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Unlock High Performance at the Edge for AI, Safety, and Real-Time Applications

Combine high bandwidth and powerful performance to run embedded and industrial IoT workloads

Meet the needs of compute-intensive, heavy-duty edge workloads; help satisfy rugged and thermal requirements; and benefit from real time and functional safety capabilities. 11th Gen Intel® Core™ vPro®, Intel® Xeon® W-11000E series, and Intel® Celeron® processors are designed specifically for high-bandwidth and powerful applications. These processors come in two classes—embedded and industrial—to help expand portfolios with greater flexibility, creativity, and right-fit solutions.

Performance, reliability, and long-life product availability

This new platform features a two-package solution with a separate CPU and Platform Controller Hub (PCH). Paired CPU-PCH SKU offerings offer greater variety so that solution providers can choose the best architecture for each use case, and end customers benefit from extended durability and reliability to help safeguard their investments.

What's included:

- Up to eight CPU cores built on powerful and efficient Intel® 10nm SuperFin technology
- Extended operating temperatures on select SKUs rated for industrial use
- Hardware-accelerated deep learning inference and computer vision, optimized via Intel® Distribution of OpenVINO™ toolkit
- Support for real-time computing and functional safety on select SKUs
- Extended product life cycles to support long-term, stable road maps

Exceptional expandability for more flavors of configuration

With 20 PCIe 4.0 lanes on the CPU and up to 24 PCIe 3.0 lanes on the PCH, the platform can support extensive high-speed storage, accelerators, discrete graphics, and Ethernet controllers. Four integrated Thunderbolt™ 4/USB4 ports support peripherals and monitors, while 30 programmable high-speed I/Os on the PCH provide extensive, flexible connectivity for cameras, SATA, or additional USB ports.

Simultaneously stream, process, and analyze 8K video

Computer vision is becoming more accessible and easier to deploy at the edge; meanwhile, industrial applications are looking to implement rich user interfaces that give operators more control and manageability over equipment. This CPU platform helps meet emerging demands with integrated Intel® UHD Graphics, featuring up to two video decode boxes and four display pipes. The platform can process up to 40 simultaneous streams of 1080p 30fps video and output four channels of 4K or one channel of 8K video.

11th Gen Intel® Core™ vPro® processors

Compared to previous-generation processors:[1]

Up to
32%
higher single-thread performance[2]

Up to
65%
higher multi-thread performance[3]

Up to
70%
faster graphics performance[4]

For workloads and configurations, visit intel.com/PerformanceIndex. Results may vary.

Hardware-enabled AI acceleration

Build accelerated deep learning computer vision and AI inferencing applications in parallel with other core functions. AI and deep learning inference can run on the integrated GPU via the INT8 data type, or on the CPU in FP32, FP16 or INT8. Intel® Deep Learning Boost (Intel® DL Boost) can combine three instructions into one, accelerating inference processing by reducing computational resources needed.

Support real-time computing

Available on select processors, Intel® Time Coordinated Computing (Intel® TCC) and Time-Sensitive Networking (TSN) enable real-time use cases. Intel provides tools, libraries, and APIs that simplify real-time tuning for proprietary and open source systems. Supported real-time hypervisors and operating systems include ACRN, Wind River VxWorks, and Real-Time Systems.

Functional safety capabilities on select SKUs

Businesses can make full use of the integrity features embedded in Intel® hardware when designing their safety concepts. Select SKUs in this platform come with the Intel® Functional Safety Essential Design Package (Intel® FSEDP), a document package that helps developers connect hardware-enabled capabilities to software functions in support of functional safety. This helps reduce time to market by simplifying core processes in meeting safety standards, including metric computation, validation, and systemic failure analysis.

Open, standards-based, cross-architecture programming model

Intel® oneAPI is an industry-wide initiative to simplify development across diverse architectures with "write once, deploy anywhere" flexibility. Developers benefit from the ability to reuse code across varying hardware targets and to fine-tune performance for different accelerators in a heterogeneous environment.

Help harden platforms and thwart attacks

Embedded devices and industrial controls are vulnerable to weaknesses in the network and on-site tampering. To help combat these threats, select SKUs offer the best of Intel vPro® platform management and hardware-enabled security capabilities:

- **Intel® Total Memory Encryption (Intel® TME):** Hardware-enabled encryption of data in memory, including credentials and keys, helps defend against cold boot attacks if thieves remove memory modules from a system.

