

Product Brief

Intel® Core™ Ultra Processors
Edge Deployments



Supercharge AI and Graphics at the Edge

Deploy edge solutions with advanced AI and graphics performance in power-efficient BGA packaging.



Quickly and easily deploy next-generation AI and graphics capabilities at the edge for vision and automation use cases, even in space- and power-constrained environments. Intel® Core™ Ultra processors are an ideal choice for demanding workloads at the edge, with multiple compute engines in a power-efficient BGA package to enable more flexibility for innovative designs. Using these powerful edge processors, you can provide faster results from AI, more media streams per device, and long-life availability¹ for long-term value.

Deploy more engines for AI in a single package

Power up your competitiveness with Intel Core Ultra processors and deploy the advanced AI workloads that your customers need now. Multiple different compute engines—P-cores, E-cores, Intel® Arc™ GPU,² and Intel® AI Boost³—work together to accelerate AI inferencing at the edge while reducing the need for a discrete accelerator, which helps lower system complexity and cost.

Plus, integrated support for the OpenVINO™ toolkit can enhance AI performance by routing workloads to the right compute engine. This integration helps streamline AI workflows through cross-architectural programming capabilities and automatic compute engine detection. OpenVINO also offers support and optimizations for popular AI frameworks, including TensorFlow, PyTorch, and ONNX, to help boost performance and simplify development. Meanwhile, Intel® Gaussian & Neural Accelerator (Intel® GNA) 3.5 helps improve audio noise cancellation and speech recognition.

Graphics-intensive performance without an entry-level discrete GPU

Consolidate systems and cut hardware costs in kiosks, terminals, and detail-rich interfaces. Intel Core Ultra processors feature a built-in Intel Arc GPU² with up to eight Xe-cores (up to 128 graphics execution units) to help minimize the need for an entry-level discrete GPU. This generation supports up to 50 HDR video streams, delivers visuals in greater detail, and accelerates the popular AV1 codec in hardware for more-efficient compression compared to H.265. For advanced video wall applications, Intel Core Ultra processors support up to 4x 4K displays or 2x 8K displays, Pipelock synchronization and bezel correction.

Curb power consumption for demanding AI and video workloads




Streamline your edge AI builds with platforms that deliver greater power efficiency vs. the previous generation.⁴ Intel Core Ultra processors deliver more AI performance at the same power levels as the previous generation in BGA packaging, giving end customers the flexibility to run more workloads in space-constrained environments. Ideal for edge designs that require fanless or minimal cooling, this platform also offers improved power design to help curb energy consumption during periods of low activity to help lower energy bills.

What's new

- Intel® 4 process based on extreme ultraviolet (EUV) lithography
- Multiple compute engines in one SoC: P-cores, E-cores, Intel® Arc™ GPU,² and Intel® AI Boost³—an integrated neural processing unit (NPU) dedicated to AI
- Built-in Intel Arc GPU² with up to eight Xe-cores (up to 128 graphics execution units)
- Hardware-accelerated AV1 encode, integrated DisplayPort 2.1 (USB-C) and HDMI 2.1, new graphics system controller

Intel Core Ultra processors also include Intel® Thread Director,⁴ which intelligently optimizes concurrent workloads across CPU cores. By identifying the class of each workload

and using its energy and performance core scoring mechanism, Intel Thread Director helps the OS schedule threads on the best core for performance or efficiency.

Intel® Core™ Ultra processors		
 ARTIFICIAL INTELLIGENCE Up to 1.5x the AI performance vs. previous generation ⁵	 POWER EFFICIENCY Up to 2.56x the AI performance/watt vs. previous generation ⁵	 GRAPHICS Up to 1.81x the graphics performance vs. previous generation ⁵

Performance varies by use, configuration, and other factors. Learn more at intel.com/processorclaims: Intel® Core™ Ultra processors, Edge. Results may vary.

