

# Intel® Tiger Lake-UP3 Solution

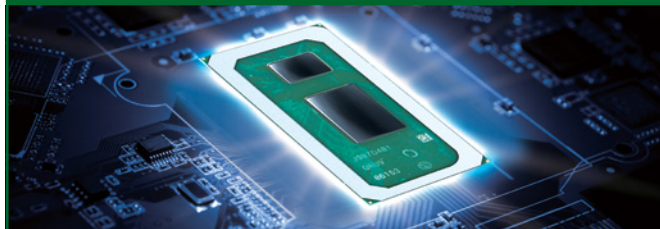
## » Intel® Tiger Lake-UP3 Platform Overview

### Graphics Media, and Display



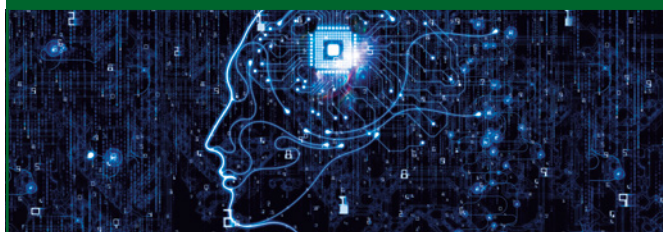
- New Xe (Gen12) Gfx Engine with up to 96 EUs
- 4 independent display units (4 x 4K or 2 x 8K)
- Image processing unit IPU6
- \* Up to 27MP image capture
- \* Up to 4K@60fps video performance
- \* Support for 4 concurrent streams
- \* VTIO and RGB-IR for facial recognition

### Security and Manageability



- Intel® Total Memory Encryption (Intel® TME)
- \* Hardware based encryption to protect entire memory contents from physical attacks
- Intel® AES-NI
- \* A new, hardware based AES-NI instruction set to protect private keys from malware
- \* Keys are no longer exposed and handlers are utilized to perform encrypt/decrypt operations
- Control-Flow Enforcement Technology

### AI Experience



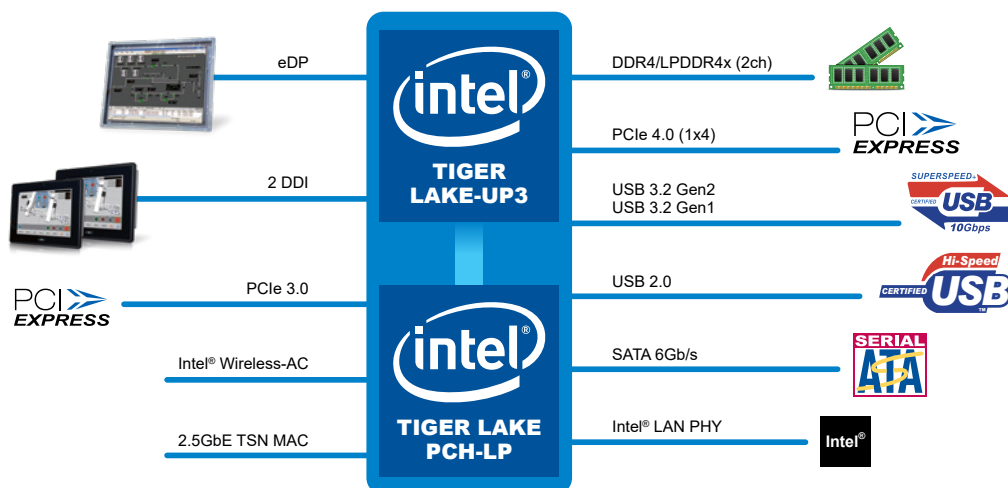
- Vector Neural Network Instruction (VNNI) improves inferencing workload performance
- Common industry wide AI frameworks optimized on Tiger Lake architecture (via OpenVINO™)
- Intel® Deep Learning Boost
- AI/DL Instruction Sets including VNNI and CV/AI applications

### Enhanced Features



- Up to 4 cores
- In-Band ECC available
- PCIe 4.0 (off CPU complex), 12 HSIO lanes (off PCH complex)
- Improved Thunderbolt™ data performance
- Integrated Type C subsystem with for USB4 compliance

## » Intel® Tiger Lake-UP3 Platform Block Diagram



# » Intel® Core™ Processor Generational Comparison

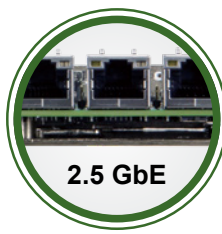
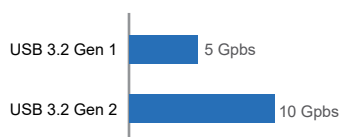
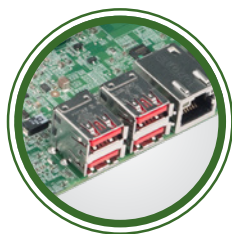
Brand	Kaby lake-U	Whiskey lake-U	Tiger lake-UP3
<b>Launch</b>	2017	2019	2020
<b>Process</b>	14nm	14nm	10nm
<b>Core</b>	2	4	4
<b>Processor TDP</b>	15W	12.5/15/25W	12/15/28W
<b>Memory</b>	LPDDR3-1866 DDR4-2133 DDR3L-1600	LPDDR3-1866/2133 DDR4-2400 DDR3L-1600	LPDDR4x 4267 DDR4 3200 In-Band ECC
<b>PCI Express Lanes</b>	Up to 12 PCIe 3.0 lanes (PCH)	Up to 16 PCIe 3.0 lanes (PCH)	Up to 12 PCIe 3.0 lanes (PCH) Up to 4 PCIe 4.0 lanes (CPU)
<b>Storage</b>	Intel® Optane™ Memory, PCIe 3.0, SATA 6Gb/s, SD 3.0, eMMC 5.0	Intel® Optane™ Memory, PCIe 3.0, SATA 6Gb/s, SD 3.0, eMMC5.1	Intel® Optane™ Memory, PCIe 3.0, PCIe 4.0, SATA 6Gb/s, SD 3.0

