AVNET® EMBEDDED

/ MSC PRODUCT ROADMAP
EMBEDDED COMPUTER MODULES

/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

Avnet Embedded builds embedded compute, display and software solutions that meet the demand for innovation and quality, with reduced time to market, utilizing our platform technologies, design and manufacturing capabilities, and a world-class team of experts.

Embedded Compute
Avnet Embedded designs, manufactures, assembles and supplies all the embedded compute technology you need to build into your product or solution. From our own award-winning modules to the widest range of options from our global partners, we're ready to empower your product design. **Find out more about our compute innovation.**

"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
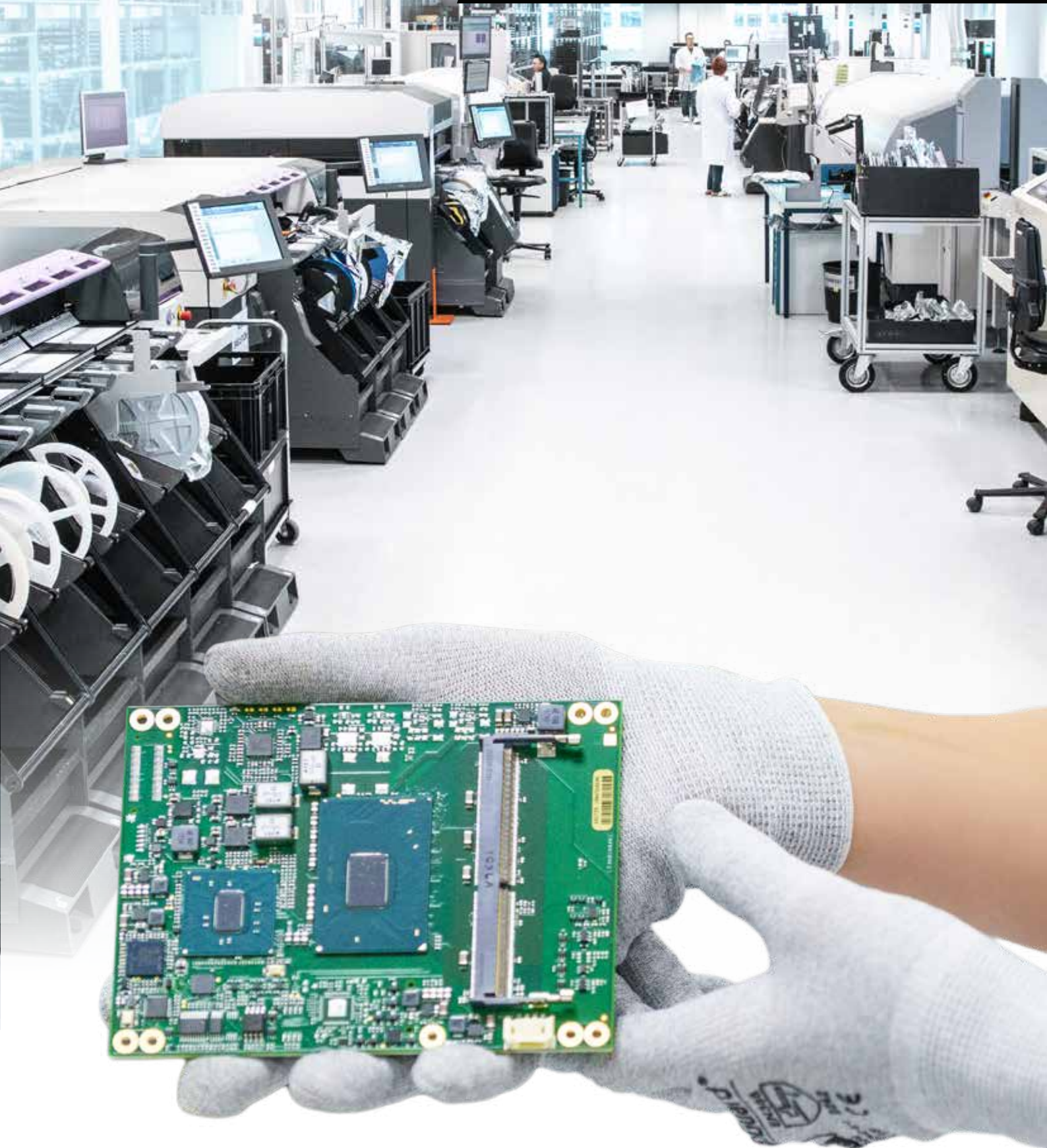
Virtual 3D Guided Tour Available – Customer Visitors Welcome

ONE OF THE LARGEST GLOBAL SOM/COM MANUFACTURERS

COM·HPC®

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

COM Express

Avnet Embedded's complete **COM Express®** portfolio: Type 2, 6, 7 and 10. From low end Intel Atom® to high end Core i7 and Xeon®, from Mini to Basic format.

SMARC module

The **SMARC® 2.0/2.1.1** product range is steadily growing and spans Arm® Cortex®-A9 to Cortex®-A72, latest x86 Atom SOCs, and latest x86 "Zen" Core APUs.

QSEVEN

Avnet Embedded's widespread **Qseven®** portfolio is one of the widest in the industry. From Single-Core Arm® to Quad-Core x86, Cortex®-A9 to latest x86.
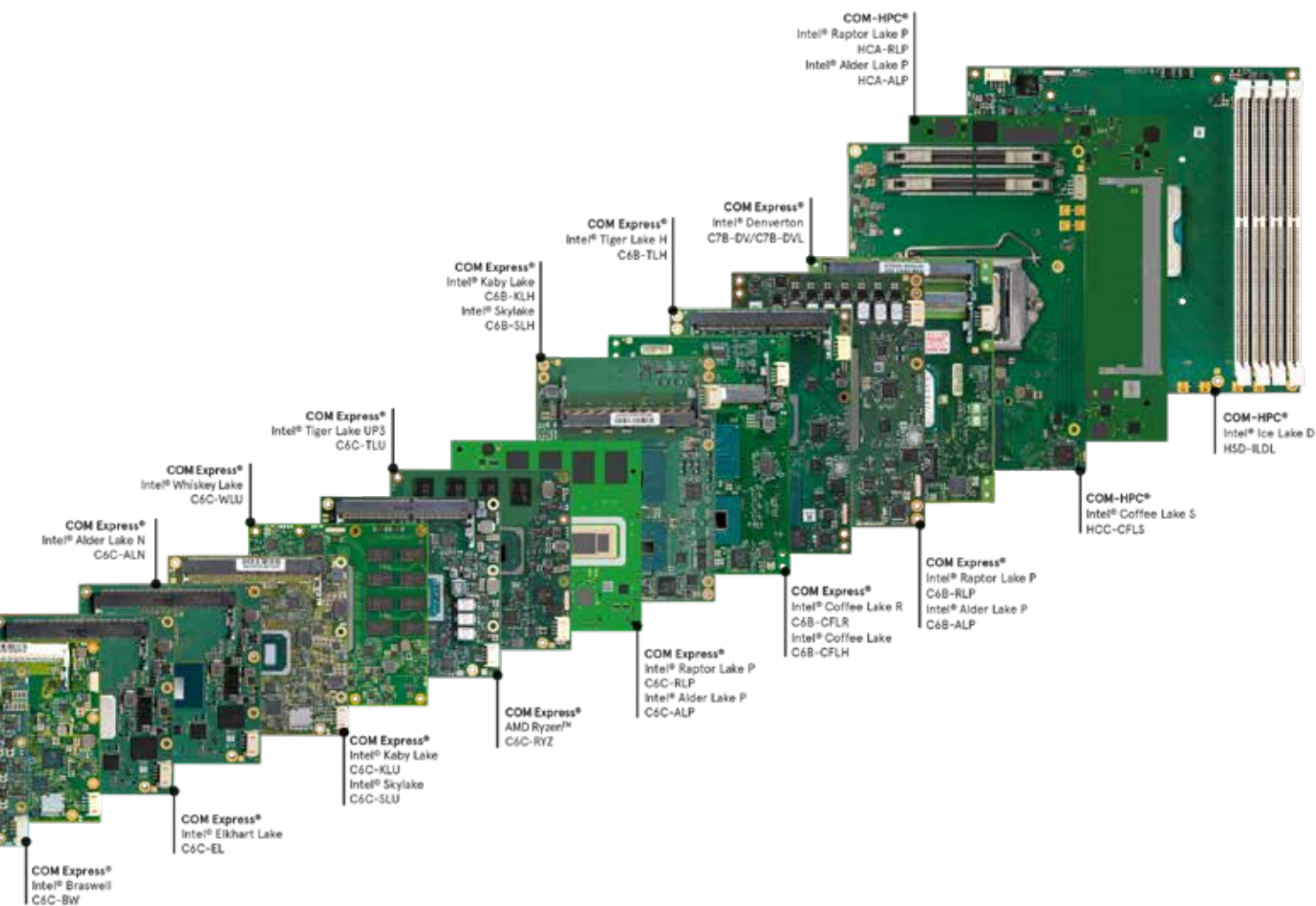
nanoRISC®

The **nanoRISC®** module family combines compact size with low power and low cost. With Arm® Cortex®-A8 and A9 processors.

OPEN STANDARD MODULE™

The Open Standard Modules™ (OSM) is a new, **future-proof**, and **versatile standard** for small, low-cost solder-on embedded computer modules.

COM-HPC®
Intel® Raptor Lake P
HCA-RLP
Intel® Alder Lake P
HCA-ALP

COM Express®
Intel® Denverton
C7B-DV/C7B-DVL

COM Express®
Intel® Tiger Lake H
C6B-TLH

COM Express®
Intel® Kaby Lake
C6B-KLH
Intel® Skylake
C6B-SLH

COM Express®
Intel® Tiger Lake UP3
C6C-TLU

COM Express®
Intel® Whiskey Lake
C6C-WLU

COM Express®
Intel® Alder Lake N
C6C-ALN

COM Express®
Intel® Kaby Lake
C6C-KLU
Intel® Skylake
C6C-SLU

COM Express®
Intel® Elkhart Lake
C6C-EL

COM Express®
Intel® Braswell
C6C-BW

COM Express®
AMD Ryzen™
C6C-RYZ

COM Express®
Intel® Raptor Lake P
C6C-RLP
Intel® Alder Lake P
C6C-ALP

COM Express®
Intel® Coffee Lake R
C6B-CFLR
Intel® Coffee Lake
C6B-CFLH

COM Express®
Intel® Raptor Lake P
C6B-RLP
Intel® Alder Lake P
C6B-ALP

COM-HPC®
Intel® Coffee Lake S
HCC-CFLS

COM-HPC®
Intel® Ice Lake D
HSD-ILDL

intel.   NXP   AMD⤒   TEXAS INSTRUMENTS   RENESAS

Industrial quality built for reliability, endurance and longevity

Award-winning range of 400+ 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

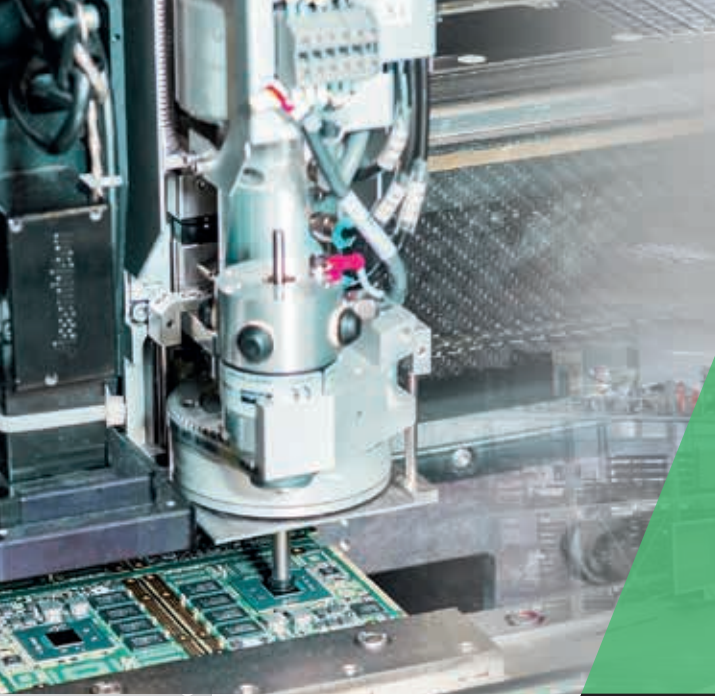|	
250+ Hard- and Software Engineers	**600K** Sq. Ft. global footprint
High Speed Measurement Equipment and Simulation Tools	**775** Operations employees
Function Test Based on Linux® (Yocto) BSP	**900+** Customer served annually
Global Brand Customer Audits	**2.0M+** Systems & boards built annually

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

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

/LEADING-EDGE MANUFACTURING

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.

Competitive Advantage – Production Flexibility

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

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, includes strict version control for each product made.
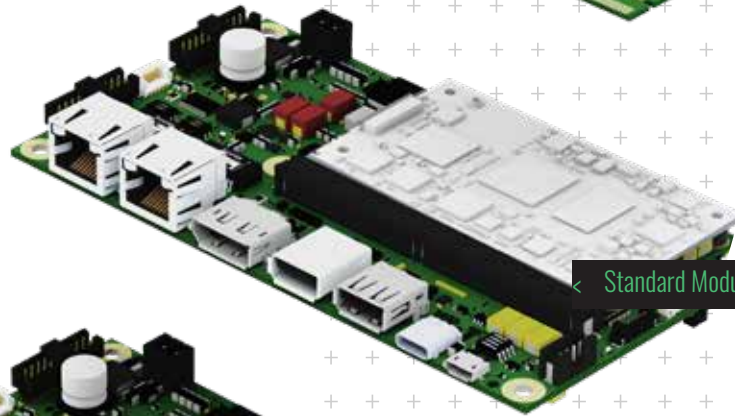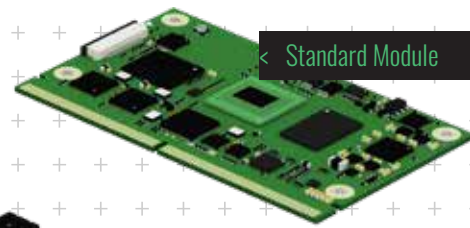
/BOARD CUSTOMIZATION

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

Custom Board Design

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

< Standard Module

< Standard Module on Baseboard

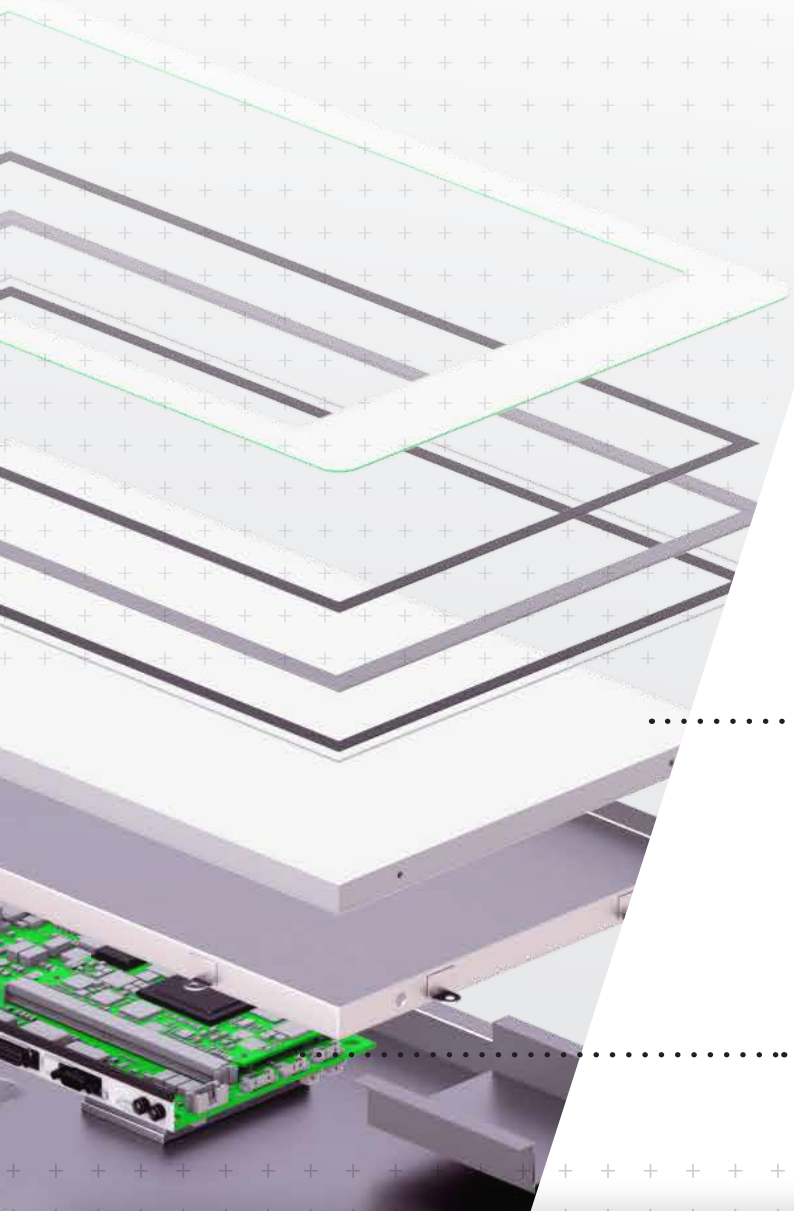< Module Technology into full-custom design

Customized Assembly – Individual Solutions

- Mounted and tested (memory, cooling, baseboard)
- Individual test profile
- Pre-configured BIOS
- Baseboard Electronic Manufacturing Service (EMS)

/CUTTING EDGE CUSTOM SOLUTIONS

COM Module >

ODM Carrier Boards >

ODM Arm® & x86 SBC >
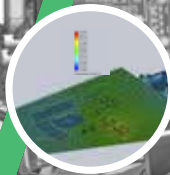
< Display/Touch Solutions

SW Design & Services >

< ODM HMI & System Solutions >

IDEA / CONCEPT

Ideas drive innovation –
We make sure you're taking
advantage of the latest
technologies to give you a
head start in your market.