- **Intel® Control-Flow Enforcement Technology (Intel® CET):** Analyzes code execution and data flow to help prevent browser-based malware attacks that try to extract data via ROP, JOP, and COP.

- **Key Locker:** Enabled by Intel® AES-NI instruction ENCODEKEY, this solution helps protect private keys with accelerated encrypt/decrypt operations.

- **Intel® Active Management Technology (Intel® AMT):** Extends the capabilities of the Intel vPro platform with out-of-band device management via cloud, wired, or wireless connection, allowing IT to troubleshoot devices remotely or even recover devices if the OS is compromised.

📋 Key features

Performance

- Intel 10nm SuperFin technology, up to eight CPU cores, 16 threads, and 24 MB cache memory
- Memory support for up to DDR4 3200
- 25 watt plus configurable 35/45 watt thermal design points (TDP)

Intel UHD Graphics

- Up to 32 graphics execution units (EUs), four display pipes, up to four channels of 4K video at 60 fps or one channel of 8K video at 60 fps
- Up to two VDBoxes process up to 40 simultaneous 1080p 30 fps video streams

Enhanced for IoT

- Intel® Time Coordinated Computing (Intel® TCC) and Time-Sensitive Networking (TSN) enable real-time use cases
- Functional safety (FuSa)–capable with design package to support the development and certification of FuSa applications
- Industrial-rated SKUs with extended operating temperatures
- Out-of-band error-correcting code (OOBECC) support

Accelerated AI

- Intel® DL Boost improves inferencing performance using INT8 or VNNI, which condenses three Intel® AVX instructions into one
- Inference workloads run across CPU cores or graphics execution units

Expansion and connectivity

- Integrated MACs to support one 1GbE port, plus 2x 2.5GbE port with TSN capability
- Wi-Fi 6E (up to 2.4 Gbps), Bluetooth 5.2
- 2.5GbE Intel® Ethernet Controller I225 support
- Integrated Thunderbolt 4/USB4 with transfer speeds up to 40 Gbps
- 20 PCIe 4.0 lanes on the CPU
- 30 programmable high speed I/O lanes on the PCH can provide up to 24 additional PCIe 3.0 lanes

Hardware-based security and device management

- Intel® TME to help protect against cold-boot attacks
- Intel® CET to help defend against browser-based malware attacks
- Key Locker to help protect encrypted keys and decrypt/encrypt operations
- The Intel vPro® platform with Intel® AMT on select SKUs to help support device management and enterprise security

Commercial and open source OS and hypervisor support

- OS: Windows 10 IoT Enterprise RS5, Wind River Linux, Ubuntu, RedHat, Suse Linux, Linux LTS kernel, Yocto Project Linux distribution
- Hypervisors: ACRN, KVM, and Real Time Systems

Streamlined Intel development environment

- Intel® oneAPI Base and IoT toolkit, Intel® oneAPI Video Processing Library
- Intel® Distribution of OpenVINO™ toolkit for deep learning inference
- Intel TCC software toolkit

▤ Use cases

Industrial and energy: Build mission-critical control systems

Applications: Real-time automation, predictive maintenance, smart control systems, industrial PCs, edge servers

- Build faster, more powerful, more expandable industrial PCs for complex systems, consolidated workloads, and software-defined control systems with long-life product availability.
- Meet the most stringent latency and jitter requirements for real-time computing in critical automation applications and enhance system reliability with out-of-band ECC memory without impacting performance.
- Deploy ruggedized systems in extreme industrial environments like factory floors, oil rigs, and wind turbines.

Healthcare: Next-gen medical devices and AI diagnostics

Applications: Smart diagnostics, ultrasound machines, medical carts, endoscopy

- Process high-resolution images faster with next-generation CPU and GPU architectures.
- Deliver accelerated deep learning inference for AI-powered imaging and guidance during procedures.
- Increase diagnostic capacity with computer vision/AI acceleration and support up to four 4K displays or one 8K display.

Gaming: Deliver immersive gaming experiences

Applications: Augmented table games, slot machines

- Immerse players in 8K or 4K action and engage with deep learning computer vision and natural language processing.
- Help improve safety monitoring with AI-powered, smart security capabilities.