# » Intel® Tiger Lake-UP3 Platform OS Support

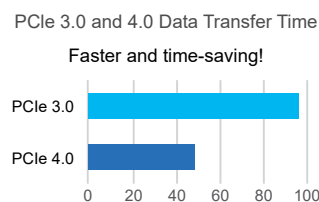
Licensing Model	Operating System and Hypervisor	Distributor and Scalability Partnership
<b>Commercial</b>	Windows 10 IOT Enterprise (64-bit) LTSC RS5	Microsoft
	Ubuntu Linux	Canonical
	Redhat Linux	Redhat
	Wind River VxWorks RTOS	Wind River
	Real-Time System (Type 1 Hypervisor)	Real Time Systems
<b>Open Source</b>	Linux LTS Kernel with Preempt RT Patch	Open Source Community: <a href="http://kernel.org">http://kernel.org</a>
	Virtualization: KVM (Type 2 Hypervisor), ACRN	Intel Open Source Community: <a href="http://01.org">http://01.org</a> <a href="http://projectacrn.org">http://projectacrn.org</a> <a href="http://1.org/projectceladon">http://1.org/projectceladon</a>
	Android Celadon	

# » Features of IEI Intel® Tiger Lake-UP3 Products

USB 3.2 Gen2	2.5GbE LAN	PCI Express® 4.0
USB 3.2 Gen2 Supporting four USB 3.2 Gen2 with Type A interface, transfer rate up to 10Gb/s	Supporting TSN (Time Sensitive Networking), providing time synchronization with IT network and timeliness between systems.	Interconnect performance bandwidth double of the PCIe 3.0 specification achieving 16GT/s and compatibility with software and mechanical interfaces is preserved.



Controller IC:  
Intel® I225LM / Intel® I225V



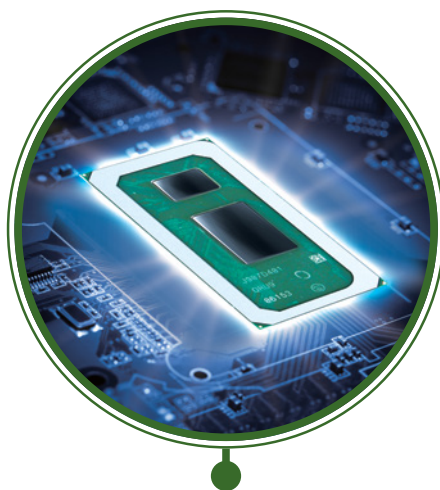
# Intel® Elkhart Lake Platform

## » Intel® Elkhart Lake Platform Overview



### » Real-Time/Time Determinis

- Intel® Time Coordinated Computing, Time Sensitive Networking features
- Scalability and consolidation of temporally deterministic workloads



### » Safety, Security, Manageability

- First Intel product designed with functional safety capabilities. SIL2/Cat.3 PL d certified, SIL3/Cat.4 PLe capable
- In-Band and OOB manageability
- Intel® PTT, Intel® DAL technologies
- Intel® Boot Guard



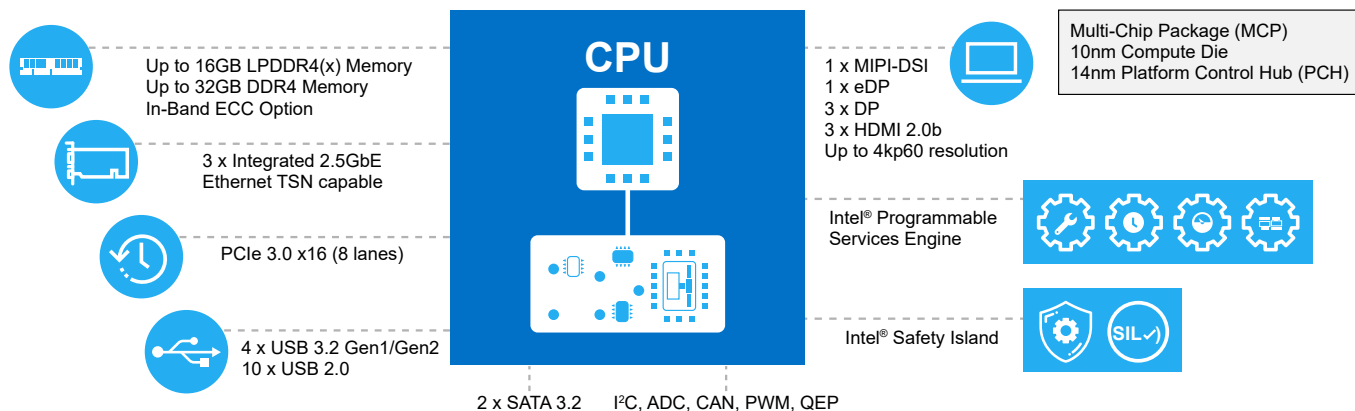
### » Function+

- Intel® Programmable Services Engine
- Intel® UHD Graphics, media, and display supporting video encode/decode requirements
- Integrated Gigabit Ethernet (2.5GbE)
- Fully Integrated Voltage Regulator (FIVR)