Key features

Performance

- Intel® 4 process based on EUV lithography
- Performance hybrid architecture in Intel® Core™ processors with Intel Thread Director⁴
- Up to 16 cores and up to 22 threads
- Up to 24 MB Intel® Smart Cache
- Processors base power between 15W and 45W

Accelerated AI

- Multiple compute engines in one SoC: P-cores, E-cores, Intel Arc GPU,² and Intel AI Boost³
- Improved Intel Gaussian & Neural Accelerator (Intel GNA) 3.5
- Intel® Deep Learning Boost (Intel® DL Boost) with DP4a instructions
- Fully supported by the OpenVINO toolkit

Power efficiency

- Dual low-power embedded DisplayPort

Graphics

- Built-in Intel Arc GPU² with up to eight Xe cores (up to 128 graphics execution units)
- Hardware-accelerated AV1 encode
- Integrated DisplayPort 2.1 (USB-C) and HDMI 2.1
- Graphics system controller (GSC)
- Integrated Intel® Image Processing Unit
- Pipelock video synchronization for Windows with bezel correction and EDID management/lock display
- Up to 50 simultaneous HEVC HDR 10b 1080p30 video streams
- Up to four concurrent 4K60 HDR displays or two 8K displays
- SR-IOV for GPU virtualization

Memory and I/O

- Up to LPDDR5-6400, LPDDR5x-7467 (Type 4 board), DDR5-5600
- 8x lanes PCIe 5.0²
- Up to 20 lanes PCIe 4.0

Flexible deployments

- Soldered-down BGA package
- Long-life availability of up to 10 years¹

Security and manageability

- Elemental security engine (ESE)
- NIST 800-88r1 (storage media sanitization)

Connectivity

- USB4/Intel® Thunderbolt™ 4 technology⁶
- Validated with Intel-based discrete Wi-Fi 7 (Intel® Wi-Fi 7 BE200, Intel® Wi-Fi 6E AX210)
- Bluetooth 5.4/5.3

Software and OS support

- OpenVINO™ toolkit, Intel® oneAPI Toolkits, Intel® oneAPI Video Processing Library (oneVPL)
- Windows 10 IoT Enterprise 2021 LTSC and Windows 11 IoT Enterprise 2024 LTSC (2H'24)
- Ubuntu, Red Hat Enterprise Linux, Wind River Linux
- Azure IoT EFLOW, Yocto Project, and Linux Kernel-based Virtual Machine (KVM)
- UEFI/BIOS + Intel® Firmware Support Package (Intel® FSP) and Slim Bootloader + Intel® FSP

Use cases

CITIES AND CRITICAL INFRASTRUCTURE

Support more cameras and larger data sets with long-lasting deployments

Applications: Digital security and safety, network video recorders, roadside units

- Multiple compute engines—including Intel AI Boost³—in one SoC deliver fast AI and vision processing without an entry-level discrete GPU.
- Built-in Intel Arc GPU² supports up to 50 video streams per socket with Intel Distribution of OpenVINO toolkit optimization.
- Long-life availability¹ extends the duration between upgrades for long-lasting devices in hard-to-reach field deployments.

INDUSTRIAL

Support advanced industry 4.0 use cases, including AI vision, and workload consolidation

Applications: AI-augmented industrial process control (AIPC), industrial PCs, human-machine interfaces (HMIs), machine control, microgrid controller

- Performance hybrid architecture, more cache, PCIe 5.0, and DDR5 memory drive platform consolidation and allow for more add-in cards.
- Low-power, 15–45W platform and BGA packaging allow for innovative fanless designs that fit easily in constrained spaces.
- Long-life availability¹ ensures more value with a consistent supply of replacement parts and longer duration between upgrades.

RETAIL AND ENTERTAINMENT

Create visually immersive experiences and drive computer vision solutions

Applications: POS/kiosks, thin client, digital signage, interactive flat-panel display (IFPD), restaurant automation, unified communications as a service (UCaaS)

- Built-in Intel Arc GPU² supports up to 4x 4K displays or 2x 8K displays, with Pipelock synchronization and bezel correction.
- Multiple compute engines in one SoC deliver powerful AI inferencing without an entry-level discrete GPU.
- Intel GNA 3.5 for noise cancellation/speech recognition
- Intel Wi-Fi 7/6E enables wireless connectivity with less interference in device-rich environments.