Retail: Drive intelligent signage, automate checkout, and fight fraud

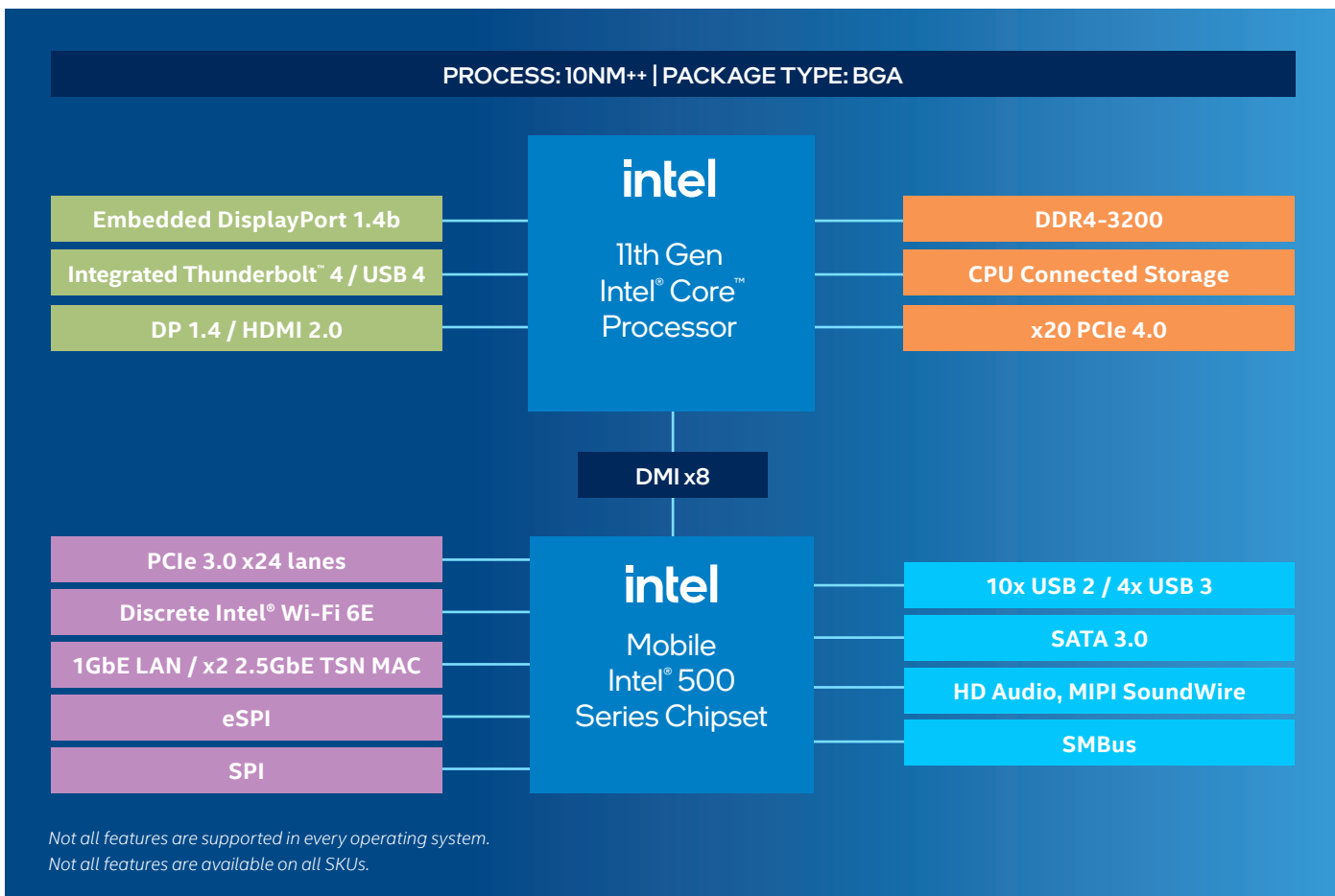**Applications:** Digital signage, kiosks, point of sale, interactive flat panel displays

- Powerful 3D, multiple-display and high-resolution signage, and video experiences. 4x 4K60 signage for menu board applications or a 2x2 video wall.
- Support core POS computer vision/AI-powered loss prevention and fraud detection at self-checkout kiosks.

Public sector: Deploy rugged, reliable, and performant devices

Applications: Avionics, general-purpose edge compute, radar, vehicle displays

- Build smart rugged devices that enable computer vision and deep learning inference at the edge, while meeting extended temperature requirements for extreme environments.
- Support multiple 4K or 8K HDR displays for pilot, driver, and tactical displays in command-and-control systems.
- Develop functional safety–capable systems for flight controls, signals, and logistics.

