

EMBEDDED COMPUTER
MODULES & BOARDS



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Trusted COM/SOM
Brand of Avnet Embedded

Scalable Performance

Flex Power/Energy

Connectivity

Intelligence

Longevity

Secure

Faster

Quality

Real Time

Innovation

AI Software Experience

Premium Design Support



/ WELCOME TO AVNET EMBEDDED



“Our focus is on enabling OEM customers to create cutting edge Compute and HMI solutions swiftly. We leverage platform technologies, design, and manufacturing capabilities, working closely with industry leaders to expedite product launches globally. We collaborate with businesses, offering expertise in product design and development, as well as a broad portfolio of solutions from our partners. Proudly part of the Avnet family, we utilize a global sales network and logistics for seamless worldwide delivery.”

Thomas Staudinger, President Avnet Embedded

“Our aim is to deliver the best engineering performance to provide our customers with a leadership position in their markets. With over 30 years of design, engineering and manufacturing experience, we are proud to be leading the world in embedded computing and electronics.”

Silvano Geissler, Vice President Product Creation,
Avnet Embedded





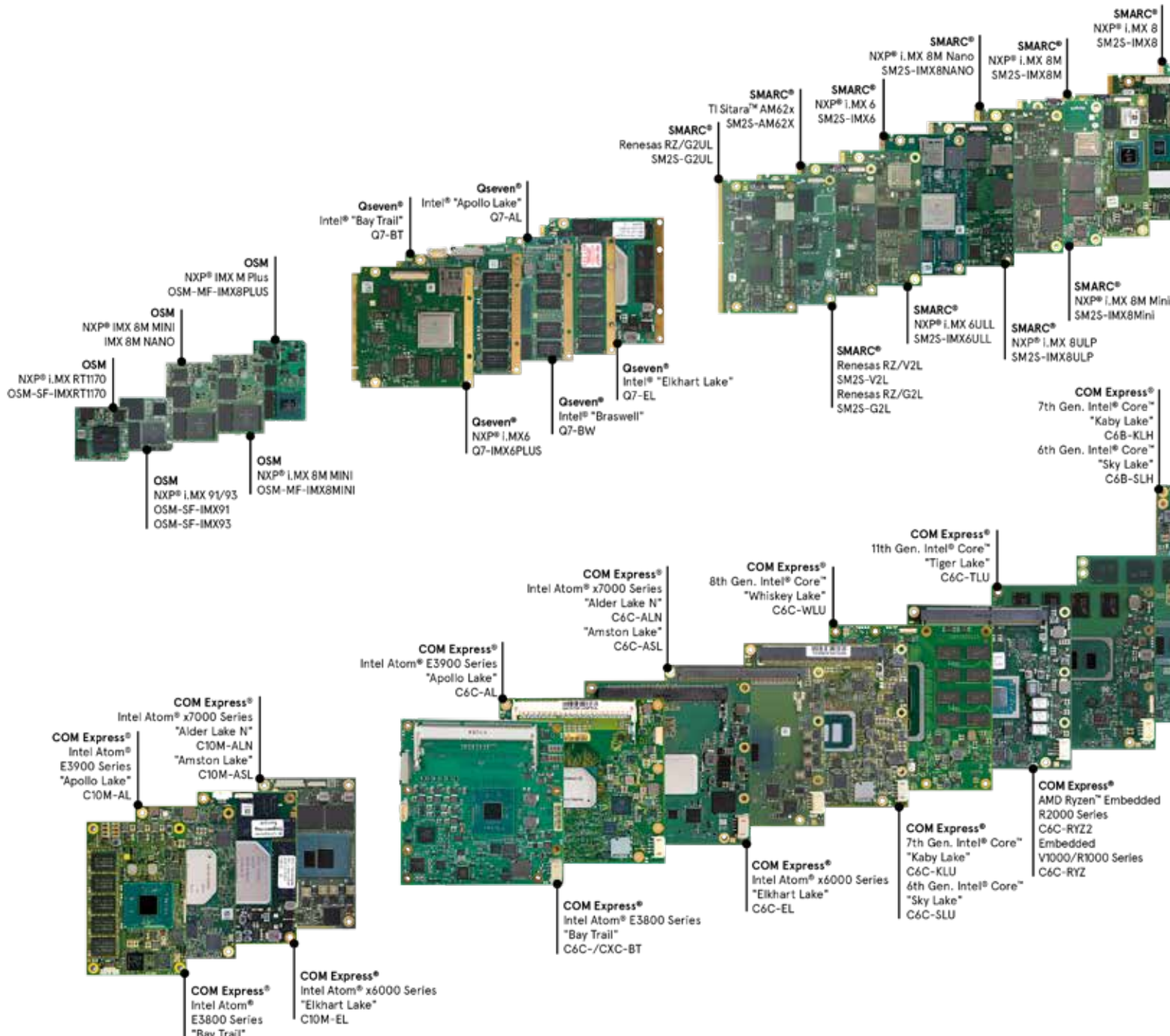
Customer Visitors Welcome



ONE OF THE LARGEST GLOBAL COM MANUFACTURERS



AVNET EMBEDDED



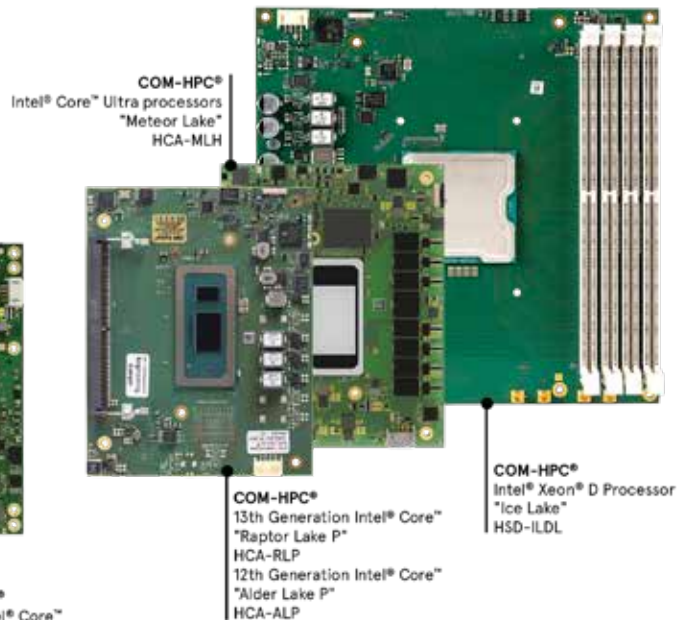
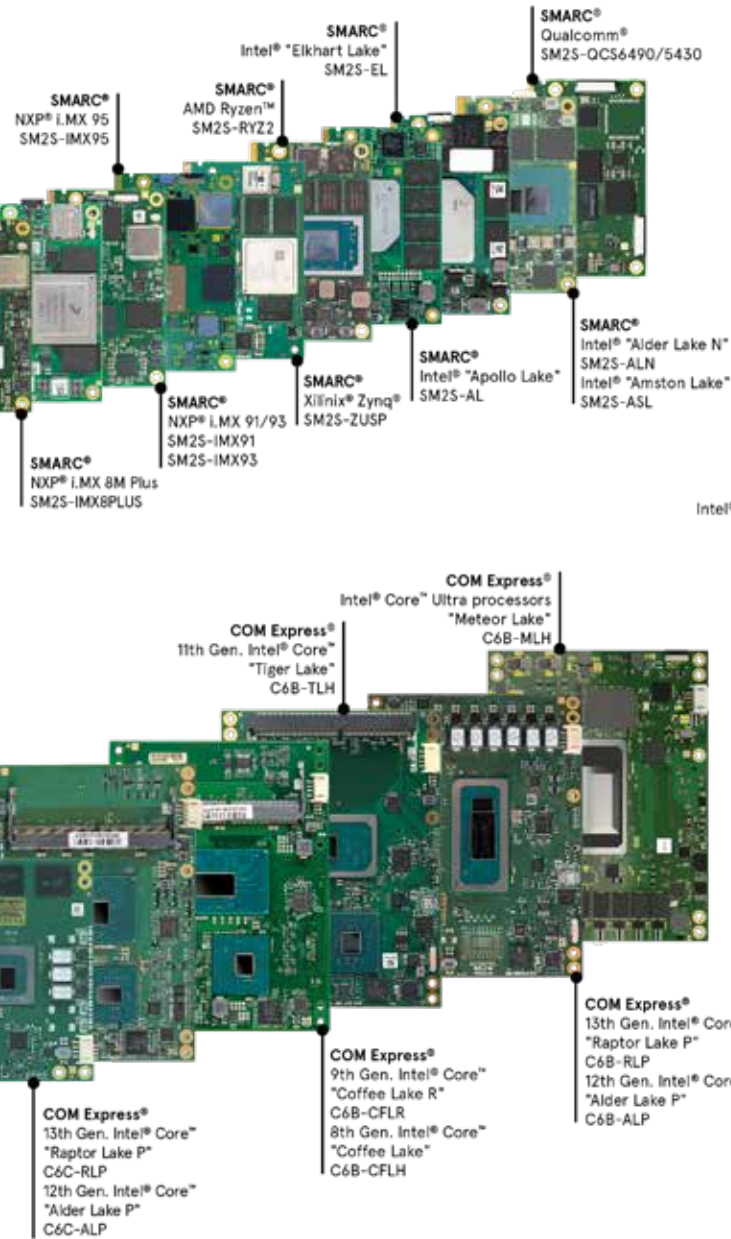
OSM is creating a new, future-proof, and versatile standard for ultra small, solder down, low cost Arm® based embedded computer modules.

SMARC® 2.0/2.1.1 is steadily growing and spans the widest range of products and performance based on Arm® and x86 technology.

Qseven® portfolio is well established in the industry focus x86 CPUs .

COM Express® complete portfolio with latest x86 technology from Intel Atom® to high end performance range.

COM-HPC® is a new Computer-on-Module standard designed specifically for High-Performance Computing.



Industrial quality built for reliability, endurance and longevity
Award-winning range of standard computer-on-modules





AVNET EMBEDDED WORLDWIDE

**Highest quality and flexibility –
Cost competitive through automation**

- x86 CPU
- Arm® MPU
- FPGA / FPGA SOC Design
- High Speed Interface Designs
- Simulation (Thermal, Signal Integrity, Functional)
- Operating System support (Windows / Windows Embedded / Linux® Embedded)
- BIOS, BSP, LDK Software Development

300+

Hard- and Software Engineers

600K

Sq. Ft. embedded global footprint

High Speed

Measurement Equipment and Simulation Tools

800

Operations employees

Function Test

Based on Linux® (Yocto) BSP

900+

Customer served annually

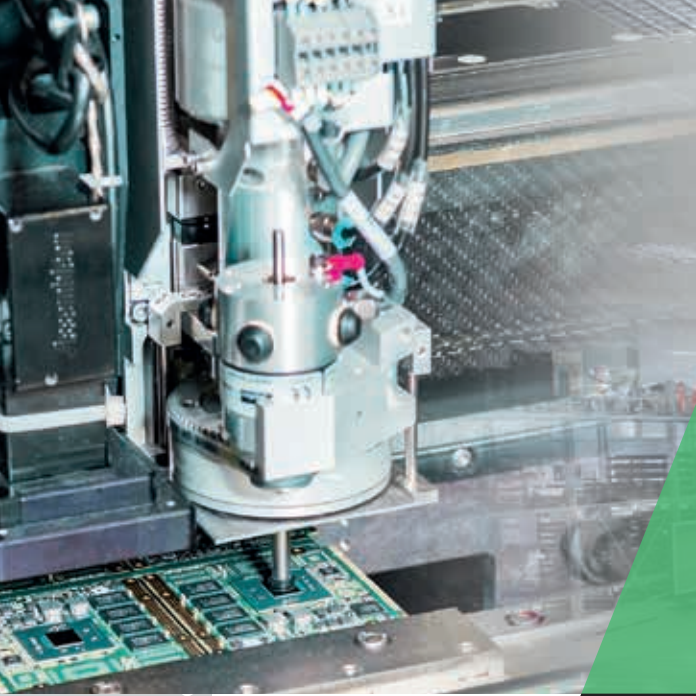
Global Brand

Customer Audits

3.0M+

Systems & boards built annually





Since 1987, Avnet Embedded (formerly MSC Technologies) has been designing and producing electronics.

Plug into instant global infrastructure
Our main technology campuses –
15+ centers of innovation – more in development



Headquarters:

Phoenix / USA

Stutensee / Germany / Technology Campus

- | | | | |
|---|--|----|--|
| 1 | Freiburg / Germany / Technology Campus | 9 | Bristol / UK / Design Center SW |
| 2 | Malta / Malta / Technology Campus | 10 | Seattle / USA / Design Center SW |
| 3 | Munich / Germany / Design Center | 11 | Chandler / USA / Integration Center |
| 4 | Aachen / Germany / Design Center | 12 | Acton / USA / Integration Center |
| 5 | Deggendorf / Germany / Design Center | 13 | Tianjin / China / Integration Center |
| 6 | Leonberg / Germany / Design Center SW | 14 | Ahmedabad in Gujarat / India / Design Center |
| 7 | Lyon / France / Design Center SW | 15 | Ivrea / Italy / Design Center |
| 8 | Paris / France / Design Center SW | | |



/ LEADING-EDGE MANUFACTURING



Competitive Advantage – Production Flexibility

- Customized BIOS
- Memory Configuration
- Depopulation of parts
- Preload OS
- Cooling mounted and tested

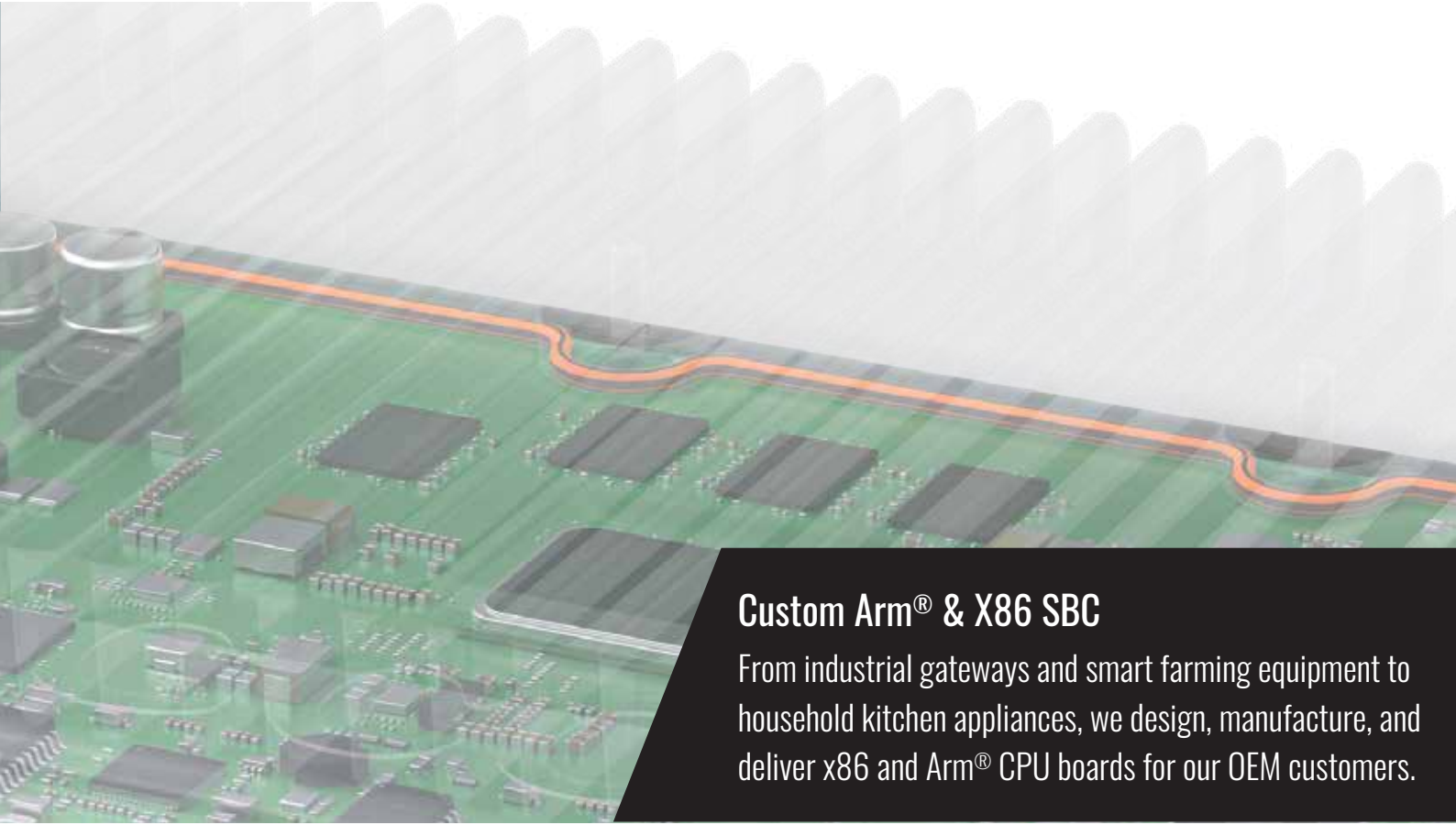
Latest production equipment and a high degree of automation allows us to achieve best-in-class throughput at very low manufacturing cost and highest quality.

Best-In-Class Quality

The Avnet Embedded product engineering, test development and production engineers are working hand in hand to achieve optimized product quality. Our sophisticated SAP-integrated MES and quality system ensures full traceability of our products, including strict version control for each product made.



/ BOARD CUSTOMIZATION



Custom Arm® & X86 SBC

From industrial gateways and smart farming equipment to household kitchen appliances, we design, manufacture, and deliver x86 and Arm® CPU boards for our OEM customers.

Standard modules (COM) are our design IP for custom board + system solutions



< Standard Module

Custom Board Design

- From Standard to Full-Custom
- Custom Development:
 - Carrier boards
 - Single-Board Computers
 - Add-on boards
 - Non-standard



< Standard Module on custom Baseboard



< Module Technology into full-custom design



/ CUTTING EDGE CUSTOM SOLUTIONS



COM Module - - - - -

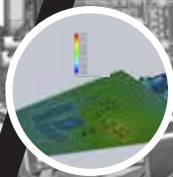
Custom Carrier Boards - -

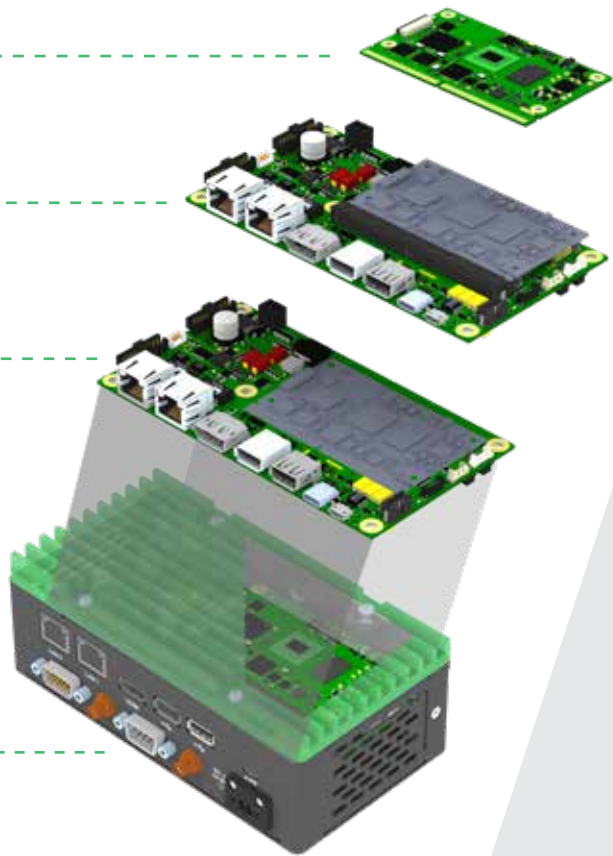
ODM Arm® & x86 SBC - - -

Display/Touch Solutions

ODM HMI & System Solutions - - -

IDEA / CONCEPT > SYSTEM DESIGN > HW- / SW-DESIGN > VERIFICATION





Define - Design - Deploy

From the idea to the deployment – we combine our compute, display and software technology into custom specific ODM board and system solutions for a wide range of industries.

Medical



HVAC



Prosumer



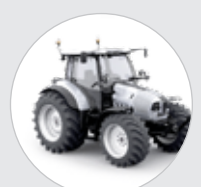
Avnet Embedded Solutions are widely accepted across all vertical markets



Industrial



Building Automation



Heavy Machinery

DESIGN / CERTIFICATION > BOARD PRODUCTION > SYSTEM MANUFACTURING



/ SCALABILITY OF COMS



”Scalability of Performance” describes the capability of COMs to allow alternative modules of different performance and feature levels to be used in the modules socket of the same carrier board.

VERTICAL MARKETS

Rising popularity on Embedded Computer Technology by Open Standards

Computer-on-Modules are widely accepted across all vertical markets



Industrial



Medical



Gaming



POS / POI



Media & Entertainment



Building Automation



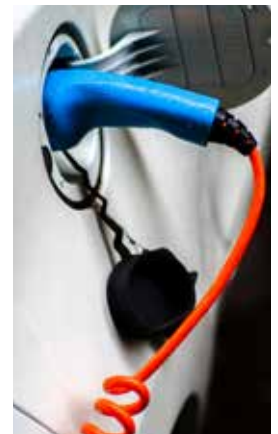
Security



Transportation



Professional Consumer



EV Charging



/ STANDARDS INNOVATOR

The evolution of Open Industry SOM/COM Standards



Committed to Open Standards (Advantage of Open Standards)

Large group of experienced engineers specialize in a wide range of computer design, including mechanical and thermal, high speed signaling, networking, power management and basic software.

With inputs of thousands of projects:

- ✓ Less development and investment risks vs proprietary solutions
- ✓ Extend longevity by scale generations of compatible performance platforms
- ✓ Open and fair commercial and performance competition (multiple sources/vendors)
- ✓ High volume cost benefits
- ✓ Easy to develop



Avnet Embedded (formerly MSC) is Executive Member of PICMG (PCI Industrial Computer Manufacturers Group)



- All COM Express® revisions were conceived at PICMG by workgroups including several MSC engineers. Early Access Partner of Intel. /MSC commitment complete scalable roadmap
- COM-HPC® signal simulation and integrity spec. was done by Avnet engineers. First COM-HPC® Proof of Concept available by /MSC

Avnet Embedded (formerly MSC) was founding member of SGeT (Standardization Group for Embedded Technologies)



- SMARC® 2.0 was created at SGeT by workgroups including several MSC engineers. First SMARC® 2.0 Product to Market by MSC.
- Qseven® Founding Member open Standard was created by /MSC and two other companies

STRATEGIC PARTNERS



X86 and Arm® Partners



BIOS Partners



Software Innovation*



Technology Community



BSP Focus



Standardization Groups

*Market leading in-house embedded software team

✓ **Technology Focus**
x86 and Arm® architectures

✓ **Platform**
Re-use in custom boards and systems

✓ **Flexibility**
Best-in-class rapid customization

✓ **Support and Service**
Intensive design partner to customers

✓ **Open Standards Executive Member**
Leading PICMG and SGeT standards innovator



AVNET EMBEDDED COMPUTE HIGHLIGHTS

NXP® i.MX 95, i.MX 91 and i.MX 93

Scalable Solutions in combination with high computing power and efficient power consumption:

i.MX 95 – for edge-based embedded vision and audio AI applications

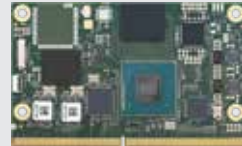
i.MX 91 and i.MX 93 – performance and energy efficiency for edge applications



MSC SM2S-IMX93



MSC SM2S-IMX95



QCS 6490/5430



Qualcomm® QCS 6490/5430

Highest Arm® performance with Windows 11 IoT and Linux support.



MSC SM2S-ASL



MSC C10M-ASL



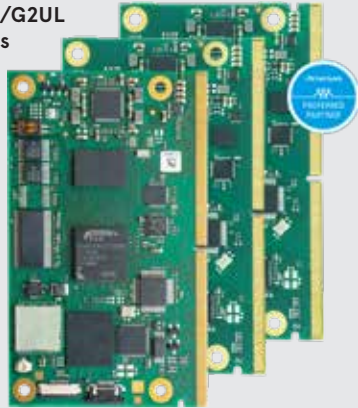
MSC C6C-ASL



Latest Intel Atom® Processor X7000 Series (products former codenamed "Amston Lake")

With industrial Temp.

RZ/V2L, RZ/G2L and RZ/G2UL processors from Renesas



Renesas RZ MPU Family

Extensive & compatible portfolio
 >10year Super-Long-term Linux Support
 Next RZ gen. on SMARC® & OSM under development

MSC C6C-RYZ2



MSC SM2S-RYZ2



AMD Ryzen™ /R2000

Industry leading SMARC® module with AMD Performance.



MSC C6C-RLP



MSC C6B-RLP



MSC C6B-MLH



COM+HPC®

MSC HCA-RLP



MSC HCA-MLH



Intel® 13. Generation (products formally Raptor Lake P)

“iCore” performance on Industrial temp
 COM Express® Basic/Compact and COM-HPC.

Intel® Core™ Ultra (products formally Meteor Lake U/H)

Highest performance on
 COM Express® Basic and COM-HPC.



/ OFF-THE-SHELF CARRIER BOARDS

/ SIMPLEFLEX

SimpleFlex is the intelligent combination of a standard Computer-On-Module (COM) with a standard carrier board. It combines the advantages of Standard Single Board Computer (SBC) and Custom Single Board Computer by choosing the COM from a huge portfolio of CPU, I/O, and memory configuration options.

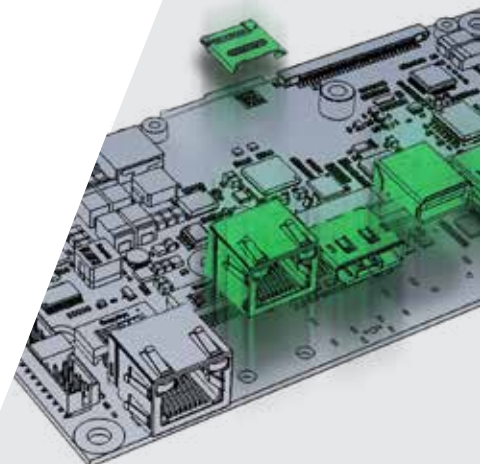
Optimized for low production cost and simple customization

- Application ready Arm® and x86 scalability
- Industrial temperature range from -40°C to +85°C
- Built-in versatility by many interfaces, more than 30 options designed in
- Easy and fast connectivity for HMI, IoT Gateways

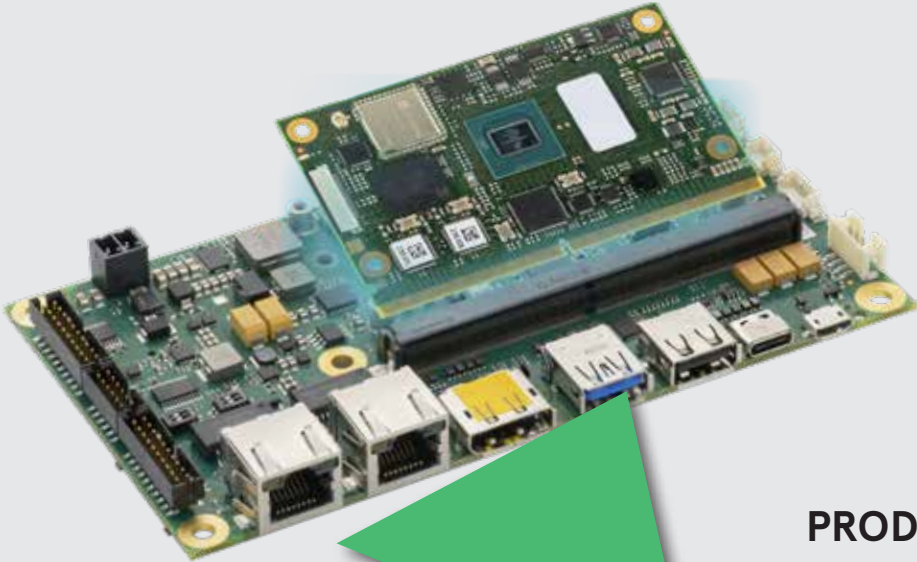
	Standard SBC	Custom SBC	SimpleFlex
Low cost	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓
Flexibility	--	✓ ✓	✓ ✓ ✓
Time to Market	✓ ✓ ✓	--	✓ ✓ ✓
Low Development cost/risk	✓ ✓ ✓	--	✓ ✓ ✓



IDEA



No Development, just Selection and Configuration



SERIAL PRODUCTION

DELIVERY

90 Days

OPTIMIZED PRODUCT

INTERFACE CONFIGURATION

48h

EVALUATION

SELECTION COM & CARRIER



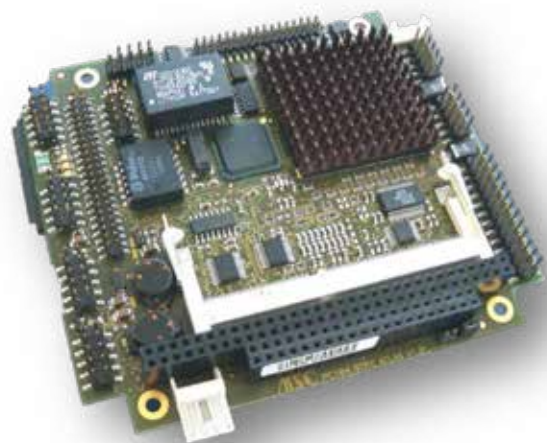
/ PRODUCT LONGEVITY

Avnet Embedded is highly committed to ensuring long-term availability

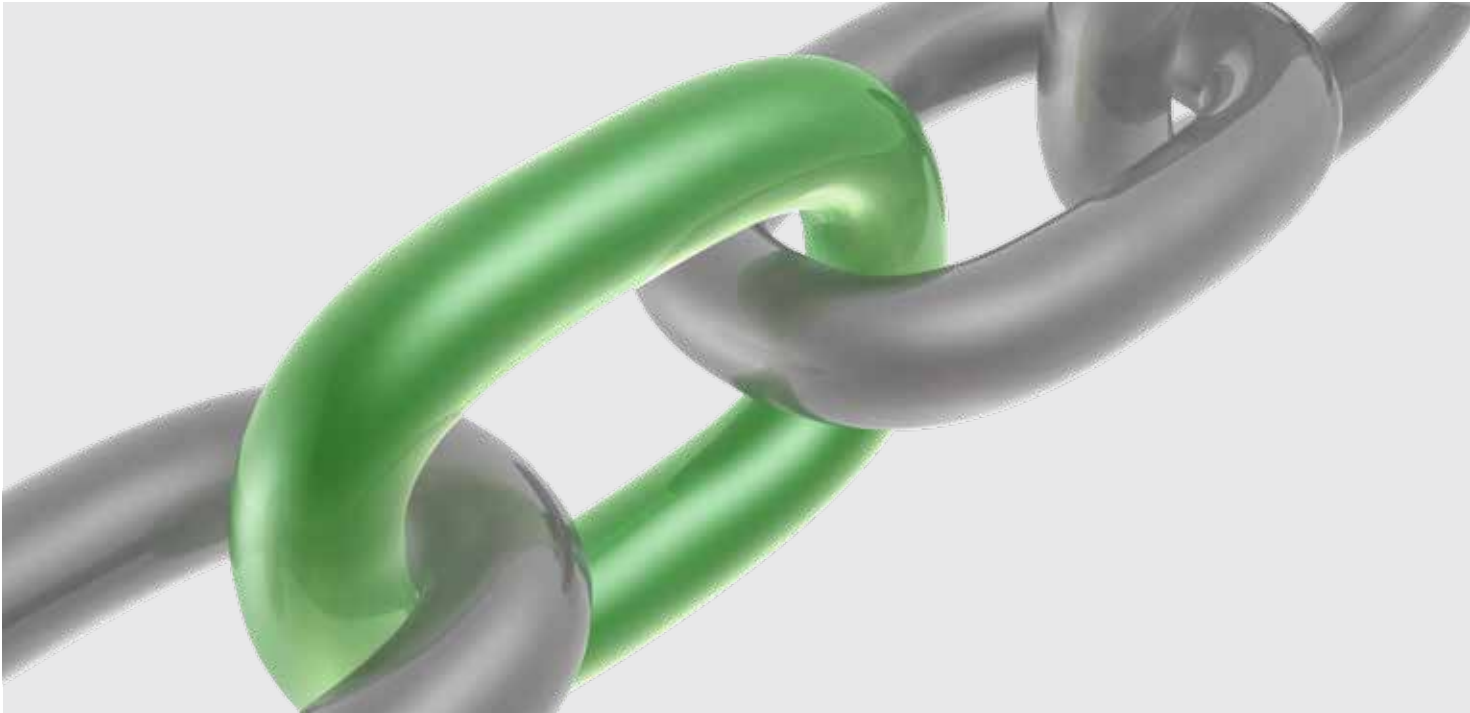
Typical industrial product life cycles are 10..15 years, very often extended by maintenance service (repair) programs.