SYSTEM DESIGN

From the concept to realization –
Best-in-class project management,
system engineering and sophisti-
cated 3D-mechanical design making
sure the product will meet the
required specification.

HW- / SW-DESIGN

Accelerate with our stand-
ard CPU platforms - Skilled
design engineers with many
years of experience at high-
end x86- and Arm®- CPUs
guarantees exceptional de-
sign and fast time to market.

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.

From industrial gateways, smart farming equipment to household kitchen appliances, we design, manufacture and deliver x86 and Arm® CPU boards, HMI solutions and headless CPU systems for OEMs so they can focus their resources on their own innovation.
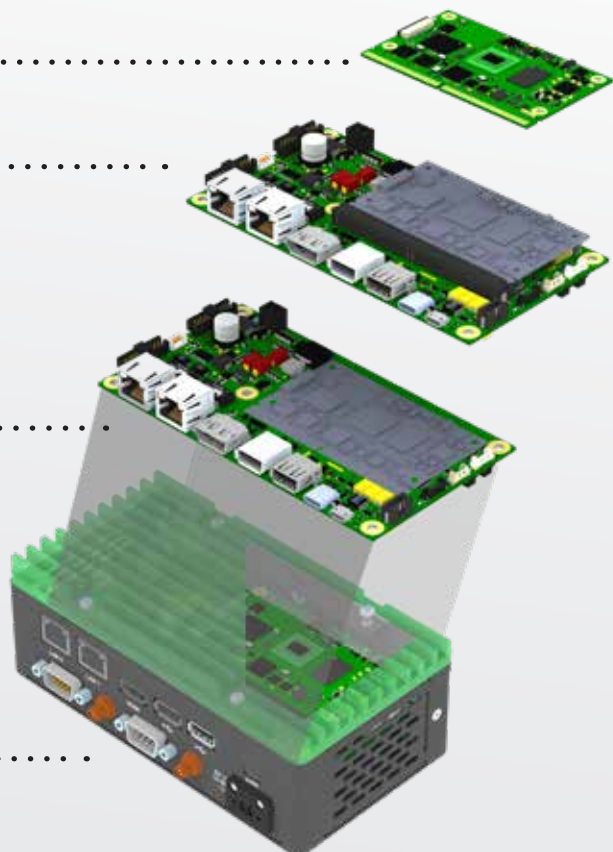
Medical

Prosumer

Avnet Embedded Solutions are widely accepted across all vertical markets

Industrial

Heavy Machinery

VERIFICATION / CERTIFICATION

Quality and reliability can't be compromised - to guarantee the compliance with the functional and environmental requirements, deep expertise in verification and certification ensures highest level of quality.

BOARD PRODUCTION

World class PCB manufacturing - Advanced equipment, efficient and highly automated process for supreme quality at competitive production cost.

SYSTEM MANUFACTURING

Entire responsibility for your product – With cutting-edge system level manufacturing, bonding and robotic assembly lines we commit premium quality and seamless delivery.

/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

1992 PC-104

2000 ETX

2005 COM Express®

2008 Qseven®

2016 SMARC® 2.0

**2020 COM-HPC®**

2022 OSM
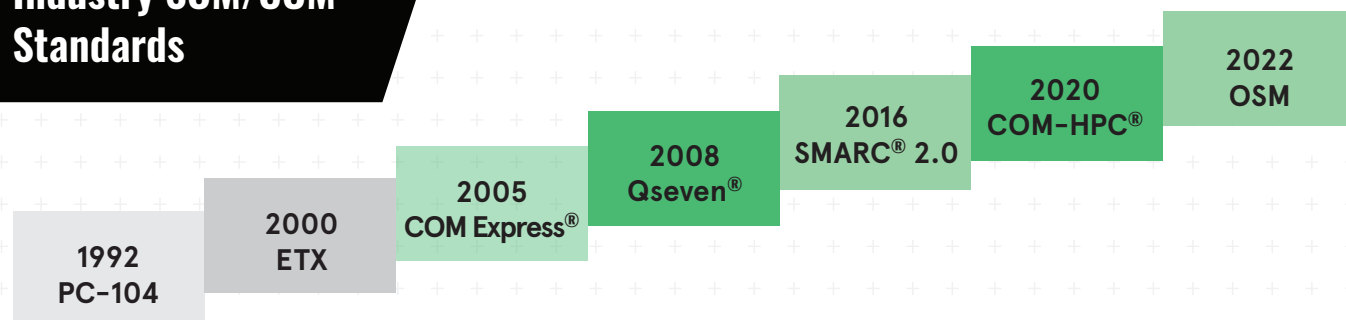
Committed to Open Standards (Advantage of Open Standards)

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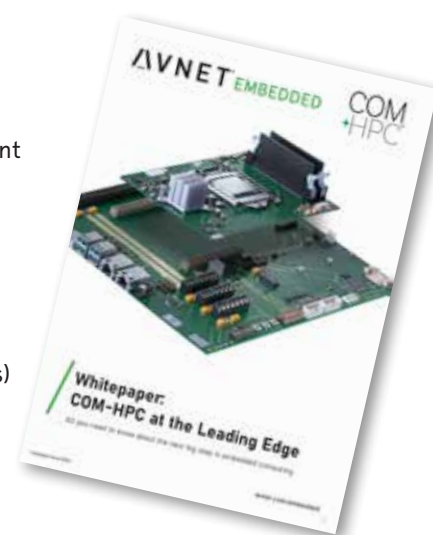
Avnet Embedded (formerly MSC) is Executive Member of PICMG (PCI Industrial Computer Manufacturers Group)

COM Express

COM HPC®

- 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

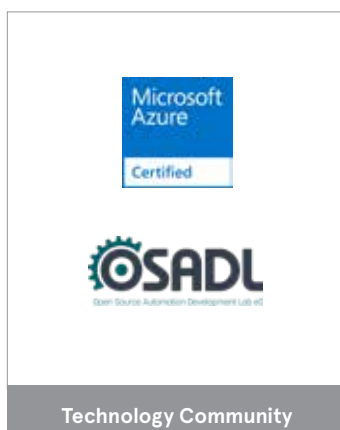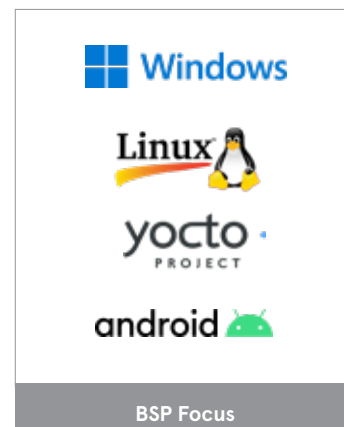**MSC was founding member of SGeT (Standardization Group for Embedded Technologies)**

SMARC module

QSEVEN

OPEN STANDARD MODULE™

- 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

|		
intel NXP AMD TEXAS INSTRUMENTS RENESAS	W Witekio AN AVNET COMPANY	Windows Linux yocto PROJECT android
X86 and Arm® Partners	**Software Innovation***	**BSP Focus**
ami	Microsoft Azure Certified OSADL Open Source Automation Development Lab e.V.	SGeT Member PICMG
BIOS Partners	**Technology Community**	**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**
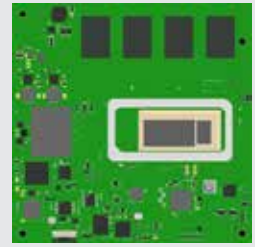Leading PICMG and SGeT standards innovator
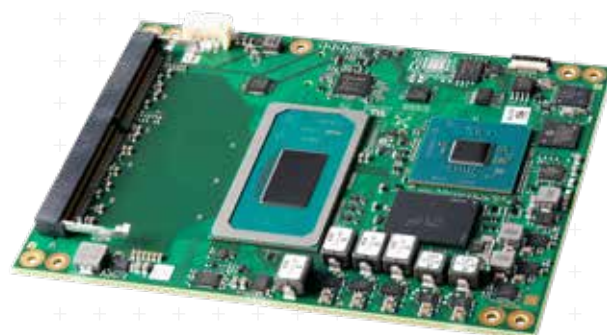
MSC HCC-CFLS   MSC HSD-ILDL

MSC C6B-ALP

MSC C6C-ALP

COM+HPC®

COM Express

intel.

intel.

First COM-HPC® Client and Server module on the market

Leading next generation roadmap.
Innovating the future in Edge computing.

Intel 12. Generation (products formally Alder Lake P)

"iCore" performance on
COM Express® Basic/Compact and COM-HPC.

/ AVNET EMBEDDED COMPUTE HIGHLIGHTS

NXP® i.MX 8M Plus and i.MX 93

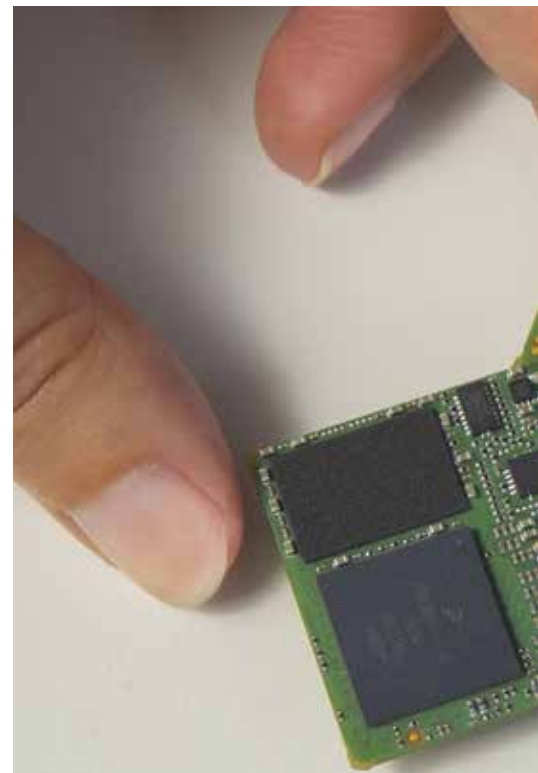Scalable Solutions in combination with high computing power and efficient power consumption:

i.MX 8M Plus – for Edge based embedded vision and audio AI applications
i.MX 93 – performance and energy efficiency for Edge applications
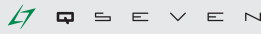
NXP

MSC SM2S-IMX8PLUS   MSC SM2S-IMX93

SMARC
module

MSC Q7-EL

MSC C6C-EL

MSC C6C-RYZ

COM Express

Q SEVEN

MSC SM2S-EL

MSC C10M-EL

MSC C6C-RYZ

SMARC module

SMARC module

COM Express

intel

AMD

Intel Atom® Processor X Series (products formally Elkhart Lake)

Flexible choice of COM module standards with best in class performance and feature sets.

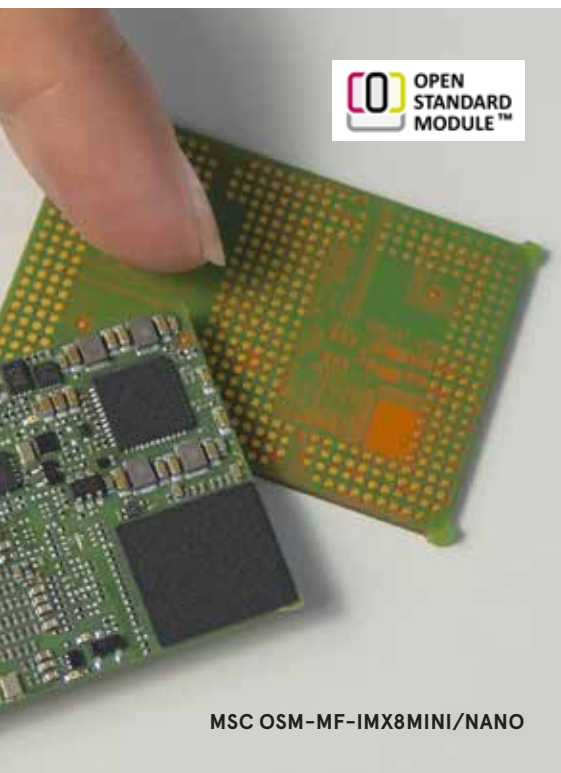## AMD Ryzen™ V1000/R1000

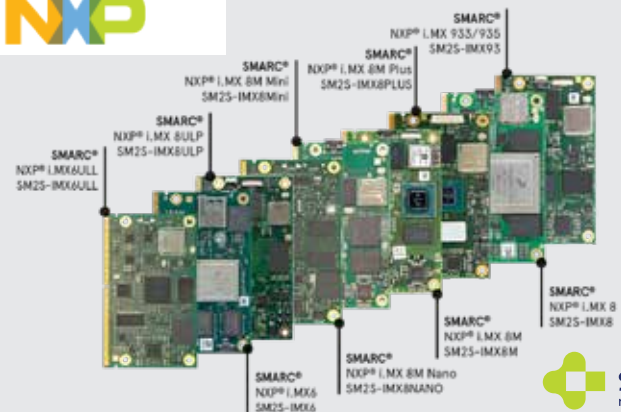**Industry leading SMARC® module**

OPEN STANDARD MODULE™

NXP® SMARC® Portfolio

- Leading SMARC® module vendor with largest NXP® i.MX based portfolio worldwide
- Complete portfolio is pin and feature compatible and scalable in price and performance

NXP

MSC OSM-MF-IMX8MINI/NANO

SMARC®
NXP® i.MX 933/935
SM2S-IMX93

SMARC®
NXP® i.MX 8M Plus
SM2S-IMX8PLUS

SMARC®
NXP® i.MX 8M Mini
SM2S-IMX8Mini

SMARC®
NXP® i.MX 8ULP
SM2S-IMX8ULP

SMARC®
NXP® i.MX6ULL
SM2S-IMX6ULL

SMARC®
NXP® i.MX 8
SM2S-IMX8

SMARC®
NXP® i.MX 8M
SM2S-IMX8M

SMARC®
NXP® i.MX 8M Nano
SM2S-IMX8NANO

SMARC®
NXP® i.MX6
SM2S-IMX6

SMARC module

/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

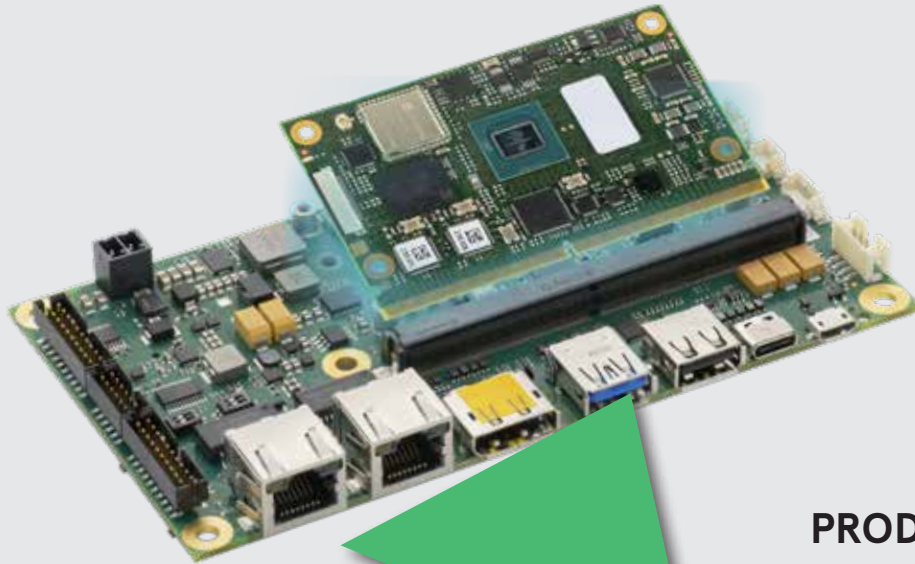|	Standard SBC	Custom SBC	SimpleFlex
Low cost	✔ ✔ ✔	✔ ✔ ✔	✔ ✔ ✔
Flexibility	– –	✔ ✔	✔ ✔ ✔
Time to Market	✔ ✔ ✔	– –	✔ ✔ ✔
Low Development cost/risk	✔ ✔ ✔	– –	✔ ✔ ✔