## » Generational Comparison

	Apollo Lake-I	Elkhart Lake
<b>Memory / ECC</b>	1867 MHz DDR3L (max. 8 GB) 2400 MHz LPDDR4 (max. 8 GB)	LPDDR4 4267MT/s (max. 8GB/16GB @3200MT/s), DDR4 3200MT/s (max. 32GB with IB ECC)
<b>TDPs</b>	6W-12W	4.5W-12W
<b>Ethernet</b>	-	3 x 2.5GbE TSN MACs
<b>Storage and IO</b>	2 SATA 6Gb/s, 6 USB 3.2 Gen 1 (1 dual role), eMMC 5.0	2 SATA 6Gb/s, 4 USB 3.2, 3 2.5GbE TSN MACs, 2 UFS 2.0, eMMC 5.1, 10 USB 2.0 (1 dual role), PWM, QEP, ADC, CAN, up to 60 GPIOs via Intel® Programmable Services Engine (40 timed GPIOs)
<b>Max. Display Resolutions</b>	4Kp60 on one display	Intel® UHD Graphics, 4Kp60 on three simultaneous displays
<b>Power Mgmt</b>	PMIC or Multiple Discrete Voltage Regulators (DVR)	Fully Integrated Voltage Regulators (FIVR)

## » Block Diagram



## » Intel® Elkhart Lake CPU Matrix

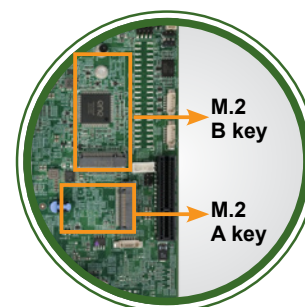
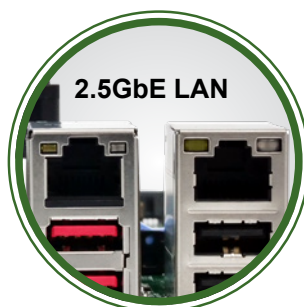
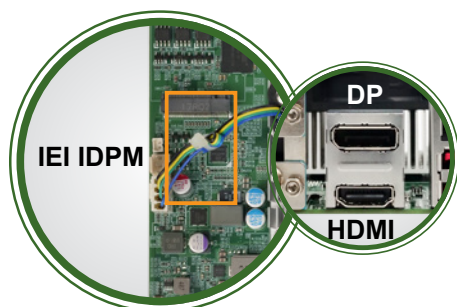
Brand	Processor No.	CPU Core Count	CPU HFM Freq (GHz)	CPU Burst Freq (GHz)	Memory Max Bandwidth/ Channel	Gfx Freq (MHz) Nominal/Turbo	Max. TDP (W)	Junction Temperature Range
Pentium®	N6415	4	1.2	3.0	51.2 (GB/s) / 4	350/800	6.5	0°C ~ 105°C
Pentium®	J6425	4	1.8	3.0	59.7 (GB/s) / 4	400/800	10	0°C ~ 105°C
Celeron®	N6211	2	1.2	3.0	51.2 (GB/s) / 4	250/750	6.5	0°C ~ 105°C
Celeron®	J6413	4	1.8	3.0	59.7 (GB/s) / 4	400/800	10	0°C ~ 105°C
ATom®	X6425E	4	1.8	3.0	59.7 (GB/s) / 4	500/750	12	-40°C ~ 105°C
ATom®	X6413E	4	1.5	3.0	51.2 (GB/s) / 4	500/750	9	-40°C ~ 105°C
ATom®	X6211E	2	1.2	3.0	51.2 (GB/s) / 4	350/750	6	-40°C ~ 105°C
ATom®	X6425RE	4	1.9	N/A	68.2 (GB/s) / 4	400/(N/A)	12	-40°C ~ 105°C
ATom®	X6414RE	4	1.5	N/A	51.2 (GB/s) / 4	400/(N/A)	9	-40°C ~ 105°C
ATom®	X6212RE	2	1.2	N/A	51.2 (GB/s) / 4	350/(N/A)	6	-40°C ~ 105°C
ATom®	X6427FE	4	1.9	N/A	68.2 (GB/s) / 4	400/(N/A)	12	-40°C ~ 105°C
ATom®	X6200FE	2	1.0	N/A	38.4 (GB/s) / 4	N/A	4.5	-40°C ~ 105°C

## » Intel® Elkhart Lake Platform OS Support

Category	Operating System (Targeted for Support)	Implementation	Distribution and Support
Microsoft	Windows 10 IoT Enterprise (64-bit)	Intel	Intel, Microsoft
Linux	Yocto Project BSP tool-based embedded Linux distribution (64-bit)	Intel	Yocto Project and ISV Partners
	Linux Distribution: Ubuntu (64-bit)	Canonical	Canonical
	Wind River Linux LTS distribution (64-bit)	Wind River	Wind River
Android	Android 10 (64-bit)	Intel	ISV Partners
RTOS	Wind River VxWorks 7	Wind River	Wind River