Strict version control, continuous component risk analysis, alternative part designs, in combination with our Proactive Obsolescence Management is mandatory.

For high volume projects End of Life (EOL) and Last Time Ship (LTS) date could be extended by **special Last Time Buy (LTB) programs** to ensure availability of key components like the processor or other active components after silicon EOL notice.



/ SECURE BY DESIGN



There is no “one-size-fits-all” solution or security standard when it comes to securing and protecting your devices against the increasing amount of threats and attacks of today’s world.

With Avnet Embedded, you can rely on our deep knowledge and long-term experience* to be ready for tomorrow’s security threats by choosing us to be your partner of choice for designing, deploying and maintaining:

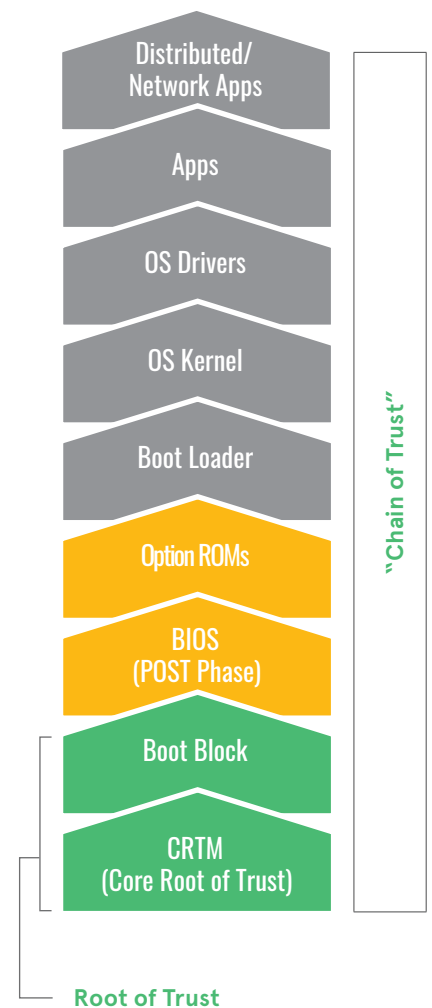
- **Embedded systems security,**
- **IoT device security**
- **End to End Consultancy and Software Solution**

LATEST ARM® SECURITY TECHNOLOGIES	LATEST X86 SECURITY TECHNOLOGIES
<ul style="list-style-type: none"> - Run time attestation - Silicon RoT - Trust provisioning - Fine grain key - Extensive crypto services - High Assurance Boot (HAB) - Zero Touch Provisioning 	<p>AMI Aptio® V BIOS utilized by Avnet Embedded supports the “Chain of Trust” according to the TCG (Trusted Computing Group)</p> <ul style="list-style-type: none"> - UEFI Secure Boot - /MSC Trusted Update (Signed Bios updates) - Intel BootGuard (on Request) (True Hardware ROT)

Trusted Platform Module(TPM) as an option.

Simpler path to security certifications

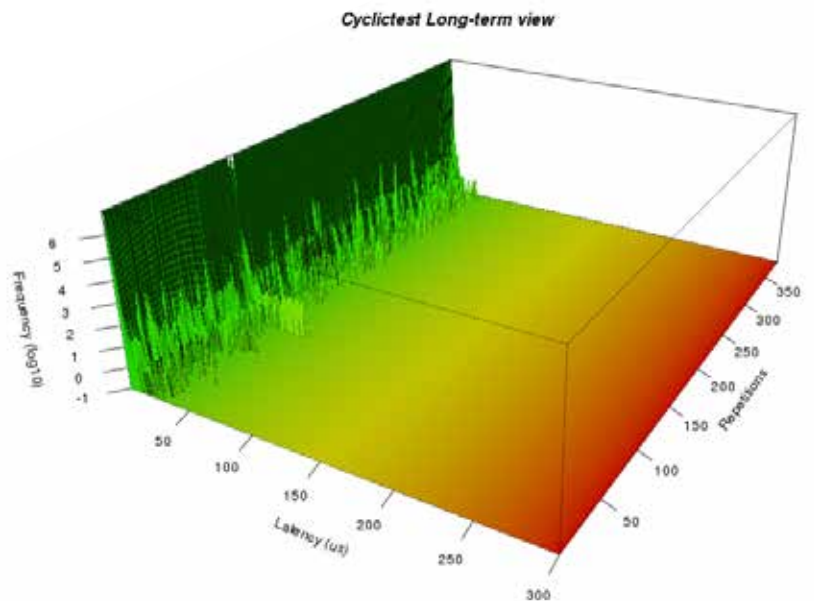
*BSI (German Federal Office for Security in Information Technology) certified key management



/ REALTIME CAPABILITIES



Our Products are designed to meet real-time requirements for mission critical applications, and they are subjected to long-term testing of their real-time capabilities as part of our product qualification.



Open Source Automation Development Lab (OSADL). Standard reference benchmark for measuring and verifying real-time capabilities of Linux® based computing systems. We run our products in OSADL test environment, the OSADL QA Farm (www.osadl.org) over years.

Mission-critical equipment for robotics, autonomous vehicles and machine control require predictable response times and deterministic and repeatable compute performance.

/ COOLING SOLUTIONS

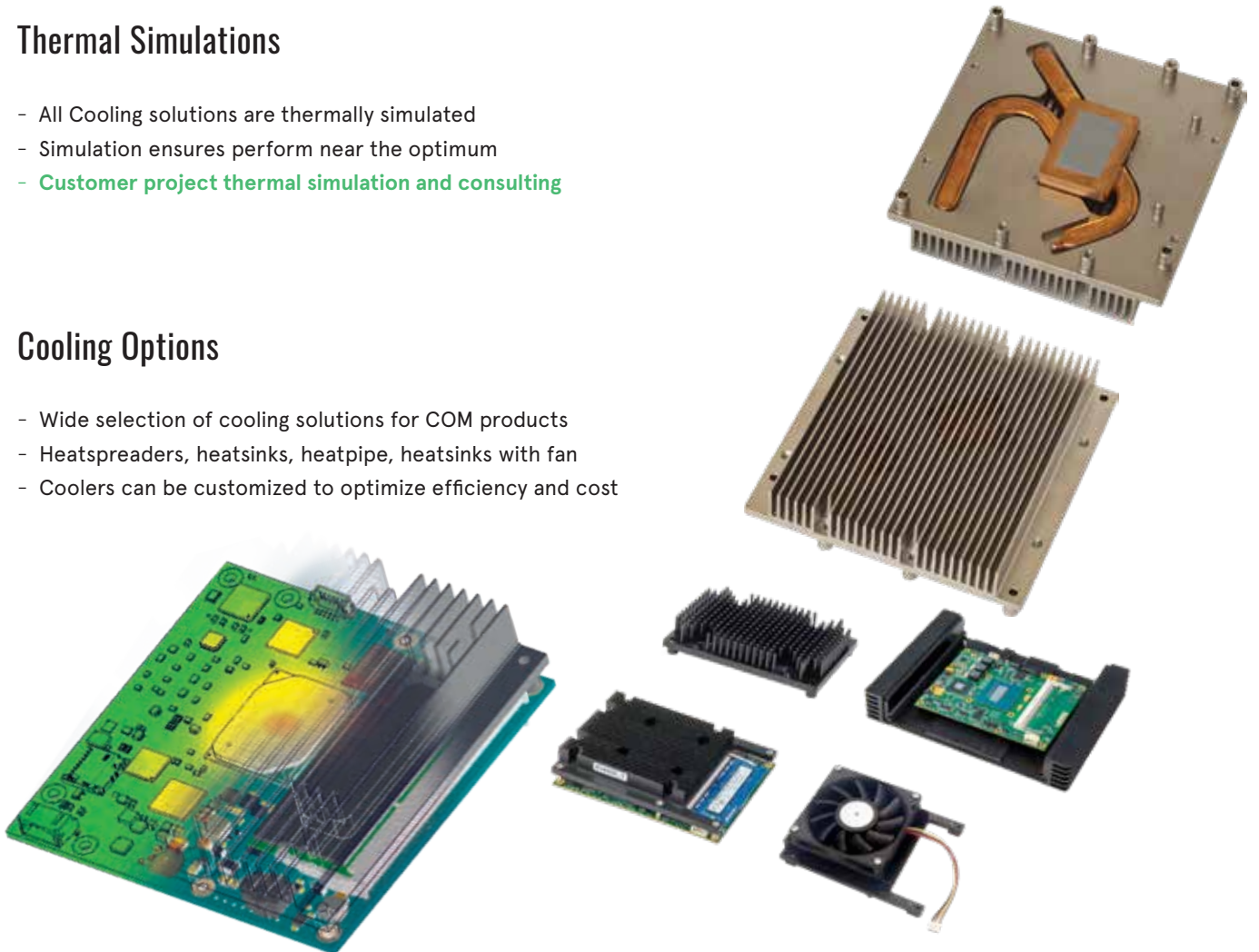


Thermal Simulations

- All Cooling solutions are thermally simulated
- Simulation ensures perform near the optimum
- **Customer project thermal simulation and consulting**

Cooling Options

- Wide selection of cooling solutions for COM products
- Heatspreaders, heatsinks, heatpipe, heatsinks with fan
- Coolers can be customized to optimize efficiency and cost



/ TECHNICAL SUPPORT & DESIGN SERVICES



More than 25 years of experience in board production means that we are and are awarded hundreds of new designs every year, equating to millions of boards.

support.boards@avnet.eu

Worldwide Available Premium Support

Pre-and Post-Sales Support

- Technical issue and request tracking
 - Design experience sharing
 - Baseboard design reviews and debugging
 - Baseboard design guidelines and trainings
 - Benchmark performance comparisons
 - MTBF calculations
 - Vibration test on request
 - Reference schematics
 - RoHS / REACH / Conflict Minerals / CE / UL documentation
 - Customized Starter Kits
- ... up to joint simulation, measurement, test and bring-up at our R&D Labs

Support Website

- Drivers, BSPs, BIOS updates
- Software APIs (eAPI) and other Software Tools
- User manuals, application notes, mechanical product infos



/MSC COM STARTER-KIT



COM+HPC®

COM 
Express

 **SMARC**
module

 Q S E V E N

 OPEN
STANDARD
MODULE™

The Avnet Embedded ready-to-run COM Starter-Kits are suitable for any form factor. You choose and order a module (COM-HPC®, COM Express®, SMARC®, Qseven®, nanoRISC® or OSM) and receive the COM Starter-Kit with all necessary components to get started quickly and easily. Below you can see an example with a SMARC® module.



SMARC® quick start reference
Select SMARC® module



Starterkit



SMARC® Evaluation
Platform EP1

- HDMI and DP
- LVDS and eDP
- 2x Ethernet
- PCIe x4 Gen. 2
- 2x USB 3.0
- 2x USB 2.0
- 2x CAN 2.0B
- SPI, I2C, GPIO



Power supply



Cooling solution

SOFTWARE

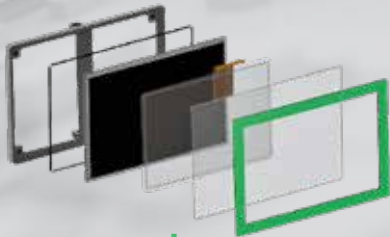
/MSC BSP
YOCTO LINUX®
U-BOOT

SUPPORT



/MSC COM DISPLAY/TOUCH OPTIONS

The Avnet Embedded Display Kits are ideal companions to the whole range of Avnet Embedded Computer-On-Module (COM) carrier boards and Starterkits. They come in different popular sizes and resolutions, and immediately fit the LVDS and backlight outputs of the baseboards. The Display Kits include a high-performance LCD panel and capacitive touch assembly, complete with PCAP touch controller and suitable cables for direct out-of-the-box experience with no installation hassles.



Displaykit
5", 7", 10.1" and 12.1"
TFT Include LVDS
cable, Backlight Cable
PCAP touch with USB
Controller

**Fast and easy combination.
Save value time and resources
at the beginning of a project.**

- 1 /SIMPLEPLUS Touchstack:
LCD with PCAP touch sensor, cover lens and housing
- 2 3-way cable for LVDS data and power:
 - Suitable LVDS connector to fit SimplePlus LCD
 - JILI30 connector to fit LVDS socket of MSC carrier boards
 - Backlight power connector to fit B/L socket of MSC carrier boards
- 3 USBmini to USB cable:
Connects SimplePlus touch controller to USB port of carrier board
- 4 FFC to USBmini adapter board:
Makes SimplePlus touch controller accessible by USBmini cable



/ COM SOFTWARE PORTFOLIO



/ SimpleSwitch™

Streamline your development process for SMARC modules

Application Dev Environment



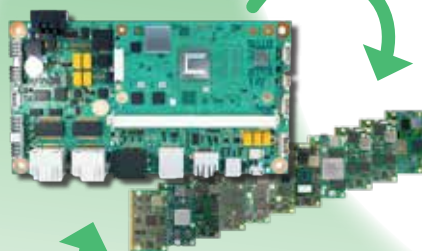
Qt Group

Flutter

Easy Application Deployment



Simply Switch Exchange Modules



Rapid Prototyping

When using SimpleSwitch™ with an Avnet Embedded SMARC module and display, our customers can have an HMI up and running on Avnet Embedded hardware (such as EP5) in just two hours. Development environment like VS Code (Flutter, web development) and Qt Creator are pre-integrated in SimpleSwitch™ tooling.

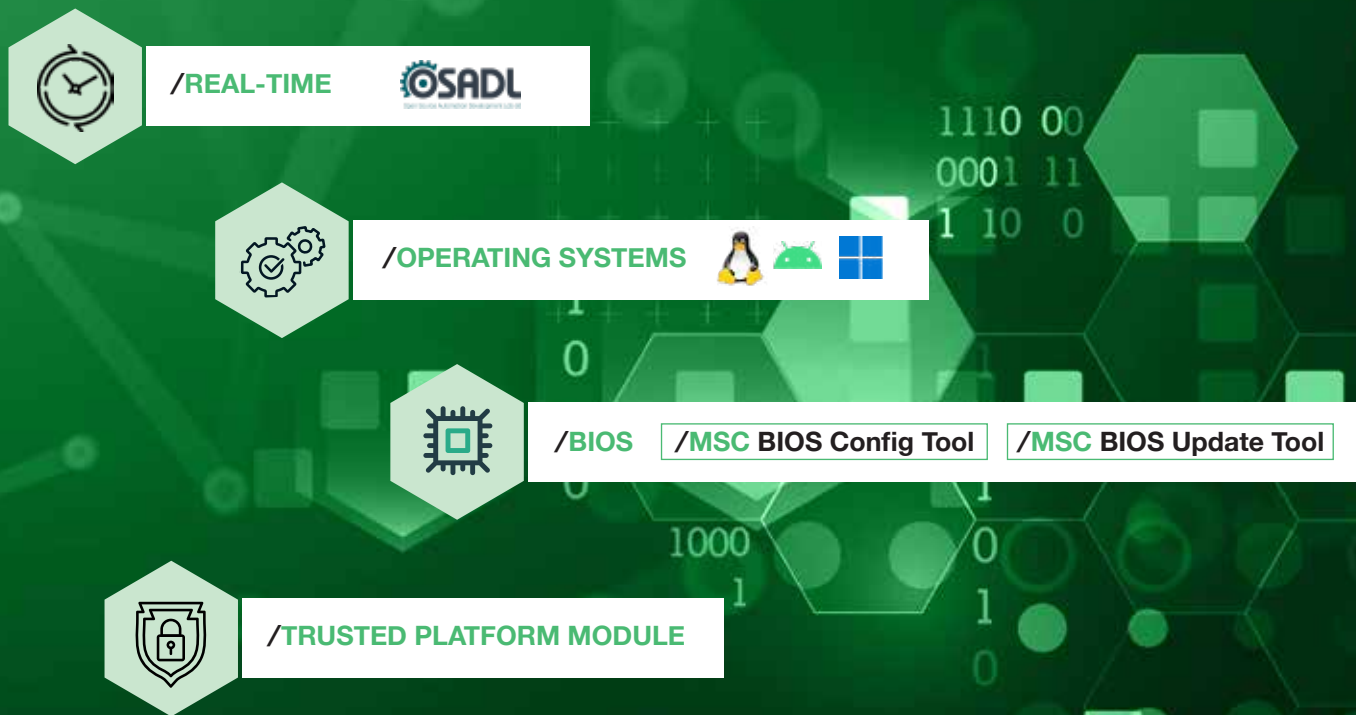
Faster together

Deploying an application on physical prototypes using SimpleSwitch™ has the advantage of making debugging substantially easier too. SimpleSwitch also comes with the 'Incubator Store', a wide range of pre-built software stacks. Think of it as a toolbox for the super-fast testing of technology on Avnet Embedded boards.

Built-in benchmarking

SimpleSwitch™ also allows to check, measure, assess and make the right decision across any compatible Avnet Embedded module. Being able to migrate their first SimpleSwitch-built prototype across our SMARC portfolio (including NXP and Intel) elevates the application's status.





/COM Software Functional Platforms

Simplify Software Product Design

We make it easy to develop new products by combining our standard modules with standardized software building blocks, **resulting in fast POC and fast software development. We provide software services for the product lifecycle.**



EDGE AI

For the latest technology capabilities, we offer high-qualified expertise in Machine Learning, Computer Vision, and Natural Language Processing.



EDGE COMPUTING

For embedded edge environments, we offer application containerizing, Open source BSP development, and latest industrial communication stacks for real-time edge apps and OTA.



UI FRAMEWORKS

True usability and user experience of customer products, through the full integration of state-of-the-art frameworks for user interface development, like Flutter and Qt in our BSP.



COM+HPC®

COM-HPC® is a new Computer-on-Module standard designed specifically for High-Performance Computing. It does not replace the COM Express® standard, but extends the Computer-on-Module idea to very powerful client and server-class processors, providing an unmatched infrastructure of high-end interfaces.

COM-HPC® is governed by the PICMG industrial group where it has recently been created by an international workgroup consisting of COM manufacturers including Avnet Embedded /MSC, semiconductor companies and infrastructure providers.

COM-HPC® Properties

Emerging technologies such as artificial intelligence, machine vision, edge computing and 5G network infrastructure require new levels of system throughput and interconnect bandwidth. The new COM-HPC® standard is well equipped for addressing ever increasing work load demands. PCI Express connectivity at Gen 4 and 5 speed can scale up to 65 lanes. Multiple network options allow for Ethernet ports covering 1G to 100G bandwidth. A variety of module form factors ranging from small to tall provide the right mix of board flavors for different performance classes. The new form factors support high performance CPUs with the need for high power and sufficient cooling, large memory arrays and I/O rich feature set.

COM-HPC® Client

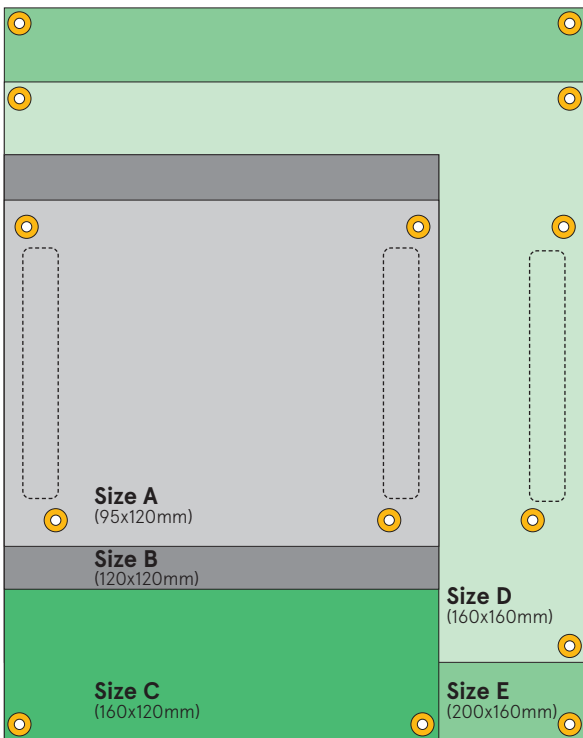
- 49x PCIe
- 2x MIPI-CSI
- 2x 25GbE KR
- 3x DDI
- 2x BaseT (up to 10 Gb)
- 2x SoundWire, I2S
- 4x USB4
- 4x USB 2.0
- 2x SATA
- eSPI, 2x SPI, SMB
- 2x I2C, 2x UART
- 12x GPIO

COM-HPC® Server

- 65x PCIe
- 8x 25GbE KR
- BaseT (up to 10 Gb)
- 2x USB 4
- 2x USB 3.2
- 4x USB 2.0
- 2x SATA
- eSPI, 2x SPI, SMB
- 2x I2C, 2x UART
- 12x GPIO



COM+HPC®



Client Sizes

Server Sizes

For COM-HPC®, new mezzanine connectors are employed, which warrant superior signal transmission characteristics for ultra-high-speed interfaces such as PCIe Gen 5, USB 3.2 and 100GbE.

Two types of COM-HPC® interface schemes are specified to serve different classes of applications. COM-HPC® Server enables an extended bulk of PCIe lanes and Ethernet ports and is well suited for server and communications applications requiring very high system throughput and extensive I/O connectivity. COM-HPC® Client focuses on graphics oriented tasks such as in gaming, medical or surveillance applications, and comes with a variety of graphics interface options, while still providing decent I/O connectivity on PCIe and network. To span a wide range of applications and meet different performance classes, a variety of module form factors are available.

Three formats are primarily intended for COM-HPC® Client computer modules:

- Size A: 95 x 120 mm
- Size B: 120 x 120 mm
- Size C: 160 x 120 mm

For COM-HPC® Server modules, two form factors have been defined:



- Size D: 160 x 160 mm
- Size E: 200 x 160 mm

The larger base width as well as length of COM-HPC® Server module formats reflects the floor space requirements of powerful server and communication systems for CPU size and cooling requirements, number of memory module slots and potential need for H/W accelerators (FPGAs, GPUs). The smaller form factors with narrow base are intended for leaner systems e.g. such as those featuring cost effective system-on-chip.



Depending on application needs, carrier solutions can be designed either to the server or client interface specification and will support either the larger or narrow module sizes.



COM-HPC® OVERVIEW

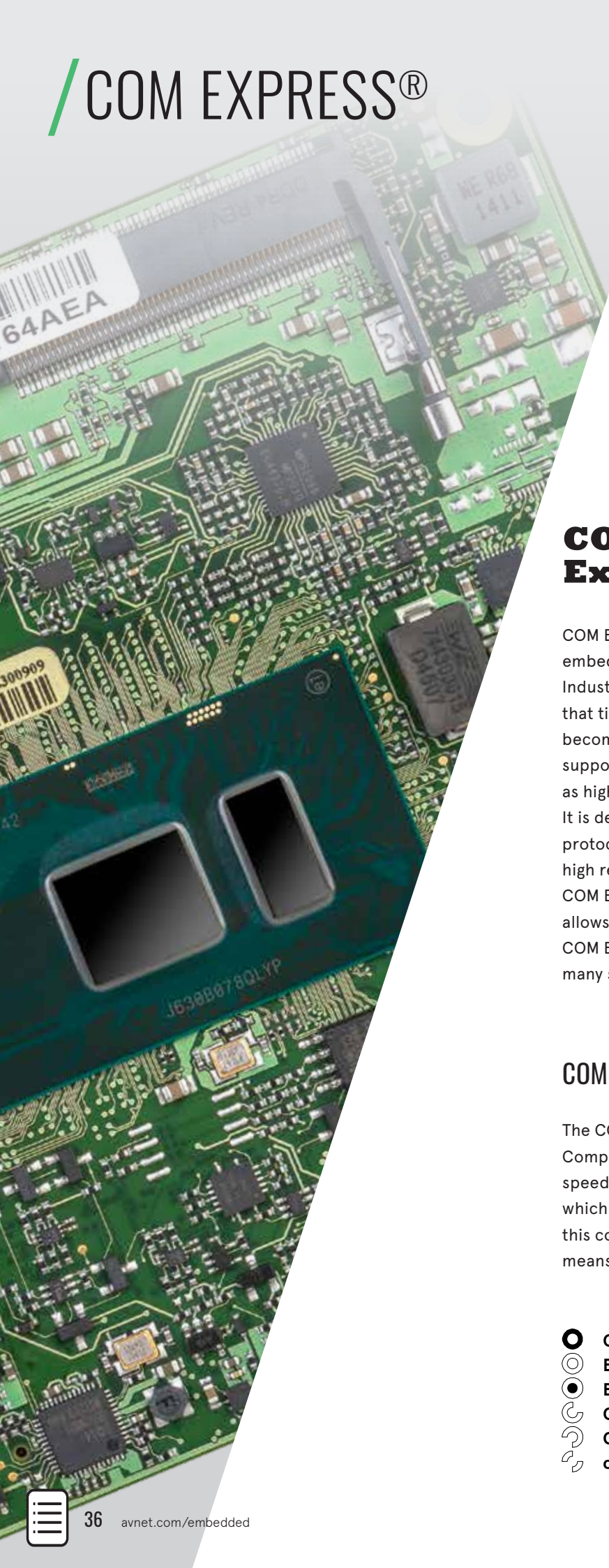
Specs	MSC HCA-ALP	MSC HCA-RLP
Technology	x86	x86
		
Form Factor	COM-HPC® Client Size A, 95 mm x 120 mm	COM-HPC® Client Size A, 95 mm x 120 mm
CPU	<p>12th Gen Intel® Core™ processors</p> <p>H-series</p> <ul style="list-style-type: none"> - i7-12800HE 14C/20T, 2.4GHz, 96 EUs, 24MB L3, 45/35W cTDP - i5-12600HE 12C/16T, 2.5GHz, 80 EUs, 18MB L3, 45/35W cTDP - i3-12300HE 8C/12T, 1.9GHz, 48 EUs, 12MB L3, 45/35W cTDP <p>P-series</p> <ul style="list-style-type: none"> - i7-1270PE 12C/16T, 1.8GHz, 96 EUs, 24MB L3, 28/20W cTDP - i5-1250PE 12C/16T, 1.7GHz, 80 EUs, 12MB L3, 28/20W cTDP - i3-1220PE 8C/12T, 1.5GHz, 48 EUs, 12MB L3, 28/20W cTDP <p>U-series</p> <ul style="list-style-type: none"> - i7-1265UE 10C/12T, 1.7GHz, 96 EUs, 12MB L3, 15/12W cTDP - i5-1245UE 10C/12T, 1.5GHz, 80 EUs, 12MB L3, 15/12W cTDP - i3-1215UE 6C/8T, 1.2GHz, 64 EUs, 10MB L3, 15/12W cTDP - 7305E 5C/5T, 1.0GHz, 48 EUs, 8MB L3, 15/12W cTDP 	<p>13th Gen Intel® Core™ processors</p> <p>H-series</p> <ul style="list-style-type: none"> - i7-13800HE 14C/20T, 2.5GHz, 96 EUs, 24MB L3, 45/35W cTDP - i7-13800HRE 14C/20T, 2.5GHz, 96 EUs, 24MB L3, 45/35W cTDP, TCC/TSN, IBECC, ET - i5-13600HE 12C/16T, 2.7GHz, 80 EUs, 18MB L3, 45/35W cTDP - i5-13600HRE 12C/16T, 2.7GHz, 80 EUs, 18MB L3, 45/35W cTDP, TCC/TSN, IBECC, ET - i3-13300HE 8C/12T, 2.1GHz, 48 EUs, 12MB L3, 45/35W cTDP - i3-13300HRE 8C/12T, 2.1GHz, 48 EUs, 12MB L3, 45/35W cTDP, TCC/TSN, IBECC, ET <p>P-series</p> <ul style="list-style-type: none"> - i7-1370PE 14C/20T, 1.9GHz, 96 EUs, 24MB L3, 28/20W cTDP - i7-1370PRE 14C/20T, 1.9GHz, 96 EUs, 24MB L3, 28/20W TDP, TCC/TSN, IBECC, ET - i5-1350PE 12C/16T, 1.8GHz, 80 EUs, 12MB L3, 28/20W cTDP - i5-1350PRE 12C/16T, 1.8GHz, 80 EUs, 12MB L3, 28/20W TDP, TCC/TSN, IBECC, ET - i5-1340PE 12C/16T, 1.8GHz, 80 EUs, 12MB L3, 28/20W cTDP - i3-1320PE 12C/12T, 1.7GHz, 48 EUs, 12MB L3, 28/20W cTDP - i3-1320PRE 8C/12T, 1.7GHz, 48 EUs, 12MB L3, 28/20W cTDP, TCC/TSN, IBECC, ET, TCC/TSN, IBECC, ET <p>U-series</p> <ul style="list-style-type: none"> - i7-1365UE 10C/12T, 1.7GHz, 96 EUs, 12MB L3, 15/12W cTDP - i7-1365URE 10C/12T, 1.7GHz, 96 EUs, 12MB L3, 15/12W cTDP, TCC/TSN, IBECC, ET - i5-1345UE 10C/12T, 1.4GHz, 80 EUs, 12MB L3, 15/12W cTDP - i5-1345URE 10C/12T, 1.4GHz, 80 EUs, 12MB L3, 15/12W cTDP, TCC/TSN, IBECC, ET - i5-1335UE 10C/12T, 1.3GHz, 80 EUs, 12MB L3, 15/12W cTDP - i3-1315UE 6C/8T, 1.2GHz, 64 EUs, 10MB L3, 15/12W cTDP - i3-1315URE 6C/8T, 1.2GHz, 64 EUs, 10MB L3, 15/12W cTDP, TCC/TSN, IBECC, ET - U300E 5C/6T, 1.1GHz, 48 EUs, 8MB L3, 15/12W cTDP
Chipset	Integrated in System-on-Chip	12th Gen Intel® Core™ processors
DRAM	2x 262-pin SO-DIMM socket for up to 2x 32GB DDR5 SDRAM (DDR5-4800); dual channel operation; minimum capacity 1x 8GB single channel operation	2x 262-pin SO-DIMM socket for up to 2x 32GB DDR5 SDRAM (DDR5-4800); dual channel operation; minimum capacity 1x 8GB single channel operation in-band ECC (IBECC)
Storage Interfaces	2x SATA channels (up to 6Gb/s), optional optional on-board NVMe, 64GB to 1TB	2x SATA channels (up to 6Gb/s), optional optional on-board NVMe, 64GB to 1TB
USB	2x USB4 / 2x USB 3.2 (Gen 1 & 2) / 8x USB 2.0	2x USB4 / 2x USB 3.2 (Gen 1 & 2) / 8x USB 2.0
Bus Interfaces	PCI Express® Graphics (PEG) 1x8, PCIe Gen 4 PCI Express® Gen 4, up to 2x4 PCI Express® Gen 3, up to 8x1, flexible bifurcation options	PCI Express® Graphics (PEG) 1x8, PCIe Gen 5 PCI Express® Gen 4, up to 2x4 PCI Express® Gen 3, up to 8x1, flexible bifurcation options
Display Controller	Intel® Iris® Xe architecture Graphics, up to 96 execution units (EU)	Intel® Iris® Xe architecture Graphics, up to 96 execution units (EU)
Display Interfaces	Four independent displays supported 3x Digital Display Interface (DP 1.4a, HDMI 2.0b) 1x Embedded DisplayPort 1.4b	Four independent displays supported 3x Digital Display Interface (DP 1.4a, HDMI 2.0b) 1x Embedded DisplayPort 1.4b
Network Interface	Two 10/100/1000Base-TX, 2.5G based on Intel i226	Two 10/100/1000Base-TX, 2.5G based on Intel i226
Audio Interface	High Definition Audio	High Definition Audio
Security Device	TPM 2.0	TPM 2.0
OS Support	Microsoft Windows® 10 IoT Enterprise 2021 LTSC BSP for Linux® (Yocto Project®)	Microsoft Windows® 10 IoT Enterprise 2021 LTSC BSP for Linux® (Yocto Project®)
Power Requirements	Voltage: +8V to +20V, +5V Stby optional, +3V RTC voltage Power Consumption: TBD	Voltage: +8V to +20V, +5V Stby optional, +3V RTC voltage Power Consumption: TBD
Operating Temp.	0° ... 60°C (operating) -25° ... 85°C (storage)	-25° ... 85°C (storage) 0° ... 60°C (commercial) -40° ... 85°C (industrial)
Humidity	5 ... 95% (operating, non-condensing), 5 ... 95% (storage, non-condensing)	