Processor block diagram

PROCESS: 10NM++	PACKAGE TYPE: BGA

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11th Gen Intel® Core™ Processor

- Embedded DisplayPort 1.4b
- Integrated Thunderbolt™ 4 / USB 4
- DP 1.4 / HDMI 2.0

- DDR4-3200
- CPU Connected Storage
- x20 PCIe 4.0

DMI x8

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Mobile Intel® 500 Series Chipset

- PCIe 3.0 x24 lanes
- Discrete Intel® Wi-Fi 6E
- 1GbE LAN / x2 2.5GbE TSN MAC
- eSPI
- SPI

- 10x USB 2 / 4x USB 3
- SATA 3.0
- HD Audio, MIPI SoundWire
- SMBus

Not all features are supported in every operating system.
Not all features are available on all SKUs.

Software overview

LICENSING MODEL	OPERATING SYSTEMS/HYPERVISOR	DISTRIBUTOR AND SUPPORT
Commercial	Windows 10 IoT Enterprise (64-bit) LTSC RS5	Microsoft
	Ubuntu Linux	Canonical
	Red Hat Linux	Red Hat
	Wind River VxWorks RTOS	Wind River
	Real-Time Systems (Type 1 hypervisor)	Real-Time Systems
Open source	Linux LTS Kernel with Preempt RT Patch, KVM (Type 2 hypervisor)	Linux Community (kernel.org)
	Yocto Project	Intel, Yocto Project Community (yoctoproject.org)
	ACRN (Type 1 hypervisor) (postlaunch)	ACRN Community (projectacrn.org)
	Android (postlaunch)	Celadon Community (01.org/projectceladon)
	Slim Bootloader	Intel, SBL Community (slimbootloader.github.io)

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

Processor lineup

Brand	Processor Number MM# Order Code	Compatible PCH	Cores/ Threads L3 Cache	DDR4 (MT/s)	TDP/ cTDP Down	Freq @ TDP / cTDP (GHz)	Max Turbo Freq (GHz)	Graphics/ Media/Display	Graphics Base/Max (MHz)	Tj (Deg C)	Intel vPro®, Intel® TXT	Lowest Package C State
General embedded (45W/35W)												
Intel® Core™ i7 processor	i7 -11850HE MM# 99AH7N FH8069004638048	RM590E QM580E	8C/16T 24M	3200	45W/35W	2.6 / 2.1	4.7	Intel® UHD Graphics 32 EU 4x4K or 1x8K displays 2 VDBox	350 / 1350	0 to +100C	√	Up to C10
Intel® Core™ i5 processor	i5-11500HE MM# 99AH7P FH8069004638049		6C/12T 12M	3200	45W/35W	2.6 / 2.1	4.5	Intel UHD Graphics 32 EU 4x4K or 1x8K displays 2 VDBox	350 / 1350	0 to +100C	√	Up to C10
Intel® Core™ i3 processor	i3-11100HE MM# 99AH80 FH8069004638051	RM590E QM580E HM570E	4C/8T 8M	3200	45W/35W	2.4 / 1.9	4.4	Intel UHD Graphics 16 EU 4x4K or 1x8K displays 1 VDBox	350 / 1250	0 to +100C		Up to C10
Intel® Celeron® processor	6600HE MM# 99AH8D FH8069004638144		2C/2T 8M	3200	35W	2.6		Intel UHD Graphics 16 EU 4x4K or 1x8K displays 1 VDBox	350 / 1100	0 to +100C		Up to C10