SMARC module   Q SEVEN

IDEA
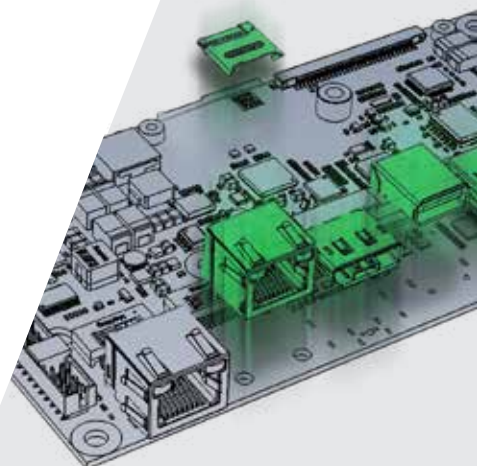
SERIAL

PRODUCTION

90 Days

DELIVERY

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 component like the processor or other active components after silicon EOL notice.
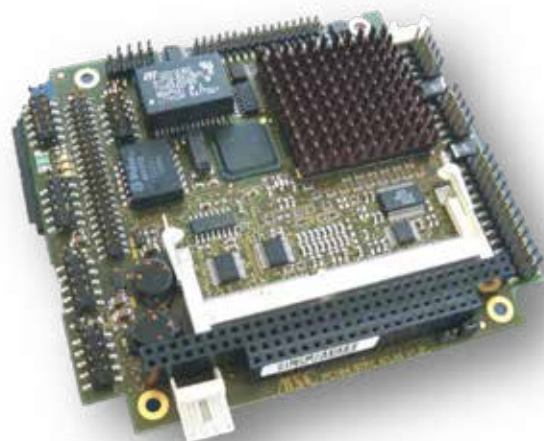
Reference: /MSC PC-104 Design since 2000 (Processor EOL 2008) Continues production and shipment based on special LTB program.

/ SECURE BY DESIGN
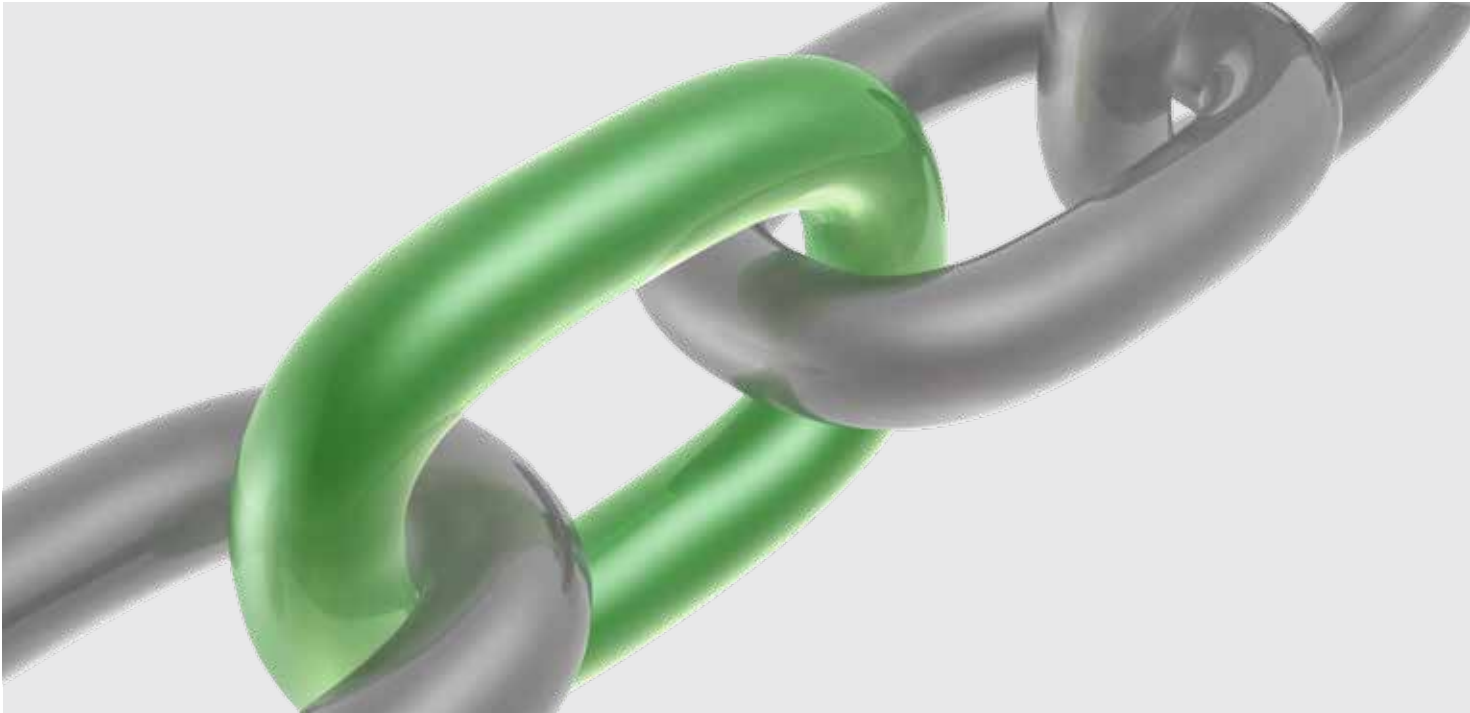
There is no "one-size-fits-all" solution or security standard when it comes to securing and protecting your devices against the increasing amount of threats & attacks of today's world.

With Avnet Embedded, you can rely on our deep knowledge and long-term experience* to be ready even for tomorrows security threats by being your partner of choice for designing, deploying and maintaining of:
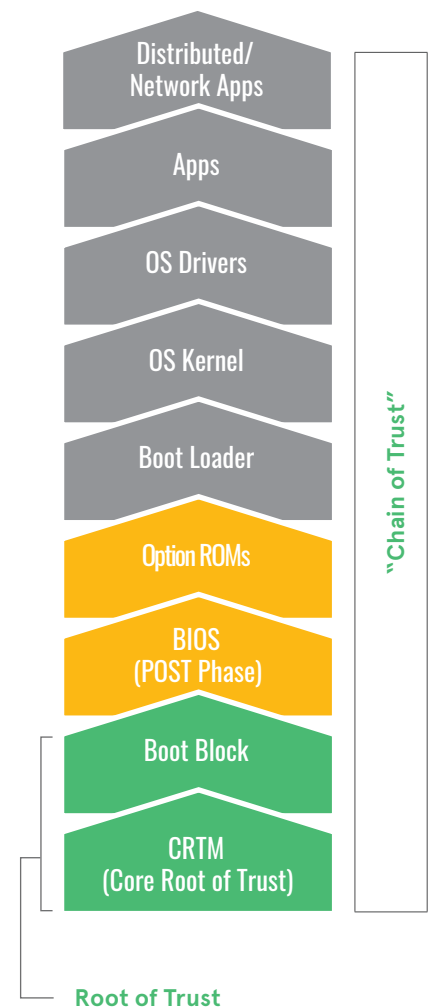
- **embedded systems security,**
- **IoT device security**
- **End to End Consultancy and Software Solution**

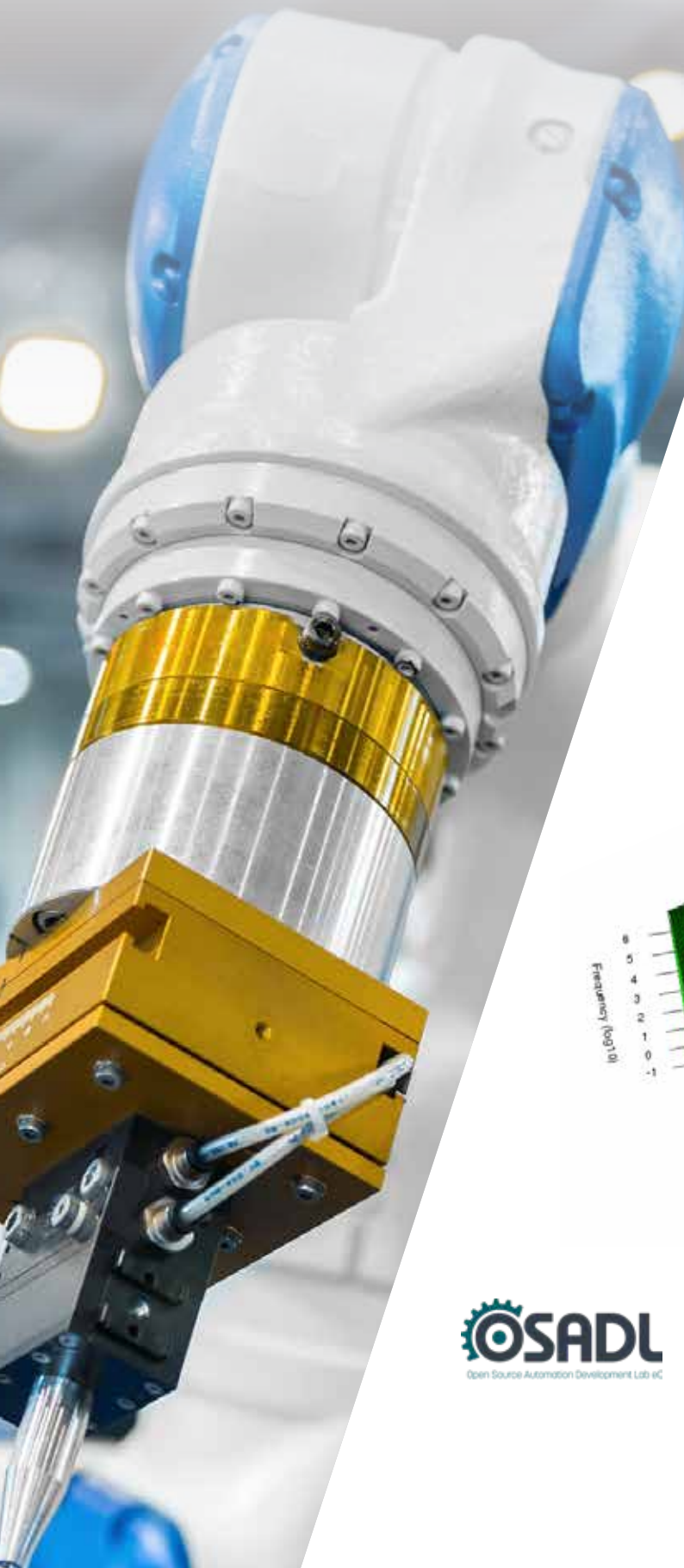| LATEST ARM® SECURITY TECHNOLOGIES	LATEST X86 SECURITY TECHNOLOGIES
- run time attestation - silicon RoT - trust provisioning - fine grain key - extensive crypto services - High Assurance Boot (HAB) - Zero Touch Provisioning	**AMI Aptio® V BIOS** utilized by Avnet Embedded supports the "Chain of Trust" according to the TCG (Trusted Computing Group) - 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

Distributed/ Network Apps

Apps

OS Drivers

OS Kernel

Boot Loader

Option ROMs

BIOS (POST Phase)

Boot Block

CRTM (Core Root of Trust)

"Chain of Trust"

Root of Trust

/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.

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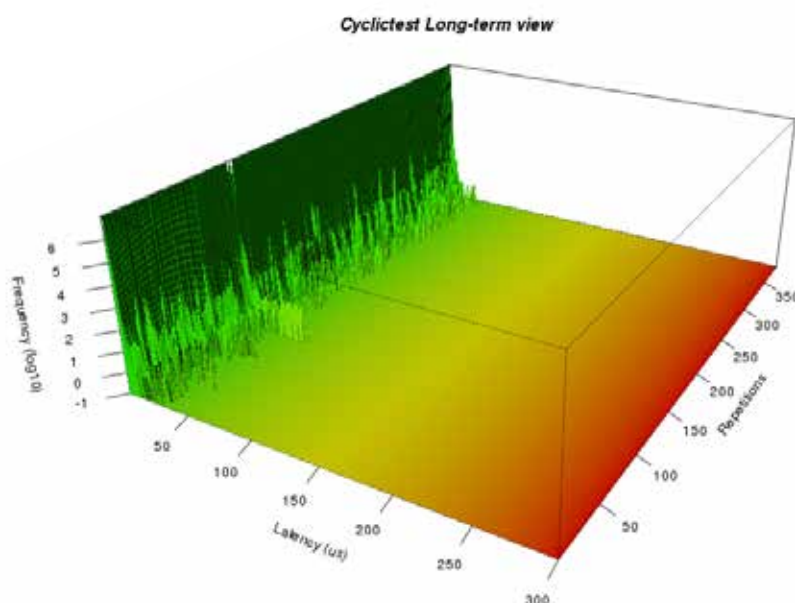
Open Source Automation Development Lab (OSADL). Standard reference benchmark for measuring and verifying real-time capabilities of Linux® based computing systems. We run our products in the OSADL test environment, the OSADL QA Farm (www.osadl.org) over years.

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
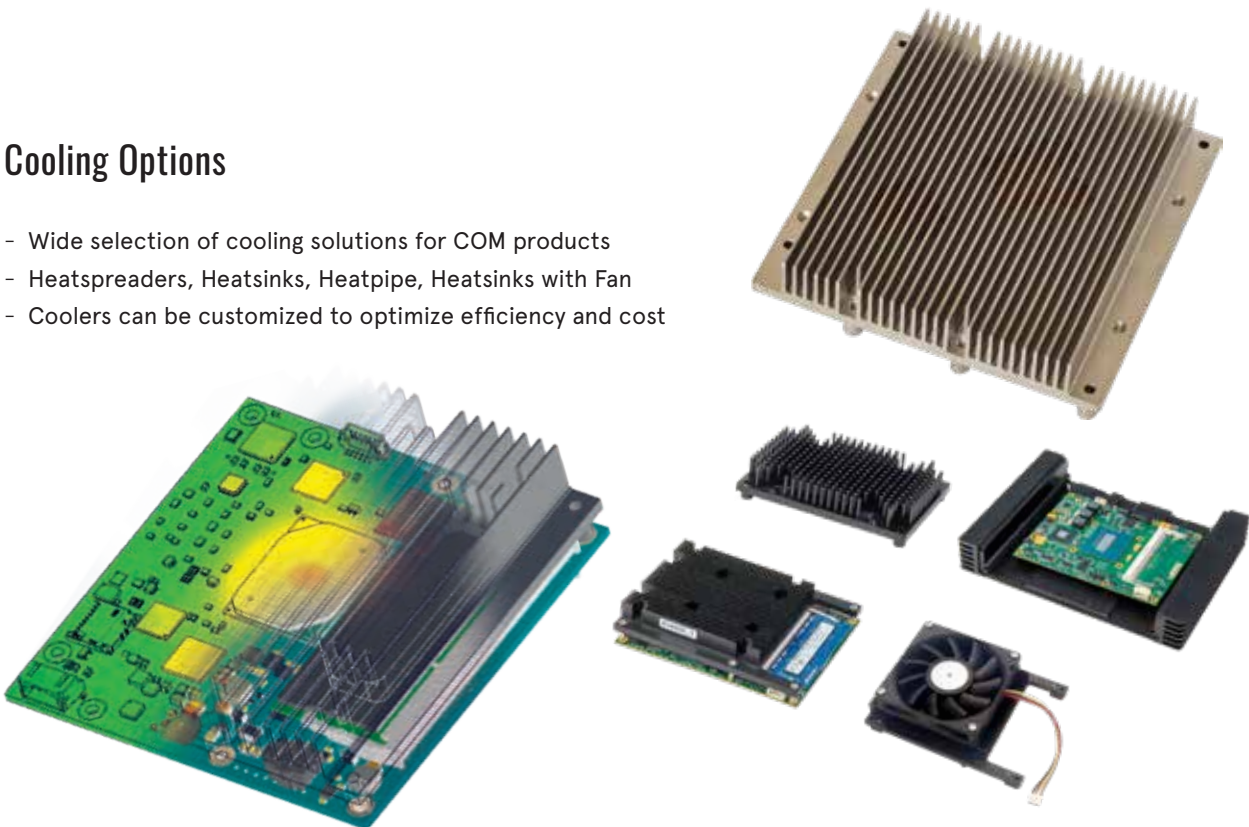
/ TECHNICAL SUPPORT & DESIGN SERVICES

With more than 25 years experience this is our key factor for hundreds of new designs awarded each year – enabled millions of produced 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

Software – Yocto BSP Software Training Program

From basic training to advanced support, we can help your team to build a solution with Yocto. We create bespoke workshops for customers working with our hardware, including (but not limited to) the following modules:

- Introduction to BSP builds using /MSC modules
- General structure of a Yocto build
- How to add a new application (e.g. a terminal etc.)
- Benchmarking for applications
- Function extension (I2S, M4/M7 Cores etc.)
- Security considerations and security update deployment
- Code samples / reference images
- Real-time applications
- Component configuration
- Boot optimization (using bootloaders like U-Boot etc.)
- Special application BSPs

If you're interested in accelerating your product development with us, reach out to our support team will be in touch to discuss your needs.