MSC HCA-MLH	MSC HSD-ILDL
x86	x86
	
COM-HPC® Client Size A, 95 mm x 120 mm	COM HPC® Server Size D, 160 mm x 160 mm
<p>Intel® Core™ Ultra processors</p> <ul style="list-style-type: none"> - Ultra 7 165H 16C/22T, 1.4GHZ, 128 EUs, 24MB L3, vPRO®, 28W BP - Ultra 7 155H 16C/22T, 1.4GHZ, 128 EUs, 24MB L3, 28W BP - Ultra 5 135H 14C/18T, 1.7GHZ, 128 EUs, 18MB L3, vPRO®, 28W BP - Ultra 5 125H 14C/18T, 1.2GHZ, 112 EUs, 18MB L3, 28W BP - Ultra 7 165U 12C/14T, 1.7GHZ, 64 EUs, 12MB L3, vPRO®, 15W BP - Ultra 7 155U 12C/14T, 1.7GHZ, 64 EUs, 12MB L3, 15W BP - Ultra 5 135U 12C/14T, 1.6GHZ, 64 EUs, 12MB L3, vPRO®, 15W BP - Ultra 5 125U 12C/14T, 1.3GHZ, 64 EUs, 12MB L3, 15W BP 	<p>Intel® Xeon® processor</p> <ul style="list-style-type: none"> - D-1746TER, ten-core, 2.0GHz, 67W TDP, 8 Eth ports, 100G, DDR4-2667, I-temp - D-1735TR, eight-core, 2.2GHz, 59W TDP, 8 Eth ports, 50G, DDR4-2933, C-temp - D-1732TE, eight-core, 1.9GHz, 52W TDP, 8 Eth ports, 50G, DDR4-2667, I-temp - D-1715TER, four-core, 2.4GHz, 50W TDP, 8 Eth ports, 50G, DDR4-2667, I-temp - D-1712TR, four-core, 2.0GHz, 40W TDP, 8 Eth ports, 50G, DDR4-2400, C-temp
Integrated in System-on-Chip	Integrated in System-on-Chip
2x 262-pin SO-DIMM socket for up to 2x 48GB DDR5 SDRAM (DDR5-5600); dual channel operation; minimum capacity 1x 8GB single channel operation; in-band ECC (OS dependent)	Up to 256GB DDR4, 4x 288pin DIMM, 2 channels, 2 DIMMs per channel
2x SATA channels (up to 6Gb/s), optional optional on-board NVMe, 64GB to 1TB	2x SATA 6Gb/s
2x USB4 / 2x USB 3.2 (Gen 1 & 2) / 8x USB 2.0	2x USB 3.2 Gen 2 / 2x USB 3.2 Gen 1 / 4x USB 2.0
PCI Express® Graphics (PEG) 1x8, PCIe Gen 5 PCI Express® Gen 4, up to 2x4 PCI Express® Gen 3, up to 8x1, flexible bifurcation options	16x PCI Express® Gen 4, bifurcation x16, x8, x4, max. 4 root ports, NTB x16, x8 16x PCI Express® Gen 3, bifurcation x8, x4, x2, max. 8 root ports 1x PCI Express® Gen3 for optional BMC on carrier, connected with PCIe_BMC
Intel® Arc™ Graphics, up to 128 execution units (EU)	-
Four independent displays supported 3x Digital Display Interface (DP 2.1, HDMI 2.1) 1x Embedded DisplayPort 1.4b	-
Two 10/100/1000Base-TX, 2.5G based on Intel i226	1x 1000BASE-T / 2.5GBASE-T, TSN (i225) / Up to 4x 25KR Ethernet / Up to 8x 10G Ethernet max. aggregated Ethernet bandwidth 100Gb
High Definition Audio	-
TPM 2.0	TPM 2.0
Windows 10 IoT Enterprise 2021 LTSC Windows 11 IoT Enterprise LTSC (future availability) / BSP for Linux (Yocto)	Microsoft Windows® 10 IoT Enterprise / BSP for Linux® (Yocto Project®) EAPI (HW Programming Interface)
Voltage: +8V to +20V, +5V Stby optional, +3V RTC voltage Power Consumption: TBD	Voltage: +12V, +5V Stby optional Power Consumption: 54 W to 89 W (typ.)
0° ... 60°C (operating) -25° ... 85°C (storage)	-25° ... 85°C (storage) 0° ... 60°C (commercial) -40° ... 85°C (industrial)
5 ... 95% (operating, non-condensing), 5 ... 95% (storage, non-condensing)	



/ COM EXPRESS®








COM Express

COM Express®, the widely spread COM standard in the embedded world, has been defined by the PICMG® (PCI Industrial Computer Manufacturers Group) in 2005. Since that time and after a few updates, COM Express® has become the versatile and most scalable COM standard supporting small and cost-sensitive applications, as well as high-end computing and graphics intensive solutions. It is designed for the latest chipsets and serial signaling protocols, including PCI Express Gen 3, SATA, USB 3.0, and high resolution video interfaces. The latest update of the COM Express® standard introduced Type 7 pin-out, which allows embedded server technology on small modules. COM Express® provides the highest performance of the many small form factor standards and products available.

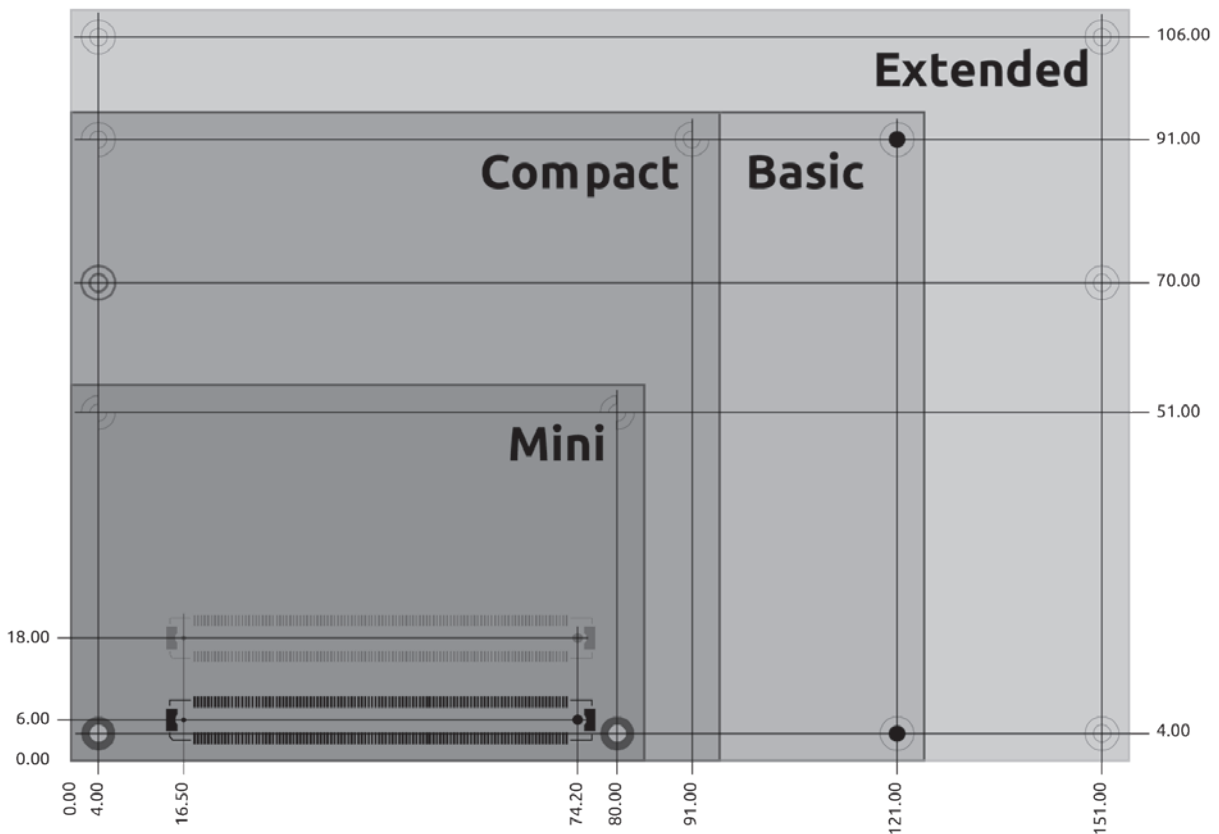
COM Express® Properties

The COM Express® Standard supports four sizes: Mini, Compact, Basic and Extended. All sizes utilize two high-speed, 220-pin connectors except for the Mini format which only supports one connector. Signal distribution of this connector is similar to the other formats but by no means identical.



-  **Common for all Form Factors**
-  **Extended only**
-  **Basic only**
-  **Compact only**
-  **Compact and Basic only Mini only**




	Type 10	Type 6	Type 7
PCIe (Gen 1, 2, 3) (*maximum bandwidth, unidirectional)	- x4 (32Gbps*)	- x8 (64Gbps*) - x16 (128Gbps*) - PCIe / PEG	- x32 (256Gbps*)
Ethernet	- 1x Gb Ethernet	- 1x Gb Ethernet	- 1x Gb Ethernet - 4x 10Gb Ethernet - NC-SI
Graphics / Multimedia	- 1x DDI - LVDS Ch. A / eDP - HDA Digital Audio	- 3x DDI - LVDS Ch. A / eDP - LVDS Ch. B - 1x VGA - HDA Digital Audio	
Data I/O	- 1x Serial Port / CAN - 1x Serial Port - 2x USB 2.0 / 3.0 - 6x USB 2.0 - 2x USB Clients out of 8	- 1x Serial Port / CAN - 1x Serial Port - 4x USB 2.0 / 3.0 - 4x USB 2.0 - 2x USB Clients out of 8	- 1x Serial Port / CAN - 1x Serial Port - 4x USB 2.0 / 3.0 - 1x USB Client out of 4
Storage	- 2x SATA (max. 6Gbps/ch.)	- 4x SATA - (max. 6Gbps/channel)	- 2x SATA (max. 6Gbps/ch.)
System I/O & Controls	- LPC / eSPI - 2x SPI - 1x SMB, 1x I2C - 4x GPI, 4xGPO or 1x SDIO - Reset, SPKR, WDT etc. - Power Management	- LPC / eSPI - 2x SPI - 1x SMB, 1x I2C - 4x GPI, 4xGPO or 1x SDIO - Reset, SPKR, WDT etc. - Power Management	- LPC / eSPI - 2x SPI - 1x SMB, 1x I2C - 4x GPI, 4xGPO or 1x SDIO - Reset, SPKR, WDT etc. - Power Management
Power	- 12V, 68W or wide input, 28W (mini FF only) - 5V Standby, 9W	- 12V, 137W - 5V Standby, 9W	- 12V, 137W - 5V Standby, 9W

Note: Maximum possible number of functions and interfaces shown. Product implementations may support subsets of functions, less interfaces or lower bandwidths.






COM EXPRESS® TYPE 6 BASIC OVERVIEW

Specs	MSC C6B-SLH	MSC C6B-KLH
Technology	x86	x86
		
Form Factor	COM Express® Basic FF, Dimension: 95 mm x 125 mm	COM Express® Basic FF, Dimension: 95 mm x 125 mm
CPU	<p>Intel® Core™ Processor</p> <ul style="list-style-type: none"> - i7-6820EQ (4C, 2.8/3.5GHz, 8MB cache, 45W) - i7-6822EQ (4C, 2.0/2.8GHz, 8MB cache, 25W) - i5-6440EQ (4C, 2.7/3.4GHz, 6MB cache, 45W) - i5-6442EQ (4C, 1.9/2.7GHz, 6MB cache, 25W) - i3-6100E (2C, 2.7GHz, 3MB cache, 35W) - i3-6102E (2C, 1.9GHz, 3MB cache, 25W) <p>Intel® Celeron® Processor</p> <ul style="list-style-type: none"> - G3900E (2C, 2.4GHz 2MB cache, 35W) - G3902E (2C, 1.6GHz 2MB cache, 25W) <p>Intel® Xeon® Processor</p> <ul style="list-style-type: none"> - E3-1505M v5 (4C, 2.8/3.7GHz, 8MB cache, 45W 35W cTDP) - E3-1505L v5 (4C, 2.0/2.8GHz, 8MB cache, 25W) 	<p>Intel® Core™ Processor</p> <ul style="list-style-type: none"> - i7-7820EQ (4C, 3.0/3.7GHz, 8MB cache, 45/35W cTDP) - i5-7440EQ (4C, 2.9/3.6GHz, 6MB cache, 45/35W cTDP) - i5-7442EQ (4C, 2.1/2.9GHz, 6MB cache, 25W TDP) - i3-7100E (2C, 2.9GHz, 3MB cache, 35W TDP) - i3-7102E (2C, 2.1GHz, 3MB cache, 25W TDP) <p>Intel® Xeon® Processor</p> <ul style="list-style-type: none"> - E3-1505M v6 (4C, 3.0/4.0GHz, 8MB cache, 45/35W cTDP), - E3-1505L v6 (4C, 2.2/3.0GHz, 8MB cache, 25W TDP)
Chipset	Intel® Platform Controller Hubs (PCH) QM170, HM170 or CM236	Intel® Platform Controller Hubs (PCH) QM170, HM170 or CM236
DRAM	2x 260-pin SO-DIMM socket for up to 2x 16GB DDR4 SDRAM (DDR4-2133); dual channel operation; ECC option	2x 260-pin SO-DIMM socket for up to 2x 16GB DDR4 SDRAM (DDR4-2133); dual channel operation; ECC option
Storage Interfaces	4x SATA channels (up to 6Gb/s)	4x SATA channels (up to 6Gb/s)
USB	4x USB 3.0/2.0, 4x USB 2.0	4x USB 3.0/2.0, 4x USB 2.0
Bus Interfaces	8x PCI Express® x1 Gen 3, 1x PCI Express® Graphics (PEG) x 16 Gen. 3 LPC bus (Low Pin Count bus; no DMA support)	8x PCI Express® x1 Gen 3, 1x PCI Express® Graphics (PEG) x 16 Gen. 3 LPC bus (Low Pin Count bus; no DMA support)
Display Controller	Integrated Intel HD graphics Gen. 9	Integrated Intel HD graphics Gen. 9
Display Interfaces	Three independent displays supported 3x Digital Display Interface (DP 1.2, HDMI 1.4b) 1x Embedded DisplayPort 1.3 1x LVDS 24bit, dual-channel	Three independent displays supported 3x Digital Display Interface (DP 1.2, HDMI 1.4b) 1x Embedded DisplayPort 1.4 1x LVDS 24bit, dual-channel
Network Interface	10/100/1000Base-T (integrated in PCH, Intel® i219LM PHY)	10/100/1000Base-T (integrated in PCH, Intel® i219LM PHY)
Audio Interface	High Definition Audio	-
Security Device	TPM 1.2	High Definition Audio
OS Support	Microsoft Windows® 7, 8, 8.1, 10 (embedded) BSP for Linux® on request EAPI (HW Programming Interface)	Microsoft Windows® 7, 8, 8.1, 10 (embedded) BSP for Linux® on request EAPI (HW Programming Interface)
Power Requirements	Voltage: +12V +/-10%, 5V Stby optional Power Consumption: 35 W to 55 W (typ.)	Voltage: +12V +/-10%, 5V Stby optional Power Consumption: 35 W to 55 W (typ.)
Operating Temp.	0° ... 60°C (operating) -25° ... 85°C (storage)	0° ... 60°C (operating) -25° ... 85°C (storage)
Humidity	5 ... 95% (operating, non-cond.), 5 ... 95% (storage, non-cond.)	

MSC C6B-CFLH	MSC C6B-CFLR	MSC C6B-TLH
x86	x86	x86
		
COM Express® Basic FF, Dimension: 95 mm x 125 mm	COM Express® Basic FF, Dimension: 95 mm x 125 mm	COM Express® Basic FF, Dimension: 95 mm x 125 mm
<p>Intel® Core™ Processor</p> <ul style="list-style-type: none"> - i7-8850H (6C, 2.6/4.3GHz, 9M cache, 45/35W cTDP) - i5-8400H (4C, 2.5/4.2GHz, 8M cache, 45/35W cTDP) - i3-8100H (4C, 3.0GHz, 6M cache, 45/35W cTDP) <p>Intel® Xeon® Processor</p> <ul style="list-style-type: none"> - E-2176M (6C, 2.7/4.4GHz, 12M cache, 45/35W cTDP) 	<p>Intel® Xeon® Processor</p> <ul style="list-style-type: none"> - E-2276ME (6C, 2.8/4.5GHz, 12MB cache, 45/35W TDP/cTDP) - E-2276ML (6C, 2.0/4.2GHz, 12MB cache, 25W TDP) - E-2254ME (4C, 2.6/3.8GHz, 8MB cache, 45/35W TDP/cTDP) - E-2254ML (4C, 1.7/3.5GHz, 8MB cache, 25 TDP) <p>Intel® Core™ Processor</p> <ul style="list-style-type: none"> - i7-9850HE (6C, 2.7/4.4GHz, 9MB cache, 45/35W TDP/cTDP) - i7-9850HL (6C, 1.9/4.1GHz, 9MB cache, 25W TDP) - i3-9100HL (4C, 1.6/2.9GHz, 6MB cache, 25W TDP) <p>Intel® Celeron® Processor</p> <ul style="list-style-type: none"> - G4930E (4C, 2.4GHz, 2MB cache, 35W TDP) - G4932E (4C, 1.9GHz, 2MB cache, 25W TDP) 	<p>Intel® Core™ Processor</p> <ul style="list-style-type: none"> - i7-11850HE, 8C/16T, 2.6/4.7 GHz, 32EUs, 24M L3, 45/35W TDP/cTDP down - i5-11500HE, 6C/12T, 2.6/4.5 GHz, 32EUs, 12M L3, 45/35W TDP/cTDP down - i3-11100HE, 4C/8T, 2.4/4.4 GHz, 16EUs, 8M L3, 45/35W TDP/cTDP down <p>Intel® Celeron® Processor 6600HE, 2C/2T, 2.6 GHz, 16EUs, 8M L3, 35W TDP</p> <p>Intel® Xeon® Processor</p> <ul style="list-style-type: none"> - W-11865MRE, 8C/16T, 2.6/4.7 GHz, 32EUs, 24M L3, 45/35W TDP/cTDP down, extended temp. - W-11555MRE, 6C/12T, 2.6/4.5 GHz, 32EUs, 12M L3, 45/35W TDP/cTDP down, extended temp. - W-11155MRE, 4C/8T, 2.4/4.4 GHz, 16EUs, 8M L3, 45/35W TDP/cTDP down, extended temp. - W-11865MLE, 8C/16T, 1.5/4.5 GHz, 32EUs, 24M L3, 25W - W-11555MLE, 6C/12T, 1.9/4.4 GHz, 32EUs, 12M L3, 25W - W-11155MLE, 4C/8T, 1.8/3.1 GHz, 16EUs, 8M L3, 25W
Intel® Platform Controller Hubs (PCH) QM370 or CM246	Intel® Platform Controller Hubs (PCH) QM370 or CM246	Intel® Platform Controller Hubs (PCH) RM590E, QM580E or HM570E
2x 260-pin SO-DIMM socket for up to 2x 16GB DDR4 SDRAM (DDR4-2666'); dual channel operation; ECC option	2x 260-pin SO-DIMM socket for up to 2x 16GB DDR4 SDRAM (DDR4-2666'); dual channel operation; ECC option	2x 260-pin SO-DIMM socket for up to 2x 32GB DDR4 SDRAM (DDR4-3200); dual channel operation; minimum capacity 1x 8GB single channel operation; ECC option
4x SATA channels (up to 6Gb/s)	4x SATA channels (up to 6Gb/s)	4x SATA channels (up to 6Gb/s) optional on-board NVMe, 64GB to 1TB
4x USB 3.1 (Gen 1 & 2)/2.0, 4x USB 2.0	4x USB 3.1 (Gen 1 & 2)/2.0, 4x USB 2.0	4x USB 3.1 (Gen 1 & 2), 8x USB 2.0
8x PCI Express x1 Gen 3 1x PCI Express® Graphics (PEG) x 16 Gen. 3 LPC bus (Low Pin Count bus; no DMA support)	8x PCI Express x1 Gen 3 1x PCI Express® Graphics (PEG) x 16 Gen. 3 LPC bus (Low Pin Count bus; no DMA support)	8x PCI Express® x1 Gen 3 1x PCI Express® Graphics (PEG) x 16 Gen 4 LPC bus (Low Pin Count bus; no DMA support)
Integrated Intel UHD graphics Gen. 9	Integrated Intel UHD graphics Gen. 9	Integrated Intel® UHD graphics
Three independent displays supported 3x Digital Display Interface (DP 1.2, HDMI 1.4b) 1x Embedded DisplayPort 1.4 1x LVDS 24bit, dual-channel	Three independent displays supported 3x Digital Display Interface (DP 1.2, HDMI 1.4b) 1x Embedded DisplayPort 1.4 1x LVDS 24bit, dual-channel	Four independent displays supported 3x Digital Display Interface (DP 1.4, HDMI 2.0b) 1x Embedded DisplayPort 1.4b 1x LVDS 24bit, dual-channel
10/100/1000Base-T (integrated in PCH, Intel® i219LM PHY)	10/100/1000Base-T (integrated in PCH, Intel® i219LM PHY)	10/100/1000Base-T, 2.5G (Intel i225)
High Definition Audio	High Definition Audio	High Definition Audio
TPM 2.0	TPM 2.0	TPM 2.0
Microsoft Windows® 10 IoT Enterprise BSP for Linux® (Yocto Project®) EAPI (HW Programming Interface)	Microsoft Windows® 10 IoT Enterprise BSP for Linux® (Yocto Project®) EAPI (HW Programming Interface)	Microsoft Windows® 10 IoT Enterprise RS5 (64bit) BSP for Linux® (Yocto Project®)
Voltage: +8.5V to +20V, +5V Stby optional Power Consumption: 35 W to 55 W (typ.)	Voltage: +8.5V to +20V, +5V Stby optional Power Consumption: 35 W to 55 W (typ.)	Voltage: +8.5V to +20V, +5V Stby optional Power Consumption: 36 W to 62 W (typ.)
0° ... 60°C (operating) -25° ... 85°C (storage)	0° ... 60°C (operating) -25° ... 85°C (storage)	-25° ... 85°C (storage) 0° ... 60°C (commercial) -40° ... 85°C (industrial)
5 ... 95% (operating, non-cond.), 5 ... 95% (storage, non-cond.)		






COM EXPRESS® TYPE 6 BASIC OVERVIEW

Specs	MSC C6B-ALP	MSC C6B-RLP	MSC C6B-MLH
Technology	x86	x86	x86
			
Form Factor	COM Express® Basic FF, Dimension: 95 mm x 125 mm		COM Express® Basic FF, Dimension: 95 mm x 125 mm
CPU	12th Gen Intel® Core™ processors H-series - i7-12800HE 14C/20T, 2.4GHz, 96 EUs, 24MB L3, 45/35W cTDP - i5-12600HE 12C/16T, 2.5GHz, 80 EUs, 18MB L3, 45/35W cTDP - i3-12300HE 8C/12T, 1.9GHz, 48 EUs, 12MB L3, 45/35W cTDP P-series - i7-1270PE 12C/16T, 1.8GHz, 96 EUs, 24MB L3, 28/20W cTDP - i5-1250PE 12C/16T, 1.7GHz, 80 EUs, 12MB L3, 28/20W cTDP - i3-1220PE 8C/12T, 1.5GHz, 48 EUs, 12MB L3, 28/20W cTDP U-series - i7-1265UE 10C/12T, 1.7GHz, 96 EUs, 12MB L3, 15/12W cTDP - i5-1245UE 10C/12T, 1.5GHz, 80 EUs, 12MB L3, 15/12W cTDP - i3-1215UE 6C/8T, 1.2GHz, 64 EUs, 10MB L3, 15/12W cTDP - 7305E 5C/5T, 1.0GHz, 48 EUs, 8MB L3, 15/12W cTDP	13th Gen Intel® Core™ processors H-series - i7-13800HE/HRE 14C/20T, 2.5GHz, 96 EUs, 24MB L3, 45/35W cTDP - i5-13600HE/HRE 12C/16T, 2.7GHz, 80 EUs, 18MB L3, 45/35W cTDP - i3-13300HE/HRE 8C/12T, 2.1GHz, 48 EUs, 12MB L3, 45/35W cTDP P-series - i7-1370PE/PRE 14C/20T, 1.9GHz, 96 EUs, 24MB L3, 28/20W cTDP - i5-1350PE/PRE 12C/16T, 1.8GHz, 80 EUs, 12MB L3, 28/20W cTDP - i5-1340PE 12C/16T, 1.8GHz, 80 EUs, 12MB L3, 28/20W cTDP - i3-1320PE/PRE 8C/12T, 1.7GHz, 48 EUs, 12MB L3, 28/20W cTDP U-series - i7-1365UE/URE 10C/12T, 1.7GHz, 96 EUs, 12MB L3, 15/12W cTDP - i5-1345UE/URE 10C/12T, 1.4GHz, 80 EUs, 12MB L3, 15/12W cTDP - i5-1335UE 10C/12T, 1.3GHz, 80 EUs, 12MB L3, 15/12W cTDP - i3-1315UE/URE 6C/8T, 1.2GHz, 64 EUs, 10MB L3, 15/12W cTDP - U300E 5C/6T, 1.1GHz, 48 EUs, 8MB L3, 15/12W cTDP Processor variants with marking RE support TCC/TSN, IBEC, extended temperatures	Intel® Core™ Ultra processors - Ultra 7 165H 16C/22T, 1.4GHz, 128 EUs, 24MB L3, vPRO®, 28W BP - Ultra 7 155H 16C/22T, 1.4GHz, 128 EUs, 24MB L3, 28W BP - Ultra 5 135H 14C/18T, 1.7GHz, 128 EUs, 18MB L3, vPRO®, 28W BP - Ultra 5 125H 14C/18T, 1.2GHz, 112 EUs, 18MB L3, 28W BP - Ultra 7 165U 12C/14T, 1.7GHz, 64 EUs, 12MB L3, vPRO®, 15W BP - Ultra 7 155U 12C/14T, 1.7GHz, 64 EUs, 12MB L3, 15W BP - Ultra 5 135U 12C/14T, 1.6GHz, 64 EUs, 12MB L3, vPRO®, 15W BP - Ultra 5 125U 12C/14T, 1.3GHz, 64 EUs, 12MB L3, 15W BP
Chipset	Integrated in System-on-Chip	Integrated in System-on-Chip	Integrated in System-on-Chip
DRAM	2x 262-pin SO-DIMM socket for up to 2x 32GB DDR5 SDRAM (DDR5-4800); dual channel operation; minimum capacity 1x 8GB single channel operation	2x 262-pin SO-DIMM socket for up to 2x 32GB DDR5 SDRAM (DDR5-4800); dual channel operation; minimum capacity 1x 8GB single channel operation; in-band ECC	2x 262-pin SO-DIMM socket for up to 96GB DDR5-5600 SDRAM; dual channel; min. capacity 1x 8GB single channel; in-band ECC (OS dependent)
Storage Interfaces	2x SATA channels (up to 6Gb/s) optional on-board NVMe, 64GB to 1TB	2x SATA channels (up to 6Gb/s) optional on-board NVMe, 64GB to 1TB	2x SATA channels (up to 6Gb/s) optional on-board NVMe, 64GB to 1TB
USB	4x USB 3.2 (Gen 1 & 2), 8x USB 2.0	4x USB 3.2 (Gen 1 & 2), 8x USB 2.0	4x USB 3.2 (Gen 1 & 2), 8x USB 2.0
Bus Interfaces	PCI Express® Graphics (PEG) 1x8, PCIe Gen 4, on -H series PCI Express® 1x4, Gen 4 PCI Express® 4x1 lanes, configurable up to x4, Gen 3 LPC bus (Low Pin Count bus, no DMA support)	PCI Express® Graphics (PEG) 1x8, PCIe Gen 4, on -H series PCI Express® 1x4, Gen 4 PCI Express® 4x1 lanes, configurable up to x4, Gen 3 LPC bus (Low Pin Count bus, no DMA support)	PCI Express® Gen 4, 1x8 & 1x4, optional PCI Express® Gen 4, 1x4 PCI Express® Gen 3, up to 8x1, bifurcation options LPC bus (Low Pin Count bus, no DMA support)
Display Controller	Intel® Iris® Xe architecture Graphics, Up to 96 execution units (EU)	Intel® Iris® Xe architecture Graphics, Up to 96 execution units (EU)	Intel® Arc™ Graphics, up to 128 execution units (EU)
Display Interfaces	Four independent displays supported 3x Digital Display Interface (DP 1.4a, HDMI 2.0b) 1x Embedded DisplayPort 1.4b 1x LVDS 24bit, dual-channel	Four independent displays supported 3x Digital Display Interface (DP 1.4a, HDMI 2.0b) 1x Embedded DisplayPort 1.4b 1x LVDS 24bit, dual-channel	Four independent displays supported 3x Digital Display Interface (DP 2.1, HDMI 2.1) 1x Embedded DisplayPort 1.4b 1x LVDS 24bit, dual-channel
Network Interface	10/100/1000Base-T, 2.5G, TSN (Intel i226)	10/100/1000Base-T, 2.5G, TSN (Intel i226)	10/100/1000Base-T, 2.5G, TSN (Intel i226)
Audio Interface	High Definition Audio	High Definition Audio	High Definition Audio
Security Device	TPM 2.0	TPM 2.0	TPM 2.0
OS Support	Microsoft Windows® 10 IoT Enterprise 2021 LTSC BSP for Linux® (Yocto Project®)	Microsoft Windows® 10 IoT Enterprise 2021 LTSC BSP for Linux® (Yocto Project®)	Windows® 10 IoT Enterprise 2021 LTSC Windows® 11 IoT Enterprise LTSC (future availability) / BSP for Linux® (Yocto Project®)
Power Requirements	Voltage: +8.5V to +20V, +5V Stby optional Power Consumption: 20 W to 64 W (typ.)	Voltage: +8.5V to +20V, +5V Stby optional Power Consumption: 20 W to 64 W (typ.)	Voltage: +8.5V to +20V, +5V Stby optional Power Consumption: TBD
Operating Temp.	-25° ... 85°C (storage) 0° ... 60°C (commercial)	-25° ... 85°C (storage) 0° ... 60°C (commercial) -40° ... 85°C (industrial)	0° ... 60°C (operating) -25° ... 85°C (storage)
Humidity	5 ... 95% (operating, non-cond.), 5 ... 95% (storage, non-cond.)		






