications:** Ultrasound imaging, medical carts, endoscopy, clinical devices

- Improved graphics performance and up to DDR5/LP5 memory with up to 16 lanes of PCIe 4.0 directly to the CPU contribute to fast data bandwidth to support medical imaging in ultrasound scans.
- Intel DL Boost accelerates inference for AI-enabled medical advances.
- Long-life availability helps medical systems leverage the most out of lengthy certification cycles common in medical device development.

Industrial manufacturing: Rugged, small form factor platforms to support machine vision

**Applications:** Assembly line verification, defect detection, human-machine interfaces (HMI)

- Higher core count, up to 96 graphics execution units, and Intel DL Boost (VNNI and DP4a) help improve workload convergence and machine vision applications on the factory floor.
- Low z-height package and a soldered-down BGA package contribute to higher mechanical integrity in industrial environments with high levels of vibration and shock.
- Low power consumption offers more configuration flexibility in HMI and embedded PC systems.
- Rich I/O allows for more peripherals and expansion on a single platform for low total cost of ownership (TCO).

Video: Incredible density for AI and graphics/video processing in compact form factors

**Applications:** AI video at the edge across verticals, including network video recorders (NVRs), healthcare, manufacturing, retail, and smart city

- More cores, more graphics execution units, and up to DDR5/LP5 memory bandwidth enable faster object detection and recognition across simultaneous video streams.
- Hardware-enabled AI acceleration improves the performance of network video recorders with onboard AI inferring and analytics.
- Low z-height package allows for compact form factors for video analytics in smart city and smart building deployments with restricted footprints (for example, traffic lights or signposts).

### Processor lineup

**12th Gen Intel® Core™ processors (H-series 45W)**

<table>
<thead>
<tr>
<th>Processor Number</th>
<th>Processor Cores</th>
<th>Number of P-cores</th>
<th>Number of E-cores</th>
<th>Number of Threads</th>
<th>Intel® Smart Cache (L3)</th>
<th>Max Turbo Freq (GHz)</th>
<th>Max Turbo Freq (CPU)</th>
<th>Max Turbo Freq (PCH)</th>
<th>Processor Base Frequency (GHz)</th>
<th>Processor Base Power (W)</th>
<th>P-core</th>
<th>E-core</th>
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<td>14</td>
<td>6</td>
<td>8</td>
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<td>24 MB</td>
<td>Up to 4.6</td>
<td>Up to 3.9</td>
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<td>18 MB</td>
<td>Up to 4.5</td>
<td>Up to 3.8</td>
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<td>1.3</td>
<td>Intel® UHD Graphics</td>
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<td>Intel® Core™ i3-12300H processor</td>
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<td>Up to 4.3</td>
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<td>1.15</td>
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<td>64</td>
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**Use cases**
12th Gen Intel® Core™ processors (P-series 28W)

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<th>Processor Cores</th>
<th>Number of P-cores</th>
<th>Number of E-cores</th>
<th>Number of Threads</th>
<th>Intel® Smart Cache (E3)</th>
<th>Max Turbo Freq (GHz)*</th>
<th>Processor Base Frequency (GHz)</th>
<th>Intel® Platform</th>
<th>Version and Type of Firmware Support</th>
<th>Processor Graphics</th>
<th>Number of Execution Units (EUs)</th>
<th>Video Decode Boxes</th>
<th>Total PCIe Lanes</th>
<th>Max Memory Speed</th>
<th>Max Memory Capacity</th>
<th>Processor Power (W)</th>
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<td>DDR5-4800</td>
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12th Gen Intel® Core™ Processors (U-series 15W)

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<th>Processor Base Frequency (GHz)</th>
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<th>Processor Graphics</th>
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Software overview

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<tr>
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<th>IMPLEMENTATION</th>
<th>DISTRIBUTION AND SUPPORT</th>
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<td>Operating systems</td>
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<td>Ubuntu, SuSe, Red Hat Enterprise, WR Linux⁴</td>
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<td>Yocto Project BSP tool-based embedded Linux distribution</td>
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<td>Celadon (Android) in VM</td>
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<td>Wind River VxWorks 7</td>
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<td>KVM, ACRN⁴</td>
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<td>Boot loaders*</td>
<td>UEFI/BIOS and Intel® FSP</td>
<td>Intel, IBVs</td>
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<td>Slim Bootloader and Intel® FSP</td>
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<td>Intel® In-Band Manageability</td>
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</table>

Not all features are supported in every operating system. Refer to Intel’s IoT Solutions Community for partner contact information.

a. Legacy boot is not supported for Windows or Linux. Customers should work with their BIOS vendors for enabling/validating legacy BIOS features.

b. Supported by Intel via upstreaming to open source community. Adoption into individual Linux distributions/hypervisors is dependent upon the OS/HV vendors.

Intel® processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families.

All processors support Intel® Virtualization Technology (Intel® VT-x, VT-d).

A. The frequency of cores and core types varies by workload, power consumption, and other factors. Visit ark.intel.com for more information.

B. To use the Intel® In-Band Manageability, the system must be populated with 128-bit (dual-channel) memory. Otherwise, use the Intel® UHD brand.

C. Intel® processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. Intel® processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families.

D. Intel® In-Band Manageability includes Intel® TXT, Intel® Hardware Shield, and Intel® AMT. Please refer to Intel vPro brand requirements for full details (RDC #635949).

For product specifications, please refer to ark.intel.com.
Processor block diagram

Learn more about 12th Gen Intel Core mobile processors at intel.com/alderlake-p.

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Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates. No product or component can be absolutely secure.

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Not all features are supported in every operating system.
Not all features are available on all SKUs.
IOTG approval is required for MIPI camera/IPU support.
IOTG approval is required for Thunderbolt™ 4 support. Please contact your Intel representative.

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