/MSC BIOS TOOLS

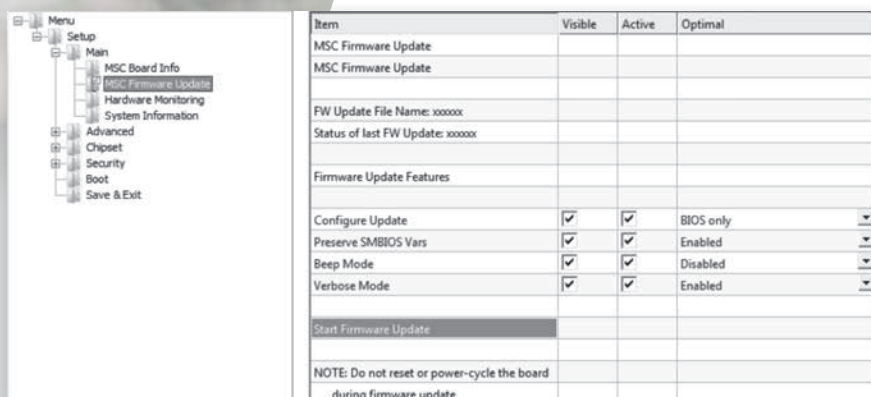## Easy development and update with innovative solutions

/**MSC** BIOS Config Tool

Windows based

- Customization of default BIOS setup parameters such as
  - Custom LCD panel timing
  - Boot priority settings
- Adding a custom boot logo / splashscreen
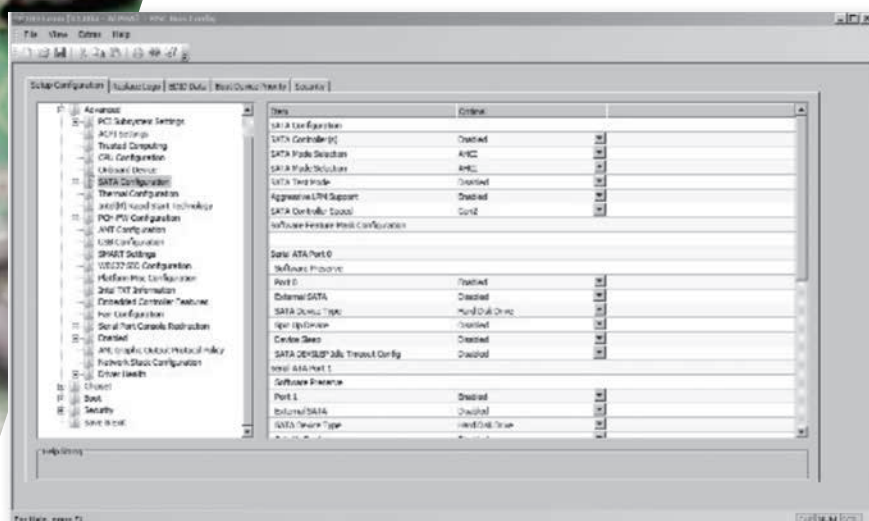
/**MSC** BIOS Update Tool

Autoflash* available for

- UEFI shell
- Linux®
- Windows
- Via LAN network

*integrated into every BIOS

/OEM BIOS CUSTOMIZATION SERVICE

AMI source code-based BIOS modifications for specific features

- Enable non-standard peripheral devices on LPC, PCI, PCIe,... interfaces
- Special security (Chain of Trust) features and updates
- /MSC On-Board Controller enhanced features
- Real-Time, Power Consumption, Battery optimized, ...

avnet.com/embedded

/QUALITY FROM PRODUCTION TO DESIGN (/MSC BSP)

Drivers and boot-loader are extremely validated and optimized by /MSC

DUAL USE of /MSC BSP (Linux®/Yocto)

- **/MSC-LDK (Linux® Development Kit)**
  our environment to build Linux® kernels, bootloaders and
  root filesystems for developers
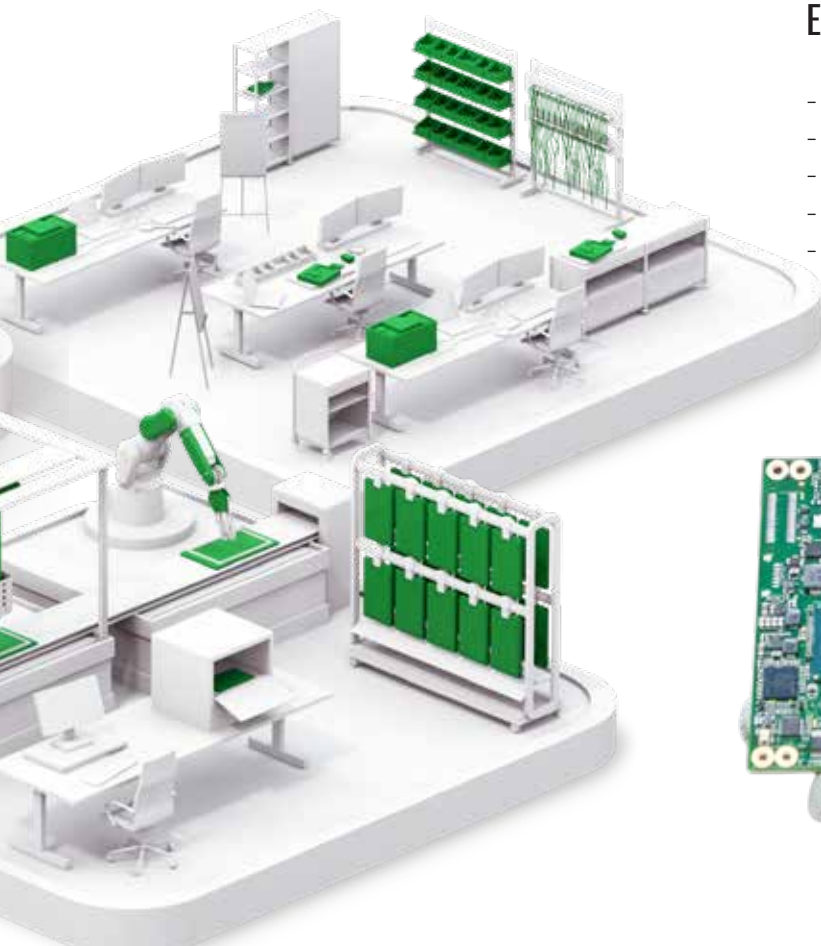- **Avnet Embedded Production Function Test**

/MSC BSP
YOCTO Linux®
U-Boot

Environmental Testing and Certification

- Thermal characteristics of standard products
- Product screening and ruggedization
- Compliance test
- Environmental test
- Certification

/MSC COM STARTER-KIT

COM·HPC®   COM Express   SMARC module   QSEVEN   nanoRISC®   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 get the fitting 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
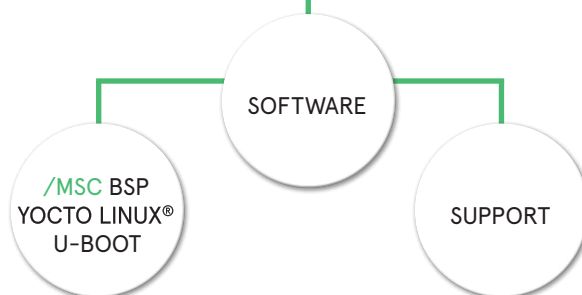
Starterkit

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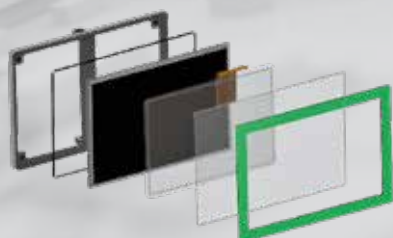
Displaykit
5", 7", 10.1" and 12.1"
TFT Include LVDS cable, Backlight Cable PCAP touch with USB Controller

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 SUPPORT BASIC

BIOS / Bootloader

- Provisioning U-Boot, Drivers, UEFI, and Legacy
- MSC BIOS Config Tool (Windows based)
- MSC BIOS Update Tool (UEFI shell, Windows, Linux®, LAN Network)
- OEM BIOS Customization Service

BSP

Drivers and bootloader provided for:
- Android, QNX, VXWorks (all on request)
- Windows (available on all x86)
- Linux® (available on all Arm®/x86)

Security

- Provisioning Secure boot Trust Zone
- TCG support: boot monitoring, Core Root of Trust for Measurement, TPM verification for SW modules, Integrity Boot process stop

OS

Providing OS Support for:
- Linux® & Android
- Windows IoT core / Windows IoT / Server
- Cortex M OS

/COM SOFTWARE SUPPORT PLUS

Artificial Intelligence

- Design and customization of Machine Learning and AI models in Computer Vision & NLP
- Optimization for AI processing via VPU, NPU and TPU

Real-Time

- Providing the integration of real-time in product development
- BIOS/UEFI ready for OEM customer real-time applications
- Cooperation with OSADL

Middleware

Simplify applications and infrastructure with
- OTA update
- Application Containers
- Cloud Connectivity
- Functional Safety

Custom Applications

Providing state-of-the-art frameworks for customized application development in
- Linux® (Qt, Flutter)
- Android
- Windows

/SOFTWARE TECHNOLOGY LAB

Software brings embedded hardware to life.

Enablers & Features

Innovative and simplified software applications and board support packages for rapid product development.

Functional Platforms

Ready to use embedded solutions combining software and Avnet Embedded hardware.
Fast go-to-market scenario.

Technology Demonstrators

Let's innovate embedded computing! Discover our demonstrators and imagine the future possibilities that can be realized with Avnet Embedded products.

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... **get fast POC and fast software development. Get full software services for the product lifecycle**.

Edge AI

To provide our customers with latest technology capabilities, we offer high-qualified expertise in Machine Learning, Computer Vision, and Natural Language Processing.

Edge Computing

To stay ahead in embedded edge environments, we provide application containerizing, Open source BSP development, and latest industrial communication stacks for real-time edge apps and OTA.

UI Frameworks

To maximize the usability and user experience of customer products, we supply the full integration of state-of-the-art frameworks for User Interface development, like Flutter and Qt in our BSP.

/COM-HPC®

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.
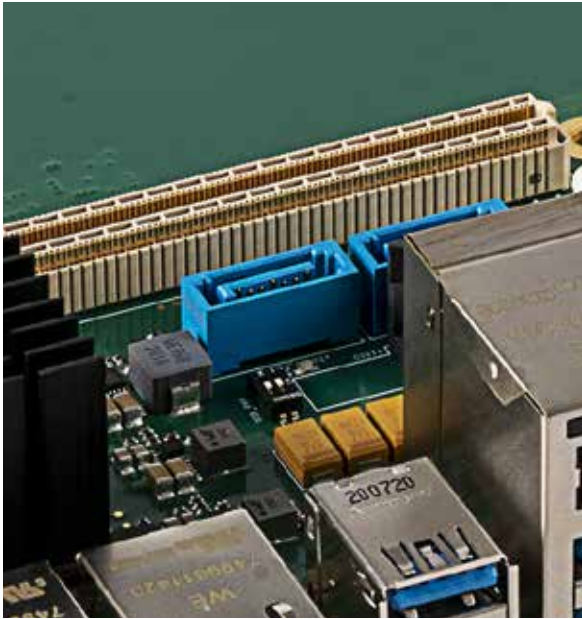
COM-HPC® Properties

Emerging technologies such as artificial intelligence, machine vision, edge computing and 5G network infra- structure 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.
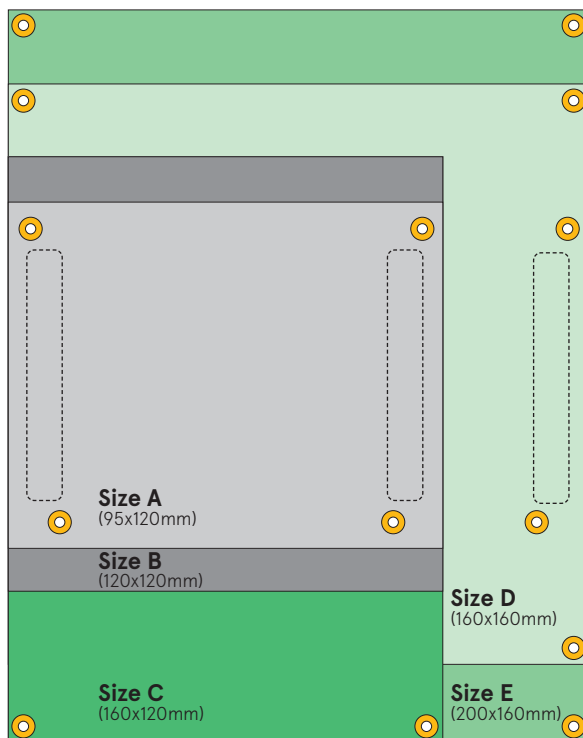
COM-HPC® Client
49x PCIe
2x MIPI-CSI
2x 25GbE KR
3x DDI
2x BaseT (up to 10 Gb)
2x SoundWire, I2S
4x USB4
4x USB 2.0
2x SATA
eSPI, 2x SPI, SMB
2x I2C, 2x UART
12x GPIO

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®

Size A
(95x120mm)

Size B
(120x120mm)

Size C
(160x120mm)

Size D
(160x160mm)

Size E
(200x160mm)

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 featuring cost effective system-on-chip.