## » Features of IEI Elkhart Lake Products

Display Port	2.5GbE LAN	M.2
IEI provides products supporting Triple-mode DisplayPort output which can auto detect the plugged-in cable type and provide multiple options of display output through one single port.	IEI provides new products supporting TSN (Time Sensitive Networking), which delivers time synchronization with IT network and timeliness between systems.	IEI provides new products supporting Next Generation Form Factor (NGFF) expansion cards with different functions, such as SSD, WWAN and WLAN cards suitable for small devices.





# Intel® Jasper Lake Platform



## Improved Performance

- New Tremont core, 6W/10W TDP, 10nm CPU/14nm PCH MCP, 1.5M L2 + 4M L3 cache, FIVR, 35x24 package
- Up to 4 Cores



## Faster Connections

- Integrated WiFi/BT with 802.11ax/ac support w/ Discrete option
- Integrated USB 3.1 Gen 2 for 2x the speed vs. Gen 1
- Up to 8 PCIe 3.0 lanes



## Gen 11 Graphics

- Next Gen Graphics and Display with significantly better Graphics up to 32 EUs improved Perf and new features
- Integrated IPU, MIPI-CSI



## Security & Manageability

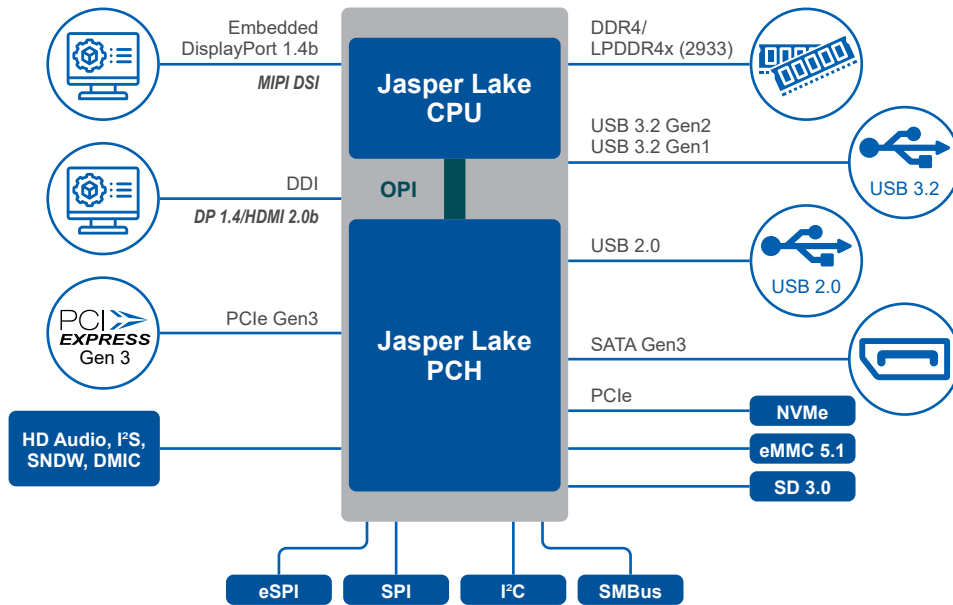
- Integral Intel Security Engine HDCP2.2, Playready 3, Widevine, Microsoft VSM.