/TYPE 6 COMPACT OVERVIEW

MSC C6C-SLU	MSC C6C-KLU	MSC C6C-WLU
x86	x86	x86
		
COM Express® Compact FF, Dimension: 95 mm x 95 mm	COM Express® Compact FF, Dimension: 95 mm x 95 mm	COM Express® Compact FF, Dimension: 95 mm x 95 mm
Intel® Core™ Processor - i7-6600U dual-core 2.6/3.4GHz, 4MB L2, 15W TDP, 7.5/25W cTDP - i5-6300U dual-core 2.4/3.0GHz, 3MB L2, 15W TDP, 7.5/25W cTDP - i3-6100U dual-core 2.3GHz, 3MB L2, 15W TDP, 7.5 cTDP Intel® Celeron® 3955U dual-core 2.0GHz, 2MB L2, 15W TDP, 10W cTDP	Intel® Core™ Processor - i7-7600U dual-core 2.8/3.9GHz, 4MB L2, 15W cTDP - i5-7300U dual-core 2.6/3.5GHz, 3MB L2, 15W cTDP - i3-7100U dual-core 2.4GHz, 3MB L2, 15W cTDP Intel® Celeron® 3965U dual-core 2.2GHz, 2MB L2, 15W TDP	Intel® Core™ Processor - i7-8665UE quad-core 1.7/4.4 GHz, 8MB L2, 15W TDP - i5-8365UE quad-core 1.6/4.1 GHz, 6MB L2, 15W TDP - i3-8145UE dual-core 2.2/3.9 GHz, 4MB L2, 15W TDP Intel® Celeron® Processor 4305UE dual-core 2.0 GHz, 2MB L2, 15W TDP
Integrated in System-on-Chip	Integrated in System-on-Chip	Integrated in System-on-Chip
2x 260-pin SO-DIMM socket for up to 2x 16 GB DDR4 SDRAM (DDR4-2133); dual channel operation	2x 260-pin SO-DIMM socket for up to 2x 16 GB DDR4 SDRAM (DDR4-2133); dual channel operation	Up to 2x 8 GB DDR4 SDRAM (DDR4-2400); dual channel operation; memory down
Up to 3x SATA 6Gb/s	Up to 3x SATA 6Gb/s	2x SATA 6Gb/s
4x USB 3.0/2.0, 4x USB 2.0	4x USB 3.0/2.0, 4x USB 2.0	4x USB 3.1/2.0, 4x USB 2.0
8x PCI Express® x1 Gen 3 LPC bus (Low Pin Count bus; no DMA support)	8x PCI Express® x1 Gen 3 LPC bus (Low Pin Count bus; no DMA support)	9x PCI Express® x1 Gen3, LPC bus (Low Pin Count bus; no DMA support)
Integrated Intel HD graphics Gen. 9	Integrated Intel HD graphics Gen. 9	Integrated Intel HD graphics Gen. 9
Two independent displays supported 2x Digital Display Interface (DP 1.2, HDMI 1.4b) 1x Embedded DisplayPort 1.4 1x LVDS 24bit, dual-channel	Two independent displays supported 2x Digital Display Interface (DP 1.2, HDMI 1.4b) 1x Embedded DisplayPort 1.4 1x LVDS 24bit, dual-channel	Three independent displays supported 2x Digital Display Interface (DP 1.2, HDMI 1.4b) 1x Embedded DisplayPort 1.4 1x LVDS 24bit, dual-channel
10/100/1000Base-T (Intel i219)	10/100/1000Base-T (Intel i219)	10/100/1000Base-T (Intel i219)
High Definition Audio	High Definition Audio	High Definition Audio
TPM 1.2	TPM 1.2	TPM 2.0
Microsoft Windows® 7, 8, 8.1, 10 (embedded) BSP for Linux® on request EAPI (HW Programming Interface)	Microsoft Windows® 7, 8, 8.1, 10 (embedded) BSP for Linux® on request EAPI (HW Programming Interface)	Microsoft Windows® 10 (embedded) BSP for Linux® (Yocto Project®) EAPI (HW Programming Interface)
Voltage: 12V +-5%, 5V Stby optional Power Consumption: 17 W to 19 W (typ.)	Voltage: 12V +-5%, 5V Stby optional Power Consumption: 17 W to 19 W (typ.)	Voltage: 12V +-5%, 5V Stby optional Power Consumption: 17 W to 19 W (typ.)
0° ... 60°C (operating) -25° ... 85°C (storage)	0° ... 60°C (operating) -25° ... 85°C (storage)	0° ... 60°C (operating) -25° ... 85°C (storage)
5 ... 95% (operating, non-condensing), 5 ... 95% (storage, non-condensing)		



COM EXPRESS® TYPE 6 COMPACT OVERVIEW




Specs	MSC C6C-TLU	MSC C6C-ALP	MSC C6C-RLP
Technology	x86	x86	x86
			
Form Factor	COM Express® Compact FF, Dimension: 95 mm x 95 mm		COM Express® Compact FF, Dimension: 95 mm x 95 mm
CPU	<p>Intel® Core™ Processor</p> <ul style="list-style-type: none"> - i7-1185GRE quad-core 2.8/4.4 GHz, 8 threads, 96 EUs, 12MB L2, 28/15/12W cTDP up/TDP/cTDP down, ext. temp. - i7-1185G7E quad-core 2.8/4.4 GHz, 8 threads, 96 EUs, 12MB L2, 28/15/12W cTDP up/TDP/cTDP down - i5-1145GRE quad-core 2.6/4.1 GHz, 8 threads, 80 EUs, 8MB L2, 28/15/12W cTDP up/TDP/cTDP down, ext. temp. - i5-1145G7E quad-core 2.6/4.1 GHz, 8 threads, 80 EUs, 8MB L2, 28/15/12W cTDP up/TDP/cTDP down - i3-1155GRE dual-core 3.0/3.9 GHz, 4 threads, 48 EUs, 6MB L2, 28/15/12W cTDP up/TDP/cTDP down, ext. temp. - i3-1155G4E dual-core 3.0/3.9 GHz, 4 threads, 48 EUs, 6MB L2, 28/15/12W cTDP up/TDP/cTDP down <p>Intel® Celeron® 6305E dual-core 1.8 GHz, 2 threads, 48 EUs, 4MB L2, 15W TDP</p>	<p>12th Gen Intel® Core™ processors</p> <p>H-series</p> <ul style="list-style-type: none"> - i7-12800HE 14C/20T, 2.4GHz, 96 EUs, 24MB L3, 45/35W cTDP - i5-12600HE 12C/16T, 2.5GHz, 80 EUs, 18MB L3, 45/35W cTDP - i3-12300HE 8C/12T, 1.9GHz, 48 EUs, 12MB L3, 45/35W cTDP <p>P-series</p> <ul style="list-style-type: none"> - i7-1270PE 12C/16T, 1.8GHz, 96 EUs, 24MB L3, 28/20W cTDP - i5-1250PE 12C/16T, 1.7GHz, 80 EUs, 12MB L3, 28/20W cTDP - i3-1220PE 8C/12T, 1.5GHz, 48 EUs, 12MB L3, 28/20W cTDP <p>U-series</p> <ul style="list-style-type: none"> - i7-1265UE 10C/12T, 1.7GHz, 96 EUs, 12MB L3, 15/12W cTDP - i5-1245UE 10C/12T, 1.5GHz, 80 EUs, 12MB L3, 15/12W cTDP - i3-1215UE 6C/8T, 1.2GHz, 64 EUs, 10MB L3, 15/12W cTDP - 7305E 5C/5T, 1.0GHz, 48 EUs, 8MB L3, 15/12W cTDP 	<p>13th Gen Intel® Core™ processors</p> <p>H-series</p> <ul style="list-style-type: none"> - i7-13800HE/HRE 14C/20T, 2.5GHz, 96 EUs, 24MB L3, 45/35W cTDP - i5-13600HE/HRE 12C/16T, 2.7GHz, 80 EUs, 18MB L3, 45/35W cTDP - i3-13300HE/HRE 8C/12T, 2.1GHz, 48 EUs, 12MB L3, 45/35W cTDP <p>P-series</p> <ul style="list-style-type: none"> - i7-1370PE/PRE 14C/20T, 1.9GHz, 96 EUs, 24MB L3, 28/20W cTDP - i5-1350PE/PRE 12C/16T, 1.8GHz, 80 EUs, 12MB L3, 28/20W cTDP - i5-1340PE 12C/16T, 1.8GHz, 80 EUs, 12MB L3, 28/20W cTDP - i3-1320PE/PRE 8C/12T, 1.7GHz, 48 EUs, 12MB L3, 28/20W cTDP <p>U-series</p> <ul style="list-style-type: none"> - i7-1365UE/URE 10C/12T, 1.7GHz, 96 EUs, 12MB L3, 15/12W cTDP - i5-1345UE/URE 10C/12T, 1.4GHz, 80 EUs, 12MB L3, 15/12W cTDP - i5-1335UE 10C/12T, 1.3GHz, 80 EUs, 12MB L3, 15/12W cTDP - i3-1315UE/URE 6C/8T, 1.2GHz, 64 EUs, 10MB L3, 15/12W cTDP - U300E 5C/6T, 1.1GHz, 48 EUs, 8MB L3, 15/12W cTDP <p>Processor variants with marking RE support TCC/TSN, IBECC, extended temperatures</p>
Chipset	Integrated in System-on-Chip	Integrated in System-on-Chip	Integrated in System-on-Chip
DRAM	Up to 32 GB SDRAM (up to LPDDR4X-4267); dual channel operation; memory down	Up to 32 GB SDRAM (up to LPDDR5-5200; dual channel operation; memory down)	Up to 32 GB SDRAM (up to LPDDR5-6400; dual channel operation; memory down)
Storage Interfaces	2x SATA 6Gb/s	2x SATA 6Gb/s	2x SATA 6Gb/s
USB	4x USB 3.1 Gen 1/Gen 2, 8x USB 2.0	4x USB 3.2 Gen 1/Gen 2, 8x USB 2.0	4x USB 3.2 Gen 1/Gen 2, 8x USB 2.0
Bus Interfaces	PCI Express® Gen3, 1x4 + 5x1 LPC bus (Low Pin Count bus; no DMA support)	PCI Express® Gen 4, 1x8, optional PCI Express® Gen 4, 1x4, optional PCI Express® Gen 4, 1x4 PCI Express® Gen 3, up to 8x1, bifurcation options LPC bus (Low Pin Count bus, no DMA support)	PCI Express® Gen 4, 1x8, optional PCI Express® Gen 4, 1x4, optional PCI Express® Gen 4, 1x4 PCI Express® Gen 3, up to 8x1, bifurcation options LPC bus (Low Pin Count bus, no DMA support)
Display Controller	Integrated Intel Gen12 Gfx Engine Up to 96 execution units (EU)	Intel® Iris® Xe architecture Graphics, Up to 96 execution units (EU)	Intel® Iris® Xe architecture Graphics, Up to 96 execution units (EU)
Display Interfaces	Four independent displays supported 3x Digital Display Interface (DP 1.4, HDMI 2.0b) 1x Embedded DisplayPort 1.4b 1x LVDS 24bit, dual-channel	Four independent displays supported 3x Digital Display Interface (DP 1.4, HDMI 2.0b) 1x Embedded DisplayPort 1.4b 1x LVDS 24bit, dual-channel	Four independent displays supported 3x Digital Display Interface (DP 1.4, HDMI 2.0b) 1x Embedded DisplayPort 1.4b 1x LVDS 24bit, dual-channel
Network Interface	10/100/1000Base-T with TSN support (Intel i225)	10/100/1000Base-T, 2.5G (Intel i226)	10/100/1000Base-T, 2.5G (Intel i226)
Audio Interface	High Definition Audio	High Definition Audio	High Definition Audio
Security Device	TPM 2.0	TPM 2.0	TPM 2.0
OS Support	Microsoft Windows® 10 IoT Enterprise RS5 (64bit) BSP for Linux® (Yocto Project®)	Windows* 10 IoT Enterprise 2021 LTSC BSP for Linux® (Yocto Project®)	Windows* 10 IoT Enterprise 2021 LTSC BSP for Linux® (Yocto Project®)
Power Requirements	Voltage: +8.5V to +20V, +5V Stby optional Power Consumption: TBD	Voltage: +8.5V to +20V, +5V Stby optional Power Consumption: TBD	Voltage: +8.5V to +20V, +5V Stby optional Power Consumption: TBD
Operating Temp.	-25° ... 85°C (storage) 0° ... 60°C (commercial) -40° ... 85°C (industrial)	-25° ... 85°C (storage) 0° ... 60°C (commercial)	-25° ... 85°C (storage) 0° ... 60°C (commercial) -40° ... 85°C (industrial)
Humidity	5 ... 95% (operating, non-condensing), 5 ... 95% (storage, non-condensing)		






MSC C6C-RYZ	MSC C6C-RYZ2
x86	x86
	
COM Express® Compact FF, Dimension: 95 mm x 95 mm	COM Express® Compact FF, Dimension: 95 mm x 95 mm
<p>AMD Ryzen™ Embedded</p> <ul style="list-style-type: none"> - V1807B, quad-core Processor, 3.35/3.8GHz, 2MB L2 / 4MB L3, 11 GPU CU, 45W (35-54W) TDP, max. DDR4-3200 - V1756B, quad-core Processor, 3.25/3.6GHz, 2MB L2 / 4MB L3, 8 GPU CU, 45W (35-54W) TDP, max. DDR4-3200 - V1605B, quad-core Processor, 2.0/3.6GHz, 2MB L2 / 4MB L3, 8 GPU CU, 15W (12-25W) TDP, max. DDR4-2400 - V1404I, quad-core Processor, 2.0/3.6GHz, 2MB L2 / 4MB L3, 8 GPU CU, 15W (12-25W) TDP, max. DDR4-2400, industrial temp. range - V1202B, dual-core Processor, 2.3/3.2GHz, 1MB L2 / 4MB L3, 3 GPU CU, 15W (12-25W) TDP, max. DDR4-2400 - R1606G, dual-core Processor, 2.6/3.5GHz, 1MB L2 / 4MB L3, 3 GPU CU, 15W (12-25W) TDP, max. DDR4-2400 - R1505G, dual-core Processor, 2.4/3.3GHz, 1MB L2 / 4MB L3, 3 GPU CU, 15W (12-25W) TDP, max. DDR4-2400 	<p>AMD Ryzen™ Embedded</p> <ul style="list-style-type: none"> - R2544, quad-core Processor, 3.35/3.7GHz, 2MB L2 / 4MB L3, 8 GPU CU, 45W (35-54W) TDP, max. DDR4-3200; - R2514, quad-core Processor, 2.1/3.7GHz, 2MB L2 / 4MB L3, 8 GPU CU, 15W (12-35W) TDP, max. DDR4-2667; - R2314, quad-core Processor, 2.1/3.5GHz, 2MB L2 / 4MB L3, 6 GPU CU, 15W (12-35W) TDP, max. DDR4-2667; - R2312, dual-core Processor, 2.7/3.5GHz, 1MB L2 / 4MB L3, 3 GPU CU, 15W (12-25W) TDP, max. DDR4-2400
Integrated in System-on-Chip	Integrated in System-on-Chip
2x 260-pin SO-DIMM socket for up to 2x 16 GB DDR4 SDRAM (DDR4-3200 max); ECC option; dual channel operation	2x 260-pin SO-DIMM socket for up to 2x 16 GB DDR4 SDRAM (DDR4-3200 max); ECC option; dual channel operation
2x SATA 6Gb/s	2x SATA 6Gb/s
Up to 4x USB 3.1/2.0, 4x USB 2.0	Up to 4x USB 3.2 Gen1/2.0, 4x USB 2.0
PEG port max x8 (depending on processor variant) LPC bus (Low Pin Count bus)	PEG port max x8 (depending on processor variant) LPC bus (Low Pin Count bus)
GPU Vega core, up to 11 CUs	GPU Vega core, up to 8 CUs
Up to four independent displays supported Up to 3x Digital Display Interface (DP 1.4, HDMI 2.0b) 1x Embedded DisplayPort 1.3 1x LVDS 24bit, dual-channel	Up to four independent displays supported Up to 3x Digital Display Interface (DP 1.4, HDMI 2.0b) 1x Embedded DisplayPort 1.3 1x LVDS 24bit, dual-channel
10/100/1000Base-T (Intel i210)	10/100/1000Base-T (Intel i210)
High Definition Audio	High Definition Audio
TPM 2.0	TPM 2.0
Microsoft Windows® 10 IoT Enterprise (64-bit) Microsoft Windows® 10 Linux®, (Yocto Project®)	Windows® 10 21H2 LTSC Windows® 11 21H2 GAC Linux®, (Yocto Project®)
Voltage: +12V primary power supply input, +5V Stby optional Power Consumption: 28 W to 64 W (typ.)	Voltage: +12V primary power supply input, +5V Stby optional Power Consumption: tbd
-25° ... 85°C (storage) 0° ... 60°C (commercial) -40° ... 85°C (industrial)	-25° ... 85°C (storage) 0° ... 60°C (commercial)
5 ... 95% (operating, non-condensing), 5 ... 95% (storage, non-condensing)	






COM EXPRESS® TYPE 6 COMPACT OVERVIEW



Specs	MSC C6C-BT	MSC C6C-BW	MSC C6C-AL
Technology	x86	x86	x86
			
Form Factor	COM Express® Compact FF, Dimension: 95 mm x 95 mm	COM Express® Compact FF, Dimension: 95 mm x 95 mm	COM Express® Compact FF, Dimension: 95 mm x 95 mm
CPU	Intel Atom® Processor – E3845 quad-core 1.91GHz, 10W TDP – E3827 dual-core 1.75GHz, 8W TDP – E3826 dual-core 1.46GHz, 7W TDP – E3825 dual-core 1.33GHz, 6W TDP – E3815 single-core 1.46GHz, 5W TDP – E3805 dual-core 1.33GHz, 3W TDP (no graphics) Intel® Celeron® Processor – N2807 dual-core 1.58/2.16GHz, 4.3W TDP – N2930 quad-core 1.83/2.16GHz, 7.5W TDP – J1900 quad-core 2.00/2.42GHz, 10W TDP	Intel Atom® x5-E8000 quad-core 1.04/2.0GHz, 2MB Cache, 5W TDP Intel® Pentium® N3710 quad-core 1.6/2.56GHz, 2MB Cache, 6W TDP Intel® Celeron® Processor – N3160 quad-core 1.6/2.24GHz, 2MB Cache, 6W TDP – N3060 dual-core 1.6/2.48GHz, 2MB Cache, 6W TDP – N3010 dual-core 1.04/2.24GHz, 2MB Cache, 4W TDP	Intel Atom® Processor – E3950 quad-core 1.6/2.0GHz, 18 EU GFX, 12W – E3940 quad-core 1.6/1.8GHz, 12 EU GFX, 9.5W – E3930 dual-core 1.3/1.8GHz, 12 EU GFX, 6.5W Intel® Pentium® N4200 quad-core 1.1/2.5GHz, 18 EU GFX, 6W Intel® Celeron® N3350 dual-core 1.1/2.4GHz, 12 EU GFX, 6W
Chipset	Integrated in System-on-Chip	Integrated in System-on-Chip	Integrated in System-on-Chip
DRAM	Up to 8GB DDR3L (1333), 2x 204 pin SO-DIMM	Up to 8GB DDR3L (1333), 2x 204 pin SO-DIMM	2x 204-pin SO-DIMM socket for up to 2x 4 GB (dual channel operation) or 1x 8 GB
Storage Interfaces	2x SATA 3Gb/s; PATA option for CXC-BT	2x SATA 6Gb/s	Up to 2x SATA 6Gb/s
USB	4x USB 2.0, 4x USB 2.0 (optional hub)	4x USB 3.0/2.0, 4x USB 2.0	4x USB 3.0/2.0, 4x USB 2.0
Bus Interfaces	Up to 5x PCI Express x1 Gen 2, LPC bus (Low Pin Count bus)	Up to 5x PCI Express® x1 Gen 2 LPC bus (Low Pin Count bus)	Up to 5x PCI Express® x1 LPC bus (Low Pin Count bus; no DMA support)
Display Controller	Integrated Intel HD graphics Gen. 7	Integrated Intel HD graphics Gen. 8	Integrated Intel HD graphics Gen. 9
Display Interfaces	Two independent displays supported 1x Digital Display Interface (DP 1.1a, HDMI 1.4a) on C6C-BT only 1x Embedded DisplayPort 1.3 on C6C-BT only 1x LVDS 24bit, dual-channel VGA	Two independent displays supported 2x Digital Display Interface (DP 1.1a, HDMI 1.4b) 1x Embedded DisplayPort 1.4 1x LVDS 24bit, dual-channel	Three independent displays supported 2x Digital Display Interface (DP 1.2a, HDMI 1.4b) 1x Embedded DisplayPort 1.3 1x LVDS 24bit, dual-channel
Network Interface	10/100/1000Base-T (Intel i210)	10/100/1000Base-T (Intel i210)	10/100/1000Base-T (Intel i210)
Audio Interface	High Definition Audio	High Definition Audio	High Definition Audio
Security Device	TPM 1.2 (option)	TPM 1.2	TPM 2.0
OS Support	Microsoft Windows® 7, 8, 8.1, 10 (embedded) BSP for Linux® on request EAPI (HW Programming Interface)	Microsoft Windows® 7, 8, 8.1 (embedded) BSP for Linux® on request EAPI (HW Programming Interface)	Microsoft Windows® 10 (embedded) BSP for Linux® on request EAPI (HW Programming Interface)
Power Requirements	Voltage: Wide range input +5 ... +17V, 5V Stby optional Power Consumption: 8 W (typ.) up to 14 W (typ.)	Voltage: Wide range input +5 ... +17V, 5V Stby optional Power Consumption: 7 W (typ.) up to 9 W (typ.)	Voltage: +5 ... +20V, 5V Stby optional Power Consumption: 7 W to 14 W (typ.)
Operating Temp.	–25° ... 85°C (storage) 0° ... 60°C (commercial) –40° ... 85°C (industrial)	–25° ... 85°C (storage) 0° ... 60°C (commercial)	–25° ... 85°C (storage) 0° ... 60°C (commercial) –40° ... 85°C (industrial)
Humidity	5 ... 95% (operating, non-condensing), 5 ... 95% (storage, non-condensing)		

MSC C6C-EL	MSC C6C-ALN	MSC C6C-ASL
x86	x86	x86
		
COM Express® Compact FF, Dimension: 95 mm x 95 mm	COM Express® Compact FF, Dimension: 95 mm x 95 mm	COM Express® Compact FF, Dimension: 95 mm x 95 mm
<p>Intel Atom® Processor</p> <ul style="list-style-type: none"> - x6425RE, quad-core / 4T, 1.9GHz, 32EU, IBECC, TCC, 12W, IUC - x6416RE, quad-core / 4T, 1.7GHz, 16EU, IBECC, TCC, 9W, IUC - x6414RE, quad-core / 4T, 1.5GHz, 16EU, IBECC, TCC, 9W, IUC - x6214RE, dual-core / 2T, 1.4GHz, 16EU, IBECC, TCC, 6W, IUC - x6212RE, dual-core / 2T, 1.2GHz, 16EU, IBECC, TCC, 6W, IUC - x6425E, quad-core / 4T, 2.0/3.0GHz, 32EU, IBECC, 12W, EUC - x6413E, quad-core / 4T, 1.5/3.0GHz, 16EU, IBECC, 9W, EUC - x6211E, dual-core / 2T, 1.3/3.0GHz, 16EU, IBECC, 6W, EUC <p>Intel® Pentium® Processor</p> <ul style="list-style-type: none"> - J6426, quad-core / 4T, 2.0/3.0GHz, 32EUs, 10W, PUC - N6415, quad-core / 4T, 1.2/3.0GHz, 16EU, 6W, PUC <p>Intel® Celeron® Processor</p> <ul style="list-style-type: none"> - J6413 quad-core / 4T, 1.8/3.0GHz, 16EU, 10W, PUC - N6211 dual-core / 2T, 1.2/3.0GHz, 16EU, 6W, PUC 	<p>Intel® Core™ Processor</p> <ul style="list-style-type: none"> - i3-N305, eight-core, 1.0GHz/1.8GHz, 32EU, 9/15W, PUC <p>Intel Atom® Processor</p> <ul style="list-style-type: none"> - x7425E, four-core, 1.5GHz, 24EU, TCC, 12W, EUC - x7213E, two-core, 1.7GHz, 16EU, TCC, 10W, EUC - x7211E, two-core, 1.0GHz, 16EU, TCC, 6W, EUC <p>Intel® Processor</p> <ul style="list-style-type: none"> - N200, quad-core, 1.0GHz, 32EU, 6W, PUC - N97, quad-core, 2.0GHz, 24EU, 12W, PUC - N50, dual-core, 1.0GHz, 16EU, 6W, PUC <p>EUC - Intel Embedded Use Conditions PUC - Intel PC Client Use Conditions</p>	<p>Intel Atom® Processor</p> <ul style="list-style-type: none"> - x7835RE, eight-core, 1.3GHz, 32EU, TCC, 12W, IUC/EUC, ET - x7433RE, four-core, 1.5GHz, 32EU, TCC, 9W, IUC/EUC, ET - x7213RE, two-core, 2.0GHz, 16EU, TCC, 9W, IUC/EUC, ET - x7211RE, two-core, 1.0GHz, 16EU, TCC, 6W, IUC/EUC, ET - x7405C, quad-core, 2.2GHz, no GPU, TCC, 12W, EUC, CT - x7203C, dual-core, 2.0GHz, no GPU, TCC, 9W, EUC, CT <p>ET- Extended Temperature CT- Commercial Temperature EUC - Intel Embedded Use Conditions IUC - Intel Industrial Use Conditions</p>
Integrated in System-on-Chip	Integrated in System-on-Chip	Integrated in System-on-Chip
2x 204-pin SO-DIMM socket for up to 2x 16 GB (dual channel operation) or 1x 16 GB	1x 262-pin SO-DIMM socket for up to 16 GB DDR5-4800 In-band ECC (on selected variants)	1x 262-pin SO-DIMM socket for up to 16 GB DDR5-4800 In-band ECC (on selected variants)
Up to 2x SATA 6Gb/s	Up to 2x SATA 6Gb/s	Up to 2x SATA 6Gb/s
2x USB 3.1/2.0, 6x USB 2.0	Up to 4x USB 3.2 Gen 2 (10Gb/s), 8x USB 2.0	Up to 4x USB 3.2 Gen 2 (10Gb/s), 8x USB 2.0
8x PCI Express® x1 LPC bus (Low Pin Count bus; no DMA support)	Up to 6x PCI Express x1 Gen 3, LPC bus (Low Pin Count bus; no DMA support)	Up to 6x PCI Express x1 Gen 3, LPC bus (Low Pin Count bus; no DMA support)
Integrated Intel graphics Gen11LP	Integrated Intel® UHD graphics	Integrated Intel® UHD graphics
Three independent displays supported 2x Digital Display Interface (DP 1.4, HDMI 1.4b) 1x Embedded DisplayPort 1.3 1x LVDS 24bit, dual-channel	Three independent displays supported: 2x Digital Display Interface (DP, HDMI) 1x Embedded DisplayPort LVDS 24bit, dual-channel	Three independent displays supported: 2x Digital Display Interface (DP, HDMI) 1x Embedded DisplayPort LVDS 24bit, dual-channel
10/100/1000Base-T (SoC integrated controller)	10/100/1000Base-T, 2.5G,TSN (Intel i226)	10/100/1000Base-T, 2.5G,TSN (Intel i226)
High Definition Audio	High Definition Audio	High Definition Audio
TPM 2.0	TPM 2.0	TPM 2.0
Microsoft Windows® 10 IoT Enterprise RS5 (64bit) Linux® (Yocto Project®) Kernel 5.4	Microsoft Windows® 10 IoT Enterprise 2021 LTSC Linux® (Yocto Project®) LTS Kernel 2021	Microsoft Windows® 10 IoT Enterprise 2021 LTSC Linux® (Yocto Project®) LTS Kernel 2021
Voltage: +8.5 ... +20V, 5V Stby optional Power Consumption: 7 W to 14 W (typ.)	Voltage: +8.5 ... +20V, 5V Stby optional Power Consumption: tbd	Voltage: +8.5 ... +20V, 5V Stby optional Power Consumption: tbd
-25° ... 85°C (storage) 0° ... 60°C (commercial) -40° ... 85°C (industrial)	-25° ... 85°C (storage) 0° ... 60°C (commercial)	-25° ... 85°C (storage) 0° ... 60°C (commercial) -40° ... 85°C (industrial)
5 ... 95% (operating, non-condensing), 5 ... 95% (storage, non-condensing)		