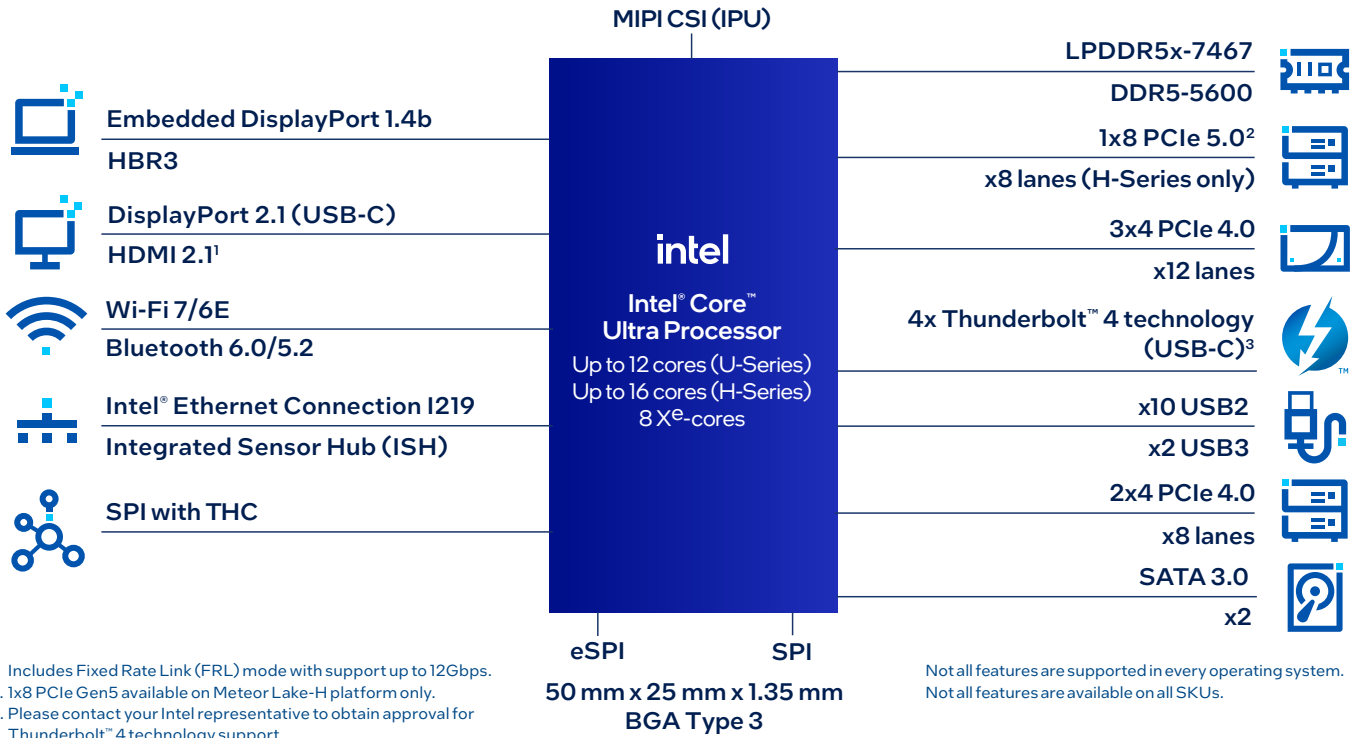
HEALTHCARE

Support detail-rich displays and augment clinician workflows with AI

Applications: X-ray, ultrasound, mammography, lab diagnostic equipment, medical panel PCs, medical kiosks/carts

- Multiple compute engines in one SoC deliver fast AI and vision processing without an entry-level discrete GPU and support up to 4x 4K displays or 2x 8K displays.
- Low-power 15–45W platform allows for innovative fanless designs that fit easily in constrained spaces.
- Long-life availability¹ ensures more value with a consistent supply of replacement parts and longer duration between upgrades.

Processor block diagram



Software overview

CATEGORY	OPERATING SYSTEMS (OSs) / SDKs / BOOTLOADERS	IMPLEMENTATION	DISTRIBUTION AND SUPPORT
Operating systems ^a	Windows 10 IoT Enterprise 2021 LTSC Windows 11 IoT Enterprise 2024 LTSC (2H'24)	Intel, Microsoft	Intel, Microsoft
	Ubuntu, Red Hat Enterprise Linux, Wind River Linux ^b	Canonical Ltd., Red Hat, and Wind River Systems	Distributed and supported by commercial Linux vendors; Intel® upstream kernel drivers
	Kernel Overlay and BKC	Intel	Intel, Linux software vendors
Hypervisors	Linux Kernel-based Virtual Machine (KVM) ³ Microsoft Hyper-V	KVM Intel, Microsoft	KVM community Intel, Microsoft
	Boot loaders ^c	UEFI/BIOS and Intel® FSP	Intel
Slim Bootloader and Intel® FSP		Intel	Bootloader ecosystem and SBL community
SDK	Intel® oneAPI Video Processing Library (oneVPL)	Intel	Intel
	OpenVINO™ toolkit	Intel	Intel
	Intel® oneAPI Toolkits	Intel	Intel
	Intel® In-Band Manageability and Intel® Active Management Technology	Intel	Intel

a. Not all features are supported in all operating systems.

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

c. Legacy boot is not supported for Windows and Linux OSes. Customers should work with their BIOS vendors to enable and validate legacy BIOS features.