## Intel® Atom™ Comparison



	Cedar Trail	Bay Trail	Braswell	Apollo Lake	Jasper Lake
<b>Launch</b>	Q1'12	Q4'13	Q1'15	Q4'16	Q4'20
<b>Process</b>	32nm	22nm	14nm	14nm	10nm
<b>Processor Frequency &amp; TDP</b>	D2550: 2C, 1.86GHz/10W N2800: 2C, 1.86GHz/6.5W N2600: 2C, 1.6GHz/3.5W	J1900: 4C, 2 GHz/10W N2930: 4C, 1.83 GHz/7.5W N2807: 2C, 1.58 GHz/4.3W E3845: 4C, 1.91 GHz/10W E3827: 2C, 1.75 GHz/8W E3826: 2C, 1.46 GHz/7W E3825: 2C, 1.33 GHz/6W E3815: 1C, 1.46 GHz/5W	N3710: 4C, up to 2.56GHz/6W N3160: 4C, up to 2.24GHz/6W N3060: 2C, up to 2.48GHz/6W N3010: 2C, up to 2.24GHz/4W	N4200: 4C, up to 2.5GHz/6W N3350: 2C, up to 2.3GHz/6W x7-E3950: 4C, up to 2.0GHz/6.5W x5-E3940: 4C, up to 1.8GHz/9.5W x5-E3930: 2C, up to 1.8GHz/12W	N6005: 4C up to 3.30GHz/10W N5105: 4C up to 2.90GHz/10W N4505: 2C up to 2.90GHz/10W N6000: 4C up to 3.30GHz/6W N5100: 4C up to 2.80GHz/6W N4500: 2C up to 2.80GHz/6W
<b>Chipset TDP</b>	Intel® NM10: 1.5W	N/A	N/A	N/A	N/A
<b>Memory</b>	DDR3 1066 MHz for D2550/ N2800 (Max. 4GB) DDR3 800MHz for N2600 (Max. 2GB)	DDR3L 1333MHz for J1900/ N2930/E3845/E3827 (Max. 8GB) DDR3L 1333MHz for N2807 (Max. 4GB) DDR3L 1066MHz for E3826/ E3825/E3815 (Max. 8GB)	DDR3L 1600MHz (Max. 8GB)	DDR3L 1866 MHz (Max. 8GB)	DDR4 2933Mhz (Max. 16GB)
<b>Graphics</b>	2 Independent Displays DirectX9 , OpenGL 3.0 Gfx @ up to 640MHz (D2550/ N2800)	Gen 7 graphics 2 Independent Displays Gen 7 4 EUs DirectX11.1 , OpenGL 4.0 Gfx @ up to 854MHz (J1900/ N2930)	Gen 8 graphics 3 Independent Displays Gen 8 LP 16 EUs DirectX12 2, OpenGL 4.2 Gfx @ up to 700MHz (N3700/ N2930)	Gen9 Low Power graphics 3 Independent Displays Gen9 LP 18 EUs OpenGL* ES 3.0/3.0+, OpenCL* 1.2 Gfx@ up to 750 MHz (N4200)	Gen11 Graphics, 3 Independent Displays Gen11 32 EUs OpenGL* ES 3.2/4.5, OpenCL* 1.2
<b>Video Decode</b>	MPEG2, h.264, VC-1/WMV9 Up to 1080p	MPEG4, h.264, VC-1/WMV9 VP8 up to 1080p	H.265/HEVC @ level 5, H.264 @ Level 5.2, MPEG2, MVC, VC-1, WMV9, JPEG, VP8	4K Codec Decode & Encode for HEVC, H.264, VP8	4K Codec Decode & Encode for HEVC, H.264, VP9
<b>Storage &amp; IO</b>	SATA 3Gb/s, 8 USB 2.0	SATA 3Gb/s, 1 USB 3.2 Gen 1, 3 USB 2.0, eMMC 4.51	SATA 6Gb/s, 4 USB 3.2 Gen 1, 1 USB 2.0, eMMC 4.51	SATA 6Gb/s, 5 USB 3.2 Gen 1, 2 USB 2.0, eMMC 5.0	SATA 6Gb/s, 3 USB 3.2 Gen 1, 2 USB 3.2 Gen 2, 4 USB 2.0, eMMC 5.1

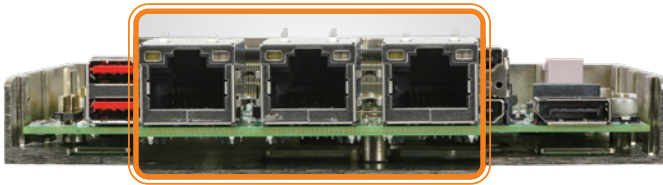
## Block Diagram



## Features of IEI Jasper Lake Product

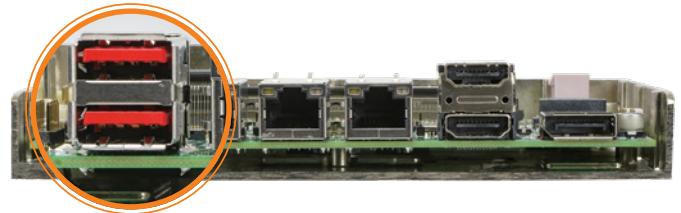
### 2.5GbE LANs

IEI provides products support triple 2.5 GbE LANs with i225V/LM which can provide a high-speed networks option for communication demand.



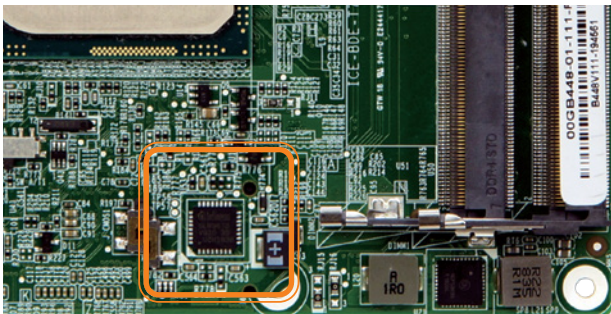
### USB 3.2 Gen 2

IEI provides products support integrated USB 3.2 Gen 2 which is twice the speed more than USB 3.2 Gen 1.



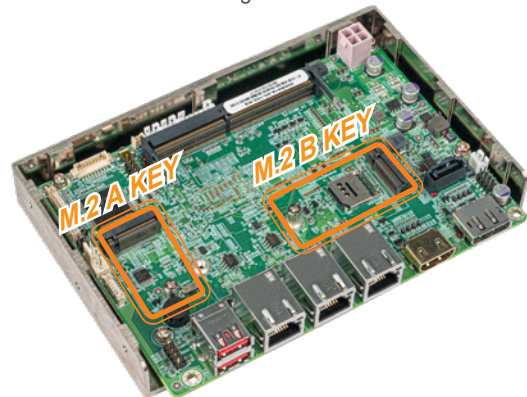
### SPI TPM

IEI provides products support Onboard TPM 2.0 a software management security solution for data protection and reliable passwords and digital certificates.