Brand	Processor Number MM# Order Code	Compatible PCH	Cores/ Threads L3 Cache	DDR4 (MT/s)	TDP/ cTDP Down	Freq @ TDP / cTDP (GHz)	Max Turbo Freq (GHz)	Graphics/ Media/Display	Graphics Base/ Max (MHz)	Tj (Deg C)	Intel vPro®, Intel® TXT	ECC, Intel® TCC/ TSN	Intel® FSEDP	Lowest Package C State
Industrial (45W/35W) – Disable core/graphics turbo for industrial use condition applications														
Intel® Xeon® W-11000E Series processor	W-11865MRE MM# 99AH7L FH8069004638046	RM590E	8C/16T 24M	3200	45W/35W	2.6 / 2.1	4.7	Intel® UHD Graphics 32 EU 4x4K or 1x8K displays 2 VDBox	350/ 1350	-40 to +100C	√	√	√	C0 only
	W-11555MRE MM# 99AH7M FH8069004638047		6C/12T 12M	3200	45W/35W	2.6 / 2.1	4.5	Intel UHD Graphics 32 EU 4x4K or 1x8K displays 2 VDBox	350/ 1350	-40 to +100C	√	√	√	C0 only
	W-11155MRE MM# 99AH7R FH8069004638050		4C/8T 8M	3200	45W/35W	2.4 / 1.9	4.4	Intel UHD Graphics 16 EU 4x4K or 1x8K displays 1 VDBox	350/ 1250	-40 to +100C			√	Up to C10
Industrial (25W) – Disable core/graphics turbo for industrial use condition applications														
Intel® Xeon® W-11000E Series processor	W-11865MLE MM# 99AH89 FH8069004638151	RM590E	8C/16T 24M	3200	25W	1.5	4.5	Intel UHD Graphics 32 EU 4x4K or 1x8K displays 2 VDBox	350/ 1350	0 to +100C	√	√		Up to C10
	W-11555MLE MM# 99AH87 FH8069004638140		6C/12T 12M	3200	25W	1.9	4.4	Intel UHD Graphics 32 EU 4x4K or 1x8K displays 2 VDBox	350/ 1350	0 to +100C	√	√		Up to C10
	W-11155MLE MM# 99AH8A FH8069004638142		4C/8T 8M	3200	25W	1.8	3.1	Intel UHD Graphics 16 EU 4x4K or 1x8K displays 1 VDBox	350/ 1250	0 to +100C			√	Up to C10

Learn more about 11th Gen Intel Core vPro, Intel Xeon W–11000E Series, and Intel Celeron processors at intel.com/tigerlake-h.

1. Vs. previous-generation Intel® Core™ i7-9850HE (IoT H Series Coffee Lake R) processors.

    Intel configurations
    Performance results are based on Intel measurements as of May 25 , 2021.

    Processor: Intel® Core™ i7-11850HE (TGL-H) PL1=45W TDP, 8C16T turbo up to 4.7 GHz
    Graphics: Intel® Graphics Gen 12 GFX
    Memory: 32 GB DDR4-3200
    Storage: Intel® SSD 545S (512 GB)
    OS: Windows 10 Pro 20H2
    Bios: TGLSFWI1.R00.4151.A01.2104060640 (Release date: 04/06/2021)
    CPUz microcode: 28h

    Processor: Intel® Core™ i7-9850HE (CFL-H) PL1=45W TDP, 4C8T turbo up to 4.4 GHz
    Graphics: Intel® Graphics Gen 9 GFX
    Memory: 32 GB DDR4-2666
    Storage: Intel SSD 545S (512 GB)
    OS: Windows 10 Pro 20H2
    Bios: CNLSFWR1.R00.X216.B01.2006110406 (release date: 06/11/2020)
    CPUz Microcode: D6h

2. Up to 32 percent single-thread performance gains as measured by SPECrate2017_int_base (1-copy)IC19_0u4 (est.).
3. Up to 65 percent multi-thread gain as measured by SPECrate2017_int_base (n-copy)IC19_0u4 (est.).
4. Up to 70 percent graphics performance gains as measured by 3DMark_v2.11 - Win10 v2009 - Fire Strike - graphics score.

Notices and disclaimers

Intel® Advanced Vector Extensions (Intel® AVX) provides higher throughput to certain processor operations. Due to varying processor power characteristics, utilizing AVX instructions may cause, a) some parts to operate at less than the rated frequency and, b) some parts with Intel® Turbo Boost Technology 2.0 to not achieve any or maximum turbo frequencies. Performance varies depending on hardware, software, and system configuration, and you can learn more at http://www.intel.com/go/turbo.

Intel® processors of the same SKU may vary in frequency or power as a result of natural variability in the production process. Performance varies by use, configuration, and other factors. Learn more at www.intel.com/PerformanceIndex.

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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.

Intel contributes to the development of benchmarks by participating in, sponsoring, and/or contributing technical support to various benchmarking groups, including the BenchmarkXPRT Development Community administered by Principled Technologies.

Your costs and results may vary.

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

Not all features are available on all SKUs.

Not all features are supported in every operating system.

All product plans and road maps are subject to change without notice.

Statements in this document that refer to future plans or expectations are forward-looking statements. These statements are based on current expectations and involve many risks and uncertainties that could cause actual results to differ materially from those expressed or implied in such statements. For more information on the factors that could cause actual results to differ materially, see our most recent earnings release and SEC filings at www.intc.com.

Customer is responsible for safety of the overall system, including compliance with applicable safety-related requirements or standards.

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