Depending or 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 HCC-CFLS	MSC HCA-ALP	MSC HCA-RLP	
Technology	x86	x86	x86	
Formfactor	COM-HPC® Client Size C, 120 mm x 160 mm	COM-HPC® Client Size A, 95 mm x 120 mm	COM-HPC® Client Size A, 95 mm x 120 mm	
CPU	Intel® Core™ Processor – i7-9700E (eight-core/eight threads, 2.6/4.4GHz, 12MB cache, 65W TDP) – i7-9700TE (eight-core/eight threads, 1.8/3.8GHz, 12MB cache, 35W TDP) – i5-9500E (six-core/six threads, 3.0/4.2GHz, 9MB cache, 65W TDP) – i5-9500TE (six-core/six threads, 2.2/3.6GHz, 9MB cache, 35W TDP) – i3-9100E (four-core/four threads, 3.1/3.7GHz, 6MB cache, 65W TDP) – i3-9100TE (four-core/four threads, 2.2/3.2GHz, 6MB cache, 35W TDP) Intel® Pentium® Processor – G5400T (two-core/four threads, 3.1GHz, 4MB cache, 35/25W TDP/cTDP)	Intel® Core™ Processor ALP 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 ALP 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 ALP U-series – i7-1265UE 10C/12T, 1.7GHz, 96 EUs, 12MB L3, 28/15/12W cTDP – i5-1245UE 10C/12T, 1.5GHz, 80 EUs, 12MB L3, 28/15/12W cTDP – i3-1215UE 6C/8T, 1.2GHz, 64 EUs, 10MB L3, 28/15/12W cTDP Intel® Celeron® Processor – 7305E 5C/5T, 1.0GHz, 48 EUs, 8MB L3, 15/12W cTDP	Intel® Core™ Processor RLP H series – 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 RLP P-series – i5-1340PE 12C/16T, 1.8GHz, 80 EUs, 12MB L3, 28/20W cTDP – i3-1320PE 8C/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 RLP U-series – 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 Intel® Processor U-series U300E 5C/6T, 1.1GHz, 48 EUs, 8MB L3, 15/12W cTDP	
Chipset	Intel® Platform Controller Hubs (PCH) Q370 or H310	Integrated in System-on-Chip		
DRAM	2x 260-pin SO-DIMM socket for up to 2x 32GB DDR4 SDRAM (DDR4-2666)	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)	2x SATA channels (up to 6Gb/s), optional optional on-board NVMe, 64GB to 1TB		
USB	4x USB 3.1 (Gen 1 & 2) 8x USB 2.0	2x USB4 2x USB 3.2 (Gen 1 & 2) 8x USB 2.0		
Bus Interfaces	16x PCI Express® x1 Gen 3, configurable up to x4 (Q370 only) 6x PCIe Gen 2 x1 lanes (H310 only) 1x PCI Express® Graphics (PEG) x 16 Gen 3	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	Integrated Intel HD graphics Gen. 9	Intel® Iris® Xe architecture Graphics, Up to 96 execution units (EU) H.264/AVC, H.265/HEVC, AV1, MJPEG encode/decode/transcode		
Display Interfaces	Three independent displays supported 3x Digital Display Interface (DP 1.2, HDMI 1.4b) 1x Embedded DisplayPort 1.4	Four independent displays supported 3x Digital Display Interface (DP 1.4a, HDMI 2.0b) 1x Embedded DisplayPort 1.4b		
Network Interface	1x 10/100/1000BASE-TX 1x 2.5GBASE-T (i225)	Two 10/100/1000Base-TX, 2.5G based on Intel i226		
Audio Interface	Total of up to 4x MIPI SoundWire audio interface	High Definition Audio		
Security Device	TPM 2.0	TPM 2.0		
OS Support	Microsoft Windows® 10 IoT Enterprise BSP for Linux® (Yocto Project®) EAPI (HW Programming Interface)	Microsoft Windows® 10 IoT Enterprise 2021 LTSC BSP for Linux® (Yocto Project®)		
Power Requirements	Voltage: +8.0V to +16V, Stby optional Power Cosumption: TBD	Voltage: +8V to +20V, +5V Stby optional, +3V RTC voltage Power Consumption: TBD		
Operating Temp.	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)	
Humidity	5 ... 95% (operating, non-condensing), 5 ... 95% (storage, non-condensing)			

MSC HSD-ILDL

x86

COM HPC® Server Size D, 160 mm x 160 mm

Intel® Xeon® Processor
- **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

Up to 256GB DDR4, 4x 288pin DIMM, 2 channels, 2 DIMMs per channel

2x SATA 6Gb/s

2x USB 3.2 Gen 2
2x USB 3.2 Gen 1
4x USB 2.0

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

–

–

1x 1000BASE-T / 2.5GBASE-T, TSN (i225)
8x 25KR Ethernet (max. aggregated bandwith 100Gb Ethernet)

–

TPM 2.0

Microsoft Windows® 10 IoT Enterprise
BSP for Linux® (Yocto Project®)
EAPI (HW Programming Interface)

Voltage: +12V, Stby optional
Power Cosumption: TBD

-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 most 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.
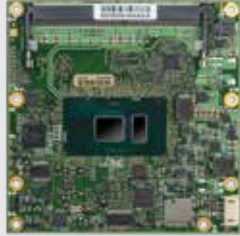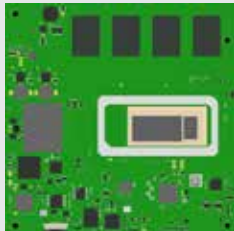
Specs	MSC C6B-SLH	MSC C6B-KLH	MSC C6B-CFLH	MSC C6B-CFLR	
Technology	x86	x86	x86	x86	
Formfactor	COM Express® Basic FF, Dimension: 95 mm x 125 mm		COM Express® Basic FF, Dimension: 95 mm x 125 mm		
CPU	**Intel® Core™ Processor** – **i7-6820EQ** (4C, 2.8/3.5GHz, 8MB cache, 45W) – **i7-6822EQ** (4C, 2.0/2.8GHz, 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) **Intel® Celeron® Processor** – **G3900E** (2C, 2.4GHz 2MB cache, 35W) – **G3902E** (2C, 1.6GHz 2MB cache, 25W) **Intel® Xeon® Processor** – **E3-1505M v5** (4C, 2.8/3.7GHz, 8MB cache, 45W 35W cTDP) – **E3-1505L v5** (4C, 2.0/2.8GHz, 8MB cache, 25W)	**Intel® Core™ Processor** – **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) **Intel® Xeon® Processor** – **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)	**Intel® Core™ Processor** – **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) **Intel® Xeon® Processor** – **E-2176M** (6C, 2.7/4.4GHz, 12M cache, 45/35W cTDP)	**Intel® Xeon® Processor** – **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) **Intel® Core™ Processor** – **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) **Intel® Celeron® Processor** – **G4930E** (4C, 2.4GHz, 2MB cache, 35W TDP) – **G4932E** (4C, 1.9GHz, 2MB cache, 25W TDP)	
Chipset	Intel® Platform Controller Hubs (PCH) QM170, HM170 or CM236		Intel® Platform Controller Hubs (PCH) QM370 or CM246		
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 (DDR4-2666[1]); 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 3.1 (Gen 1 & 2)/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 UHD 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	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	-	High Definition Audio		
Security Device	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® 10 IoT Enterprise BSP for Linux® (Yocto Project®) EAPI (HW Programming Interface)		
Power Requirements	Voltage: +12V +/-10%, 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.)		
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-TLH	MSC C6B-ALP	MSC C6B-RLP
x86	x86	x86

COM Express® Basic FF, Dimension: 95 mm x 125 mm	COM Express® Basic FF, Dimension: 95 mm x 125 mm	

Intel® Core™ Processor – **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, 45/35WTDP/cTDP down **Intel® Celeron® Processor 6600HE**, 2C/2T, 2.6 GHz, 16EUs, 8M L3, 35W TDP **Intel® Xeon® Processor** – **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® Core™ Processor** **ALP 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 **ALP P-series** – **i7-1270PE** 14C/20T, 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 **ALP U-series** – **i7-1265UE** 10C/12T, 1.7GHz, 96 EUs, 12MB L3, 28/15/12W cTDP – **i5-1245UE** 10C/12T, 1.5GHz, 80 EUs, 12MB L3, 28/15/12W cTDP – **i3-1215UE** 6C/8T, 1.2GHz, 64 EUs, 10MB L3, 28/15/12W cTDP **Intel® Celeron® Processor** – **7305E** 5C/6T, 1.0GHz, 48 EUs, 8MB L3, 15/12W cTDP	**Intel® Core™ Processor** **RLP-H series** – **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 **RLP P-series** – **i5-1340PE** 12C/16T, 1.8GHz, 80 EUs, 12MB L3, 28/20W cTDP – **i3-1320PE** 8C/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 **RLP U-series** – **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 **Intel® Processor U-series** U300E 5C/6T, 1.1GHz, 48 EUs, 8MB L3, 15/12W cTDP
Intel® Platform Controller Hubs (PCH) RM590E, QM580E or HM570E	Integrated in System-on-Chip	
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	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
4x 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	
4x USB 3.1 (Gen 1 & 2), 8x 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 4 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)	
Integrated Intel® UHD graphics	Intel® Iris® Xe architecture Graphics, Up to 96 execution units (EU)	
Four independent displays supported 3x Digital Display Interface (DP 1.4, HDMI 2.0b) 1x Embedded DisplayPort 1.4b 1x LVDS 24bit, dual-channel 1x VGA (optional)	Four independent displays supported 3x Digital Display Interface (DP 1.4a, HDMI 2.0b) 1x Embedded DisplayPort 1.4b 1x LVDS 24bit, dual-channel 1x VGA (optional)	
10/100/1000Base-T, 2.5G (Intel i225)	10/100/1000Base-T, 2.5G, TSN (Intel i226)	
High Definition Audio	High Definition Audio	
TPM 2.0	TPM 2.0	
Microsoft Windows® 10 IoT Enterprise RS5 (64bit) BSP for Linux® (Yocto Project®)	Microsoft Windows® 10 IoT Enterprise 2021 LTSC BSP for Linux® (Yocto Project®)	
Voltage: +8.5V to +20V, +5V Stby optional Power Consumption: TBD	Voltage: +8.5V to +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-cond.), 5 ... 95% (storage, non-cond.)	

/COM EXPRESS® TYPE 6 COMPACT OVERVIEW

Specs	MSC C6C-SLU	MSC C6C-KLU	MSC C6C-WLU	
Technology	x86	x86	x86	
Formfactor	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® 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	
Chipset	Integrated in System-on-Chip		Integrated in System-on-Chip	
DRAM	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	
Storage Interfaces	Up to 3x SATA 6Gb/s		2x SATA 6Gb/s	
USB	4x USB 3.0/2.0, 4x USB 2.0		4x USB 3.1/2.0, 4x USB 2.0	
Bus Interfaces	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)	
Display Controller	Integrated Intel HD graphics Gen. 9		Integrated Intel HD graphics Gen. 9	
Display Interfaces	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	
Network Interface	10/100/1000Base-T (Intel i219)		10/100/1000Base-T (Intel i219)	
Audio Interface	High Definition Audio		High Definition Audio	
Security Device	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® 10 (embedded) BSP for Linux® (Yocto Project®) EAPI (HW Programming Interface)	
Power Requirements	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.)	
Operating Temp.	0° ... 60°C (operating) -25° ... 85°C (storage)		0° ... 60°C (operating) -25° ... 85°C (storage)	
Humidity	5 ... 95% (operating, non-condensing), 5 ... 95% (storage, non-condensing)			

MSC C6C-TLU	MSC C6C-ALP	MSC C6C-RYZ
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 – **i7-1185GRE** quad-core 2.8/4.4 GHz, 8 threads, 96 EUs, 12MB L2, 28/15/12W cTDP up/TDP/cTDP down, exten. 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, exten. temp. – **i5-1145G7E** quad-core 2.6/4.1 GHz, 8 threads, 80 EUs, 8MB L2, 28/15/12W cTDP up/TDP/cTDP down – **i3-1115GRE** dual-core 3.0/3.9 GHz, 4 threads, 48 EUs, 6MB L2, 28/15/12W cTDP up/TDP/cTDP down, exten. temp. – **i3-1115G4E** dual-core 3.0/3.9 GHz, 4 threads, 48 EUs, 6MB L2, 28/15/12W cTDP up/TDP/cTDP down **Intel® Celeron® 6305E** dual-core 1.8 GHz, 2 threads, 48 EUs, 4MB L2, 15W TDP	**Intel® Core™ Processor** **ALP P-series** – **i7-1270PE** 14C/20T, 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 **ALP U-series** – **i7-1265UE** 10C/12T, 1.7GHz, 96 EUs, 12MB L3, 28/15/12W cTDP – **i5-1245UE** 10C/12T, 1.5GHz, 80 EUs, 12MB L3, 28/15/12W cTDP – **i3-1215UE** 6C/8T, 1.2GHz, 64 EUs, 10MB L3, 28/15/12W cTDP **Intel® Celeron® Processor** – **7305E** 5C/6T, 1.0GHz, 48 EUs, 8MB L3, 15/12W cTDP	**AMD Ryzen™ Embedded** – **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
Integrated in System-on-Chip	Integrated in System-on-Chip	Integrated in System-on-Chip
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)	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	2x SATA 6Gb/s
4x USB 3.1 Gen 1/Gen 2, 8x USB 2.0	4x USB 3.1 Gen 1/Gen 2, 8x USB 2.0	Up to 4x USB 3.1/2.0, 4x USB 2.0
PCI Express® Gen3, 1x4 + 5x1 LPC bus (Low Pin Count bus; no DMA support)	PCI Express® 1x4, Gen 4 up to 2x4, Gen 3 2x4, with bifurcation options LPC bus (Low Pin Count bus, no DMA support)	PEG port max x8 (depending on processor variant) LPC bus (Low Pin Count bus)
Integrated Intel Gen12 Gfx Engine Up to 96 execution units (EU)	Intel® Iris® Xe architecture Graphics, up to 96 execution units (EU)	GPU Vega core, up to 11 CUs
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	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 1x VGA (optional)
10/100/1000Base-T with TSN support (Intel i225)	10/100/1000Base-T, 2.5G (Intel i226)	10/100/1000Base-T (Intel i210)
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) BSP for Linux® (Yocto Project®)	Windows* 10 IoT Enterprise 2021 LTSC	Microsoft Windows® 10 IoT Enterprise (64-bit) Microsoft Windows® 10 Linux®, (Yocto Project®)
Voltage: +8.5V to +20V, +5V Stby optional Power Consumption: TBD	Voltage: +8.5V to +20V, +5V Stby optional Power Consumption: TBD	Voltage: +12V primary power supply input, +5V Stby optional Power Consumption: 28 W to 64 W (typ.)
-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 6 COMPACT OVERVIEW

Specs	MSC C6C-BT	MSC CXC-BT	MSC C6C-BW	
Technology	x86	x86	x86	
Formfactor	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	
Chipset	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	
Storage Interfaces	2x SATA 3Gb/s; PATA option for CXC-BT		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	
Bus Interfaces	Up to 5x PCI Express x1 Gen 2, LPC bus (Low Pin Count bus)	COM Express Type 2: 2x PCI Express x1 Gen 2, PCI Bus 32 Bit, 33MHz standard interface (PCI 2.3); LPC bus (Low Pin Count bus)	Up to 5x PCI Express® x1 Gen 2 LPC bus (Low Pin Count bus)	
Display Controller	Integrated Intel HD graphics Gen. 7		Integrated Intel HD graphics Gen. 8	
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	
Network Interface	10/100/1000Base-T (Intel i210)		10/100/1000Base-T (Intel i210)	
Audio Interface	High Definition Audio		High Definition Audio	
Security Device	TPM 1.2 (option)		TPM 1.2	
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)	
Power Requirements	Voltage: Wide range input +5 ... +17V, 5V Stby optional Power Cosumption: 8 W (typ.) up to 14 W (typ.)		Voltage: Wide range input +5 ... +17V, 5V Stby optional Power Cosumption: 7 W (typ.) up to 9 W (typ.)	
Operating Temp.	–25° ... 85°C (storage) 0° ... 60°C (commercial) –40° ... 85°C (industrial)		–25° ... 85°C (storage) 0° ... 60°C (commercial)	
Humidity	5 ... 95% (operating, non-condensing), 5 ... 95% (storage, non-condensing)			

MSC C6C-AL	MSC C6C-EL	MSC C6C-ALN
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 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	**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	**Intel® Core™ Processor** **– i3-N305**, eight-core, 1.0GHz/1.8GHz, 32EU, 9/15W, PUC **Intel Atom® Processor** **– 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 **Intel® Processor** **– N200**, quad-core, 1.0GHz, 32EU, 6W, PUC **– N97**, quad-core, 2.0GHz, 24EU, 12W, PUC **– N50**, dual-core, 1.0GHz, 16EU, 6W, PUC EUC - Intel Embedded Use Conditions PUC - Intel PC Client Use Conditions
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 4 GB (dual channel operation) or 1x 8 GB	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)
Up to 2x SATA 6Gb/s	Up to 2x SATA 6Gb/s	Up to 2x SATA 6Gb/s
4x USB 3.0/2.0, 4x USB 2.0	2x USB 3.1/2.0, 6x USB 2.0	Up to 4x USB 3.1, 8x USB 2.0
Up to 5x PCI Express® x1 LPC bus (Low Pin Count bus; no DMA support)	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)
Integrated Intel HD graphics Gen. 9	Integrated Intel graphics Gen11LP	Integrated Intel® UHD graphics
Three independent displays supported 2x Digital Display Interface (DP 1.2a, HDMI 1.4b) 1x Embedded DisplayPort 1.3 1x LVDS 24bit, dual-channel	Three independent displays supported 2x Digital Display Interface (DP 1.4, HDMI 1.4b) 1x Embedded DisplayPort 1.3 1x LVDS 24bit, dual-channel	2x Digital Display Interface (DP, HDMI) 1x Embedded DisplayPort LVDS 24bit, dual-channel VGA (optional)
10/100/1000Base-T (Intel i210)	10/100/1000Base-T (SoC integrated controller)	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 (embedded) BSP for Linux® on request EAPI (HW Programming Interface)	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
Voltage: +5 ... +20V, 5V Stby optional Power Cosumption: 7 W to 14 W (typ.)	Voltage: +8.5 ... +20V, 5V Stby optional Power Cosumption: 7 W to 14 W (typ.)	Voltage: +8.5 ... +20V, 5V Stby optional Power Cosumption: tbd
-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)
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
Formfactor	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 RS5 (64bit) Linux® (Yocto Project®) Kernel 5.4
Power Requirements	Voltage: +5 ... +20V, 5V Stby optional Power Cosumption: 8 W (typ.) up to 14 W (typ.)	Voltage: +5 ... +20V, 5V Stby optional Power Cosumption: 7 W (typ.) up to 14 W (typ.)	Voltage: +5 ... +20V, 5V Stby optional Power Cosumption: 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)		