### M.2

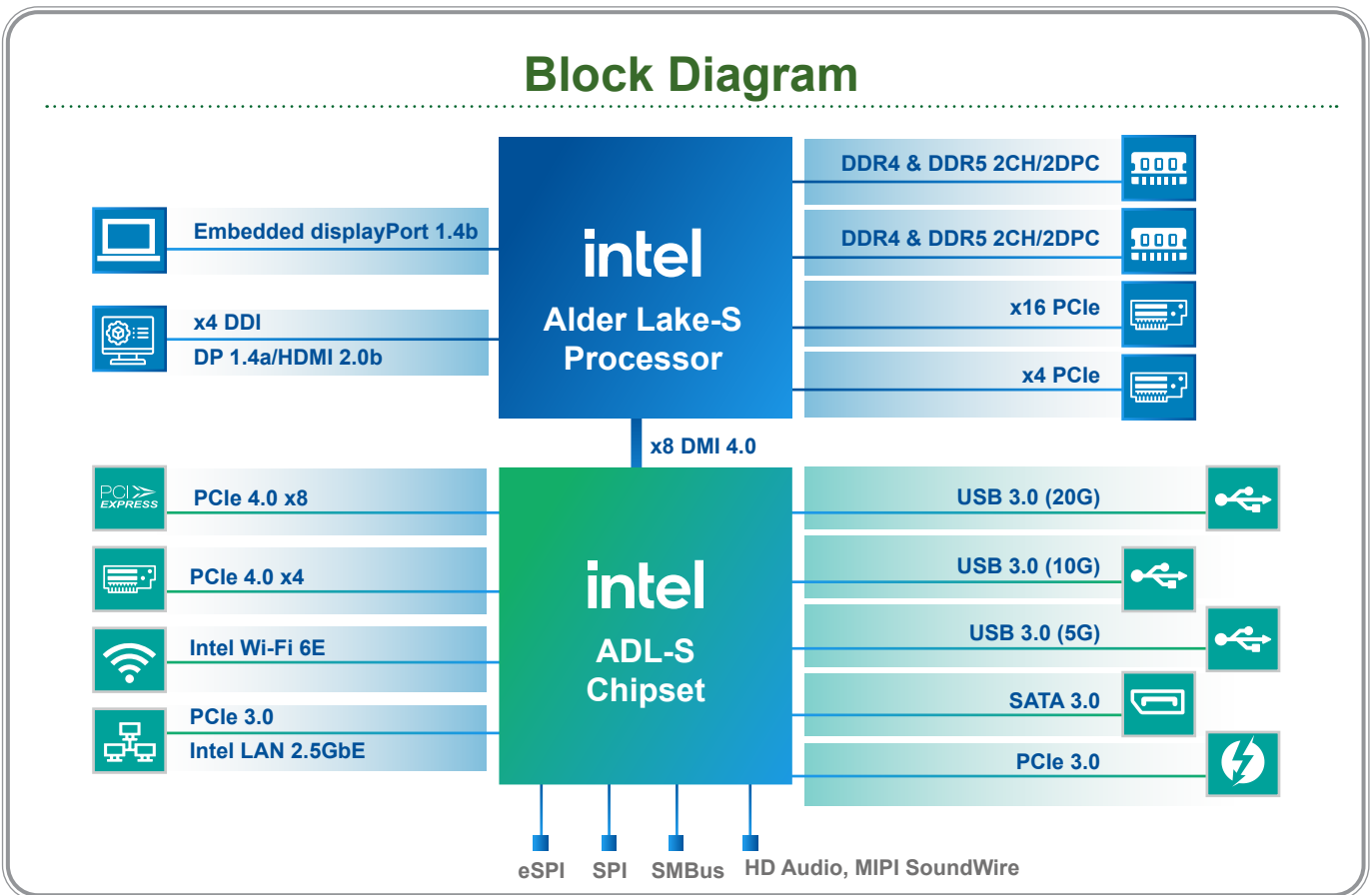
IEI provides new products supporting M.2 expansion cards in different types, such as A key for WWAN, WLAN, Bluetooth cards, and B key for 5G module card or NVMe storage.



# 12th Gen Intel® Alder Lake-S Platform

IOTG Alder Lake-S is the latest platform follow on to Comet Lake. Alder Lake-S Platform is the first desktop with Intel® Hybrid Technology. And it also the first IOTG 10nm Intel® Core™ S Processor Platform, new socket for LGA1700. It supports PCIe Gen 5, PCIe Gen 4. Intel® Core platform with up to 16 Cores and improved performance over CML-S. Alder Lake-S platform supports up to DDR5-4800 or DDR4-3200, 16x PCIe Gen5 & 4x PCIe Gen4 from CPU performance, and up to 12x PCIe Gen 4 & Up to 16x PCIe Gen 3 from PCH performance, which provides high performance on various applications.