COM EXPRESS®: TYPE 10 MINI OVERVIEW

Specs	MSC C10M-BT/BTC	MSC C10M-AL	MSC C10M-EL
Technology	x86	x86	x86
			
Form Factor	COM Express® Mini, Dimension: 84 mm x 55 mm	COM Express® Mini, Dimension: 84 mm x 55 mm	COM Express® Mini, Dimension: 84 mm x 55 mm
CPU	Intel Atom® Processor - E3845 quad-core 1.91GHz, 10W TDP - E3827 dual-core 1.75GHz, 8W TDP - E3826 dual-core 1.46GHz, 7W TDP - E3825 dual-core 1.33GHz, 6W TDP - E3815 single-core 1.46GHz, 5W TDP - E3805 dual-core 1.33GHz, 3W TDP (no graphics) Intel® Celeron® Processor - N2807 dual-core 1.58/2.16GHz, 4.3W TDP - N2930 quad-core 1.83/2.16GHz, 7.5W TDP - J1900 quad-core 2.00/2.42GHz, 10W TDP	Intel Atom® Processor - X7-E3950 quad-core 1.6/2.0GHz, 18 EU GFX, 12W - X5-E3940 quad-core 1.6/1.8GHz, 12 EU GFX, 9.5W - X5-E3930 dual-core 1.3/1.8GHz, 12 EU GFX, 6.5W Intel® Pentium® Processor - N4200 quad-core 1.1/2.5GHz, 18 EU GFX, 6W Intel® Celeron® Processor - N3350 dual-core 1.1/2.4GHz, 12 EU GFX, 6W	Intel Atom® Processor - x6425RE, quad-core / 4T, 1.9GHz, 32EU, IBECC, TCC, 12W, IUC - x6414RE, quad-core / 4T, 1.5GHz, 16EU, IBECC, TCC, 9W, IUC - x6212RE, dual-core / 2T, 1.2GHz, 16EU, IBECC, TCC, 6W, IUC - x6425E, quad-core / 4T, 2.0/3.0GHz, 32EU, IBECC, 12W, EUC - x6413E, quad-core / 4T, 1.5/3.0GHz, 16EU, IBECC, 9W, EUC - x6211E, dual-core / 2T, 1.3/3.0GHz, 16EU, IBECC, 6W, EUC Intel® Pentium® Processor - J6426, quad-core / 4T, 2.0/3.0GHz, 32EUs, 10W, PUC - N6415, quad-core / 4T, 1.2/3.0GHz, 16EU, 6W, PUC Intel® Celeron® Processor - J6413 quad-core / 4T, 1.8/3.0GHz, 16EU, 10W, PUC - N6211 dual-core / 2T, 1.2/3.0GHz, 16EU, 6W, PUC
Chipset	Integrated in System-on-Chip	Integrated in System-on-Chip	Integrated in System-on-Chip
DRAM	up to 8GB DDR3L@1.35V SDRAM (DDR1333) soldered on board, ECC optional	up to 8GB DDR3L@1.35V SDRAM soldered on board, ECC optional	Up to 16GB LPDDR4x SDRAM, up to 4267MT/s, soldered on board, in-band ECC optional
Storage Interfaces	2x SATA 3Gb/s	2x SATA 6Gb/s	2x SATA 6Gb/s
USB	1x USB 3.0, 4x USB 2.0, 3x USB 2.0 (optional hub)	2x USB 3.0, 6 x USB 2.0, 1 x USB 2.0/3.0 client	2x USB 3.0, 8 x USB 2.0
Bus Interfaces	3x PCI Express® x1 Gen 2 LPC bus (Low Pin Count bus)	4x PCI Express® x1 Gen 2 LPC bus (Low Pin Count bus)	4x PCI Express® x1 Gen 3 LPC bus (Low Pin Count bus)
Display Controller	Integrated Intel HD graphics Gen. 7	Integrated Intel HD graphics Gen. 9	Integrated Intel HD graphics Gen. 9
Display Interfaces	1x Digital Display Interface (DP 1.1a, HDMI 1.4a) 1x Embedded DisplayPort 1.3 1x LVDS 24bit, dual-channel	Two independent displays supported 1x Digital Display Interface (DP 1.2a, HDMI 1.4b) 1x Embedded DisplayPort 1.3 1x LVDS 24bit, dual-channel	Two independent displays supported 1x Digital Display Interface (DP 1.4, HDMI 1.4b) 1x Embedded DisplayPort 1.3 1x LVDS 24bit, dual-channel
Network Interface	10/100/1000Base-T (Intel® i210)	10/100/1000Base-T (Intel® i210)	10/100/1000Base-T (SoC integrated controller)
Audio Interface	High Definition Audio	High Definition Audio	High Definition Audio
Security Device	TPM 1.2 (option)	TPM 2.0 (option)	TPM 2.0
OS Support	Microsoft Windows® 7 Microsoft Windows® 10, Windows 10 IoT Core BSP for Linux® on request, EAPI (HW Programming Interface)	Microsoft Windows® 10 (embedded) BSP for Linux® on request EAPI (HW Programming Interface)	Microsoft Windows® 10 IoT Enterprise R55 (64bit) Linux® (Yocto Project®) Kernel 5.4
Power Requirements	Voltage: +5 ... +20V, 5V Stby optional Power Consumption: 8 W (typ.) up to 14 W (typ.)	Voltage: +5 ... +20V, 5V Stby optional Power Consumption: 7 W (typ.) up to 14 W (typ.)	Voltage: +5 ... +20V, 5V Stby optional Power Consumption: 8 W (typ.) up to 17 W (typ.)
Operating Temp.	-25° ... 85°C (storage) 0° ... 60°C (commercial) -40° ... 85°C (industrial)	-25° ... 85°C (storage) 0° ... 60°C (commercial) -40° ... 85°C (industrial)	-25° ... 85°C (storage) 0° ... 60°C (commercial) -40° ... 85°C (industrial)
Humidity	5 ... 95% (operating, non-condensing), 5 ... 95% (storage, non-condensing)		

MSC C10M-ALN		MSC C10M-ASL	
x86		x86	
			
COM Express® Mini, Dimension: 84 mm x 55 mm		COM Express® Mini, Dimension: 84 mm x 55 mm	
<p>Intel® Core™ i3-N305, eight-core, 1.0GHz/1.8GHz, 32EU, 9/15W, PUC</p> <p>Intel Atom® x7425E, four-core, 1.5GHz, 24EU, TCC, 12W, EUC</p> <p>Intel Atom® x7213E, two-core, 1.7GHz, 16EU, TCC, 10W, EUC</p> <p>Intel Atom® x7211E, two-core, 1.0GHz, 16EU, TCC, 6W, EUC</p> <p>Intel® Processor N200, quad-core, 1.0GHz, 32EU, 6W, PUC</p> <p>Intel® Processor N97, quad-core, 2.0GHz, 24EU, 12W, PUC</p> <p>Intel® Processor N50, dual-core, 1.0GHz, 16EU, 6W, PUC</p> <p>EUC - Intel Embedded Use Conditions PUC - Intel PC Client Use Conditions</p>		<p>Intel Atom® x7835RE, eight-core, 1.3GHz, 32EU, TCC, 12W, IUC/EUC, ET</p> <p>Intel Atom® x7433RE, four-core, 1.5GHz, 32EU, TCC, 9W, IUC/EUC, ET</p> <p>Intel Atom® x7213RE, two-core, 2.0GHz, 16EU, TCC, 9W, IUC/EUC, ET</p> <p>Intel Atom® x7211RE, two-core, 1.0GHz, 16EU, TCC, 6W, IUC/EUC, ET</p> <p>Intel Atom® x7405C, quad-core, 2.2GHz, no GPU, TCC, 12W, EUC, CT</p> <p>Intel Atom® x7203C, dual-core, 2.0GHz, no GPU, TCC, 9W, EUC, CT</p> <p>Note: base frequency shown, other frequencies supported</p> <p>ET- Extended Temperature CT- Commercial Temperature EUC - Intel Embedded Use Conditions IUC - Intel Industrial Use Conditions</p>	
Integrated in System-on-Chip		Integrated in System-on-Chip	
Up to 16GB LPDDR5 SDRAM, up to 4800MT/s, IB ECC (only Atom SKU's), soldered		Up to 16GB LPDDR5 SDRAM, up to 4800MT/s, IB ECC (only Atom SKU's), soldered	
1x SATA 6Gb/s		1x SATA 6Gb/s	
2x USB 3.2 Gen 2 (10Gb/s), 8 x USB 2.0		2x USB 3.2 Gen 2 (10Gb/s), 8 x USB 2.0	
4x PCI Express x1 Gen 3 (1x PCI Express x4 Gen 3 on request), LPC bus (Low Pin Count bus; no DMA support) (eSPI on request)		4x PCI Express x1 Gen 3 (1x PCI Express x4 Gen 3 on request), LPC bus (Low Pin Count bus; no DMA support) (eSPI on request)	
Integrated Intel UHD Graphics (Gen12)		Integrated Intel UHD Graphics (Gen12)	
Two independent displays supported: 1x Digital Display Interface (DP, HDMI) 1x Embedded DisplayPort (on variants without LVDS only); LVDS 24bit, single-channel (not on all variants);		Two independent displays supported: 1x Digital Display Interface (DP, HDMI) 1x Embedded DisplayPort (on variants without LVDS only); LVDS 24bit, single-channel (not on all variants);	
10/100/1000Base-TX, 2.5G based on Intel i226		10/100/1000Base-TX, 2.5G based on Intel i226	
High Definition Audio		High Definition Audio	
TPM 2.0		TPM 2.0	
Microsoft Windows® 10 IoT Enterprise 2021 LTSC Linux® (Yocto Project®) (LTS kernel 2021)		Microsoft Windows® 10 IoT Enterprise 2021 LTSC Linux® (Yocto Project®) (LTS kernel 2021)	
Wide range input +5 ... +20V, 5V Stby optional, Power Consumption: 8W (typ.) up to 17W (typ.)		Wide range input +5 ... +20V, 5V Stby optional, Power Consumption: 8W (typ.) up to 14W (typ.)	
-25° ... 85°C (storage) 0° ... 60°C (commercial)		-25° ... 85°C (storage) 0° ... 60°C (commercial) -40° ... 85°C (industrial)	
5 ... 95% (operating, non-condensing), 5 ... 95% (storage, non-condensing)			



SMARC® 2.0/2.1.1

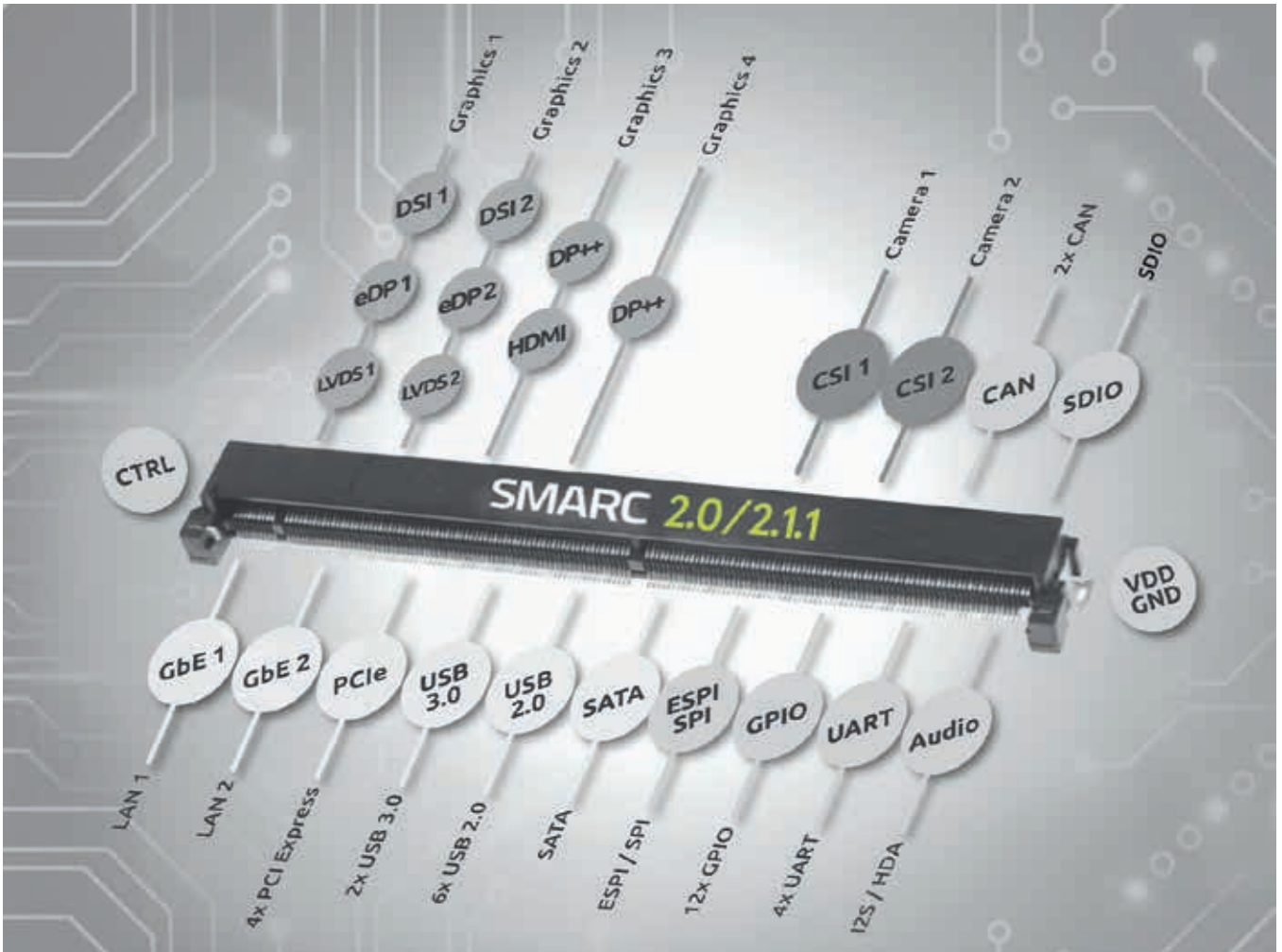


The recent revision 2.1.1 of the SMARC® module standard (Smart Mobility ARChitecture) has become the best and most future-proof standard for small Form Factor embedded modules. With 314 pins available on its inexpensive and robust MXM3 connector, SMARC® has ample space for proven and popular interfaces. In the new standard revision, PCIe now features four lanes instead of 3, USB now covers up to 2x USB 3.0 and up to 6x USB 2.0 interfaces, LVDS now supports two independent dual-channel connections which alternatively can be used for embedded DisplayPort (eDP) or for DSI, two Gigabit Ethernet ports are now supported, Audio has independent HDA and I2S ports and up to 4 UARTs are available. In addition to SPI, eSPI is supported for the attachment of peripheral devices on the baseboard or application hardware. And there are still plenty of reserved pins left for future upgrades. Never before has it been so easy and natural to use Arm®-based and x86-based computer modules on a modern and up-to-date module standard.




SMARC® 2.0/2.1.1 Properties




The SMARC® 2.0/2.1.1 Standard uses the inexpensive MXM-3 connector which provides 314 pin connections. The connector is robust and proven, and there are versions available which are certified for automotive use. The edge contacts enable a low-resistance high-speed contact, which is usable even for advanced signal speed up to Gigabit Ethernet, PCI-Express and SATA. The Standard defines two Module sizes: 82mm x 50mm (short size) and 82mm x 80mm (full size).








SMARC® MODULE OVERVIEW

Specs	MSC SM2S-RYZ2	MSC SM2S-RYZ	MSC SM2S-ALN
Technology	x86	x86	x86
			
Form Factor	SMARC® 2.1.1, Dimension: 82 mm x 50 mm	SMARC® 2.1.1, Dimension: 82 mm x 50 mm	SMARC® 2.1.1, Dimension: 82 mm x 50 mm
CPU	AMD Ryzen™ Embedded - R2514 , QC (8 threads) 2.1–3.7GHz, 15W (12–35W) - R2314 , QC (4 threads) 2.1–3.5GHz, 15W (12–35W) - R2312 , DC (4 threads) 2.7–3.5GHz, 15W (12–25W)	AMD Ryzen™ Embedded - V1404I , QC (8 threads) 2.0–3.6GHz, 15W (12–25W) - R1606G , DC (4 threads) 2.6–3.5GHz, 15W (12–25W) - R1505G , DC (4 threads) 2.4–3.3GHz, 15W (12–25W) - R1305G , DC (4 threads) 1.5–2.8GHz, 8W (8–10W) - R1102G , DC (2 threads) 1.2/2.6GHz, 6W	Intel® Core™ Processor - i3-N305 , QC, 1.0GHz–1.8GHz, 32EU, 9–15W, PC Client Intel Atom® Processor - x7425E , QC, 1.5GHz, 24EU, TCC, IBECC, 12W, Emb. - x7213E , DC, 1.7GHz, 16EU, TCC, IBECC, 10W, Emb. - x7211E , DC, 1.0GHz, 16EU, TCC, IBECC, 6W, Emb. Intel® Celeron® Processor - N200 , QC, 1.0GHz, 32EU, 6W, PC Client - N97 , QC, 2.0GHz, 24EU, 12W, PC Client - N50 , DC, 1.0GHz, 16EU, 6W, PC Client
DRAM	Up to 8GB 2667MT/s DDR4 (2400MT/s with R2312)	Up to 8GB 2400MT/s DDR4	Up to 16GB LPDDR5 with up to 4.800 MT/s, IBECC (only Atom SKU's), soldered
Flash	Up to 256GB eMMC V5.0 Flash, soldered (optional)	Up to 256GB eMMC V5.0 Flash, soldered (optional)	Up to 256GB eMMC V5.1 Flash, soldered (optional)
Storage Interfaces	1x SATA-III 6Gbps	1x SATA-III 6Gbps	1x SATA-III 6Gbps
USB	4x USB 2.0 2x USB 3.1	2x USB 3.0 4x USB 2.0	2x USB 3.2 Gen2 (up to 10Gb/s) 6x USB 2.0
Bus Interfaces	Up to 4x PCI-Express Gen. 3 lanes (PCIe x2 and 2x PCIe x1 or PCIe x2) 1x I2C Bus 1x SPI Bus 1x SMBus	Up to 4x PCI-Express Gen. 3 lanes (PCIe x2 and 2x PCIe x1 or PCIe x2) 1x I2C Bus 1x SPI Bus 1x SMBus	Up to 4x PCI-Express® x1 Gen. 3 1x I2C Bus, 1x SMBus 1x SPI Bus (Boot) 1x SPI Bus (general purpose)/ eSPI (optional)
Display Controller	AMD Radeon™ GPU with up to 8 Compute Units	AMD Vega GPU	Integrated Intel® UHD Graphics Gen. 12
Display Interfaces	2x DP++ Dual-channel LVDS interface, 18 or 24 Bit (optional up to 2 x eDP 1.4)	2x DP++ Dual-channel LVDS interface, 18 or 24 Bit (optional up to 2 x eDP 1.4)	2x DP++ Dual-Channel LVDS interface, 18 or 24 Bit (optional eDP 1.4b or MIPI-DSI)
Network Interface	Up to 2x 10/100/1000Base-T	Up to 2x 10/100/1000Base-T	2x 10/100/1000Base-T, up to 2.5G based on Intel i226 1x SGMII Interface on PCIe-D (opt. only Atom SKU's)
Audio Interface	HDA Audio	HDA Audio	HDA and I2S or 2x I2S Audio
Security Device	Trusted Platform Module (TPM) 2.0 (optional)	Trusted Platform Module (TPM) 2.0 (optional)	Trusted Platform Module (TPM) 2.0 (optional)
OS Support	Microsoft Windows® 10 IoT (64bit) Linux® (Yocto Project®) EAPI (HW Programming Interface)	Microsoft Windows® 10 IoT (64bit) Linux® (Yocto Project®) EAPI (HW Programming Interface)	Microsoft Windows® 10 IoT (64bit) Linux® (Yocto Project®) EAPI (HW Programming Interface)
Power Requirements	Voltage: +5V +/-5%, 5V Standby Power Consumption: 12–15 W typ.	Voltage: +5V +/-5%, 5V Standby Power Consumption: 6–15 W typ.	Voltage: +5V +/-5%, 5V Standby Power Consumption: 8–17W typ.
Operating Temp.	0° ... 60°C (commercial)	0° ... 60°C (commercial) -40° ... 85°C (industrial) only with V1404I CPU	0° ... 60°C (commercial)
Humidity	5 ... 95% (operating, non-cond.), 5 ... 95% (storage, non-cond.)		




MSC SM2S-ASL	MSC SM2S-EL	MSC SM2S-AL
x86	x86	x86
		
SMARC® 2.1.1, Dimension: 82 mm x 50 mm	SMARC® 2.1.1, Dimension: 82 mm x 50 mm	SMARC® 2.0, Dimension: 82 mm x 50 mm
Intel Atom® Processor - x7835RE , QC, 1.3GHz, 32EU, TCC, IBECC, 12W, Ind. - x7433RE , QC, 1.5GHz, 32EU, TCC, IBECC, 9W, Ind. - x7213RE , DC, 2.0GHz, 16EU, TCC, IBECC, 9W, Ind. - x7211RE , DC, 1.0GHz, 16EU, TCC, IBECC, 6W, Ind. - x7405C , QC, 2.2GHz, no GPU, TCC, IBECC, 12W, emb. - x7203C , DC, 2.0GHz, no GPU, TCC, IBECC, 9W, emb. Note: base frequency shown, other frequencies supported	Intel Atom® Processor - x6425RE , QC, 1.9GHz, 32EU, TCC, IBECC, 12W, Ind. - x6414RE , QC, 1.5GHz, 16EU, TCC, IBECC, 9W, Ind. - x6212RE , DC, 1.2GHz, 16EU, TCC, IBECC, 6W, Ind. - x6425E , QC, 2.0-3.0GHz, 32EU, IBECC, 12W, Emb. - x6413E , QC, 1.5-3.0GHz, 16EU, IBECC, 9W, Emb. - x6211E , DC, 1.3-3.0GHz, 16EU, IBECC, 6W, Emb. Intel® Pentium® Processor - J6426 , QC, 2.0-3.0GHz, 32EU, 10W, PC Client - N6415 , QC, 1.2-3.0GHz, 16EU, 6.5W, PC Client Intel® Celeron® Processor - J6413 , QC, 1.8-3.0GHz, 16EU, 10W, PC Client - N6211 , QC, 1.2-3.0GHz, 16EU, 6.5W, PC Client	Intel Atom® Processor - E3950 , QC, 1.6-2.0GHz, 18 EU, 12W - E3940 , QC, 1.6-1.8GHz, 12 EU, 9.5W - E3930 , DC, 1.3-1.8GHz, 12 EU, 6.5W Intel® Pentium® N4200 , QC, 1.1-2.5GHz, 18 EU, 6W Intel® Celeron® N3350 , DC, 1.1-2.4GHz, 12 EU, 6W
Up to 16GB LPDDR5 with up to 4.800 MT/s, IBECC, soldered	Up to 16GB LPDDR4x with up to 4.267MT/s, IBECC (only Atom SKU's), soldered	Up to 8GB 2400MT/s LPDDR4, quad-channel, soldered
Up to 256GB eMMC V5.1 Flash, soldered (optional)	Up to 256GB eMMC V5.1 Flash, soldered (optional)	Up to 64GB eMMC V5.x Flash, soldered (optional)
1x SATA-III 6Gbps	1x SATA-III 6Gbps 1x SD 3.01/SDIO 3.0	1x SATA-III 6Gbps 1x SD 3.01
2x USB 3.2 Gen2 (up to 10Gb/s) 6x USB 2.0	2x USB 3.1 (1x Host/Device) 6x USB 2.0 (1x Host/Device)	2x USB 3.0 6x USB 2.0 (1x Host/Device)
Up to 4x PCI-Express® x1 Gen. 3 1x I2C Bus, 1x SMBus 1x SPI Bus (Boot) 1x SPI Bus (general purpose)/ eSPI (optional)	Up to 4x PCI-Express® x1 Gen. 3 1x I2C Bus, 1x SMBus 1x SPI Bus (Boot) 1x SPI Bus (general purpose)/ eSPI (optional) 2x CAN-FD (Flexible Data-Rate)	Up to 4x PCI-Express® x1 Gen. 2 1x I2C Bus, 1x SMBus 2x SPI Bus (Boot/SIO)
Integrated Intel® UHD Graphics Gen. 12 (only Atom x7000RE Series)	Integrated Intel® UHD Graphics Gen. 11	Integrated Intel® HD Graphics Gen. 9
2x DP++ Dual-Channel LVDS interface, 18 or 24 Bit (optional eDP 1.4b or MIPI-DSI)	2x DP++ Dual-Channel LVDS interface, 18 or 24 Bit (optional eDP 1.3 or MIPI-DSI)	2x DP++ Dual-Channel LVDS interface, 18 or 24 Bit (optional eDP 1.3 or MIPI-DSI)
2x 10/100/1000Base-T, up to 2.5G based on Intel i226 1x SGMII Interface (up to 2.5Gbps) on PCIE-D (only Atom x7000RE Series)	2x 10/100/1000Base-T 1x SGMII Interface on PCIE-D (opt.)	Up to 2x 10/100/1000Base-T
HDA and I2S or 2x I2S Audio	HDA and I2S or 2x I2S Audio	HDA and I2S Audio
Trusted Platform Module (TPM) 2.0 (optional)	Trusted Platform Module (TPM) 2.0 (optional)	Trusted Platform Module (TPM) 2.0 (optional)
Microsoft Windows® 10 IoT (64bit) Linux® (Yocto Project®) EAPI (HW Programming Interface)	Microsoft Windows® 10 IoT (64bit) Linux® (Yocto Project®) EAPI (HW Programming Interface)	Microsoft Windows® 10 IoT (64bit) Linux® (Yocto Project®) EAPI (HW Programming Interface)
Voltage: +5V +/-5%, 5V Standby Power Consumption: 8-17W typ.	Voltage: +5V +/-5%, 5V Standby Power Consumption: 6-15W typ.	Voltage: +5V +/-5%, 5V Standby Power Consumption: 7-14 W typ.
0° ... 60°C (commercial) Atom x7000C Series -25°C ... 85°C (extended) -40° ... 85°C (industrial)	0° ... 60°C (commercial) -25°C ... 85°C (extended) -40° ... 85°C (industrial)	0° ... 60°C (commercial) -25°C ... 85°C (extended) -40° ... 85°C (industrial)
	5 ... 95% (operating, non-cond.), 5 ... 95% (storage, non-cond.)	



SMARC® MODULE OVERVIEW




Specs	MSC SM2S-IMX95	MSC SM2S-IMX93	MSC SM2S-IMX91
Technology	Arm®	Arm®	Arm®
			
Form Factor	SMARC® 2.1.1, Dimension: 82 mm x 50 mm	SMARC® 2.1.1, Dimension: 82 mm x 50 mm	SMARC® 2.1.1, Dimension: 82 mm x 50 mm
CPU	<p>NXP® i.MX 95 Arm® Cortex®-A55 Applications Processor</p> <ul style="list-style-type: none"> - i.MX 95x6, hexa-core, 1.6 - 2.0GHz - i.MX 95x4, quad-core, 1.6 - 2.0GHz - i.MX 95x2, dual-core, 1.6 - 2.0GHz <p>different versions with options for ISP, NPU, GPU, VPU, Display Controller, 10GbE</p> <p>Arm® Cortex®-M7 Real Time Processor at 800MHz Arm® Cortex®-M33 Real Time Processor at 333MHz NXP eIQ® Neutron NPU with 2.0 TOPS/s</p>	<p>NXP® i.MX 93 Arm® Cortex®-A55 Applications Processor</p> <ul style="list-style-type: none"> - i.MX 9352, dual-core, NPU, 1.5 - 1.7GHz - i.MX 9332, dual-core, 1.5 - 1.7GHz - i.MX 9351, single-core, NPU, 1.5 - 1.7GHz - i.MX 9331, single-core, 1.5 - 1.7GHz <p>Arm® Cortex®-M33 Real Time Processor at 250MHz Arm® Ethos-U65 microNPU with 256 MACs/Cycle</p>	<p>NXP® i.MX 91 Arm® Cortex®-A55 Applications Processor</p> <ul style="list-style-type: none"> - i.MX 9131, single-core, 1.4GHz
DRAM	Up to 16GB 6400MT/s LPDDR5 SDRAM, soldered, inline ECC support	Up to 2GB 3700MT/s LPDDR4 SDRAM, soldered, inline ECC support	Up to 2GB 2400MT/s LPDDR4 SDRAM, soldered, inline ECC support
Flash	Flash Up to 256GB eMMC Flash	Flash Up to 256GB eMMC Flash	Flash Up to 256GB eMMC Flash
Storage Interfaces	1x MMC/SD/SDIO	1x MMC/SD/SDIO	1x MMC/SD/SDIO
USB	1x USB 2.0 Host/Client, 1x USB 3.0 Host or 1x USB 2.0 Host/Client, 2x USB 2.0 Host, 2x USB 3.0 (optional)	1x USB 2.0 Host/Client, 4x USB 2.0 Host or 1x USB 2.0 Host/Client, 1x USB 2.0 Host (optional)	1x USB 2.0 Host/Client, 4x USB 2.0 Host or 1x USB 2.0 Host/Client, 1x USB 2.0 Host (optional)
Bus Interfaces	2x PCI Express® x1 Gen. 3 5x I2C up to 400 Kbit/s 2x SPI (with two chip selects) 2x CAN-FD / CAN 2.0B	4x I2C up to 400 Kbit/s 2x SPI (with two chip selects) 2x CAN-FD / CAN 2.0B	4x I2C up to 400 Kbit/s 2x SPI (with two chip selects) 2x CAN-FD / CAN 2.0B
Display Controller	Arm Mali Graphics Processing Unit	Pixel processing pipeline (PXP) engine	not available
Display Interfaces	Dual-channel LVDS interface, 18 or 24 bit or 1x MIPI-DSI and 1x single channel LVDS 1x HDMI (optional)	Single-channel LVDS interface, 18 or 24 bit or 1x MIPI-DSI	not available
Network Interface	2x 10/100/1000BASE-T Ethernet 10 Gigabit Ethernet (SerDes, optional) WIFI/BT module (optional)	2x 10/100/1000BASE-T Ethernet WIFI/BT module (optional)	2x 10/100/1000BASE-T Ethernet WIFI/BT module (optional)
Audio Interface	2x I2S Audio	2x I2S Audio	1x I2S Audio
Security Device	Advanced security, safety, and reliability integrated in the SOC	Advanced security, safety, and reliability integrated in the SOC	Advanced security, safety, and reliability integrated in the SOC
OS Support	Linux® Board Support Package Android Board Support Package (on request)	Linux® Board Support Package Android Board Support Package (on request)	Linux® Board Support Package Android Board Support Package (on request)
Power Requirements	Voltage: +5V +/-5%, 5V Standby Power Consumption: 8-10 W typ.	Voltage: +5V +/-5%, 5V Standby Power Consumption: 2-4 W typ.	Voltage: +5V +/-5%, 5V Standby Power Consumption: 2-3 W typ.
Operating Temp.	0° ... 70°C (commercial) -25° ... 85°C (extended) -40° ... 85°C (industrial)	0° ... 70°C (commercial) -25° ... 85°C (extended) -40° ... 85°C (industrial)	0° ... 70°C (commercial) -25° ... 85°C (extended) -40° ... 85°C (industrial)
Humidity	5 ... 95% (operating, non-cond.), 5 ... 95% (storage, non-cond.)		