COM Express

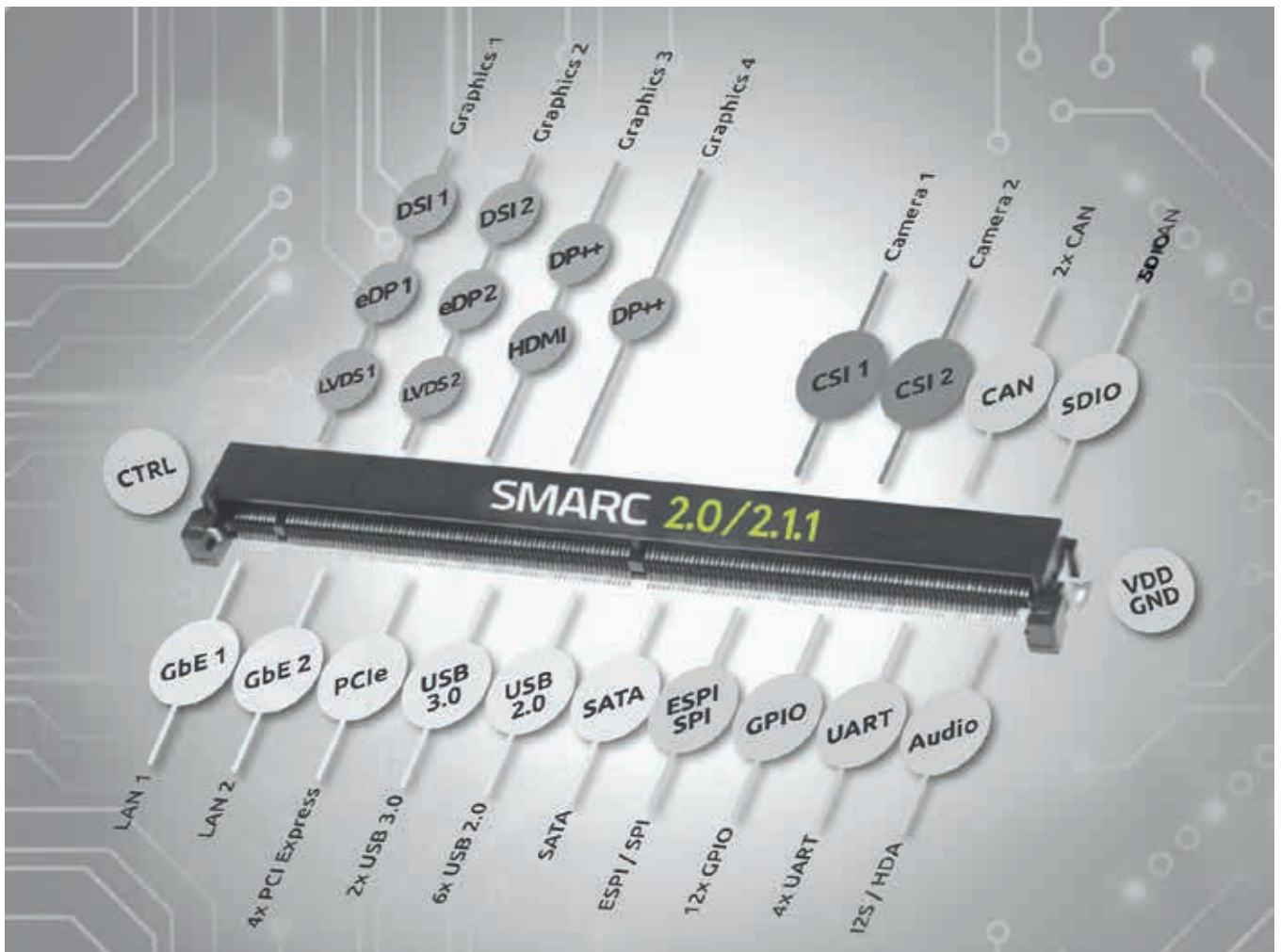| Specs	MSC C7B-DVL
Technology	x86
Formfactor	COM Express® Basic FF, Dimension: 95 mm x 125 mm
CPU	**Intel Atom® Processor** – **C3958** 16C, 2.0GHz, 20HSIO, 4x 10G, 31W TDP, QAT 20Gb/s, DDR4-2400 – **C3858** 12C, 2.0GHz, 20HSIO, 4x 10G, 25W TDP, QAT 20Gb/s, DDR4-2400 – **C3758** 8C, 2.2GHz, 20HSIO, 4x 10G, 25W TDP, QAT 10Gb/s, DDR4-2400 – **C3558** 4C, 2.2GHz, 12HSIO, 2x 10G, 16W TDP, QAT 5Gb/s, DDR4-2133 – **C3538** 4C, 2.1GHz, 12HSIO, 2x 10G, 15W TDP, QAT 5Gb/s comp. only, DDR4-2133 – **C3808** 12C, 2.0GHz, 20HSIO, 4x 10G, 25W TDP, QAT 20Gb/s, DDR4-2133, ext. temp – **C3708** 8C, 1.7GHz, 20HSIO, 4x 10G, 17W TDP, QAT 10Gb/s, DDR4-2133, ext. temp
Chipset	Integrated in System-on-Chip
DRAM	3x 260-pin SO-DIMM socket for up to 3x 32GB DDR4 SDRAM
Storage Interfaces	2x SATA channels (up to 6Gb/s)
USB	Up to 2x USB 3.0, 4x USB 2.0
Bus Interfaces	Up to 14 PCI Express® lanes Gen. 3
Display Controller	-
Display Interfaces	-
Network Interface	Up to four 10GBASE-KR one 10/100/1000Base-T (Intel® i210)
Audio Interface	-
Security Device	TPM 2.0
OS Support	Microsoft Windows® 10 IoT Enterprise (using add. Graphics card or BMC VGA) Windows Server 2016 Windows Server 2012 R2 (on request) Linux® (Yocto Project®)
Power Requirements	Voltage: +12V +/-10%, 5V Stby optional Power Cosumption: 20 W to 40 W (typ.)
Operating Temp.	-25° ... 85°C (storage) 0° ... 60°C (commercial) -40° ... 85°C (industrial)
Humidity	5 ... 95% (operating, non-condensing), 5 ... 95% (storage, non-condensing)

SMARC® 2.0 / 2.1.1

SMARC module

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 4 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, also eSPI is supported for attachment of peripheral devices on the baseboard or the application hardware. And still there are a lot of reserved pins left for future upgrades. Never bevore 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 2.0/2.1.1

CTRL

DSI 1
DSI 2
eDP 1
eDP 2
DP++
LVDS 1
LVDS 2
HDMI
DP++

Graphics 1
Graphics 2
Graphics 3
Graphics 4

Camera 1
Camera 2
2x CAN
SDIOAN

CSI 1
CSI 2
CAN
SDIO

VDD GND

GbE 1
GbE 2
PCIe
USB 3.0
USB 2.0
SATA
ESPI SPI
GPIO
UART
Audio

LAN 1
LAN 2
4x PCI Express
2x USB 3.0
6x USB 2.0
SATA
ESPI / SPI
12x GPIO
4x UART
I2S / HDA

82 mm
80 mm

82 mm
50 mm

/SMARC® MODULE OVERVIEW

Specs	MSC SM2S-RYZ	MSC SM2S-ALN	MSC SM2S-EL	
Technology	x86	x86	x86	
Formfactor	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 – **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**, OC, 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	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	
DRAM	Up to 8GB 2400MT/s DDR4	Up to 16GB LPDDR5 with up to 4.800 MT/s, IBECC (only Atom SKU's), soldered	Up to 16GB LPDDR4x with up to 4.267MT/s, IBECC (only Atom SKU's), soldered	
Flash	Up to 64GB eMMC V5.0 Flash, soldered (optional)	Up to 256GB eMMC V5.1 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 1x SD 3.01/SDIO 3.0	
USB	2x USB 3.0 4x USB 2.0	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)	
Bus Interfaces	Up to 4x PCI-Express® x1 Gen. 3 1x I2C Bus, 1x SMBus 1x SPI Bus	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)	
Display Controller	AMD Vega GPU	Integrated Intel® UHD Graphics Gen. 12	Integrated Intel® UHD Graphics Gen. 11	
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 eDP 1.4b or MIPI-DSI)	2x DP++ Dual-Channel LVDS interface, 18 or 24 Bit (optional eDP 1.3 or MIPI-DSI)	
Network Interface	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)	2x 10/100/1000Base-T 1x SGMII Interface on PCIE-D (opt.)	
Audio Interface	HDA Audio	HDA and I2S or 2x I2S 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 Cosumption: 6-15 W typ.	Voltage: +5V +/-5%, 5V Standby Power Cosumption: 8-17W typ.	Voltage: +5V +/-5%, 5V Standby Power Cosumption: 6-15W typ.	
Operating Temp.	0° ... 60°C (commercial) -40° ... 85°C (industrial) only with V1404I CPU	0° ... 60°C (commercial)	0° ... 60°C (commercial) -25° ... 85°C (extended) -40° ... 85°C (industrial)	
Humidity	5 ... 95% (operating, non-cond.), 5 ... 95% (storage, non-cond.)			

MSC SM2S-AL	MSC SM2S-G2UL	MSC SM2S-AM62X
x86	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
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	**Renesas RZ/G2UL Arm® Cortex®-A55 Microprocessor** – Single Core, 1.0GHz, secure – Single Core, 1.0GHz, non-secure Arm® Cortex® M33 Real Time Processor at 200MHz	**Sitara AM62x Arm® Cortex®-A53 Microprocessor** – **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 Arm® Cortex®-M4F Real Time Processor up to 400 MHz
Up to 8GB 2400MT/s LPDDR4, quad-channel, soldered	Up to 2GB 1600MT/s DDR4 SDRAM, soldered, inline ECC support	Up to 2GB 1600MT/s DDR4 SDRAM, soldered, inline ECC support
Up to 64GB eMMC V5.x Flash, soldered (optional)	Up to 256GB eMMC Flash	Up to 256GB eMMC Flash QSPI NAND Flash (optional)
1x SATA-III 6Gbps 1x SD 3.01	1x MMC/SD/SDIO	1x MMC/SD/SDIO
2x USB 3.0 6x USB 2.0 (1x Host/Device)	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)
Up to 4x PCI-Express® x1 Gen. 2 1x I2C Bus, 1x SMBus 2x SPI Bus (Boot/SIO)	4x I2C up to 400 Kbit/s 2x SPI (with two chip selects) 1x CAN-FD or 2x CAN-FD (optional)	4x I2C up to 400 Kbit/s 2x SPI (with two chip selects) 2x CAN-FD / CAN 2.0B
Integrated Intel® HD Graphics Gen. 9	Image Processing Unit to support simple HMI graphics	Imagination AXE-1-16M Graphics Processing Unit (GPU)
2x DP++ Dual-Channel LVDS interface, 18 or 24 Bit (optional eDP 1.3 or MIPI-DSI)	Dual-channel LVDS interface, 18 or 24 bit; also usable as one single-channel LVDS interface	Dual-channel LVDS interface, 18 or 24 bit; also usable as one single-channel LVDS interface
Up to 2x 10/100/1000Base-T	1x 10/100/1000BASE-T Ethernet WIFI/BT module (optional)	2x 10/100/1000BASE-T Ethernet WIFI/BT module (optional)
HDA and I2S Audio	1x I2S Audio or 2x I2S Audio (optional)	2x I2S Audio
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)
Microsoft Windows® 10 IoT (64bit) Linux® (Yocto Project®) EAPI (HW Programming Interface)	Linux® Board Support Package Android Board Support Package (on request)	Linux® Board Support Package Android Board Support Package (on request)
Voltage: +5V +/-5%, 5V Standby Power Cosumption: 7-14 W typ.	Voltage: +5V +/-5%, 5V Standby Power Cosumption: 3-4 W typ.	Voltage: +5V +/-5%, 5V Standby Power Cosumption: 2-5 W typ.
0° … 60°C (commercial) -25°C … 85°C (extended) -40° … 85°C (industrial)	0° … 70°C (commercial) -25°C … 85°C (extended) -40° … 85°C (industrial)	0° … 70°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-IMX93	MSC SM2S-IMX8	MSC SM2S-IMX8M	
Technology	Arm®	Arm®	Arm®	
Formfactor	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	
CPU	**NXP™ i.MX 93 Plus Arm® Cortex®-A55 Applications Processor** – **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 8QuadMax Applications Processor** - 2x Arm® Cortex®-A72, 4x A53, 2x M4F **NXP™ i.MX 8QuadPlus Applications Processor** - 1x Arm® Cortex®-A72, 4x A53, 2x M4F 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	**NXP™ i.MX 8M Arm® Cortex®-A53 Applications Processor** – **i.MX 8MQuad**, quad-core, 1.3-1.5GHz – **i.MX 8MDual**, dual-core, 1.3-1.5GHz – **i.MX 8MQuadLite**, quad-core, 1.3-1.5GHz Arm® Cortex®-M4 Real Time Processor at 266MHz	
DRAM	Up to 2GB 3700MT/s LPDDR4 SDRAM, soldered, inline ECC support	Up to 8GB 3200MT/s LPDDR4 SDRAM, soldered, non ECC	Up to 4GB 3200MT/s LPDDR4 SDRAM, soldered, non ECC	
Flash	Up to 256GB eMMC Flash	Up to 64GB eMMC Flash, QSPI NOR Flash (optional)	Up to 64GB eMMC Flash, QSPI NOR Flash (optional)	
Storage Interfaces	1x MMC/SD/SDIO	1x SATA-III 6Gbps 1x MMC/SD/SDIO	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, 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	
Bus Interfaces	4x I2C up to 400 Kbit/s 2x SPI (with two chip selects) 2x CAN-FD / CAN 2.0B	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)	
Display Controller	Pixel processing pipeline (PXP) engine	Dual GC7000Lite/XSVX 3D GPU	Vivante GC7000Lite 3D GPU	
Display Interfaces	Single-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 2x MIPI-DSI	HDMI 2.0a or DP 1.3 Dual-channel LVDS interface, 18 or 24 bit or 1x MIPI-DSI	
Network Interface	2x 10/100/1000BASE-T Ethernet WIFI/BT module (optional)	2x 10/100/1000BASE-T WIFI/BT module (optional)	1x 10/100/1000BASE-T WIFI/BT module (optional)	
Audio Interface	2x I2S Audio	2x I2S Audio	2x I2S Audio	
Security Device	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) 2.0 (optional)	Integrated advanced Security, Safety, and Reliability Trusted Platform Module (TPM) 2.0 (optional)	
OS Support	Linux® Board Support Package Android Board Support Package (on request)	Linux® (Yocto Project®) Android Board Support Package (on request)	Linux® (Yocto Project®) Android Board Support Package (on request)	
Power Requirements	Voltage: +5V +/-5%, 5V Standby Power Cosumption: 2-4 W typ.	Voltage: +5V +/-5%, 5V Standby Power Cosumption: 7-14 W typ.	Voltage: +5V +/-5%, 5V Standby Power Cosumption: 3-6 W typ.	
Operating Temp.	0° ... 70°C (commercial) -25° ... 85°C (extended) -40° ... 85°C (industrial)	0° ... 70°C (commercial) -40° ... 85°C (industrial)	0° ... 70°C (commercial) -40° ... 85°C (industrial)	
Humidity		5 ... 95% (operating, non-cond.), 5 ... 95% (storage, non-cond.)		

