

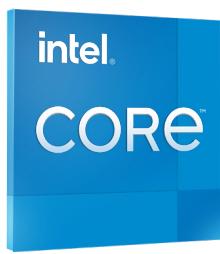
# Product Brief

12th Gen Intel® Core™ Mobile Processors for IoT



## 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<sup>1</sup> 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 1.07x faster single-thread performance and up to 1.29x faster multithread performance vs. 11th Gen Intel® Core™ processors.<sup>2</sup>

### Exceptional graphics density for video at the edge

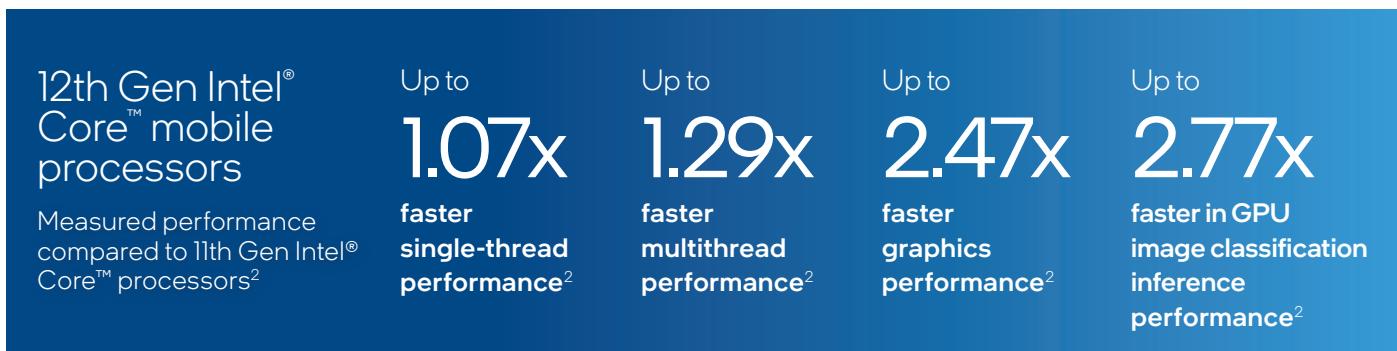
12th Gen Intel Core mobile processors deliver up to 2.47x faster graphics performance vs. 11th Gen Intel Core processors.<sup>2</sup> With Intel Iris Xe Graphics, the mobile platform features up to 96 graphics EUs to drive eye-catching visuals across IoT deployments, opening the door to potential cost 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.

### 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)



For workloads and configurations, visit [intel.com/PerformanceIndex](https://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 availability<sup>1</sup> 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

## Use cases

### 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<sup>1</sup> 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)

Processor Number	Processor Cores	Number of P-cores	Number of E-cores	Number of Threads	Intel® Smart Cache (L3)	Max Turbo Freq (GHz) <sup>a</sup>		Processor Base Frequency (GHz)		Graphics Max Freq (GHz)	Intel® Platform	Version and Type of Firmware Support		Processor Graphics	Number of Execution Units (EUs)	Video Decode Boxes	Total PCIe Lanes	Max Memory Speed	Max Memory Capacity	Processor Base Power (W)
						P-core	E-core	P-core	E-core			ME16	ME16							
Intel® Core™ i7-12800HE processor	14	6	8	20	24 MB	Up to 4.6	Up to 3.5	2.4 (@45W) 1.6 (@35W)	1.8	1.35	Yes	Corp	Consumer	Intel® Iris® Xe Graphics <sup>b</sup>	96	2	DDR5-4800 16 (CPU)	LPDDR5-5200 12 (PCH)	45W (Base power)	
Intel® Core™ i5-12600HE processor	12	4	8	16	18 MB	Up to 4.5	Up to 3.3	2.5 (@45W) 1.7 (@35W)	1.8	1.3	Yes	Corp	Consumer	Intel® Iris® Xe Graphics <sup>b</sup>	80	2	DDR4-3200 12 (PCH)	64 GB	35W (Min assured power)	
Intel® Core™ i3-12300HE processor	8	4	4	12	12 MB	Up to 4.3	Up to 3.3	1.9 (@45W) 1.1 (@35W)	1.5	1.15	No	Corp <sup>c</sup>	Consumer	Intel® UHD Graphics	48	1	LPDDR4X-4267			