*Qualcomm branded products are products of Qualcomm Technologies, Inc. and/or its subsidiaries.

MSC SM2S-QCS6490	MSC SM2S-QCS5430	MSC SM2S-ZUSP
Arm®	Arm®	Arm®
		
SMARC® 2.1.1 Dimension: 82 mm x 50 mm	SMARC® 2.1.1 Dimension: 82 mm x 50 mm	SMARC® 2.0, Dimension: 82 mm x 50 mm
Qualcomm® QCS6490: 1x A78@2.7GHz, 3x A78@2.4GHz, 4xA55@1.95GHz 2x HVX, 4K-HMX 1.45GHz (12.15 INT8 TOPS)	Qualcomm® QCS5430: 2x A78@2.1GHz, 4xA55@1.8GHz 2x HVX, 4K-HMX 1.45GHz (3.5 INT8 TOPS)	Xilinx® Zynq® UltraScale+™ MPSoC - ZU2CG, ZU3CG, ZU4CG or ZU5CG - Dual core Arm® Cortex®-A53 Processor up to 1.3GHz - Dual core Arm® Cortex®-R5 Processor up to 533MHz - ZU2EG, ZU3EG, ZU4EG, ZU5EG, ZU4EV or ZU5EV - Quad core Arm® Cortex®-A53 Processor up to 1.5GHz - Dual core Arm® Cortex®-R5 Processor up to 600MHz
-	-	Up to 8GB DDR4-2400, soldered, PS-DDR4, ECC (optional) Up to 2GB DDR4-2133, soldered, PL-DDR4 (optional)
Up to 16GB 6400MT/s LPDDR5 SDRAM, soldered, non ECC	Up to 16GB 6400MT/s LPDDR5 SDRAM, soldered, non ECC	Up to 64GB eMMC Flash, QSPI NOR Boot Flash
UFS (onboard) NVME (carrier) SD-Card (carrier)	UFS (onboard) NVME (carrier) SD-Card (carrier)	1x SATA-III (6Gbps) 1x MMC/SD/SDIO
2x USB 3.1 Host interfaces 5x USB 2.0 Host interfaces	2x USB 3.1 Host interfaces 5x USB 2.0 Host interfaces	1x USB 3.0/2.0 Host, 3x USB 2.0 Host, 1x USB 2.0 Host/Client or 1x USB 3.0/2.0 Host, 2x USB 2.0 Host, 1x USB 2.0 Host/Client or 1x USB 3.0 Host, 1x USB 2.0 Host, 1x USB 2.0 Host/Client
Up to 4x PCI-Express x1 Gen. 3 5x I²C (1x general, 2x CAM, 1x LCD, 1x PM) 2x SPI Bus 1x SDIO 2x CAN2.0-FD	Up to 4x PCI-Express x1 Gen. 3 5x I²C (1x general, 2x CAM, 1x LCD, 1x PM) 2x SPI Bus 1x SDIO 2x CAN2.0-FD	1x PCI Express® x1 Gen. 2 (5Gbps) using ZU2/3 devices 2x PCI Express® x2 Gen. 3 (8Gbps) using ZU4/5 devices 3x I2C up to 400 Kbit/s 2x SPI (with two chip selects) 2x CAN 2.0B
Adreno 643 GPU @ up to 812MHz	Adreno 642L GPU @ up to 315MHz	Arm® Mali™-400 MP2 GPU (EG/EV only)
MIPI-DSI 4 - lane / Display FHD+ @144Hz LVDS (optional instead of MIPI-DSI) 1920x1200 WUXGA 60Hz DP 1.4 (2 lane), eDP/DP (4 lane)	MIPI-DSI 4 - lane / Display FHD+ @120Hz LVDS (optional instead of MIPI-DSI) 1920x1200 WUXGA 60Hz DP 1.4 (2 lane), eDP/DP (4 lane)	DP 1.2a Dual-channel LVDS interface, 18 or 24 bit (optional)
2x 10/100/1000Base-T	2x 10/100/1000Base-T	Up to 2x 10/100/1000Base-T
2x I2S Audio	2x I2S Audio	optional / WIFI/BT module (optional)
TPM 2.0 HW Key manager and ECC, Secure boot, Crypto engines, Key provisioning security, Qualcomm® Trusted Execution Environment (TEE), Qualcomm® Content Protection (Widevine), Secure camera/UI(Widevine), Secure camera/UI	TPM 2.0 HW Key manager and ECC, Secure boot, Crypto engines, Key provisioning security, Qualcomm® Trusted Execution Environment (TEE), Qualcomm® Content Protection (Widevine), Secure camera/UI(Widevine), Secure camera/UI	Integrated advanced security, safety, and reliability
Windows 11 IoT / Yocto Linux / Ubuntu Linux (on request) Android (on request)	Windows 11 IoT / Yocto Linux / Ubuntu Linux (on request) Android (on request)	Linux® (Yocto Project®) Android Board Support Package (on request)
Power Supply +5V +/-5%, 5V Standby Power Consumption 7W typ. (tbd: depending on CPU, CPU load and onboard features)	Power Supply +5V +/-5%, 5V Standby Power Consumption 5W typ. (tbd: depending on CPU, CPU load and onboard features)	Voltage: +5V +/-5%, 5V Standby Power Consumption: 5-15 W typ. (depending on MPSoC and PL)
0° ... 70°C (commercial) -30° ... 85°C (extended)	0° ... 70°C (commercial) -30° ... 85°C (extended)	0° ... 85°C (extended) -40° ... 85°C (industrial)
	5 ... 95% (operating, non-cond.), 5 ... 95% (storage, non-cond.)	






SMARC® MODULE OVERVIEW




Specs	MSC SM2S-IMX8	MSC SM2S-IMX8M	MSC SM2S-IMX8PLUS
Technology	Arm®	Arm®	Arm®
			
Form Factor	SMARC® 2.1.1, Dimension: 82 mm x 50 mm	SMARC® 2.0, Dimension: 82 mm x 50 mm	SMARC® 2.1.1, Dimension: 82 mm x 50 mm
CPU	<p>NXP® i.MX 8QuadMax Applications Processor - 2x Arm® Cortex®-A72, 4x A53, 2x M4F</p> <p>NXP™ i.MX 8QuadPlus Applications Processor - 1x Arm® Cortex®-A72, 4x A53, 2x M4F</p> <p>Arm® Cortex®-A72 with 1.3GHz (Ind.) or 1.6GHz (Auto.) Arm® Cortex®-A53 with 1.1GHz (Ind.) or 1.2GHz (Auto.) Arm® Cortex®-M4F Real Time Processor at 266MHz</p>	<p>NXP® i.MX 8M Arm® Cortex®-A53 Applications Processor - i.MX 8M Quad, quad-core, 1.3-1.5GHz - i.MX 8M Dual, dual-core, 1.3-1.5GHz - i.MX 8M QuadLite, quad-core, 1.3-1.5GHz</p> <p>Arm® Cortex®-M4 Real Time Processor at 266MHz</p>	<p>NXP® i.MX 8M Plus Arm® Cortex®-A53 Applications Processor - i.MX 8M Plus Quad: - NPU, ISP, VPU, HIFI4, CAN, 1.6 - 1.8GHz - ISP, VPU, CAN, 1.6 - 1.8GHz - i.MX 8M Plus QuadLite: CAN, 1.6 - 1.8GHz - i.MX 8M Plus Dual: NPU, ISP, VPU, HIFI4, AN, 1.6 - 1.8GHz</p> <p>Arm® Cortex®-M7 Real Time Processor at 800MHz</p>
DRAM	Up to 8GB 3200MT/s LPDDR4 SDRAM, soldered, non ECC	Up to 4GB 3200MT/s LPDDR4 SDRAM, soldered, non ECC	Up to 8GB 4000MT/s LPDDR4 SDRAM, soldered, inline ECC support
Flash	Up to 64GB eMMC Flash, QSPI NOR Flash (optional)	Up to 64GB eMMC Flash, QSPI NOR Flash (optional)	Up to 256GB eMMC Flash, QSPI NOR Flash (optional)
Storage Interfaces	1x SATA-III 6Gbps 1x MMC/SD/SDIO	1x MMC/SD/SDIO	1x MMC/SD/SDIO
USB	1x USB 2.0 Host/Client, 2x USB 2.0 Host, 2x USB 3.0 Host or 1x USB 2.0 Host/Client, 1x USB 2.0 Host	1x USB 2.0 Host/Client, 2x USB 2.0 Host, 2x USB 3.0 Host or 1x USB 2.0 Host/Client, 1x USB 2.0 Host, 2x USB 3.0 Host or 1x USB 2.0 Host/Client, 1x USB 2.0 Host	1x USB 2.0 Host/Client, 2x USB 2.0 Host, 2x USB3.0 Host or 1x USB 3.0 Host/Client, 3x USB 2.0 Host, 1x USB3.0 Host or 1x USB 2.0 Host/Client, 1x USB 2.0 Host
Bus Interfaces	2x PCI Express® x1 Gen. 3 6x I2C up to 400 Kbit/s 2x SPI (with two chip selects) 2x CAN-FD / 2.0B	2x PCI Express® x1 Gen. 2 6x I2C up to 400 Kbit/s Up to 2x SPI (with two chip selects) Up to 2x CAN 2.0B (optional)	1x PCI Express® x1 Gen. 3 5x I2C up to 320 Kbit/s 2x SPI (with two chip selects) 2x CAN-FD / 2.0B
Display Controller	Dual GC7000Lite/XSVX 3D GPU	Vivante GC7000Lite 3D GPU	Vivante GC7000UL 2D/3D GPU
Display Interfaces	Dual-channel LVDS interface, 18 or 24 bit or 2x single-channel LVDS interface or 2x MIPI-DSI HDMI 2.0a or DP 1.3	Dual-channel LVDS interface, 18 or 24 bit or 1x MIPI-DSI HDMI 2.0a or DP 1.3	Dual-channel LVDS interface, 18 or 24 bit or 2x single-channel LVDS interface or 1x MIPI-DSI and 1x single channel LVDS 1x HDMI
Network Interface	2x 10/100/1000BASE-T WIFI/BT module (optional)	1x 10/100/1000BASE-T WIFI/BT module (optional)	2x 10/100/1000BASE-T Ethernet WIFI/BT module (optional)
Audio Interface	2x I2S Audio	2x I2S Audio	2x I2S Audio
Security Device	Integrated advanced security, safety, and reliability	Integrated advanced security, safety, and reliability	Integrated advanced security, safety, and reliability
OS Support	Linux® (Yocto Project®) Android Board Support Package (on request)	Linux® (Yocto Project®) Android Board Support Package (on request)	Linux® (Yocto Project®) Android Board Support Package
Power Requirements	Voltage: +5V +/-5%, 5V Standby Power Consumption: 7-14 W typ.	Voltage: +5V +/-5%, 5V Standby Power Consumption: 3-6 W typ.	Voltage: +5V +/-5%, 5V Standby Power Consumption: 2-7 W typ.
Operating Temp.	0° ... 70°C (commercial) -40° ... 85°C (industrial)	0° ... 70°C (commercial) -40° ... 85°C (industrial)	0° ... 70°C (commercial) -25° ... 85°C (extended) -40° ... 85°C (industrial)
Humidity	5 ... 95% (operating, non-cond.), 5 ... 95% (storage, non-cond.)		

MSC SM2S-IMX8MINI	MSC SM2S-IMX8NANO	MSC SM2S-IMX8ULP
Arm®	Arm®	Arm®
		
SMARC® 2.0, Dimension: 82 mm x 50 mm	SMARC® 2.1.1, Dimension: 82 mm x 50 mm	SMARC® 2.1.1, Dimension: 82 mm x 50 mm
<p>NXP® i.MX 8M Mini Arm® Cortex®-A53 Applications Processor</p> <ul style="list-style-type: none"> - i.MX 8M Mini Solo, single-core, 1.6-1.8GHz - i.MX 8M Mini Dual, dual-core, 1.6-1.8GHz - i.MX 8M Mini Quad, quad-core, 1.6-1.8GHz - i.MX 8M Mini SoloLite, single-core, 1.6-1.8GHz - i.MX 8M Mini DualLite, dual-core, 1.6-1.8GHz - i.MX 8M Mini QuadLite, quad-core, 1.6-1.8GHz <p>Arm® Cortex®-M4 Real Time Processor at 400MHz</p>	<p>NXP® i.MX 8M Nano Arm® Cortex®-A53 Applications Processor</p> <ul style="list-style-type: none"> - i.MX 8M Nano Solo, single-core, 1.4 - 1.5GHz - i.MX 8M Nano Dual, dual-core, 1.4 - 1.5GHz - i.MX 8M Nano Quad, quad-core, 1.4 - 1.5GHz - i.MX 8M Nano SoloLite, single-core, 1.4 - 1.5GHz - i.MX 8M Nano DualLite, dual-core, 1.4 - 1.5GHz - i.MX 8M Nano QuadLite, quad-core, 1.4 - 1.5GHz <p>Arm® Cortex®-M7 Real Time Processor at 750MHz</p>	<p>NXP® i.MX 8ULP Arm® Cortex®-A35 Applications Processor</p> <ul style="list-style-type: none"> - i.MX 8ULP Dual, dual-core, 800MHz - 1.0GHz - i.MX 8ULP Solo, single-core, 800MHz - 1.0GHz - i.MX 8ULP SoloLite, single-core, 800MHz - 1.0GHz <p>Arm® Cortex®-M33 Real Time Processor at 216MHz</p>
Up to 4GB 3000MT/s LPDDR4 SDRAM, soldered, non ECC	Up to 2GB 2400MT/s DDR4 SDRAM, soldered, non ECC	Up to 2GB 2400MT/s LPDDR4x SDRAM, soldered, non ECC
Up to 64GB eMMC Flash, QSPI NOR Flash (optional)	Up to 256GB eMMC Flash, QSPI NOR Flash (optional)	Up to 256GB eMMC Flash, QSPI NOR/NAND Flash
1x MMC/SD/SDIO 1x Micro SD Card Socket (optional)	1x MMC/SD/SDIO	1x MMC/SD/SDIO
1x USB 2.0 Host/Client, 4x USB 2.0 Host or 1x USB 2.0 Host/Client, 1x USB 2.0 Host	4x USB 2.0 Host or 1x USB 2.0 Host/Client	1x USB 2.0 Host/Client, 4x USB 2.0 Host or 1x USB 2.0 Host/Client, 1x USB 2.0 Host
1x PCI Express® x1 Gen. 2 4x I2C up to 400 Kbit/s Up to 2x SPI (with two chip selects) Up to 2x CAN 2.0B (optional)	4x I2C up to 400 Kbit/s 2x SPI (with two chip selects)	4x I2C up to 400 Kbit/s 2x SPI (with two chip selects) 1x CAN-FD / 2.0B
Vivante GC NanoUltra 3D GPU	Vivante GC7000UL 3D GPU	Vivante GC NanoUltra 3D GPU
Dual-channel LVDS interface, 18 or 24 bit or 1x MIPI-DSI	Dual-channel LVDS interface, 18 or 24 bit or 1x MIPI-DSI	Dual-channel LVDS interface, 18 or 24 bit or 1x MIPI-DSI
Up to 2x 10/100/1000BASE-T WIFI/BT module (optional)	1x 10/100/1000BASE-T Ethernet	1x 10/100BASE-T Ethernet WIFI/BT module (optional)
2x I2S Audio	1x I2S Audio	2x I2S Audio
Integrated advanced security, safety, and reliability	Integrated advanced security, safety, and reliability	Integrated advanced security, safety, and reliability
Linux® (Yocto Project®) Android Board Support Package	Linux® (Yocto Project®) Android Board Support Package	Linux® (Yocto Project®) Microsoft Azure Sphere (on request) Android Board Support Package (on request)
Voltage: +5V +/-5%, 5V Standby Power Consumption: 2-5 W typ.	Voltage: +5V +/-5%, 5V Standby Power Consumption: 2-4 W typ.	Voltage: 3V - 5,25V, 5V Standby Power Consumption: 1-3 W typ.
0° ... 70°C (commercial) -25°C ... 85°C (extended) -40° ... 85°C (industrial)	0° ... 70°C (commercial) -25° ... 85°C (extended) -40° ... 85°C (industrial)	0° ... 70°C (commercial) -25° ... 85°C (extended) -40° ... 85°C (industrial)
	5 ... 95% (operating, non-cond.), 5 ... 95% (storage, non-cond.)	

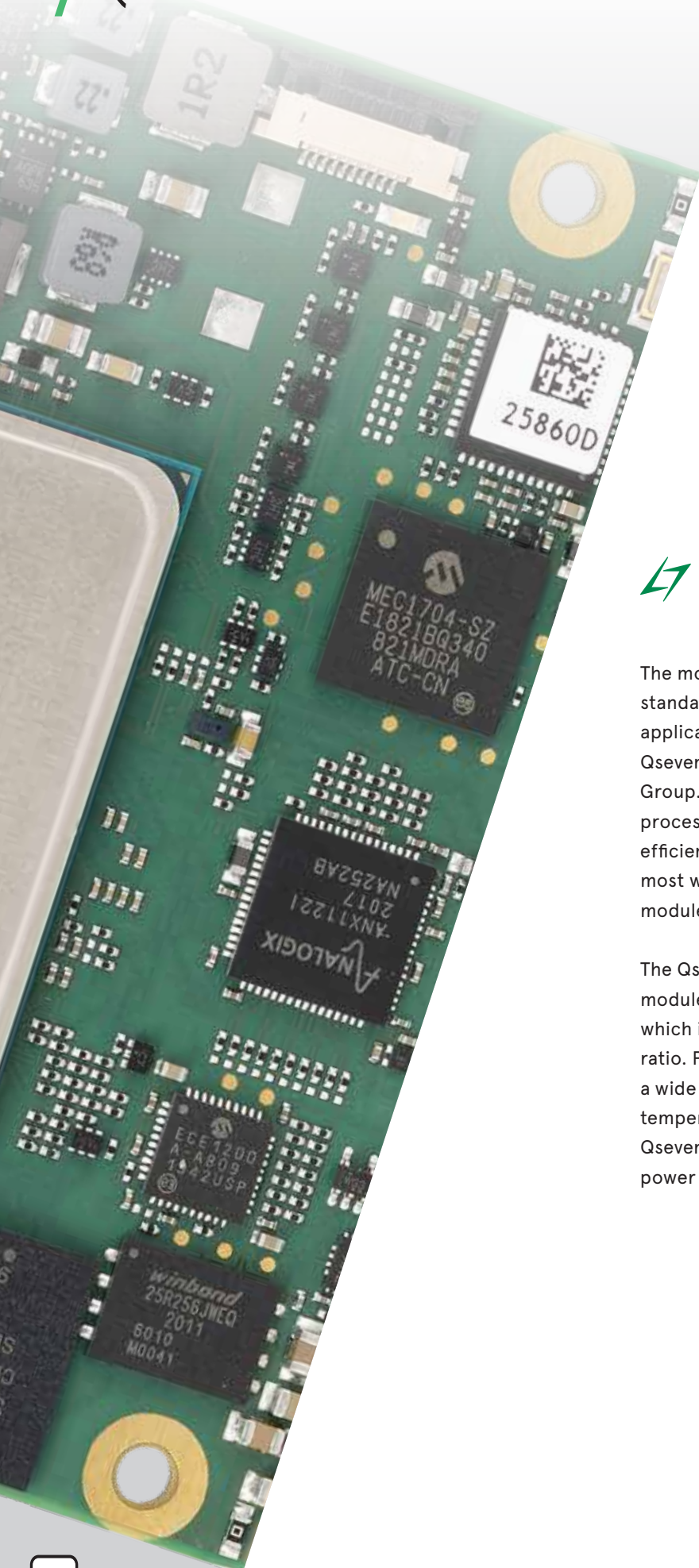


SMARC® MODULE OVERVIEW

Specs	MSC SM2S-V2L	MSC SM2S-G2L	MSC SM2S-G2UL
Technology	Arm®	Arm®	Arm®
			
Form Factor	SMARC® 2.1.1, Dimension: 82 mm x 50 mm	SMARC® 2.1.1, Dimension: 82 mm x 50 mm	SMARC® 2.1.1, Dimension: 82 mm x 50 mm
CPU	Renesas RZ/V2L family <ul style="list-style-type: none"> - Single Core Arm® Cortex®-A55 at 1.2GHz, secure - Single Core Arm® Cortex®-A55 at 1.2GHz, non-secure - Dual Core Arm® Cortex®-A55 at 1.2GHz, secure - Dual Core Arm® Cortex®-A55 at 1.2GHz, non-secure Arm® Cortex®-M33 Real Time Processor at 200MHz Embedded DRP-AI (Dedicated AI-Accelerator)	Renesas RZ/G2L family <ul style="list-style-type: none"> - Single Core Arm® Cortex®-A55 at 1.2GHz, secure - Single Core Arm® Cortex®-A55 at 1.2GHz, non-secure - Dual Core Arm® Cortex®-A55 at 1.2GHz, secure - Dual Core Arm® Cortex®-A55 at 1.2GHz, non-secure Arm® Cortex®-M33 Real Time Processor at 200MHz	Renesas RZ/G2UL Arm® Cortex®-A55 Microprocessor <ul style="list-style-type: none"> - Single Core, 1.0GHz, secure - Single Core, 1.0GHz, non-secure Arm® Cortex® M33 Real Time Processor at 200MHz
DRAM	Up to 2GB 1600MT/s DDR4 SDRAM, soldered, inline ECC support	Up to 2GB 1600MT/s DDR4 SDRAM, soldered, inline ECC support	Up to 2GB 1600MT/s DDR4 SDRAM, soldered, inline ECC support
Flash	Up to 256GB eMMC Flash	Up to 256GB eMMC Flash	Up to 256GB eMMC Flash
Storage Interfaces	1x MMC/SD/SDIO (optional, SDIO and WIFI/BT are mutually exclusive)	1x MMC/SD/SDIO (optional, SDIO and WIFI/BT are mutually exclusive)	1x MMC/SD/SDIO
USB	1x USB 2.0 Host/Client, 4x USB 2.0 Host or 1x USB 2.0 Host/Client, 1x USB 2.0 Host (optional)	1x USB 2.0 Host/Client, 4x USB 2.0 Host or 1x USB 2.0 Host/Client, 1x USB 2.0 Host (optional)	1x USB 2.0 Host/Client, 4x USB 2.0 Host or 1x USB 2.0 Host/Client, 1x USB 2.0 Host (optional)
Bus Interfaces	4x I2C up to 400 Kbit/s 2x SPI (with two chip selects) 2x CAN-FD	4x I2C up to 400 Kbit/s 2x SPI (with two chip selects) 2x CAN-FD	4x I2C up to 400 Kbit/s 2x SPI (with two chip selects) 1x CAN-FD or 2x CAN-FD (optional)
Display Controller	Arm Mali-G31 multimedia 2D/3D GPU Video Codec with H.264 support	Arm Mali-G31 multimedia 2D/3D GPU Video Codec with H.264 support	Image Processing Unit to support simple HMI graphics
Display Interfaces	Dual-channel LVDS interface, 18 or 24 bit or 1x MIPI-DSI	Dual-channel LVDS interface, 18 or 24 bit or 1x MIPI-DSI	Dual-channel LVDS interface, 18 or 24 bit; also usable as one single-channel LVDS interface
Network Interface	2x 10/100/1000BASE-T Ethernet WIFI/BT module (optional)	2x 10/100/1000BASE-T Ethernet WIFI/BT module (optional)	1x 10/100/1000BASE-T Ethernet WIFI/BT module (optional)
Audio Interface	2x I2S Audio	2x I2S Audio	1x I2S Audio or 2x I2S Audio (optional)
Security Device	Advanced security, safety, and reliability integrated in the SOC Trusted Platform Module (TPM) 2.0 (optional)	Advanced security, safety, and reliability integrated in the SOC Trusted Platform Module (TPM) 2.0 (optional)	Advanced security, safety, and reliability integrated in the SOC Trusted Platform Module (TPM) 2.0 (optional)
OS Support	Linux® Board Support Package Android Board Support Package (on request)	Linux® Board Support Package Android Board Support Package (on request)	Linux® Board Support Package Android Board Support Package (on request)
Power Requirements	Voltage: +5V +/-5%, 5V Standby Power Consumption: 4-6 W typ.	Voltage: +5V +/-5%, 5V Standby Power Consumption: 4-6 W typ.	Voltage: +5V +/-5%, 5V Standby Power Consumption: 3-4 W typ.
Operating Temp.	0° ... 70°C (commercial) -25° ... 85°C (extended) -40° ... 85°C (industrial)	0° ... 70°C (commercial) -25° ... 85°C (extended) -40° ... 85°C (industrial)	0° ... 70°C (commercial) -25°C ... 85°C (extended) -40° ... 85°C (industrial)
Humidity	5 ... 95% (operating, non-cond.), 5 ... 95% (storage, non-cond.)		

MSC SM2S-AM62X	MSC SM2S-IMX6	MSC SM2S-IMX6ULL
Arm®	Arm®	Arm®
		
SMARC® 2.1.1, Dimension: 82 mm x 50 mm	SMARC® 2.0, Dimension: 82 mm x 50 mm	SMARC® 2.0, Dimension: 82 mm x 50 mm
<p>Sitara AM62x Arm® Cortex®-A53 Microprocessor</p> <ul style="list-style-type: none"> - AM6254 Quad Core, 800MHz ... 1.4GHz - AM6252 Dual Core, 800MHz ... 1.4GHz - AM6251 Single Core, 800MHz ... 1.4GHz - AM6234 Quad Core w/o GPU, 800MHz ... 1.4GHz - AM6232 Dual Core w/o GPU, 800MHz ... 1.4GHz - AM6231 Single Core w/o GPU, 800MHz ... 1.4GHz <p>Arm® Cortex®-M4F Real Time Processor up to 400 MHz</p>	<p>NXP® i.MX 6 Arm® Cortex®-A9:</p> <ul style="list-style-type: none"> - i.MX 6QuadPlus, quad-core, 800MHz...1.2GHz - i.MX 6Quad, quad-core, 800MHz...1.2GHz - i.MX 6DualPlus, dual-core, 800MHz...1.2GHz - i.MX 6Dual, dual-core, 800MHz...1.2GHz - i.MX 6DualLite, dual-core, 800MHz...1.0GHz - i.MX 6Solo, single-core, 800MHz...1.0GHz 	<p>NXP® i.MX6 ULL/ULZ Arm® Cortex®-A7:</p> <ul style="list-style-type: none"> - i.MX 6ULL Base, MXIMX6Y0, at 528 MHz - i.MX 6ULL General Purpose 1, MXIMX6Y1, at 528 MHz - i.MX 6ULL General Purpose 2, MXIMX6Y2, at 528/792/900 MHz - i.MX 6ULZ Base, MXIMX6Z0, at 900 MHz
Up to 2GB 1600MT/s DDR4 SDRAM, soldered, inline ECC support	Up to 4GB DDR3L SDRAM (DDR-1066), soldered, non ECC	Up to 1GB DDR3L SDRAM (DDR-800), soldered, non ECC
Up to 256GB eMMC Flash QSPI NAND Flash (optional)	Up to 64GB eMMC Flash	Up to 64GB eMMC Flash
1x MMC/SD/SDIO	1x SATA-II (3Gbps, not supported by Solo/DualLite) 1x MMC/SD/SDIO, Micro SD Card Socket	1x MMC/SD/SDIO
1x USB 2.0 Host/Client, 4x USB 2.0 Host or 1x USB 2.0 Host/Client, 1x USB 2.0 Host (optional)	1x USB 2.0 Host/Client, 4x USB 2.0 Host or 1x USB 2.0 Host/Client, 5x USB 2.0 Host or 1x USB 2.0 Host/Client, 1x USB 2.0 Host	1x USB 2.0 Host/Client, 4x USB 2.0 Host or 1x USB 2.0 Host/Client, 1x USB 2.0 Host
4x I2C up to 400 Kbit/s 2x SPI (with two chip selects) 2x CAN-FD / CAN 2.0B	1x PCI Express® x1 5x I2C up to 400 Kbit/s 2x SPI (with two chip selects) 2x CAN 2.0B	3x I2C up to 400 Kbit/s 2x SPI (with two chip selects) 2x CAN 2.0B
Imagination AXE-1-16M Graphics Processing Unit (GPU)	Integrated Video, 2D and 3D GPU	NEON Media Processor Engine co-processor
Dual-channel LVDS interface, 18 or 24 bit; also usable as one single-channel LVDS interface	HDMI 2.0a Dual-channel LVDS interface, 18 or 24 bit Also usable as 2x single-channel LVDS interfaces	Single-channel LVDS interface, 18 or 24 bit
2x 10/100/1000BASE-T Ethernet WIFI/BT module (optional)	1x 10/100/1000BASE-T Ethernet	Up to 2x 10/100BASE-T Ethernet
2x I2S Audio	1x I2S Audio	1x I2S Audio
Advanced security, safety, and reliability integrated in the SOC Trusted Platform Module (TPM) 2.0 (optional)	Integrated advanced security, safety, and reliability Trusted Platform Module (TPM) 1.2, optional	Integrated advanced Security, Safety, and Reliability Trusted Platform Module (TPM) 2.0 (optional)
Linux® Board Support Package Android Board Support Package (on request)	Linux® (Yocto Project®) Android Board Support Package (on request)	Linux® (Yocto Project®)
Voltage: +5V +/-5%, 5V Standby Power Consumption: 2-5 W typ.	Voltage: +5V +/-5%, 5V Standby Power Consumption: 4-6 W typ.	Voltage: +5V +/-5%, 5V Standby Power Consumption: 0.5-2 W typ.
0° ... 70°C (commercial) -25°C ... 85°C (extended) -40° ... 85°C (industrial)	0° ... 70°C (commercial) -25° ... 85°C (extended) -40° ... 85°C (industrial)	0° ... 70°C (commercial) -25° ... 85°C (extended) -40° ... 85°C (industrial)
	5 ... 95% (operating, non-cond.), 5 ... 95% (storage, non-cond.)	