## Block Diagram



## » Intel® Alder Lake-S Platform OS Support







Category	Operating Systems / SDKs / Bootloaders	Implementation	Distribution and Support
Operating Systems <sup>1</sup>	Windows® 10 IoT Enterprise 2021 LTSC	Intel	Intel, Microsoft
	Windows® Server	Intel	Intel, Microsoft
	Ubuntu, SuSe, Redhat Enterprise, WR Linux <sup>3</sup>	Canonical Ltd., Attachmate Grp, Red Hat & Wind River Systems	Canonical Ltd., Attachmate Grp, Red Hat & Wind River Systems
	Yocto Project® BSP tool-based embedded Linux distribution	Intel	Intel, Yocto Project® community
	Celadon (Android) in VM	Intel	Intel, Celadon community
	Wind River VxWorks® 7	Wind River	Wind River

<sup>1</sup> Not all features are supported in all Operating Systems

<sup>2</sup> Legacy boot is not supported for Windows, Linux. Customers should work with their BIOS vendors for enabling/validating legacy BIOS features.

<sup>3</sup> Supported by Intel via the upstreaming to Open Source Community. Adoption into individual Linux distributions/hypervisors is dependent upon the OS/HV vendors.

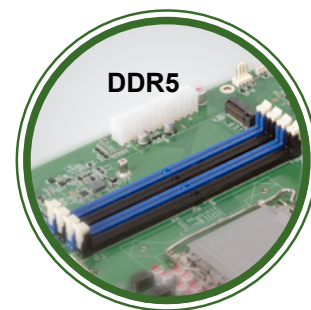
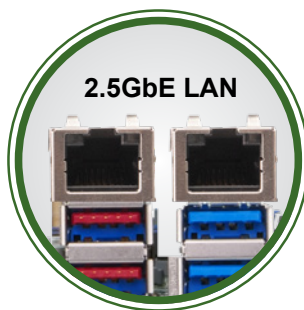
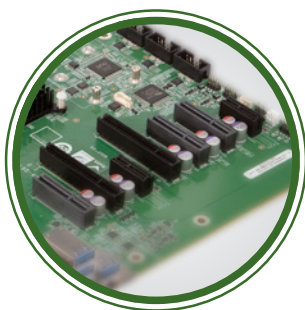
# » IOTG S Series Gen over Gen Improvements (CML-S to ADL-S)

IOTG Comet Lake-S		IOTG Alder Lake-S
14nm Up to 10C Up to 20 Threads		New processor architecture supporting up to 16 cores and 24 threads <sup>1</sup> with Intel® Hybrid technology for outstanding Multi Threaded performance. Up to 30MB Intel® Smart cache
Up to Intel UHD Graphics 630 3 Independent Displays HDCP2.3, HDMI 1.4, HDMI 2.0 (via LSPCON), DP 1.2, 3 display pipes, 1VDBox, 4k60 10b decode		New Intel® Xe Graphics architecture with up to 4 Independent Displays and up to 2 VD boxes, HDMI 2.0b integrated, HDMI 2.1 supported with LSPCON, AV1 Codec, 8k60 12b decode, E2E Compression. SRIOV, Genlock
Up to DDR4 2933 OOB ECC available		Up to DDR5 – 4800, Up to DDR4- 3200 OOB ECC available
Embedded Use Condition 1GbE		Embedded Use Condition 1GbE + 2x 2.5GbE with TSN Targeted as 1st Real-Time in Core S Series
Up to 40 PCIe 3.0 Lanes (16x CPU, up to 24x PCH) DMI x4 Gen 3, Intel® Wi-Fi 5 Integrated + Discrete Intel® Wireless-AC (Wi-Fi/BT CNVi) Quad Core aDSP		New socket for LGA1700 16x PCIe Gen5 + 4x PCIe Gen4 (CPU) Up to 12x PCIe Gen 4 + Up to 16x PCIe Gen 3 (PCH) Up to DMI x8 Gen 4, Discrete TBT Integrated WiFi 5 (802.11ac) – WiFi6E Discrete
Intel® vPro™ Platform eligible with Intel® Active Management Technology Intel® Management Engine Firmware		Intel® vPro™ Platform eligible with Intel® Active Management Technology Intel® Converged Security and Management Engine Version 16 Intel Multi-Key Total Memory Encryption (MK-TME) (Windows only) One Click Recovery



## » Features of IEI Aler Lake-S Products

PCIe Gen 5	2.5GbE LAN	DDR5
IEI provides new products supporting pure PCIe expansion slots, total 7. Two of them support PCIe Gen 5 x16 (with x8 signal)	IEI provides new products supporting TSN (Time Sensitive Networking), which delivers time synchronization with IT network and imeliness between systems.	IEI provides new product supports DDR5-4800 memory. System max supports 128G. (ECC&non-ECC supported)