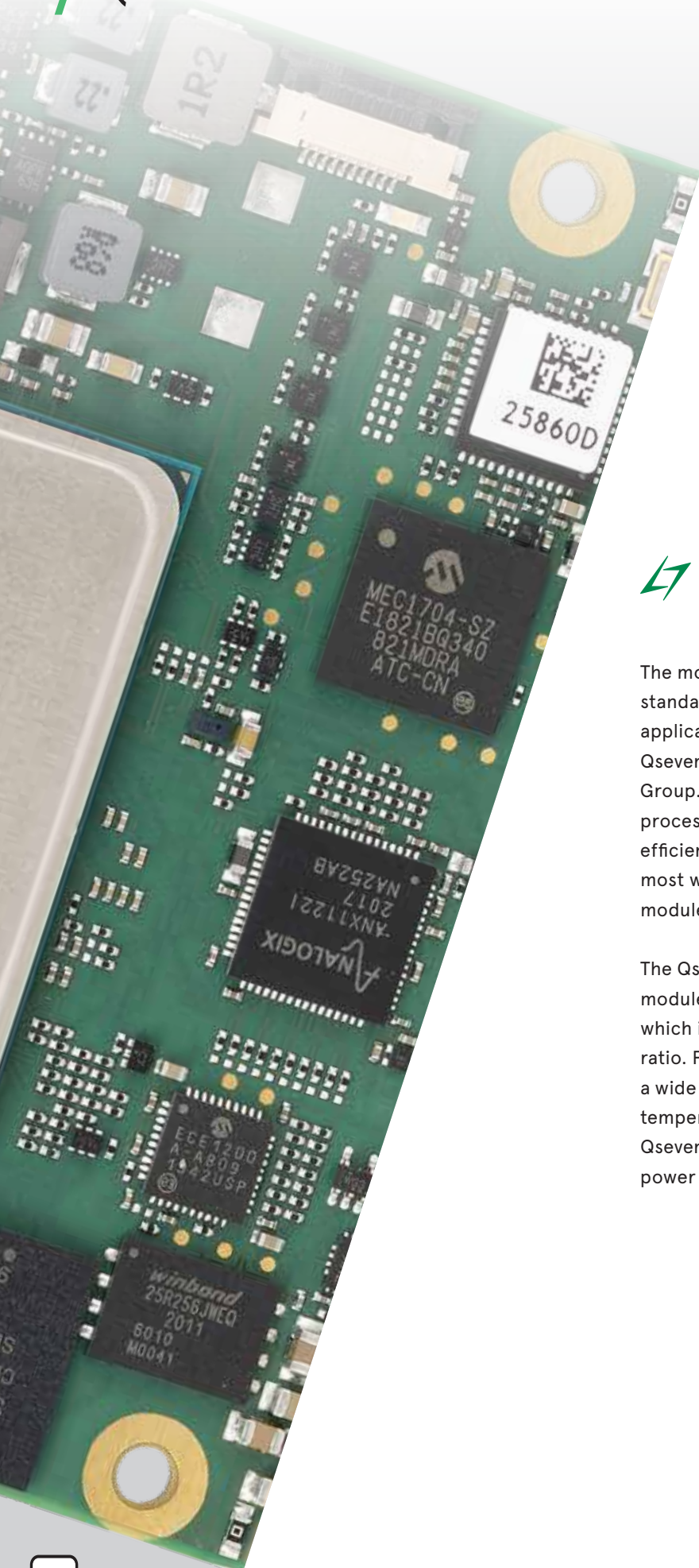| MSC SM2S-IMX8PLUS	MSC SM2S-IMX8MINI	MSC SM2S-IMX8NANO
Arm®	Arm®	Arm®
SMARC® 2.1.1, Dimension: 82 mm x 50 mm	SMARC® 2.0, Dimension: 82 mm x 50 mm	SMARC® 2.1.1, Dimension: 82 mm x 50 mm
NXP™ i.MX 8M Plus Arm® Cortex®-A53 Applications Processor **– i.MX 8M Plus Quad**: – NPU, ISP, VPU, HIFI4, CAN, 1.6 – 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, CAN, 1.6 – 1.8GHz Arm® Cortex®-M7 Real Time Processor at 800MHz	**NXP® i.MX 8M Mini Arm® Cortex®-A53 Applications Processor** **– 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** **– 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
Up to 8GB 4000MT/s LPDDR4 SDRAM, soldered, inline ECC support	Up to 4GB 3000MT/s LPDDR4 SDRAM, soldered, non ECC	Up to 2GB 2400MT/s DDR4 SDRAM, soldered, non ECC
Up to 256GB eMMC Flash, QSPI NOR Flash (optional)	Up to 64GB eMMC Flash, QSPI NOR Flash (optional)	Up to 256GB eMMC Flash, QSPI NOR Flash (optional)
1x MMC/SD/SDIO	1x MMC/SD/SDIO 1x Micro SD Card Socket (optional)	1x MMC/SD/SDIO
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	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 PCI Express® x1 Gen.3 5x I2C up to 320 Kbit/s 2x SPI (with two chip selects) 2x CAN-FD / 2.0B	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)
Vivante GC7000UL 2D/3D GPU	Vivante GC NanoUlta 3D GPU	Vivante GC7000UL 3D GPU
Dual-channel LVDS interface, 18 or 24 bit or 2x single-channel LVDS interface or 1x MIPI-DSI and 1x single channel LVDS	Dual-channel LVDS interface, 18 or 24 bit or 1x MIPI-DSI	Dual-channel LVDS interface, 18 or 24 bit or 1x MIPI-DSI
2x 10/100/1000BASE-T Ethernet WIFI/BT module (optional)	Up to 2x 10/100/1000BASE-T WIFI/BT module (optional)	1x 10/100/1000BASE-T Ethernet
2x I2S Audio	2x I2S Audio	1x I2S Audio
Integrated advanced Security, Safety, and Reliability Trusted Platform Module (TPM) 2.0 (optional)	Integrated advanced Security, Safety, and Reliability Trusted Platform Module (TPM) 2.0 (optional)	Integrated advanced Security, Safety, and Reliability Trusted Platform Module (TPM) 2.0 (optional)
Linux® (Yocto Project®) Android Board Support Package	Linux® (Yocto Project®) Android Board Support Package	Linux® (Yocto Project®) Android Board Support Package
Voltage: +5V +/-5%, 5V Standby Power Cosumption: 2-7 W typ.	Voltage: +5V +/-5%, 5V Standby Power Cosumption: 2-5 W typ.	Voltage: +5V +/-5%, 5V Standby Power Cosumption: 2-4 W typ.
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)	0° ... 70°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-IMX8ULP	MSC SM2S-IMX6	MSC SM2S-IMX6ULL
Technology	Arm®	Arm®	Arm®
Formfactor	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
CPU	NXP® i.MX 8ULP Arm® Cortex®-A35 Applications Processor – 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 Arm® Cortex®-M33 Real Time Processor at 216MHz	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	NXP® i.MX6 ULL/ULZ Arm® Cortex®-A7: – 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
DRAM	Up to 2GB 2400MT/s LPDDR4x SDRAM, soldered, non ECC	Up to 4GB DDR3L SDRAM (DDR-1066), soldered, non ECC	Up to 1GB DDR3L SDRAM (DDR-800), soldered, non ECC
Flash	Up to 256GB eMMC Flash, QSPI NOR/NAND Flash	Up to 64GB eMMC Flash	Up to 64GB eMMC Flash
Storage Interfaces	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
USB	1x USB 2.0 Host/Client, 4x 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, 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
Bus Interfaces	4x I2C up to 400 Kbit/s 2x SPI (with two chip selects) 1x CAN-FD / 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
Display Controller	Vivante GC NanoUlta 3D GPU	Integrated Video, 2D and 3D GPU	NEON Media Processor Engine co-processor
Display Interfaces	Dual-channel LVDS interface, 18 or 24 bit or 1x MIPI-DSI	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
Network Interface	1x 10/100BASE-T Ethernet WIFI/BT module (optional)	1x 10/100/1000BASE-T Ethernet	Up to 2x 10/100BASE-T Ethernet
Audio Interface	2x I2S Audio	1x I2S Audio	1x I2S Audio
Security Device	Advanced Security, Safety, Reliability and EdgeLock secure enclave 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)
OS Support	Linux® (Yocto Project®) Microsoft Azure Sphere (on request) Android Board Support Package (on request)	Linux® (Yocto Project®) Android Board Support Package (on request)	Linux® (Yocto Project®)
Power Requirements	Voltage: 3V - 5,25V, 5V Standby Power Cosumption: 1-3 W typ.	Voltage:+5V +/-5%, 5V Standby Power Cosumption: 4-6 W typ.	Voltage: +5V +/-5%, 5V Standby Power Cosumption: 0.5-2 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.)		

Specs	MSC SM2S-ZUSP
Technology	Arm®
Formfactor	SMARC® 2.0, Dimension: 82 mm x 50 mm

CPU	**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

DRAM	Up to 8GB DDR4-2400, soldered, PS-DDR4, ECC (optional) Up to 2GB DDR4-2133, soldered, PL-DDR4 (optional)
Flash	Up to 64GB eMMC Flash, QSPI NOR Boot Flash
Storage Interfaces	1x SATA-III (6Gbps) 1x MMC/SD/SDIO
USB	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
Bus Interfaces	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
Display Controller	Arm® Mali™-400 MP2 GPU (EG/EV only)
Display Interfaces	DP 1.2a Dual-channel LVDS interface, 18 or 24 bit (optional)
Network Interface	Up to 2x 10/100/1000Base-T
Audio Interface	optional WIFI/BT module (optional)
Security Device	Integrated advanced Security, Safety, and Reliability
OS Support	Linux® (Yocto Project®) Android Board Support Package (on request)
Power Requirements	Voltage: +5V +/-5%, 5V Standby Power Cosumption: 5-15 W typ. (depending on MPSoC and PL)
Operating Temp.	0° ... 85°C (extended) -40° ... 85°C (industrial)
Humidity	5 ... 95% (operating, non-cond.), 5 ... 95% (storage, non-cond.)

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.
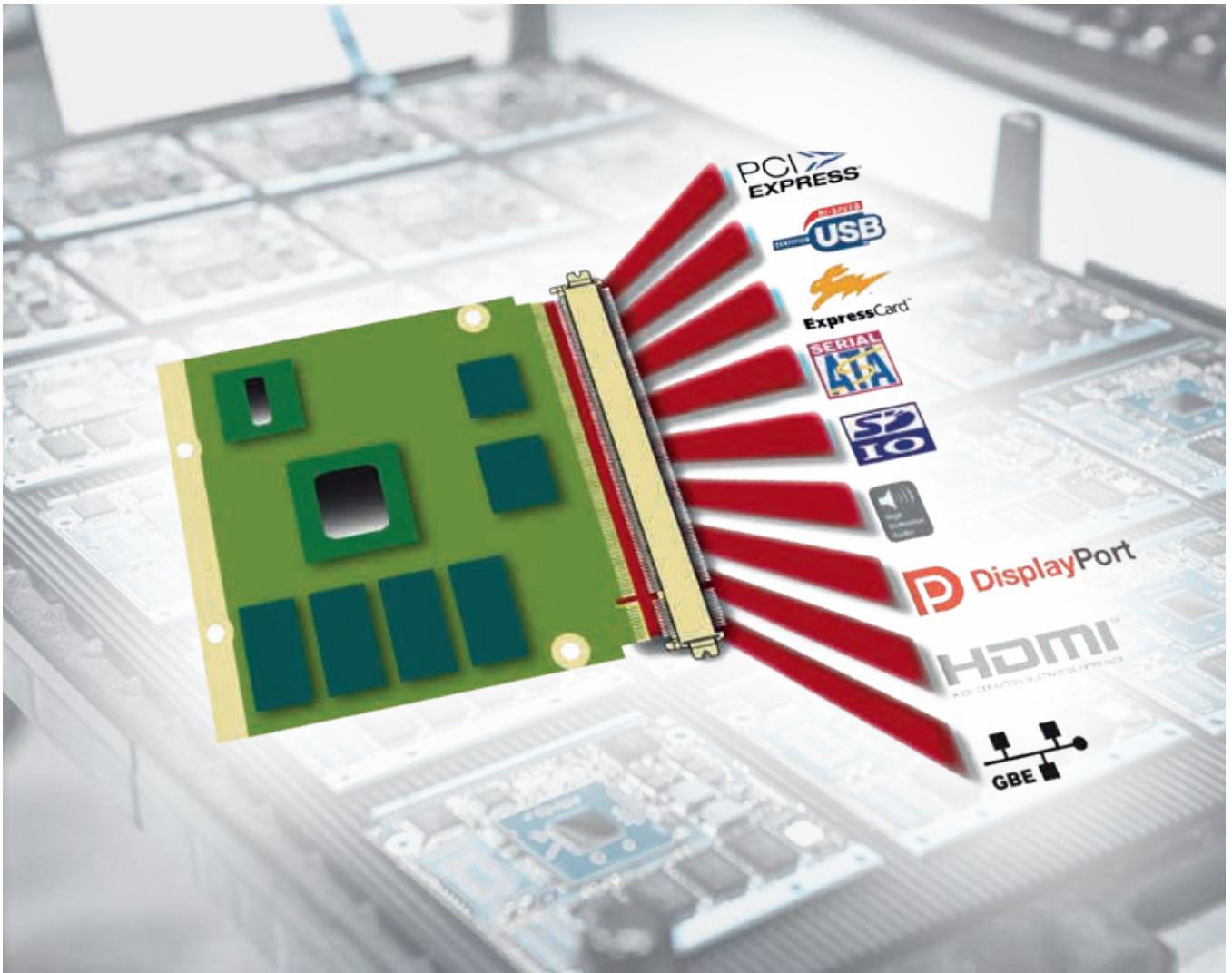
Qseven® 2.0/2.1 Properties

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.
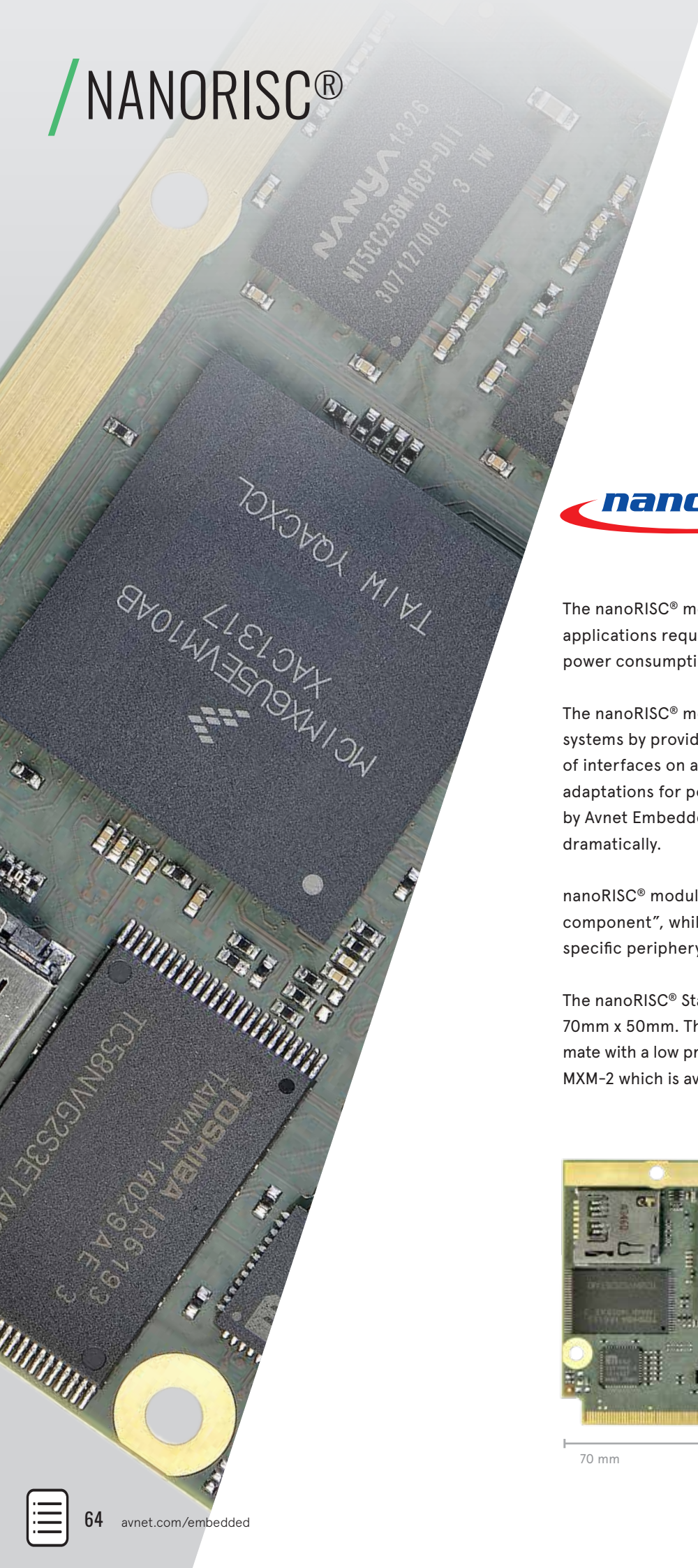

70 mm

70 mm

/QSEVEN® OVERVIEW

Specs	MSC Q7-EL	MSC Q7-AL	
Technology	x86	x86	
Formfactor	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, 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	
DRAM	Up to 16GB LPDDR4x SDRAM, up to 4267MT/s, IBECC (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 Cosumption: 6-15W typ.	Voltage: +5V +/-5%, +5V Standby Power Cosumption: 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/Halti, 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 Cosumption: 4-11 W typ.	Voltage: +5V +/-5%, +5V Standby Power Cosumption: 3-13 W typ.	Voltage: +5V +/-5%, +5V Standby Power Cosumption: 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.)	