## 12th Gen Intel® Core™ processors (P-series 28W)

Processor Number	Processor Cores	Number of P-cores	Number of E-cores	Number of Threads	Intel® Smart Cache (L3)	Max Turbo Freq (GHz) <sup>a</sup>		Processor Base Frequency (GHz)		Graphics Max Freq (GHz)	Intel® Platform	Version and Type of Firmware Support		Processor Graphics	Number of Execution Units (EUs)	Video Decode Boxes	Total PCIe Lanes	Max Memory Speed	Max Memory Capacity	Processor Base Power (W)
						P-core	E-core	P-core	E-core			Intel vPro® Enterprise <sup>a</sup>	ME16	ME16						
Intel® Core™ i7-1270PE processor	12	4	8	16	18 MB	4.5	3.3	1.9 (@35W) 1.8 (@28W) 1.2 (@20W)	1.2	1.35	Yes	Corp	Consumer	Intel® Iris® Xe Graphics <sup>b</sup>	96	2	DDR5-4800 LPDDR5-5200 DDR4-3200	35W (Max assured power) 28W (Base power) 20W (Min assured power)		
Intel® Core™ i5-1250PE processor	12	4	8	16	12 MB	4.4	3.2	1.8 (@35W) 1.7 (@28W) 1.1 (@20W)	1.2	1.3	Yes	Corp	Consumer		80	2				
Intel® Core™ i3-1220PE processor	8	4	4	12	12 MB	4.2	3.1	1.7 (@35W) 1.5 (@28W) 1.0 (@20W)	1.1	1.25	No	Corp <sup>c</sup>	Consumer		48	1				

## 12th Gen Intel® Core™ Processors (U-series 15W)

Processor Number	Processor Cores	Number of P-cores	Number of E-cores	Number of Threads	Intel® Smart Cache (L3)	Max Turbo Freq (GHz) <sup>a</sup>		Processor Base Frequency (GHz)		Graphics Max Freq (GHz)	Intel® Platform	Version and Type of Firmware Support		Processor Graphics	Number of Execution Units (EUs)	Video Decode Boxes	Total PCIe Lanes	Max Memory Speed	Max Memory Capacity	Processor Base Power (W)
						P-core	E-core	P-core	E-core			Intel vPro® Enterprise <sup>a</sup>	ME16	ME16						
Intel® Core™ i7-1265UE processor	10	2	8	12	12 MB	4.7	3.5	2.6 (@28W) 1.7 (@15W) 1.1 (@12W)	1.2	1.25	Yes	Corp	Consumer	Intel® Iris® Xe Graphics <sup>b</sup>	96	2	DDR5-4800 LPDDR5-5200 DDR4-3200	28W (Max assured power) 15W (Base power) 12W (Min assured power)		
Intel® Core™ i5-1245UE processor	10	2	8	12	12 MB	4.4	3.3	2.5 (@28W) 1.5 (@15W) 1.1 (@12W)	1.1	1.2	Yes	Corp	Consumer		80	2				
Intel® Core™ i3-1215UE processor	6	2	4	8	10 MB	4.4	3.3	2.5 (@28W) 1.2 (@15W) 0.8 (@12W)	0.9	1.1	No	Corp <sup>c</sup>	Consumer		64	1				
Intel® Celeron® 7305E processor	5	1	4	6	8 MB	—	—	N/A (@28W) 1.0 (@15W) 0.8 (@12W)	0.9	1.1	No	Corp <sup>c</sup>	Consumer	Intel® UHD Graphics	48	1				

Intel® processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families.  
All processors are lead free (per EU RoHS directive July 2006) and halogen free (residual amounts of halogens are below November 2007 proposed IPC/JEDEC J-STD-709 standards).

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 [intel.com/go/turbo](http://intel.com/go/turbo) for more information.

B. Intel vPro® Enterprise includes Intel® TXT, Intel® Hardware Shield, and Intel® AMT. Please refer to Intel vPro brand requirements for full details (RDC #635949).

C. Validated, but Intel® Active Management and other security features not available.

D. To use the Intel® Iris® Xe brand, the system must be populated with 128-bit (dual-channel) memory. Otherwise, use the Intel® UHD brand.

For product specifications, please refer to [ark.intel.com](http://ark.intel.com).

