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.

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.

Key features

Performance
- Intel® 7 process technology
- Up to 14 cores, up to 20 threads in IoT SKUs
- Up to 24 MB Intel® Smart Cache
- Processor base power range of 15W to 45W

Intel Iris Xe Graphics
- Intel Iris Xe Graphics with up to 96 execution units (EUs)
- HDMI 2.1 (with LSPSON) and support for up to four concurrent displays at up to 4K60 HDR resolution or one display at 8K resolution
- Up to two video decode boxes (VDboxes), support for up to 48 simultaneous 1080p input streams
- Pipelock video synchronization for Windows, graphics and display virtualization

Accelerated AI
- High graphics EU count (up to 96) for highly parallel AI workload processing in applications like medical imaging and network video recorders (NVRs)
- Intel DL Boost with VNNI instructions on the CPU and DP4a (int8) instructions on the GPU to accelerate AI inferencing workloads with the Intel Distribution of OpenVINO toolkit

Memory and I/O
- Up to DDR5-4800; LP5-5200 (2R); and up to DDR4-3200, LP4x-4267 memory
- Up to 16 lanes PCIe 4.0 on the CPU
- Up to 12 lanes PCIe 3.0 on the PCH

Security and manageability
- Intel vPro® platform eligible on select SKUs
- Intel® Converged Security and Management Engine version 16

Flexible deployments
- Soldered-down BGA package built for low z-height package and mechanical integrity in compact IoT applications
- Long-life availability¹ to support ongoing validation and certification in key markets

Software
- Windows 10 IoT Enterprise 2021 LTSC
- Yocto Project Linux
- Celadon (Android) in VM (community support)
- KVM and ACRN (community support)
- UEFI, Slim Bootloader
- Software development kits

Connectivity
- Thunderbolt™ 4 or USB 4
- Integrated 1GbE port, 2.5GbE discrete LAN
- Support for discrete Intel® Wi-Fi 6E/Bluetooth 5.2 (Intel® AX 210) and Integrated Intel® Wi-Fi 5/Bluetooth 5.1 (Intel® Wireless-AC 9560) with embedded-use conditions
- Intel 5G platform based on Intel’s host modem SW and M.2 module from Fibocom

Estimated performance compared to 11th Gen Intel® Core™ processors²

<table>
<thead>
<tr>
<th>Performance</th>
<th>Single-thread</th>
<th>Multithread</th>
<th>Graphics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.04x</td>
<td>1.18x</td>
<td>2.29x</td>
<td></td>
</tr>
</tbody>
</table>
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 (HMIs)
• 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 inferencing 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>P-core</th>
<th>E-core</th>
<th>P-core</th>
<th>E-core</th>
<th>ME16</th>
<th>ME16</th>
<th>Processor Graphics</th>
<th>Number of Execution Units (EU)</th>
<th>Video Decode Boxes</th>
<th>Total PCIe Lanes</th>
<th>Max Memory Speed</th>
<th>Max Memory Capacity</th>
<th>Processor Base Power (W)</th>
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<tbody>
<tr>
<td>Intel® Core™ i7-12800H processor</td>
<td>14</td>
<td>6</td>
<td>8</td>
<td>20</td>
<td>24 MB</td>
<td>Up to 4.6</td>
<td>Up to 3.5</td>
<td>2.5</td>
<td>1.8</td>
<td>1.35</td>
<td>Corp</td>
<td>Consumer</td>
<td>Intel® Iris® X Graphics&lt;sup&gt;5&lt;/sup&gt;</td>
<td>96</td>
<td>2</td>
<td>DDR5-4800</td>
<td>LPDDR5-5200</td>
<td>16 (CPU)</td>
<td>12 (PCH)</td>
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<tr>
<td>Intel® Core™ i5-12600H processor</td>
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<td>18 MB</td>
<td>Up to 4.5</td>
<td>Up to 3.3</td>
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<td>1.8</td>
<td>1.3</td>
<td>Corp</td>
<td>Consumer</td>
<td>Intel® UHD Graphics</td>
<td>80</td>
<td>2</td>
<td>DDR4-3200</td>
<td>DDR4-3200</td>
<td>64 GB</td>
<td>45W (base)</td>
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<td>12 MB</td>
<td>Up to 4.3</td>
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<td>LPDDR4x-4267</td>
<td>45W (base)</td>
<td>35W (cTDP down)</td>
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### 12th Gen Intel® Core™ processors (P-series 28W)