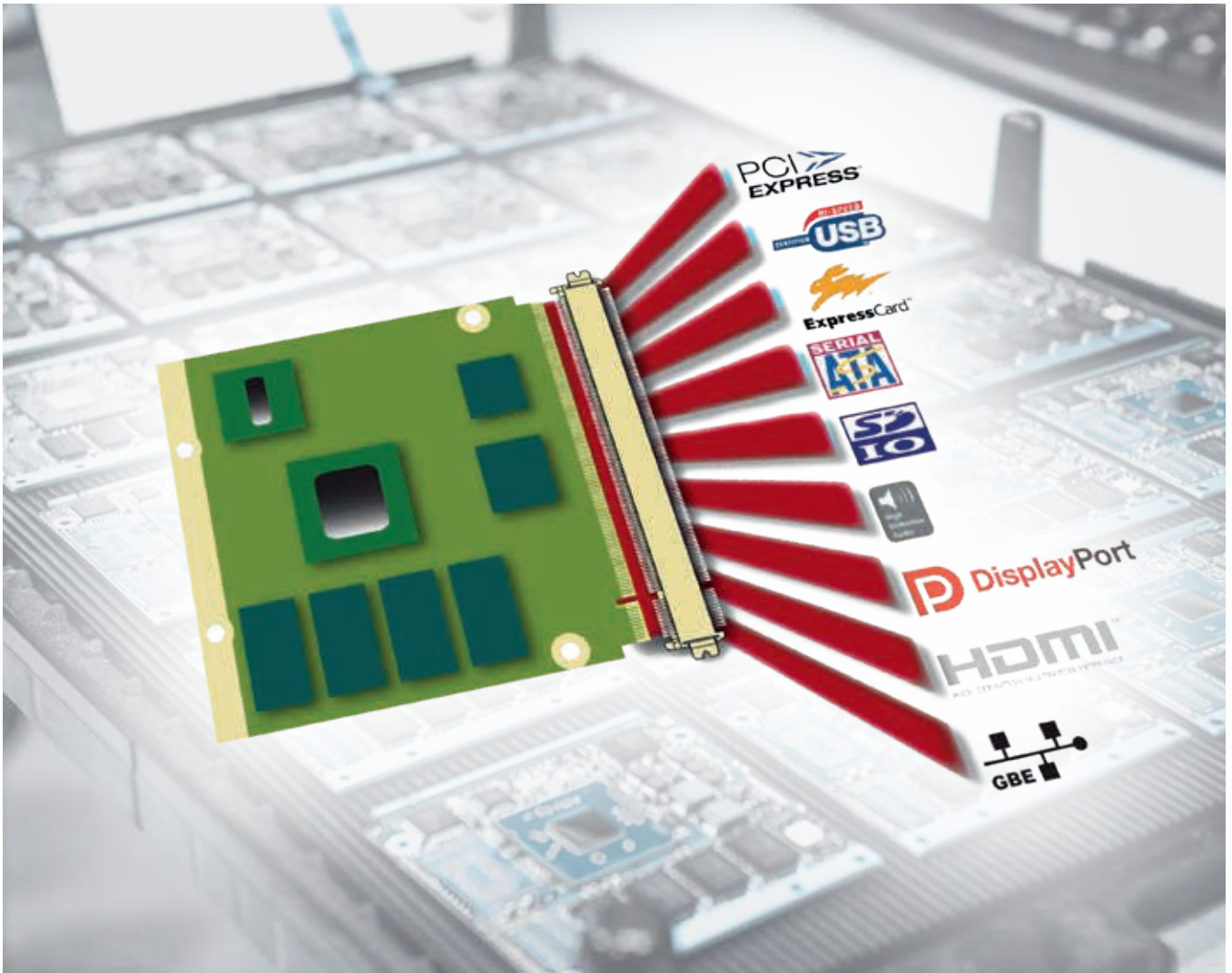




Q S E V E N

The most popular embedded Computer-On-Module standard for entry level performance and low power applications with a very attractive price performance ratio. Qseven® is an open standard of the SGeT Standardization Group. Taking advantage of the ongoing development in processor technology towards smaller and more power efficient CPUs, Qseven® has in recent years become the most widely adopted new standard for small form factor modules.

The Qseven® specification has been extended to include module architectures based on the Arm® processor which is renowned for its excellent performance to power ratio. Providing different processor architectures and a wide range of modules for commercial and extended temperature together with matching baseboards, the MSC Qseven® family leads the way to feature rich and small, low power modular systems.








Qseven® 2.0/2.1 Properties

The Qseven® Standard uses the inexpensive MXM-2 connector which provides 230 pin connections. The connector is robust and proven, and there are versions available which are certified for automotive use. The edge contacts enable a low-resistance high-speed contact which is usable even for advanced signal speed up to Gigabit Ethernet, PCI-Express and SATA.

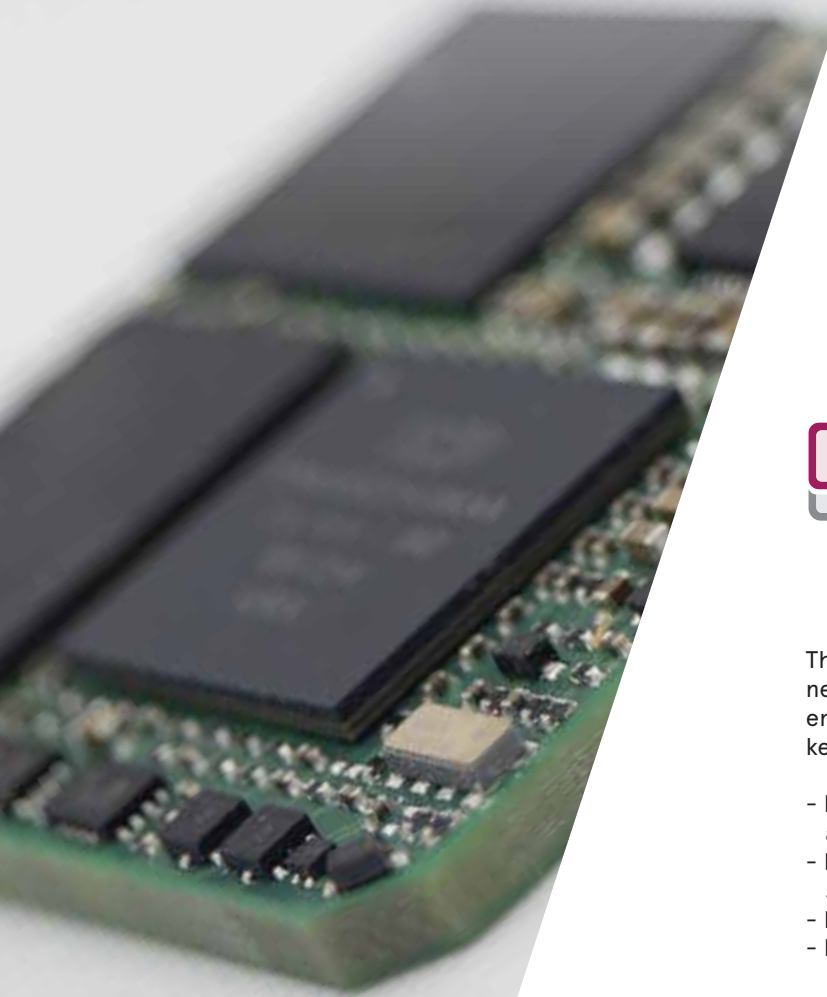


/ QSEVEN® OVERVIEW

Specs	MSC Q7-EL	MSC Q7-AL
Technology	x86	x86
		
Form Factor	Qseven® Rev. 2.1 platform, Dimension: 70 mm x 70 mm	Qseven® Rev. 2.1 platform, Dimension: 70 mm x 70 mm
CPU	Intel Atom® Processor - x6425RE , QC, 1.9GHz, 32EU, TCC, IBEC, 12W, Ind. - x6414RE , QC, 1.5GHz, 16EU, TCC, IBEC, 9W, Ind. - x6212RE , DC, 1.2GHz, 16EU, TCC, IBEC, 6W, Ind. - x6425E , QC, 2.0-3.0GHz, 32EU, IBEC, 12W, Emb. - x6413E , QC, 1.5-3.0GHz, 16EU, IBEC, 9W, Emb. - x6211E , DC, 1.3-3.0GHz, 16EU, IBEC, 6W, Emb. Intel® Pentium® Processor - J6426 , QC, 2.0-3.0GHz, 32EU, 10W, PC Client - N6415 , QC, 1.2-3.0GHz, 16EU, 6.5W, PC Client Intel® Celeron® Processor - J6413 , QC, 1.8-3.0GHz, 16EU, 10W, PC Client - N6211 , QC, 1.2-3.0GHz, 16EU, 6.5W, PC Client	Intel Atom® Processor - E3950 , QC, 1.6-2.0GHz, 18 EU, 12W - E3940 , QC, 1.6-1.8GHz, 12 EU, 9,5W - E3930 , DC, 1.3-1.8GHz, 12 EU, 6,5W Intel® Pentium® N4200 , QC, 1.1-2.5GHz, 18 EU, 6W Intel® Celeron® N3350 , DC, 1.1-2.4GHz, 12 EU, 6W
DRAM	Up to 16GB LPDDR4x SDRAM, up to 4267MT/s, IBEC (only Atom SKU's), soldered	Up to 8GB 1866 MT/s DDR3L SDRAM, dual-channel, soldered, ECC support (optional)
Flash	Up to 256GB eMMC 5.1 Flash (optional)	Up to 64GB eMMC V5.0 Flash, soldered (optional)
Storage Interfaces	2x SATA-III 6Gbps 1x MMC/SD/SDIO	2x SATA-III 6Gbps 1x MMC/SD/SDIO
USB	2x USB 3.1, 6x USB 2.0, (1x Host/Device)* or 1x USB 3.1, 8x USB 2.0, (1x Host/Device)* *One USB 3.1 port according to Qseven® Rev. 2.1 (only SS signals)	3x USB 3.0, 3x USB 2.0, 1x USB 3.0/2.0 Host/Device* or 2x USB 3.0, 5x USB 2.0, 1x USB 2.0 Host/Device* or 1x USB 3.0, 7x USB 2.0, 1x USB 2.0 Host/Device* *One USB 3.0 port according to Qseven® Rev. 2.1 (only SS signals)
Bus Interfaces	Up to 4x PCI-Express® x1 Gen. 3 1x I2C Bus, 1x SMBus 1x SPI Bus 1x LPC Bus 1x CAN-FD (Flexible Data-Rate)	Up to 4x PCI-Express® x1 Gen. 2 1x I2C Bus, 1x SMBus 1x SPI Bus 1x LPC Bus
Display Controller	Integrated Intel UHD Graphics Gen. 11	Integrated Intel HD Graphics Gen. 9
Display Interfaces	1x DP++ Dual-Channel LVDS 24/18 Bit (opt. eDP 1.3 or MIPI-DSI)	1x DP++ Dual-Channel LVDS 24/18 Bit (opt. eDP 1.3 or MIPI-DSI)
Network Interface	1x 10/100/1000Base-T Ethernet 1x SGMII Interface on SATA-Port1 (optional)	1x 10/100/1000Base-T Ethernet
Audio Interface	HDA Audio	HDA Audio
Security Device	Trusted Platform Module 2.0 (optional)	Trusted Platform Module 2.0 (optional)
OS Support	Microsoft Windows® 10 IoT (64bit) Linux® (Yocto Project®) EAPI (HW Programming Interface)	Microsoft Windows® 10 IoT (64bit) Linux® (Yocto Project®) EAPI (HW Programming Interface)
Power Requirements	Voltage: +5V +/-5%, +5V Standby Power Consumption: 6-15W typ.	Voltage: +5V +/-5%, +5V Standby Power Consumption: 7-14W typ.
Operating Temp.	0° ... 60°C (commercial) -25°C ... 85°C (extended) -40° ... 85°C (industrial)	0° ... 60°C (commercial) -40° ... 85°C (industrial)
Humidity	5 ... 95% (operating, non-cond.), 5 ... 95% (storage, non-cond.)	

MSC Q7-BT	MSC Q7-BW	MSC Q7-IMX6PLUS
x86	x86	Arm®
		
Qseven® Rev. 2.0 platform, Dimension: 70 mm x 70 mm	Qseven® Rev. 2.0 platform, Dimension: 70 mm x 70 mm	Qseven® Rev. 2.0 platform, Dimension: 70 mm x 70 mm
Intel Atom® Processor - E3845 , QC, 1.91GHz, 10W - E3827 , QC, 1.75GHz, 8W - E3826 , DC, 1.46GHz, 7W - E3825 , DC, 1.33GHz, 6W - E3815 , DC, 1.46GHz, 5W - E3805 , DC, 1.33GHz, 3W (without graphic)	Intel Atom® x5-E8000 , QC, 1.04-2.0GHz, 12 EU, 5W Intel® Pentium® N3710 , QC, 1.6-2.56GHz, 16 EU, 6W Intel® Celeron® Processor - N3160 , QC, 1.6-2.24GHz, 12 EU, 6W - N3060 , QC, 1.6-2.48GHz, 12 EU, 6W Intel® Celeron® N3010 , QC, 1.04-2.24GHz, 12 EU, 4W	NXP® i.MX 6 Arm® Cortex®-A9: - i.MX 6QuadPlus , quad-core, 800MHz...1.2GHz - i.MX 6Quad , quad-core, 800MHz...1.2GHz - i.MX 6DualPlus , dual-core, 800MHz...1.2GHz - i.MX 6Dual , dual-core, 800MHz...1.2GHz - i.MX 6DualLite , dual-core, 800MHz...1.0GHz - i.MX 6Solo , single-core, 800MHz...1.0GHz
up to 4 GB LPDDR3-1333 SDRAM, soldered optional ECC	Up to 64GB eMMC Flash, soldered (optional) Up to 64GB SATA NAND Drive, soldered (optional)	Up to 4GB DDR3L SDRAM (DDR-1066), soldered
Up to 64GB eMMC Flash, soldered (optional) Up to 32GB SATA NAND Drive, soldered (optional)	Up to 64GB eMMC Flash, soldered (optional) Up to 64GB SATA NAND Drive, soldered (optional)	Up to 64GB eMMC Flash or (optional) Up to 1GB SLC NAND Flash (optional)
2x SATA 3Gb/s	1x MMC/SD/SDIO	Micro SD Card Socket (optional) 1x SATA-II 3Gbps (not on Solo/DualLite CPU) 1x MMC/SD/SDIO
4x USB 2.0 Host or 6x USB 2.0 Host 1x USB 3.0 Host optional USB 2.0 Device optional USB 3.0 Device	4x USB 2.0 + 2x USB 3.0, (1x USB 2.0/3.0 Host/Device) or 5x USB 2.0 + 1x USB 3.0, (1x USB 2.0 Host/Device) or 6x USB 2.0 + 1x USB 3.0, (1x USB 2.0 Host/Device) or 8x USB 2.0, (1x USB 2.0 Host/Device)	1x USB 2.0 Host/Client, 1x USB 2.0 Host or 1x USB 2.0 Host/Client, 4x USB 2.0 Host
3x PCI-Express® x1 Gen. 2 1x I2C Bus, 1x SMBus 1x SPI Bus 1x LPC Bus	Up to 3x PCI-Express® x1 Gen. 2 1x I2C Bus, 1x SMBus 1x SPI Bus* 1x LPC Bus *User/SIO SPI not supported; only external BIOS Flash	1x PCI Express® x1 Gen. 1 1x I2C, 1x SMBus 1x SPI (with two chip selects) 1x CAN 2.0B
Integrated Intel HD Graphics Gen. 7	Integrated Intel HD graphics Gen. 8	Video, 2D and 3D Graphics Units integrated in i.MX6 Proc. OpenGL® ES 1.1/2.0/Halt, OpenVG™ 1.1, OpenCL™ 1.1 EP
1x DP++ Dual-Channel LVDS 24/18 Bit (opt. eDP)	1x DP++ Dual-Channel LVDS 24/18 Bit (opt. eDP 1.4)	1x HDMI Dual-Channel LVDS 24/18 Bit (opt. eDP 1.4)
1x 10/100/1000Base-T Ethernet	1x 10/100/1000Base-T Ethernet	1x 10/100/1000BASE-T Ethernet
HD Audio (I2S optional)	HDA Audio	I2S Audio
Trusted Platform Module (TPM) 1.2 (optional)	Trusted Platform Module (TPM) 1.2 (optional)	-
Microsoft Windows® 7 / ES7 / 8 / 10 Linux® (Yocto Project®) EAPI (HW Programming Interface)	Microsoft Windows® 7 / 8 / 10 Linux® (Yocto Project®) EAPI (HW Programming Interface)	Linux® Board Support Package Android Board Support Package (on request)
Voltage: +5V +/-5%, +5V Standby Power Consumption: 4-11 W typ.	Voltage: +5V +/-5%, +5V Standby Power Consumption: 3-13 W typ.	Voltage: +5V +/-5%, +5V Standby Power Consumption: 4-6 W typ.
0° ... 60°C (commercial) -40° ... 85°C (industrial)	0° ... 60°C (commercial) -40° ... 85°C (industrial)	0° ... 70°C (commercial) -40° ... 85°C (industrial)
	5 ... 95% (operating, non-cond.), 5 ... 95% (storage, non-cond.)	





The idea of all Open Standard Modules™ (OSM) is to create a new, **futureproof**, and **versatile standard** for small, low-cost embedded computer modules that combines the following key features:

- Fully automated processing for soldering, assembly, and testing.
- Pre-tinned LGA package for direct PCB soldering without connectors
- Predefined hardware interfaces
- Robust (shock, vibration)

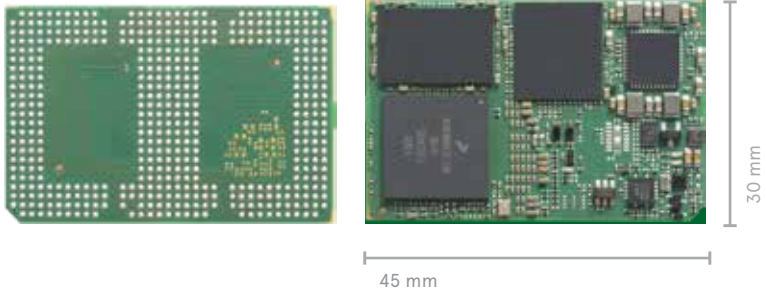
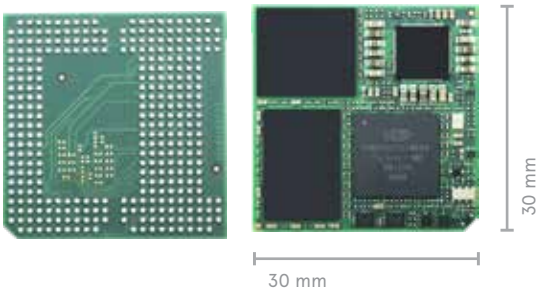
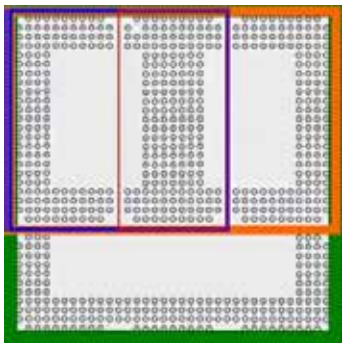
For a growing number of IoT applications, this standard helps to combine the advantages of modular embedded computing with the increasing demands on cost, space, and interfaces.






OSM format	Dimensions	Pins
Size-S (small)	30 x 30 mm	332
Size-M (medium)	30 x 45 mm	476
Size-L (large)	45 x 45 mm	662




OSM modules are notably smaller than previous alternatives. Even the largest OSM module, at 45x45mm, is 28% smaller than the Qseven (40x70mm) standard and 51% smaller than SMARC (82x50mm).

This reduction in size is enabled by solder-on design without any connector, allowing for more interfaces on a smaller footprint. This advancement in miniaturization addresses the growing complexity of requirements, establishing the OSM standard as a pioneering solution.



OSM OVERVIEW

Specs	MSC OSM-MF-IMX8PLUS	MSC OSM-MF-IMX8MINI	MSC OSM-MF-IMX8NANO
Technology	Arm®	Arm®	Arm®
			
Form Factor	OSM 1.1 standard (Size-M), Dimension: 45 mm x 30 mm OSM-MF, 476 Pin, RM 1,25 mm	OSM 1.1 standard (Size-M), Dimension: 45 mm x 30 mm OSM-MF, 476 Pin, RM 1,25 mm	OSM 1.1 standard (Size-M), Dimension: 45 mm x 30 mm OSM-MF, 476 Pin, RM 1,25 mm
CPU	NXP® i.MX 8M Plus Arm® Cortex®-A53 Applications Processor <ul style="list-style-type: none"> - i.MX 8M Plus Quad: <ul style="list-style-type: none"> - NPU, ISP, VPU, HIFI4, CAN, 1.6 - 1.8GHz - ISP, VPU, CAN, 1.6 - 1.8GHz - i.MX 8M Plus QuadLite: CAN, 1.6 - 1.8GHz - i.MX 8M Plus Dual: NPU, ISP, VPU, HIFI4, CAN, 1.6 - 1.8GHz Arm® Cortex®-M7 Real Time Processor at 800MHz	NXP® i.MX 8M Mini Arm® Cortex®-A53 Applications Processor <ul style="list-style-type: none"> - i.MX 8M Mini Solo, single-core, 1.6-1.8GHz - i.MX 8M Mini Dual, dual-core, 1.6-1.8GHz - i.MX 8M Mini Quad, quad-core, 1.6-1.8GHz - i.MX 8M Mini SoloLite, single-core, 1.6-1.8GHz - i.MX 8M Mini DualLite, dual-core, 1.6-1.8GHz - i.MX 8M Mini QuadLite, quad-core, 1.6-1.8GHz Arm® Cortex®-M4 Real Time Processor at 400MHz	NXP® i.MX 8M Nano Arm® Cortex®-A53 Applications Processor <ul style="list-style-type: none"> - i.MX 8M Nano Solo, single-core, 1.4 - 1.5GHz - i.MX 8M Nano Dual, dual-core, 1.4 - 1.5GHz - i.MX 8M Nano Quad, quad-core, 1.4 - 1.5GHz - i.MX 8M Nano SoloLite, single-core, 1.4 - 1.5GHz - i.MX 8M Nano DualLite, dual-core, 1.4 - 1.5GHz - i.MX 8M Nano QuadLite, quad-core, 1.4 - 1.5GHz Arm® Cortex®-M7 Real Time Processor at 750MHz
DRAM	Up to 8GB 4000MT/s LPDDR4 SDRAM, soldered, inline ECC support	Up to 4GB 3000MT/s LPDDR4, soldered, non ECC	Up to 1GB 3200MT/s LPDDR4 SDRAM, soldered, non ECC
Flash	Up to 256GB eMMC Flash, QSPI NOR Flash (optional)	Up to 256GB eMMC Flash, QSPI NOR Flash (optional)	Up to 256GB eMMC Flash, QSPI NOR Flash (optional)
Storage Interfaces	2x MMC/SD/SDIO	2x MMC/SD/SDIO	2x MMC/SD/SDIO
USB	1x USB 2.0 Host/Client, 1x USB 3.0 Host	1x USB 2.0 Host/Client, 1x USB 2.0 Host	1x USB 2.0 Host/Client
Bus Interfaces	1x PCI Express® x1 Gen. 3 2x CAN-FD / CAN 2.0B 2x I2C up to 400 Kbit/s 3x SPI (with two chip selects)	1x PCI Express® x1 Gen.2 2x I2C up to 400 Kbit/s Up to 2x SPI (with two chip selects)	2x I2C up to 400 Kbit/s 2x SPI (with two chip selects)
IO Interfaces	30x GPIO, configurable as input or output 4x PWM	24x GPIO, configurable as input or output 4x PWM	24x GPIO, configurable as input or output 4x PWM
Display Controller	Vivante GC7000UL 2D/3D GPU	Vivante GC NanoUltra 3D GPU	Vivante GC7000UL 3D GPU
Display Interfaces	1x MIPI-DSI Display Interface, 4 lanes Single-channel LVDS interface, 18 or 24 bit (on RGB Pins)	1x MIPI-DSI Display Interface, 4 lanes, up to 1920x1080 @ 60fps	1x MIPI-DSI Display Interface, 4 lanes, up to 1920x1080 @ 60fps
Network Interface	2x Gb Ethernet (RGMII interface)	1x Gb Ethernet (RGMII interface)	1x Gb Ethernet (RGMII interface)
Audio Interface	2x I2S Audio	2x I2S Audio	1x I2S Audio
Security Device	Integrated advanced security, safety, and reliability	Integrated advanced security, safety, and reliability	Integrated advanced security, safety, and reliability
OS Support	Linux® (Yocto Project®) Android Board Support Package	Linux® (Yocto Project®) Android Board Support Package	Linux® (Yocto Project®) Android Board Support Package (on request)
Power Requirements	Voltage: +5V +/-5% Power Consumption: 2-6 W typ.	Voltage: +5V +/-5% Power Consumption: 2-5 W typ.	Voltage: +5V +/-5% Power Consumption: 2-4 W typ.
Operating Temp.	0° ... 70°C (commercial) -25° ... 85°C (extended) -40° ... 85°C (industrial)	0° ... 70°C (commercial) -25° ... 85°C (extended) -40° ... 85°C (industrial)	0° ... 70°C (commercial) -25° ... 85°C (extended) -40° ... 85°C (industrial)
Humidity	5 ... 95% (operating, non-cond.), 5 ... 95% (storage, non-cond.)		

MSC OSM-SF-IMX93	MSC OSM-SF-IMX91	MSC OSM-SF-IMXRT170
Arm®	Arm®	Arm®
		
OSM 1.1 standard (Size-S), Dimension: 30 mm x 30 mm OSM-SF, 322 Pin, RM 1,25 mm	OSM 1.1 standard (Size-S), Dimension: 30 mm x 30 mm OSM-SF, 322 Pin, RM 1,25 mm	OSM 1.1 standard (Size-S), Dimension: 30 mm x 30 mm OSM-SF, 322 Pin, RM 1,25 mm
NXP® i.MX 93 Arm® Cortex®-A55 Applications Processors - i.MX 9352 , dual-core, NPU, 1.5 - 1.7GHz - i.MX 9332 , dual-core, 1.5 - 1.7GHz - i.MX 9351 , single-core, NPU, 1.5 - 1.7GHz - i.MX 9331 , single-core, 1.5 - 1.7GHz Arm® Cortex®-M33 Real Time Processor at 250MHz Arm Ethos-U65 microNPU with 256 MACs/Cycle	NXP® i.MX 91 Arm® Cortex®-A55 Applications Processor - i.MX 9131 , single-core, 1.4GHz	NXP® i.MX 91 RT1170 CROSSOVER MCUs with up to 1GHz - i.MX RT1170 - i.MX RT1171 - i.MX RT1172 - i.MX RT1173 - i.MX RT1175 - i.MX RT1176
Up to 2GB 3700MT/s LPDDR4 SDRAM, soldered, inline ECC support	Up to 2GB 2400MT/s LPDDR4 SDRAM, soldered, inline ECC support	Up to 2 MB SRAM (internal) + optional HyperRAM™ with up to 64MB
Up to 256GB eMMC Flash	Up to 256GB eMMC Flash	Up to 256MB QUAD SPI NOR Flash
2x MMC/SD/SDIO	2x MMC/SD/SDIO	1x eMMC/SD
1x USB 2.0 Host/Client, 1x USB 2.0 Host	1x USB 2.0 Host/Client, 1x USB 2.0 Host	1x USB 2.0 Host/Client, 1x USB 2.0 Host
2x I2C up to 400 Kbit/s 2x CAN-FD / CAN 2.0B 2x SPI (with two chip selects)	2x I2C up to 400 Kbit/s 2x CAN-FD / CAN 2.0B 2x SPI (with two chip selects)	up to 2x I2C 2x SPI (with two chip selects) up to 2x CAN-FD /CAN 2.0B
20x GPIO, configurable as input or output 2x PWM 2x Analog In (12-bit)	20x GPIO, configurable as input or output 2x PWM 2x Analog In (12-bit)	24x GPIO, configurable as input or output, 14x configurable as FlexIO up to 2x ADC inputs (12-bit) up to 6x PWM
Pixel processing pipeline (PXP) engine to support 2D image processing (i.e. Blending/Composition, Rotation, Resize, Color Space Conversion)	not available	2D GPU with Vector Graphics Acceleration
MIPI-DSI Display Interface, 4 lanes, up to 1920x1080	not available	1x MIPI-DSI Display Interface
2x Gb Ethernet (RGMII interface)	2x Gb Ethernet (RGMII interface)	1x Gb Ethernet (RGMII interface) 1x 100 Mbit Ethernet (RMII interface)
2x I2S Audio	1x I2S Audio	1x I2S Audio
Integrated advanced security, safety, and reliability	Integrated advanced security, safety, and reliability	Integrated advanced security, safety, and reliability Optional SE050 Secure Element
Linux® (Yocto Project®) Android Board Support Package (on request)	Linux® (Yocto Project®) Android Board Support Package (on request)	NXP's MCUXpresso software and tools
Voltage: +5V +/-5% Power Consumption: 2-4 W typ.	Voltage: +5V +/-5% Power Consumption: 2-4 W typ.	Voltage: +5V +/-5% Power Consumption: 1-2 W typ.
0° ... 70°C (commercial) -25° ... 85°C (extended) -40° ... 85°C (industrial)	0° ... 70°C (commercial) -25° ... 85°C (extended) -40° ... 85°C (industrial)	0° ... 70°C (commercial) -25° ... 85°C (extended) -40° ... 85°C (industrial)
5 ... 95% (operating, non-cond.), 5 ... 95% (storage, non-cond.)		



/ SYSTEM-ON-MODULES



PROPRIETARY SOM FORM FACTORS




Today's heightened demands on time to market are forcing you to rethink how you design, build and deploy your products. While a customized solution can be most versatile, an off-the-shelf solution can offer benefits you may not have considered. By incorporating an SOM into your design, you can reduce your cost, lower your risk and accelerate your time to market.

SINGLE BOARD COMPUTERS

Avnet Embedded's range of single board computers are designed in-house by our experts in close collaboration with the top chip manufacturers. A spring-board for compact embedded compute, the SBCs can also be customized for specific product designs.

We offer development kits for a wide range of applications and varying levels of complexity. You'll also gain access to documentation, reference designs and training material for kits for every type of project, from entry-level designs to highly complex solutions with embedded vision, test and measurement, and industrial IoT.