## Software overview

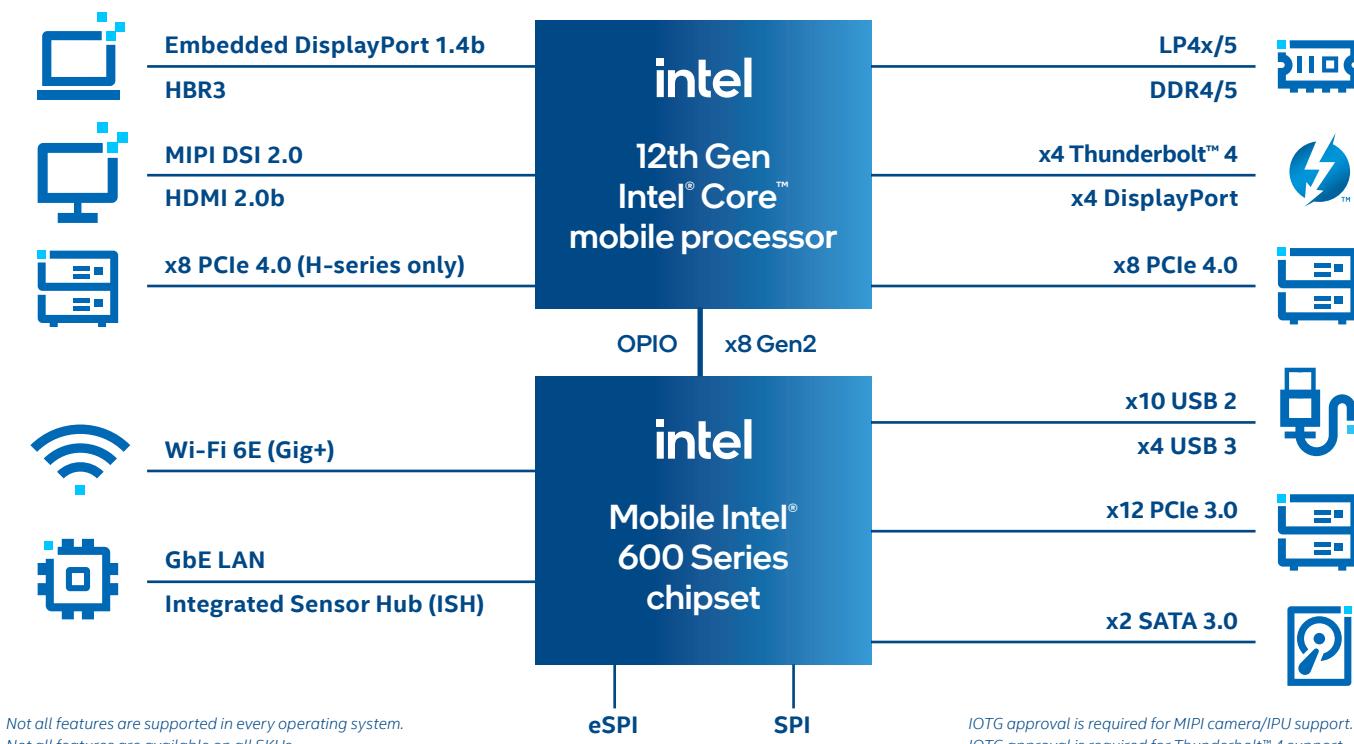
CATEGORY	OPERATING SYSTEMS/SDKS/BOOT LOADERS	IMPLEMENTATION	DISTRIBUTION AND SUPPORT
Operating systems	Windows 10 IoT Enterprise 2021 LTSC	Intel	Intel, Microsoft
	Ubuntu, SuSe, Red Hat Enterprise, WR Linux <sup>b</sup>	Canonical Ltd., Attachmate Group, Red Hat, and Wind River Systems	Canonical Ltd., Attachmate Group, Red Hat, and Wind River Systems
	Yocto Project BSP tool-based embedded Linux distribution	Intel	Intel, Yocto Project community
	Celadon (Android) in VM	Intel	Celadon community
	Wind River VxWorks 7	Wind River	Wind River
Hypervisors	KVM, ACRN <sup>b</sup>	KVM, ACRN community	KVM, ACRN community
Boot loaders <sup>a</sup>	UEFI/BIOS and Intel® FSP	Intel	Intel, IBVs
	Slim Bootloader and Intel FSP	Intel	Intel, SBL community
SDK	Intel® oneAPI Video Processing Library (Intel® oneVPL)	Intel	Intel
	Intel® Distribution of OpenVINO™ toolkit	Intel	Intel
	Intel® oneAPI Toolkit	Intel	Intel
	Intel® In-Band Manageability	Intel	Intel

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.

## Processor block diagram



Learn more about 12th Gen Intel Core mobile processors at [intel.com/alderlake-p](https://intel.com/alderlake-p).



1. Intel does not commit or guarantee product availability or software support by way of road map guidance. Intel reserves the right to change road maps or discontinue products, software, and software support services through standard EOL/PDN processes. Contact your Intel account rep for additional information.
2. Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates. Results have been estimated or simulated. For more complete information about performance and benchmark results, visit [intel.com/PerformanceIndex](https://intel.com/PerformanceIndex).

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Not all features are supported in every operating system.

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Your costs and results may vary.

Intel® technologies may require enabled hardware, software, or service activation.

Performance hybrid architecture combines two new core microarchitectures, Performance-cores (P-cores) and Efficient-cores (E-cores), on a single processor die. Select 12th Gen Intel® Core™ processors (certain 12th Gen Intel® Core™ i5 processors and lower) do not have performance hybrid architecture, only P-cores.

Built into the hardware, Intel® Thread Director is provided only in performance hybrid architecture configurations of 12th Gen Intel® Core™ processors; OS enablement is required. Available features and functionality vary by OS.

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