<table>
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<tr>
<th>Processor</th>
<th>Number of P-cores</th>
<th>Number of E-cores</th>
<th>Number of Threads</th>
<th>Max Turbo Freq (GHz)</th>
<th>Processor Base Frequency (GHz)</th>
<th>Intel® Smart Cache (EB)</th>
<th>Intel® vPro® Enterprise</th>
<th>Operating System</th>
<th>Video Decode Boxes</th>
<th>Total PCIe Lanes</th>
<th>Max Memory Speed</th>
<th>Max Memory Capacity</th>
<th>Processor Base Power (W)</th>
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<tbody>
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<td>3.5</td>
<td>Intel® UHD Graphics</td>
<td>Linux</td>
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<td>28W (base)</td>
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<td>Intel® Core™ i5-12500PE processor</td>
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<td>Intel® UHD Graphics</td>
<td>Linux</td>
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<td>Intel® Core™ i3-12200PE processor</td>
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<td>6</td>
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### 12th Gen Intel® Core™ Processors (U-series 15W)

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<tr>
<th>Processor</th>
<th>Number of P-cores</th>
<th>Number of E-cores</th>
<th>Number of Threads</th>
<th>Max Turbo Freq (GHz)</th>
<th>Processor Base Frequency (GHz)</th>
<th>Intel® Smart Cache (EB)</th>
<th>Intel® vPro® Enterprise</th>
<th>Operating System</th>
<th>Video Decode Boxes</th>
<th>Total PCIe Lanes</th>
<th>Max Memory Speed</th>
<th>Max Memory Capacity</th>
<th>Processor Base Power (W)</th>
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<td>Intel® Core™ i5-12405U processor</td>
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<tr>
<td>Intel® Celadon™ 730SE processor</td>
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<td>28W (base)</td>
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### Software overview

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<tr>
<th>CATEGORY</th>
<th>OPERATING SYSTEMS/SDKS/BOOT LOADERS</th>
<th>IMPLEMENTATION</th>
<th>DISTRIBUTION AND SUPPORT</th>
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<tr>
<td>Operating systems</td>
<td>Windows 10 IoT Enterprise 2021 LTSC</td>
<td>Intel</td>
<td>Intel, Microsoft</td>
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<td>Ubuntu, SuSe, Red Hat Enterprise, WR Linux</td>
<td>Canonical Ltd., Attachmate Group, Red Hat, and Wind River Systems</td>
<td>Canonical Ltd., Attachmate Group, Red Hat, and Wind River Systems</td>
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<td>Yocto Project BSP tool-based embedded Linux distribution</td>
<td>Intel</td>
<td>Intel, Yocto Project community</td>
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<td>Celadon (Android) in VM</td>
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<td>Celadon community</td>
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<td>Wind River VxWorks 7</td>
<td>Wind River</td>
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<td>Hypervisors</td>
<td>KVM, ACRN</td>
<td>KVM, ACRN community</td>
<td>KVM, ACRN community</td>
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<td>Boot loaders*</td>
<td>UEFI/BIOS and Intel® FSP</td>
<td>Intel</td>
<td>Intel, IBVs</td>
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<td>Slim Bootloader and Intel FSP</td>
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<td>Intel, SBL community</td>
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<td>SDK</td>
<td>Intel® oneAPI Video Processing Library (Intel® oneVPL)</td>
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<td>Intel® Distribution of OpenVINO™ toolkit</td>
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<td>Intel® oneAPI Toolkit</td>
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<td></td>
<td>Intel® In-Band Manageability</td>
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*Not all features are supported in every operating system. Refer to Intel's IoT Solutions Community for partner contact information.

For more information, please visit the Intel® website.
Processor block diagram

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

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Not all features are available on all SKUs.

Not all features are supported in every operating system.

IOTG approval is required for MIPI camera/IPU support.

IOTG approval is required for Thunderbolt™ 4 support.

Please contact your Intel representative.