/NANORISC®

nanoRISC®

The nanoRISC® module standard has been created for applications requiring a very small form factor and lowest power consumption.

The nanoRISC® modules simplify the design of embedded systems by providing a processor core with an extensive set of interfaces on a small form factor board. Boot loader and adaptations for popular Operating Systems will be provided by Avnet Embedded so that design times will be shortened dramatically.

nanoRISC® modules can be used as a processing "super-component", while users only need to add application-specific periphery.

The nanoRISC® Standard uses a compact module size of 70mm x 50mm. The module PCBs have 230 edge fingers that mate with a low profile 230 pin 0.5mm pitch connector called MXM-2 which is available in abundance, rugged and proven.

50 mm

70 mm

/ NANORISC® OVERVIEW

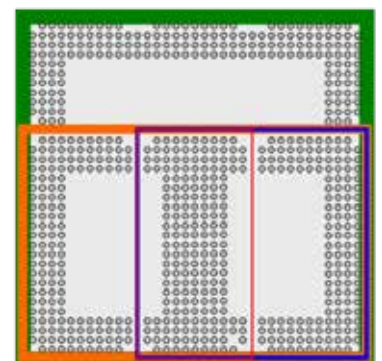| Specs	MSC NANORISC-AM335X	MSC NANORISC-IMX6
Technology	Arm®	Arm®
Formfactor	nanoRISC®, Dimension: 70 mm x 50 mm	nanoRISC®, Dimension: 70 mm x 50 mm
CPU	Texas Instruments Arm® Cortex®-A8 AM335x	NXP® i.MX6 Arm® Cortex® A9 Series
DRAM	Up to 512MB DDR3 SDRAM, soldered	Up to 4GB DDR3 SDRAM, soldered
Flash	Up to 512 MB NAND Flash soldered Up to 64 GB eMMC Flash (optional)	Up to 4GB NAND Flash soldered or up to 64 GB eMMC Flash (optional)
Storage Interfaces	1x SATA-II (3Gbps, not supported by Solo/DualLite CPU) 1x MMC/SD 1x microSD card socket on module	1x MMC/SD 1x microSD card socket on module
USB	1x USB 2.0 HS (Host) 1x USB 2.0 OTG HS (Host or Client)	1x USB 2.0 HS (Host) 1x USB 2.0 OTG HS (Host or Client)
Bus Interfaces	Local Bus Interface (limited functionality only) 2x I2C 2x SPI 1x CAN 2.0B	Local Bus Interface 2x I2C 2x SPI 1x CAN 2.0B
Display Controller	SGX530 Graphics Accelerator in CPU	Vivante Graphics Accelerator in CPU
Display Interfaces	RGB 16/18/24 bit up to 1366x768	RGB 16/18/24 bit up to 1920x1080 LVDS dual channel (1920x1080) or 2x single channel (1366x768) (RGB-TTL for single-core and dual-lite modules) HDMI/DVI up to 1920x1080
Network Interface	10/100 Base-TX Second 10/100 LAN or GbE optional	10/100/1000 Base-TX
Audio Interface	I2S Audio	I2S Audio
Security Device	Crypto Hardware Accelerators (AES, SHA, PKA, RNG)	Integrated advanced Security, Safety, and Reliability
OS Support	BSP for Linux® BSP for Windows EC7	BSP for Linux® BSP for Windows EC7
Power Requirements	Voltage: +5V DC +/-5% (Power Brick or USB); +3V6...+4V2 (single lithium cell) Power Cosumption: 2 W typ.	Voltage: +5V DC +/-5% (Power Brick or USB); +3V6...+4V2 (single lithium cell) Power Cosumption: 4-6 W typ.
Operating Temp.	0° ... 70°C (commercial) -40°C ... 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.)	

/OSM

OPEN STANDARD MODULE™

The idea of all Open Standard Modules™ (OSM) is to create a new, **future-proof**, 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.

45 mm

30 mm

/OSM OVERVIEW

Specs	MSC OSM-MF-IMX8MINI	MSC OSM-MF-IMX8NANO	MSC OSM-SF-IMX93
Technology	Arm®	Arm®	Arm®
Formfactor	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-S), Dimension: 30 mm x 30 mm OSM-SF, 322 Pin, RM 1,25 mm
CPU	**NXP® i.MX 8M Mini Arm® Cortex®-A53 Applications Processor** – **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** – **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	**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
DRAM	Up to 4GB 3000MT/s LPDDR4, soldered, non ECC	Up to 1GB 3200MT/s LPDDR4 SDRAM, soldered, non ECC	Up to 2GB 3700MT/s LPDDR4 SDRAM, soldered, inline ECC support
Flash	Up to 256GB eMMC Flash, QSPI NOR Flash (optional)	Up to 256GB eMMC Flash, QSPI NOR Flash (optional)	Up to 256GB eMMC Flash
Storage Interfaces	2x MMC/SD/SDIO	1x MMC/SD/SDIO	1x MMC/SD/SDIO
USB	1x USB 2.0 Host/Client, 1x USB 2.0 Host	1x USB 2.0 Host/Client	1x USB 2.0 Host/Client, 1x USB 2.0 Host
Bus Interfaces	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)	2x I2C up to 400 Kbit/s 2x CAN-FD / CAN 2.0B 2x SPI (with two chip selects) 2x Analog In (12-bit)
IO Interfaces	24x 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 GC NanoUlta 3D GPU	Vivante GC7000UL 3D GPU	Pixel processing pipeline (PXP) engine to support 2D image processing (i.e. Blending/Composition, Rotation, Resize, Color Space Conversion)
Display Interfaces	1x MIPI-DSI Display Interface, 4 lanes, up to 1920x1080 @ 60fps	1x MIPI-DSI Display Interface, 4 lanes, up to 1920x1080 @ 60fps	MIPI-DSI Display Interface, 4 lanes, up to 1920x1080
Network Interface	1x Gb Ethernet (RGMII interface)	1x Gb Ethernet (RGMII interface)	2x Gb Ethernet (RGMII interface) one interface with TSN/1588 support
Audio Interface	2x I2S Audio	1x 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	Linux® (Yocto Project®) Android Board Support Package (on request)	Linux® (Yocto Project®) Android Board Support Package (on request)
Power Requirements	Voltage: +5V +/-5% Power Cosumption: 2-5 W typ.	Voltage: +5V +/-5% Power Cosumption: 2-4 W typ.	Voltage: +5V +/-5% Power Cosumption: 2-4 W typ.
Operating Temp.	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)
Humidity	5 ... 95% (operating, non-cond.), 5 ... 95% (storage, non-cond.)		

/MSC CARRIER BOARDS OVERVIEW

| Specs	SimpleFlex	MSC SM2S-MB-EP5	MSC Q7-MB-EP5
Platform		Embedded Platform SMARC® 2.0/2.1.1	Embedded Platform Qseven® Rev. 2.0
	 /SIMPLEFLEX	 /SIMPLEFLEX	 /SIMPLEFLEX
Highlights	SimpleFlex is the intelligent combination of a standard Computer-On-Module (COM) with a standard carrier board. It combines the advantages of Standard SBC and Custom SBC by choosing the COM from a huge portfolio of CPU and memory configuration. **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	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. - 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	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. - 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 (option) - 4-wire touch controller (option) - I2S or HD Audio codec (option) - SPI / I2C / GPIO on Feature Connector - Input voltage 10 to 36V - Industrial temperature versions available - Dimension: 148 x 102 mm

Specs	MSC NANORISC-MB2	MSC Q7-MB-EP6	MSC SM2-MB-EP1	
Platform	Embedded Platform	Embedded Platform Qseven® Rev. 2.0	Embedded Platform SMARC® 2.0/2.1.1	
Highlights	The Evaluation Platform MSC nanoRISC® MB2 offers dual LAN, USB, UARTs, audio and graphics RGB 18/24 Bit and extension connectors for graphics, SATA, PCIe, CAN (CPU I/O), Local Bus, I²C and SPI. In addition touch controllers for projected capacitive touches and for resistive touches are provided. An SD Card socket is supported. - Socket for nanoRISC® compatible modules - LCD panel interfaces with RGB TTL output - Backlight power 8..20VDC - Graphics extension connector for optional graphics modules (LVDS, HDMI) - 2x 10/100 Base-T Ethernet interface or GbE - 2x USB Host, USB OTG Host/Client port - Touch Screen support (capacitive + resistive) - ITU656 video input interface on ext. connector - 2x COM ports on 9pin Sub-D connector - I2S audio codec with standard audio connectors - SD Card socket - PCIe, SATA, CAN, Local Bus, SPI, I2S on extension pad field - Battery charger support (Lithium cell) - 8..20V power supply input - Dimension: 160 x 110 mm	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 Display-Port and LVDS display interfaces. In addition a mini PCI Express®, an mSATA and an SD Card socket are supported. Module slot on bottom side. - 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	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. - 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

Evaluation Motherboard Type 6

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.

- 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

MSC C6-MB-EVA

Evaluation Motherboard Type 6

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.

- 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

MSC C6-MB-EV4

Evaluation Motherboard Type 6

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.

- Socket for COM Express® Type 6 modules
- Mini/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 3.0/2.0 connectors
- Four USB 2.0 pin header
- Three DisplayPort/HDMI 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 on SMB
- ATX form factor
- Dimension: 305 x 244 mm

MSC C10-MB-EV

Evaluation Motherboard Type 10

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.

- 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

MSC COM-HPC® CLIENT EP

COM-HPC® Client Carrier

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.

- 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

MSC COM-HPC® SERVER EP

COM-HPC® Server Carrier Board

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.

- 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 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
- Connector with 12 GPIO 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
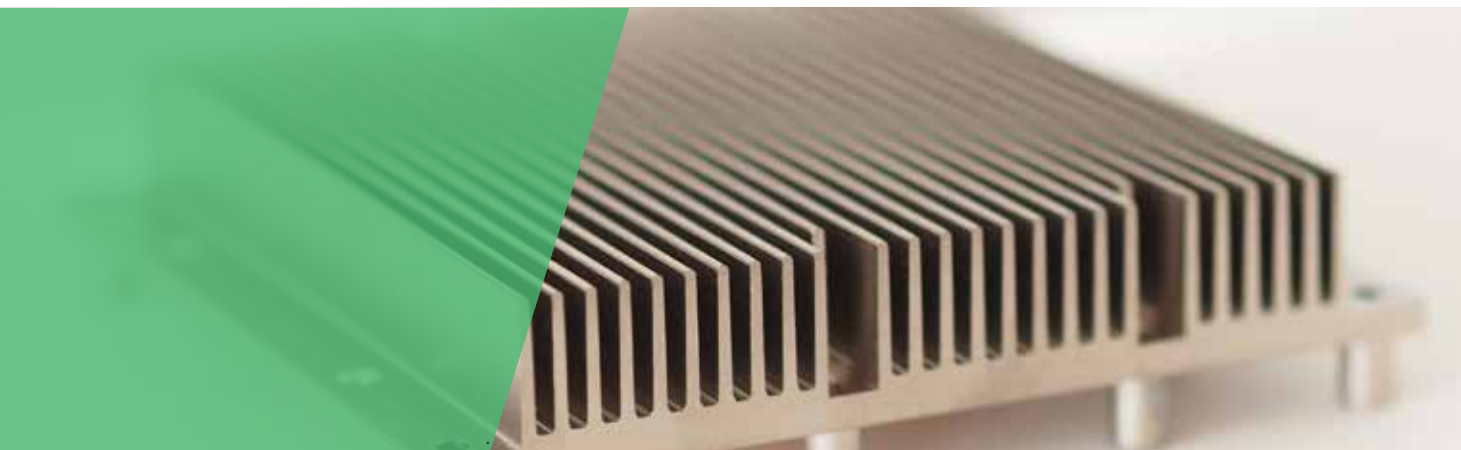
SMARC® 2.0 - Cooling Solutions

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

Heatspreaders Full and Short Size
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 Full and Short Size
A heatsink is shaped like the heatspreader, but shows cooling fins on the upper side so as to maximize the surface used to dissipate heat into the surrounding air.

Qseven® - Cooling Solutions

For all its Qseven® modules, Avnet Embedded is offering 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.

Passive cooling
A heatsink is shaped like the heatspreader, but provides cooling fins on the upper side so as to maximize the surface used to dissipate heat into the surrounding air. Depending on the ambient temperature and the power dissipation of the Qseven® 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. Avnet Embedded has 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, Avnet Embedded offers 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 in customers' cooling concepts and full interchangeability.
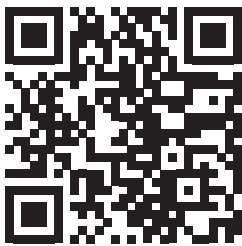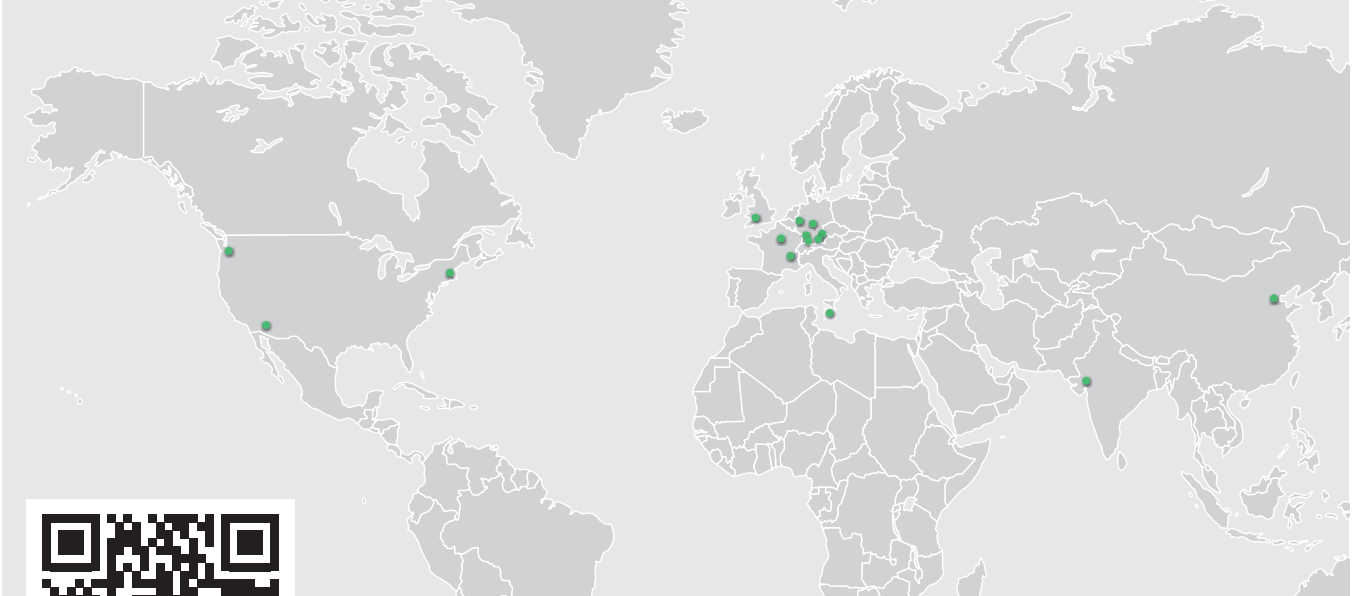
Passive cooling
Optimized heatsinks for best cooling performance even in industrial environments.

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

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Complete the form online to connect with one of our Avnet Embedded solutions experts to learn how we can guide you through your entire business journey.

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