Processor lineup

Intel® Core™ Ultra processors (H-series 28W)

Processor Name	Processor Cores	Number of P-cores	Number of E-cores	Number of LPE-cores	Number of Threads	Intel® Smart Cache (L3)	Max Turbo Freq (GHz) ^A		Processor Base Frequency (GHz)		Graphics Max Freq (GHz)	Processor Graphics	Number of Execution Units (EUs)	Video Decode Boxes	Total PCIe Lanes	Max Memory Speed	Max Memory Capacity	TCC/TSN	Extended Temp	Processor Base Power (W)
							P-core	E-core	P-core	E-core										
Intel® Core™ Ultra7 processor 165H	16	6	8	2	22	24MB	5.0	3.8	1.4 (@28W)	0.9	2.3	Intel® Arc™ Graphics ^B	128	2	8 (CPU; 1x8 PCIe 5.0) 20 (PCIe 4.0)	DDR5-5600 LPDDR5-6400 LPDDR5x-6400 LPDDR5x-7467	64GB	No	No	65W (max assured power) 28W (base power) 20W (min assured power)
Intel® Core™ Ultra7 processor 155H	16	6	8	2	22	24MB	4.8	3.8	1.4 (@28W)	0.9	2.25		128	2				No	No	
Intel® Core™ Ultra5 processor 135H	14	4	8	2	18	18MB	4.6	3.6	1.7 (@28W)	1.2	2.2		128	2				No	No	
Intel® Core™ Ultra5 processor 125H	14	4	8	2	18	18MB	4.5	3.6	1.2 (@28W)	0.7	2.2		112	2				No	No	

Intel® Core™ Ultra processors (U-series 15W)

Processor Name	Processor Cores	Number of P-cores	Number of E-cores	Number of LPE-cores	Number of Threads	Intel® Smart Cache (L3)	Max Turbo Freq (GHz) ^A		Processor Base Frequency (GHz)		Graphics Max Freq (GHz)	Processor Graphics	Number of Execution Units (EUs)	Video Decode Boxes	Total PCIe Lanes	Max Memory Speed	Max Memory Capacity	TCC/TSN	Extended Temp	Processor Base Power (W)
							P-core	E-core	P-core	E-core										
Intel® Core™ Ultra7 processor 165U	12	2	8	2	14	12MB	4.9	3.8	1.7 (@15W)	1.2	2.0	Intel® Graphics	64	2	20 PCIe 4.0	DDR5-5600 LPDDR5-6400 LPDDR5x-6400 LPDDR5x-7467	64GB	No	No	28W (max assured power) 15W (base power) 12W (min assured power)
Intel® Core™ Ultra7 processor 155U	12	2	8	2	14	12MB	4.8	3.8	1.7 (@15W)	1.2	1.95		64	2				No	No	
Intel® Core™ Ultra5 processor 135U	12	2	8	2	14	12MB	4.4	3.6	1.6 (@15W)	1.1	1.9		64	2				No	No	
Intel® Core™ Ultra5 processor 125U	12	2	8	2	14	12MB	4.3	3.6	1.3 (@15W)	0.8	1.85		64	2				No	No	

- A. The frequency of cores and core types varies by workload, power consumption, and other factors. Visit [intel.com/content/www/us/en/architecture-and-technology/turbo-boost/turbo-boost-technology](https://www.intel.com/content/www/us/en/architecture-and-technology/turbo-boost/turbo-boost-technology) for more information.
- B. Intel® Arc™ GPU only available on select H-Series, Intel® Core™ Ultra processor-powered systems with at least 16 GB of system memory in a dual-channel configuration. OEM enablement required; check with OEM for system configuration details.

For product specifications, please refer to ark.intel.com.

Learn more about Intel Core Ultra processors at intel.com/coreultra-edge.



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. Intel® Arc™ GPU only available on select H-Series, Intel® Core™ Ultra processor-powered systems with at least 16 GB of system memory in a dual-channel configuration. OEM enablement required; check with OEM for system configuration details.
3. Intel® AI Boost enablement limited at launch.
4. Support for Thread Director is expected in Windows 11 IoT Enterprise LTSC and Linux 6.x.
5. Performance varies by use, configuration, and other factors. Learn more at intel.com/processorclaims: Intel® Core™ Ultra processors, Edge. Results may vary.
6. Please contact your Intel representative to obtain approval for Thunderbolt™ 4 technology support.

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

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Not all features are available on all SKUs.

Not all features are supported in every operating system.

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