PROPRIETARY SOM FORM FACTORS




Specs	MicroZed	PicoZed	UltraZed EG
Technology	Arm®	Arm®	Arm®
			
Form Factor	Proprietary: 102 x 57 mm Two B2B Connectors	Proprietary: 102 x 57 mm Three B2B Connectors	Proprietary: 89 x 51 mm Three B2B Connectors
CPU	AMD Zynq™ 7000 SoC - Z-7010, Z-7020 - Dual Arm® Cortex®-A9 Processor - Neon™ SIMD and FPU - Artix™ Programmable Logic	AMD Zynq™ 7000 SoC - Z-7010, Z-7015, Z-7020 - Dual Arm® Cortex®-A9 Processor - Neon™ SIMD and FPU - Artix Programmable Logic - Z-7030 - Dual Arm® Cortex®-A9 Processor - Neon™ SIMD and FPU - Kintex™ Programmable Logic	AMD Zynq™ UltraScale+™ MPSoC - ZU5EG** - Quad Arm® Cortex®-53 Processor - Dual Arm® Cortex®-R5F RPU - Arm® Mali®-400MP2 - 16nm Programmable Logic
DRAM	1GB DDR3L @ Processor Subsystem	1GB DDR3L @ Processor Subsystem	2GB DDR4 @ Processor Subsystem
Flash	128Mb QSPI Boot Storage	8 GB eMMC 128Mb QSPI Boot Storage	8 GB eMMC Dual 64MB QSPI Boot Storage 2Kb I2C EEPROM
Storage Interfaces	uSD Card Cage		SATA
Network Interfaces	1x GbE	1x GbE	1x GbE
USB	USB 2.0 USB-UART	USB 2.0	USB 2.0
Bus Interfaces			PCIe Gen2
Other Interfaces/ Functions	108/123 GPIOs (Z-7010/Z-7020) 28 K Prog Logic Cells (Z-7010) 85 K Prog Logic Cells (Z-7020)	113 GPIOs (Z-7010) 148 GPIOs + 4 GTP Transceivers (Z-7015) 138 GPIOs (Z-7020) 148 GPIOs + 4 GTX Transceivers (Z-7030)	206 GPIOs + 4 GTR Transceivers 154 K Prog Logic Cells
Software/OS Support	PetaLinux BSP	PetaLinux BSP	PetaLinux BSP
Core Power Requirements	5V Input*	5V to 12 V Input*	5V to 12 V Input*
Operating Temp.	Commercial: 0° to 70°C Industrial: -40°C to +85°C	Commercial: 0° to 70°C Industrial: -40°C to +85°C	Commercial: 0° to 70°C Industrial: -40°C to +85°C

* Note: Additional input voltages may be required for IO bank voltages, transceivers, and VBAT.

** Note: Additional device options are available for custom builds





PROPRIETARY SOM FORM FACTORS

Specs	UltraZed EV	XRF 8	XRF 16
Technology	Arm®	Arm®	Arm®
			
Form Factor	Proprietary: 102 x 63.5 mm Three B2B Connectors	Proprietary: 127 x 101 mm Four B2B Connectors	Proprietary: 127 x 101 mm Four B2B Connectors
CPU	AMD Zynq™ UltraScale+ MPSoC - ZU7EV** - Quad Arm® Cortex®-53 Processor - Dual Arm® Cortex®-R5F RPU - Arm® Mali®-400MP2 - H.264/H.265 Video Codec - 16nm Programmable Logic	AMD Zynq™ UltraScale+ RFSoC - ZU47DR Gen3 - Quad Arm® Cortex®-53 Processor - Dual Arm® Cortex®-R5F RPU - 16nm Programmable Logic	AMD Zynq™ UltraScale+ RFSoC - ZU49DR Gen3 - Quad Arm® Cortex®-53 Processor - Dual Arm® Cortex®-R5F RPU - 16nm Programmable Logic
DRAM	1GB DDR4 @ Programmable Logic 4GB DDR4 @ Processor Subsystem	4GB DDR4 @ Programmable Logic 4GB DDR4 @ Processor Subsystem	4GB DDR4 @ Programmable Logic 4GB DDR4 @ Processor Subsystem
Flash	8 GB eMMC Dual 64MB QSPI Boot Storage 2Kb I2C EEPROM	32GB eMMC 128MB QSPI Boot Storage	32GB eMMC 128MB QSPI Boot Storage
Storage Interfaces	SATA	SATA	SATA
Network Interfaces	1x GbE	1x GbE	1x GbE
USB	USB 2.0	USB 2.0/3.0 USB-UART	USB 2.0/3.0 USB-UART
Bus Interfaces	PCIe Gen2	PCIe Gen1/2 I2C SPI UART	PCIe Gen1/2 I2C SPI UART
Other Interfaces/ Functions	178 GPIOs + 4 GTR Transceivers 16 PL GTH Transceivers 504 K Prog Logic Cells Video Codec Unit (VCU)	8x RF-ADC, 14-bit upto 5.0 GSPS 8x RF-DAC, 14-bit upto 8.92 GSPS USB-UART 16x Ultra-fast GTY Serial Transceivers 72x GPIOs 930 K Prog Logic Cells Ultra-low Jitter Prog Sampling Clocks Ext/On-board Prog TCXO Ref Clock	16x RF-ADC, 14-bit upto 2.5 GSPS 16x RF-DAC, 14-bit upto 9.85 GSPS USB-UART 16x Ultra-fast GTY Serial Transceivers 72x GPIOs 930 K Prog Logic Cells Ultra-low Jitter Prog Sampling Clocks Ext/On-board Prog TCXO Ref Clock
Software/ OS Support	PetaLinux BSP	Avalon™ Software Suite	Avalon™ Software Suite
Core Power Requirements	5V to 12 V Input*	5.5V to 16V Input	5.5V to 16V Input
Operating Temp.	Extended: 0° to 85°C Industrial: -40°C to +85°C	Industrial: -40°C to +85°C	Industrial: -40°C to +85°C




* Note: Additional input voltages may be required for IO bank voltages, transceivers, and VBAT.




** Note: Additional device options are available for custom builds

	VE2302	8ULP
	Arm®	Arm®
		
	Proprietary: 50 x 50 mm Three B2B Connectors	Proprietary: 43 x 36 mm Two B2B Connectors
	AMD Versal™ AI Edge - VE2302** - Dual Arm® Cortex®-72 Processor - Dual Arm® Cortex®-R5F RPU - 34 AI Engine-ML - 464 DSP Engines - 7nm Programmable Logic	NXP® i.MX 8ULP MPU - Dual Arm® Cortex®-A53 - Arm® Cortex®-M33 MCU - HiFi 4 DSP - Fusion DSP - 3D/2D GPU
	4GB DDR4 (Shared)	2GB LPDDR4X
	32GB eMMC 64MB QSPI Boot Storage	32 GB eMMC 8 MB Octal SPI PSRAM 4 MB Octal SPI NOR
		2x SDHC
	1x GbE	10/100 Ethernet
	USB 2.0	2x USB 2.0 OTG
	PCIe Gen4 I2C SPI UART CAN-FD	I2C SPI UART CAN-FD
	151 XPIO/HDIO/MIO GPIOs 8 GTYP Serial Transceivers 329 K Prog Logic Cells	MIPI-CSI (2 Lane) MIPI-DSI (4 Lane) I2S 2x DAC 2x ADC EdgeLock™ Secure Enclave
	PetaLinux BSP	Yocto Linux BSP
	5V Input*	5V Input*
	Extended: 0° to +85°C Industrial: Available on Request	Industrial: -40°C to +85°C






SINGLE BOARD COMPUTERS

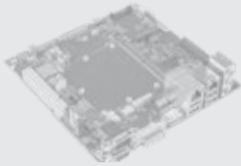


Specs	MaaXBoard RT	MaaXBoard	MaaXBoard Mini
Technology	Arm®	Arm®	Arm®
			
Form Factor	R-Pi Form Factor: 85 x 56 mm	R-Pi Form Factor: 85 x 56 mm	R-Pi Form Factor: 85 x 56 mm
CPU	NXP® i.MX RT1176 Crossover Processor - Arm® Cortex®-M7 (1 GHz) - Arm® Cortex®-M4F (400 MHz)	NXP® i.MX 8M Applications Processor - Quad Arm® Cortex®-A53 (1.5 GHz) - Arm® Cortex®-M4F (266 MHz)	NXP® i.MX 8M Mini Applications Processor - Quad Arm® Cortex®-A53 (1.8 GHz) - Arm® Cortex®-M4F (400 MHz)
DRAM	2 MB OCRAM 32 MB SDRAM (16M x 16)	2 GB DDR4	2 GB DDR4
Flash	32 MB Hyperflash	eMMC (optional)	eMMC (optional)
Storage Interfaces		uSD Card Cage	uSD Card Cage
Network Interfaces	10/100 Ethernet with 1588 1x GbE with TSN Wi-Fi 802.11ac Bluetooth 5	1x GbE Wi-Fi 802.11b/g/n/ac Bluetooth 4.2	1x GbE Wi-Fi 802.11b/g/n/ac Bluetooth 4.2
USB	USB 2.0 Host USB 2.0 Device	2x USB 3.0	4x USB 2.0
Bus Interfaces	I2C SPI UART CAN	I2C SPI UART	I2C SPI UART
Display Controller	2D GPU 2D PXP Accelerator	Vivante GC7000Lite 3D GPU	Vivante GC NanoUltra 3D GPU
Display Interfaces	MIPI-DSI (2 Lane) 1280x800 60fps	HDMI 4K60 MIPI-DSI (4 Lane) 1080P30	MIPI-DSI (4 Lane) 1080P30
Audio Interface	Stereo Codec with Audio Jack 4x Digital Microphones	SAI Audio Connectors	SAI Audio Connectors
Other Functions	MIPI-CSI (2 Lane) 40-pin HAT 0.1" IO Header 18-Pin Custom Expansion Header	MIPI-CSI (2 Lane) 40-pin HAT 0.1" IO Header	MIPI-CSI (4 Lane) 40-pin HAT 0.1" IO Header
Software/ OS Support	FreeRTOS	Linux® (Yocto Project®) BSP	Linux® (Yocto Project®) BSP
Core Power Requirements	5V Input (USB-C)	5V Input (USB-C)	5V Input (USB-C)
Operating Temp.	Commercial: 0° to 70°C	Commercial: 0° to 70°C	Commercial: 0° to 70°C




	MaaXBoard 8ULP	MaaXBoard OSM93	RZBoard V2L
	Arm®	Arm®	Arm®
			
	R-Pi Form Factor: 85 x 56 mm	R-Pi Form Factor: 85 x 56 mm	R-Pi Form Factor: 85 x 56 mm
	NXP® i.MX 8ULP Applications Processor <ul style="list-style-type: none"> - Dual Arm® Cortex®-A35 (1.0 GHz) - Arm® Cortex®-M33 (216 MHz) - Hifi 4 DSP (600 MHz) - Fusion DSP (200 MHz) 	NXP® i.MX 93 Applications Processor <ul style="list-style-type: none"> - Dual Arm® Cortex®-A55 (1.7 GHz) - Arm® Cortex®-M33 (250 MHz) - Arm® Ethos®-U65 NPU (0.5 TOPS) 	Renesas RZ/V2L Applications Processor <ul style="list-style-type: none"> - Dual Arm® Cortex®-A55 (1.2 GHz) - Arm® Cortex®-M33 (200 MHz) - Arm® Mali® G31 3D GPU - DRP-AI Accelerator
	2 GB LPDDR4X 8 MB PSRAM	2 GB LPDDR4 w/ECC	2 GB LPDDR4
	32 GB eMMC 4 MB QSPI NOR	16 GB eMMC 16 MB QSPI NOR	32 GB eMMC 16 MB QSPI NOR
			uSD Card Cage
	10/100 Ethernet	2x GbE (1 w/TSN)	1x GbE Wi-Fi 802.11ac Bluetooth 5
	2x USB 2.0 Host USB 2.0 Device	3x USB 2.0 Host USB 2.0 Device	3x USB 2.0 Host USB 2.0 Device
	I2C SPI UART	I2C SPI UART 2x CAN	I2C SPI UART CAN-FD
	Vivante GC NanoUltra 3D GPU	Pixel Processing Pipeline (PXP) Engine	Image Processing Unit
	MIPI-DSI (4 Lane) 1080P30	MIPI-DSI (4 Lane) 1080P60	MIPI-DSI (4 Lane) 1080P30
	Stereo Codec with Audio Jack Digital Microphone	SAI Audio 2x PDM Digital Microphones	Stereo Codec with Audio Jack
	MIPI-CSI (2 Lane) M.2 WiFi/BT Connector 40-pin HAT 0.1" IO Header 16-pin Click™ Header	MIPI-CSI (2 Lane) M.2 WiFi/BT Connector 40-pin HAT 0.1" IO Header	MIPI-CSI (2 Lane) 40-pin HAT 0.1" IO Header
	Linux® (Yocto Project®) BSP	Linux® (Yocto Project®) BSP	Linux® (Yocto Project®) BSP
	5V Input (USB-C)	5V Input (USB-C)	5V Input (USB-C)
	Commercial: 0° to 70°C Industrial: Optional	Commercial: 0° to 70°C Industrial: Optional	Commercial: 0° to 70°C





MSC CARRIER BOARDS OVERVIEW

Specs	MSC OSM-MB-EP5	MSC SM2S-MB-EP5	MSC Q7-MB-EP5
Platform	Embedded Platform OSM 1.1	Embedded Platform SMARC® 2.0/2.1.1	Embedded Platform Qseven® Rev. 2.0
	 /SIMPLEFLEX	 /SIMPLEFLEX	 /SIMPLEFLEX
Highlights	<p>The new OSM 1.1 embedded platform MSC OSM-MB-EP5 offers a variety of interfaces commonly used in embedded applications such as Gigabit LAN, USB 3.0, USB 2.0, RS232/485 and CAN as well as RGB, MIPI-DSI and LVDS display interfaces. By design the EP5 was optimized for low production cost and simple customization.</p> <ul style="list-style-type: none"> - OSM-SF/MF/LF - Reference Carrier + SBC solution - Input voltage 5VDC-36VDC - USB-C power input - MICROBUS Slot for different I/O expansions - LVDS/DSI/RGB Display support - M.2 Key-E, µSD Card, MIPI CSI-2 - Audio, USB 2.0, USB 3.0 - RS232, RS485, 2x UART - I2C, SPI, PWM, GPIO, ADC - 2x 2x Gigabit Ethernet - WLAN/BT, 2x CAN - Industrial temp. range from - 40 to +85°C - Dimension 146 mm x 102 mm 	<p>The new SMARC® 2.0/2.1.1 embedded platform MSC SM2-MB-EP5 offers a variety of interfaces commonly used in embedded applications such as Gigabit LAN, USB 3.0, USB 2.0, RS232/485 and CAN as well as DisplayPort and LVDS display interfaces. By design the EP5 was optimized for low production cost and simple customization. MSC is offering to produce any customized variant of the MSC SM2S-MB-EP5 for medium to high volume with a very short lead time.</p> <ul style="list-style-type: none"> - For open-frame HMI applications with display size 7" and larger - Low-cost application board (for x86 and Arm® based SMARC® 2.0/2.1.1 modules) - LVDS display and backlight supply generated on board - USB Type C (with power delivery 5V/3A, alternate mode, USB-OTG) - 2x CAN interface (1x galvanically isolated) - Up to 2x Gigabit Ethernet - Industrial temperature range from - 40 to +85°C - WLAN / BT / NFC module (H&D Wireless SPB209A) opt. - Dimension: 146 x 80 mm 	<p>The new Qseven® Rev. 2.0 embedded platform MSC Q7-MB-EP5 offers a variety of interfaces commonly used in embedded applications such as Gigabit LAN, USB 3.0, USB 2.0, RS232/485 and CAN as well as DisplayPort and LVDS display interfaces. By design the EP5 was optimized for low production cost and simple customization. Avnet Embedded is offering to produce any customized variant of the MSC Q7-MB-EP5 for medium to high volume.</p> <ul style="list-style-type: none"> - Low-cost application board for any Qseven® - Dual Gigabit Ethernet - Mini PCI Express® Card / mSATA Card socket - 1x USB 3.0, up to 3x USB 2.0 connectors - 1x USB 2.0 Host/Client on µUSB connector - DisplayPort, RS-232, RS-485 or opt. CAN - Dual-channel LVDS on JILI30 connector - WLAN / Bluetooth / NFC with antenna (optional) - 4-wire touch controller (optional) - I2S or HD Audio codec (optional) - SPI / I2C / GPIO on Feature Connector - Input voltage 10 to 36V - Industrial temperature versions available - Dimension: 148 x 102 mm

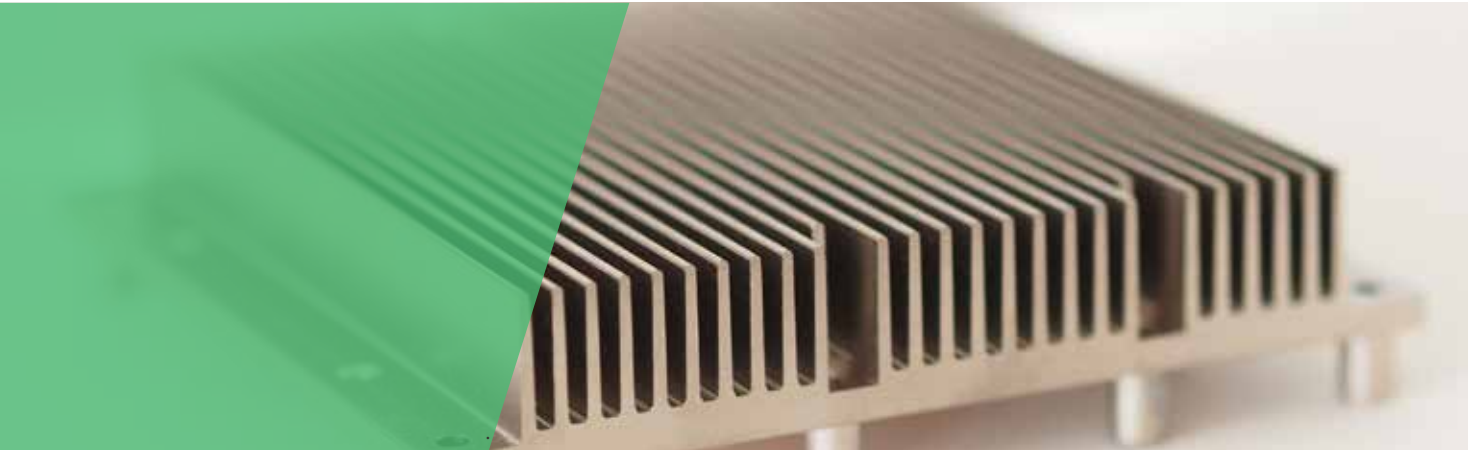
Specs	MSC SM2-MB-EP2	MSC Q7-MB-EP6	MSC SM2-MB-EP1
Platform	Embedded Platform SMARC® 2.0/2.1.1	Embedded Platform Qseven® Rev. 2.0	Embedded Platform SMARC® 2.0/2.1.1
			
Highlights	<p>The latest SMARC® 2.1.1 Embedded Platform MSC SM2-MB-EP2 offers many embedded interfaces such as dual Gigabit LAN, USB 3, USB 2, SATA, UART/RS232 and CAN as well as DVI/HDMI, embedded DisplayPort and LVDS display interfaces. In addition four PCI Express® sockets and a SD Card socket are supported.</p> <ul style="list-style-type: none"> - Socket for SMARC® 2.1.1 modules - 4x PCI Express® x1 slots - 2x M.2 (Key B and Key E) - Mini-PCI-Express® Card slot - SD Card slot - 2x USB 3.0 interfaces (Type A and Type C) - USB 2.0 OTG, 2x USB 2.0 Host, - USB 2.0 Debug port (Type C with Serial Port on USB) - DVI/HDMI and 2x DisplayPort connectors - LVDS and eDP connectors - SATA connector and M.2 Key M (SATA only) - 2x GbE interfaces - 2x CAN interfaces - I2S audio and HD audio codec - 2x UART interfaces - Various additional SMARC® specific interfaces - ATX supply or Power jack for 8-24V input voltage - Dimension: TBD / ATX compliance 	<p>The Qseven® Rev. 2.0 Embedded Platform MSC Q7-MB-EP6 offers a variety of embedded interfaces such as dual Gigabit LAN, USB 3.0, USB 2.0, RS232/485 and CAN as well as DisplayPort and LVDS display interfaces. In addition a mini PCI Express®, an mSATA and an SD Card socket are supported. Module slot on bottom side.</p> <ul style="list-style-type: none"> - DisplayPort connector - Dual Gigabit Ethernet - Mini PCI Express card slot - MMC/SD card and mSATA card sockets - 1x SATA connector - RS-232 on DB9 connector - LPC / GPIO on pin header - USB 3.0 host connector - 2x USB 2.0 host connector - 1x USB 2.0 on pin header - 1x microUSB 2.0 OTG connector - LVDS / eDP via Jili30 connector - Backlight interface 3.3 / 5 / 12VDC - SPI / I2C / SMBus, CAN bus, HDA Audio - Wide input range from 10 - 28VDC - Dimension: 148 x 102 mm 	<p>The SMARC® 2.0/2.1.1 Embedded Platform MSC SM2-MB-EP1 offers many embedded interfaces such as dual Gigabit LAN, USB 3.0, USB 2.0, SATA, UART/RS232 and CAN as well as DVI/HDMI, embedded DisplayPort and LVDS display interfaces. In addition a PCI Express® socket and an SD Card socket are supported.</p> <ul style="list-style-type: none"> - Socket for SMARC® 2.0/2.1.1 modules - PCI Express® x4 slot - SD card slot - Mini-PCI-Express® card slot - Two USB 3.0 interfaces - USB 2.0 OTG, two USB 2.0 Host - DVI/HDMI and DisplayPort connectors - LVDS and eDP connectors - SATA connector - Two GbE interfaces - Two CAN interfaces - I2S audio and HD audio codec - Two UART interfaces - Various additional SMARC® specific interfaces - Power jack for 12-24V input voltage - Dimension: 170 x 170 mm

MSC C6-MB-EV	MSC C6-MB-EVA	MSC C6-MB-EV4
Evaluation Motherboard Type 6	Evaluation Motherboard Type 6	Evaluation Motherboard Type 6
		
<p>This evaluation board in the popular Mini-ITX format provides the interface infrastructure for COM Express® Type 6 modules and offers various PC type connectors for external access.</p> <ul style="list-style-type: none"> - Socket for COM Express® Type 6 modules - PCI Express x16 slot (useable as PEG or x4) - PCI Express Mini Card slot - Four SATA connectors - Four USB 3.0 interfaces - Up to four USB 2.0 ports - Three DisplayPort connectors - LVDS and eDP connectors - GbE interface SD Card slot - HD audio codec - Super I/O - Various additional COM Express® specific interfaces - Power supply via ATX-style power connector or 12V-only power jack - Wide power input range - Dimension: 170 x 170 mm 	<p>This versatile carrier board was designed for evaluation, prototyping and software development. It provides the interface infrastructure for COM Express® Type 6 modules and offers various PC type connectors for external access.</p> <ul style="list-style-type: none"> - Socket for COM Express® Type 6 modules in Basic or Compact form factor - One PCI Express® x4 slot - Four PCI Express® x1 slots - One PCI Express® x16 PEG slot - Four SATA connectors - Four USB 3.0, four USB 2.0 interfaces - Two DisplayPort/HDMI connectors - VGA/DVI connector - LAN interface - mSATA and Mini PCI Express sockets - Various additional COM Express® specific interfaces - ATX-style power connector - POST code LED display - ATX form factor - Dimension: 305 x 244 mm 	<p>This carrier board supports PCI Express® Gen 4 and 2.5Gb Ethernet available with latest module generations. It is intended for evaluation, prototyping and software development.</p> <ul style="list-style-type: none"> - Socket for COM Express® Type 6 modules - Compact/Basic form factors supported - Support for PCI Express® Gen 4 - One PCI Express® x4 slot - Three PCI Express® x1 slots shared with PCIe x4 slot - One PCI Express® x16 PEG slot - One M.2 Key-M Slot - Four SATA connectors - Four USB 3.1 Gen 1/2.0 connectors - Four USB 2.0 pin header - Three DisplayPort++ connectors - Audio codec; three audio jacks and SPDIF - LAN interface max 2.5GbE - SD Memory Card Socket - Power supply via ATX connector or wide input - POST display (optional) - ATX form factor - Dimension: 305 x 244 mm

MSC C10-MB-EV	MSC COM-HPC® CLIENT EP	MSC COM-HPC® SERVER EP
Evaluation Motherboard Type 10	COM-HPC® Client Carrier	COM-HPC® Server Carrier Board
		
<p>This evaluation board in the popular Mini-ITX format provides the interface infrastructure for COM Express® Type 10 modules and offers various PC type connectors for external access.</p> <ul style="list-style-type: none"> - Socket for COM Express® Type 10 modules - PCI Express® x4 slot - PCI Express® Mini Card slot - Two SATA connectors - Two USB 3.0 interfaces - Up to six USB 2.0 ports - DisplayPort connectors - LVDS and eDP connectors - GbE interface SD card slot - HD audio codec - Super I/O - Various additional COM Express® specific interfaces - One USB 2.0/3.0 client (optional) - Power supply via ATX-style power connector or 12V-only power jack - Wide power input range - Dimension: 170 x 170 mm 	<p>The MSC HC-MB-EV is intended for design teams that require an easy and fast enablement of COM-HPC® based solutions for lab evaluation, rapid prototyping and application development. Engineers can use it as a reference design for developing their own COM-HPC® platform with client interface.</p> <ul style="list-style-type: none"> - Socket for COM-HPC® Client modules, Size A, B, C - PCI Express® x16 slot (PEG/general PCIe) - PCI Express® x16 slot (general PCIe) - Three PCI Express® slots 1x4 - Support for PCIe Gen 3 and 4 - Two SATA connectors - M.2 socket for mass storage and AI modules - Two USB4 Gen 2x2, Type-C connectors - Two USB 3.2 Gen 2x1 Type-A connectors - Two 1G/2.5G/10GBASE-T connectors (RJ45) - Three DisplayPort connectors - One eDP connector - HDA audio codec - Various additional COM-HPC® specific interfaces - Power supply via ATX-style power connectors - Wide power input range - ATX form factor - Dimension: 305 x 244 mm 	<p>The MSC HS-MB-EV is intended for lab evaluation, rapid prototyping, and application development. Engineers can use it as a reference design for developing their own COM-HPC® platform. The COM-HPC® carrier provides a COM-HPC® Server interface with a rich set of I/O routed to the module socket.</p> <ul style="list-style-type: none"> - COM-HPC® Server Carrier - Socket for COM-HPC® Server module with size D or E - One PCI Express® x16 slots - Two PCI Express® x8 slots - Two PCI Express® x4 slots - Two M.2 slots with PCIe x4 - All PCIe slots support up to Gen 4 - Four USB 3.2 Gen 1 (5Gbps) - Four SFP28 card cages for up to 25G Ethernet per port - Two 10GBASE-T connectors - One 1000BASE-T / 2.5GBASE-T connector - Two SATA connectors, up to 6Gbps - 2x UART ports - Connectors for optional BMC module and I/O break-out - Fan connector - ATX-style power connector and 12V single supply - POST code LED display - Dimension: 305 x 244 mm



/ COOLING SOLUTIONS OVERVIEW



SMARC® 2.0 - Cooling Solutions

For all its SMARC® modules, we offer tailored cooling solutions which perfectly fit the geometry of the COM product. We also provide a heatspreader for each SMARC® module, and a single-piece heatsink for the higher-performance modules.



Qseven® - Cooling Solutions

For all its Qseven® modules, we offer tailored cooling solutions which perfectly fit the geometry of the COM product. MSC is providing a heatspreader for each Qseven® module, and a single-piece heatsink for the higher-performance modules.



Heatspreaders

A heatspreader offers a blank surface allowing to mount a cooling device or to contact the metal housing of a system, while the underside provides contact areas for the heat generating parts of the module's geometry.



Heatsinks

Depending on the ambient temperature and the power dissipation of the module, forced airflow may or may not be required.

COM Express® Cooling Solutions

Depending on the computing performance, processor technology and system environment, COM Express® modules require different cooling measures. We have developed various solutions that help the system designer to quickly solve the heat dissipation problems and ensure optimum environmental conditions for the module. These off-the-shelf cooling solutions have been optimized in many ways, using thermal simulation and intensive climate chamber testing. Therefore we can offer cost-efficient monolithic aluminium coolers without extra heat transfer layers, minimized heat resistance, optional embedded heat pipe and industry proven fans.



Heatspreaders

Standardized thermal interfaces for easy integration into customers' cooling concepts and full interchangeability.



Passive cooling

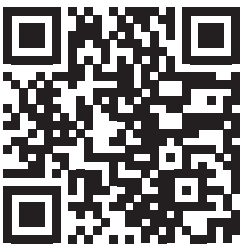
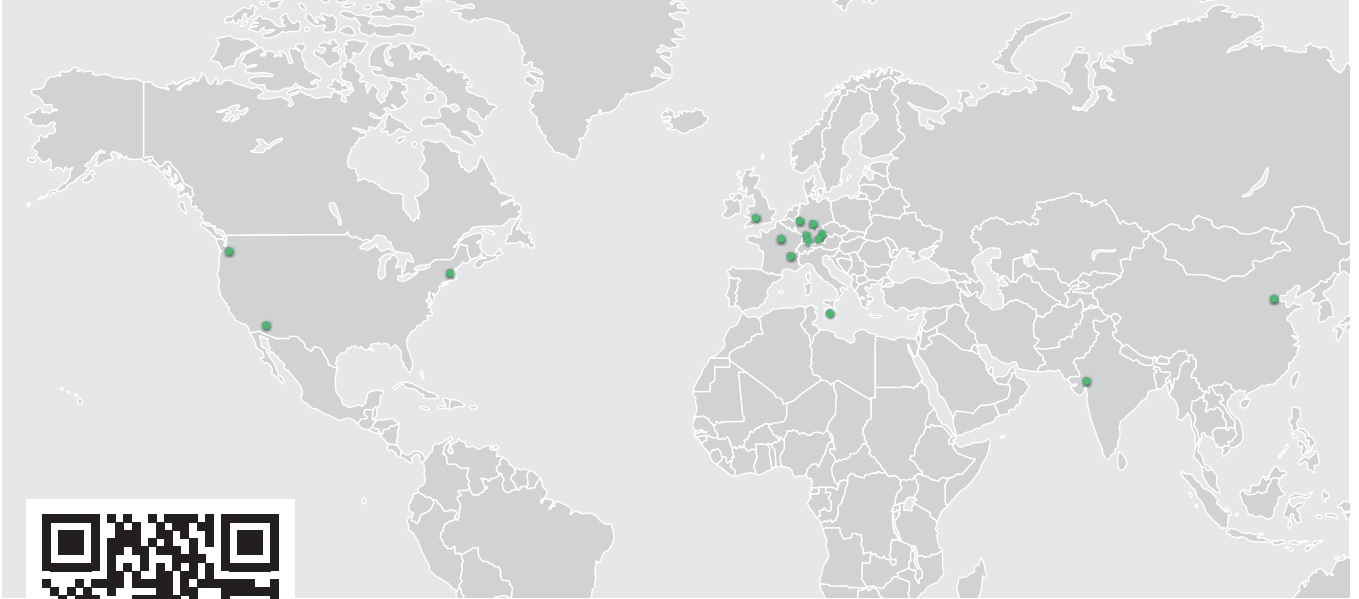
Optimized heatsinks for best cooling performance even in industrial environments.



Active cooling

Heatsinks combined with a dedicated speed controlled fan. Off-the-shelf solutions for demanding ambient conditions.





Use the QR code to connect with one of our **Avnet Embedded** solutions experts and learn how we can guide you through your entire business journey.

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