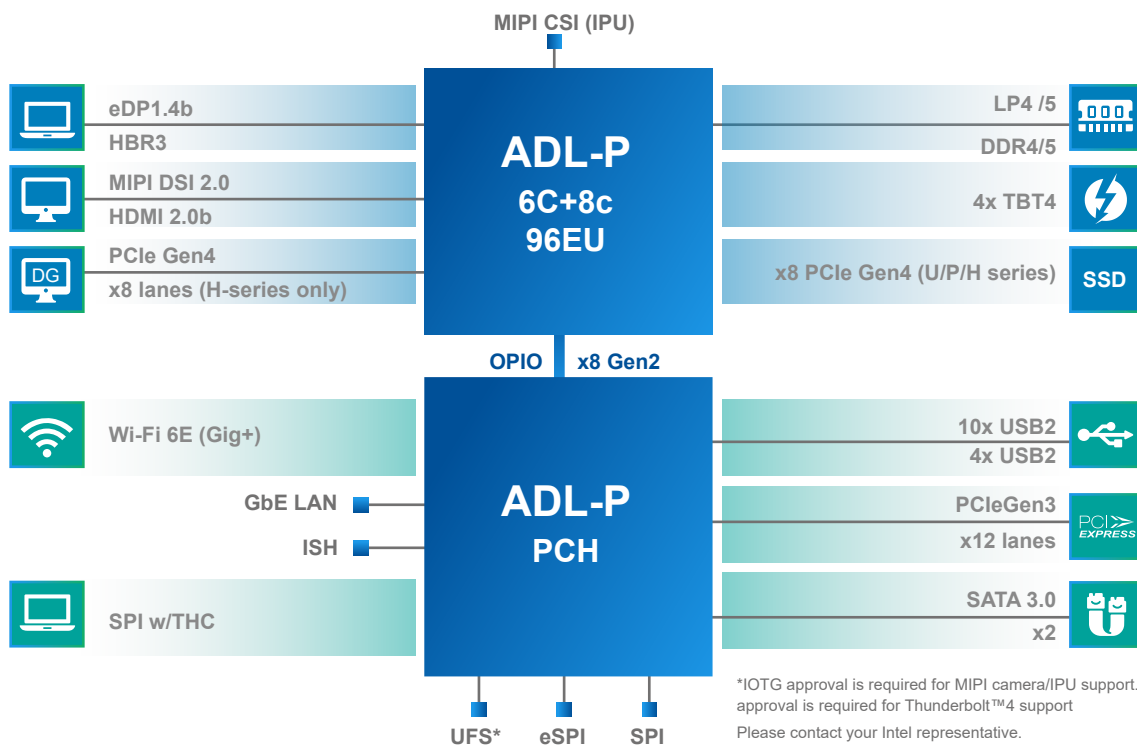




# 12th Gen Intel® Alder Lake-P Platform

- New processor architecture supporting up to 14 cores and 20 threads with Intel® Hybrid technology
- Up to DDR5 – 4800 & LP5-5200
- CPU PCIe Gen 4
- Intel® Xe Graphics architecture, 4 Independent Displays, Up to 8K Display
- AI Acceleration with Intel® Deep Learning Boost (VNNI)
- Discrete Wi-Fi 6E
- Embedded Use Condition

## Block Diagram



## » Intel® Alder Lake-P Platform OS Support

Category	Operating Systems / SDKs / Bootloaders / Hypervisors	Implementation	Distribution and Support
Operating Systems <sup>1</sup>	Windows* 10 IoT Enterprise 2021 LTSC	Intel	Intel, Microsoft
	Ubuntu*, SuSe*, Red Hat Enterprise*, WR Linux* <sup>3</sup>	Canonical Ltd.*, Attachmate Grp*, Red Hat* & Wind River* Systems	Canonical* Ltd., Attachmate Grp*, Red Hat* & Wind River* Systems
	Yocto Project* BSP tool-based embedded Linux distribution	Intel	Intel, Yocto Project* community
	Celadon (Android) in VM	Intel	Intel, Celadon community
	Wind River VxWorks* 7	Wind River	Wind River

<sup>1</sup> Not all features are supported in all Operating Systems

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<sup>3</sup> Supported by Intel via the upstreaming to Open Source Community. Adoption into individual Linux distributions/hypervisors is dependent upon the OS/HV vendors.

\* Other names and brands may be claimed as property

## » Generational Comparison (TGL-U to ADL-P)

Tiger Lake -UP3		Alder Lake -U/P
Up to 4C/8T WLC Core 10nm Superfin 12MB LLC/14nm PCH Embedded and Industrial Use Conditions		Up to 4C/8T P-cores + 8c/8T E-cores Enhanced 10nm Superfin Up to 18MB LLC 14nm PCH Embedded Use Conditions
Up to Xe96EU 4x display, Dual eDP1.4 8K HDR, 12b, AV1 Dec IPU6SE, GNA 2.0		Up to Intel® Iris® Xe96EU IPU6EP*, GNA 3.0
DDR4 3200 LP4x 4267		DDR5 4800, DDR4 3200 LP5 5200, LP4x 4267
ROP CET, Keylocker, Total Memory Encryption		HLAT MK-TME
4x TBT4 Discrete Intel® Wi-Fi 6E (Gig+)		4x TBT4* Discrete Intel® Wi-Fi 6E (Gig+)
x4 Gen4 (CPU) x12 Gen3 (PCH)		2 x4 Gen4 (CPU) x12 Gen3 (PCH)

## » Features of IEI Alder Lake-P Products

Rich Expansion	2.5GbE LAN	Quadra Independent Display
IEI provides new products supporting 1 x PCIe Gen4 x4 slot, 1 x M.2 A Key for WiFi or Bluetooth module, 1 x M.2 M Key (with PCIe Gen3 x4 signal) for NVME storage and 1 x M.2 B Key for 5G module.	IEI provides new products designed triple 2.5GbE LAN supporting TSN (Time Sensitive Networking), which delivers time synchronization with IT network and imeliness between systems.	IEI provides products supporting Quadra-mode DisplayPort output which can auto detect the plugged-in cable type and provide multiple options of display output through one single port.