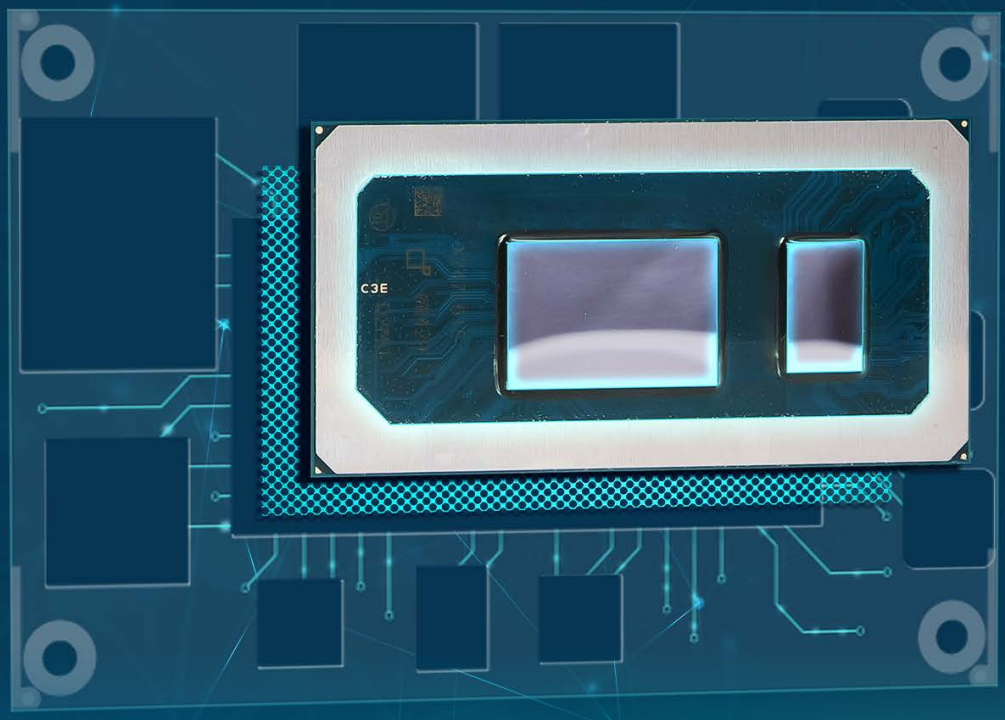
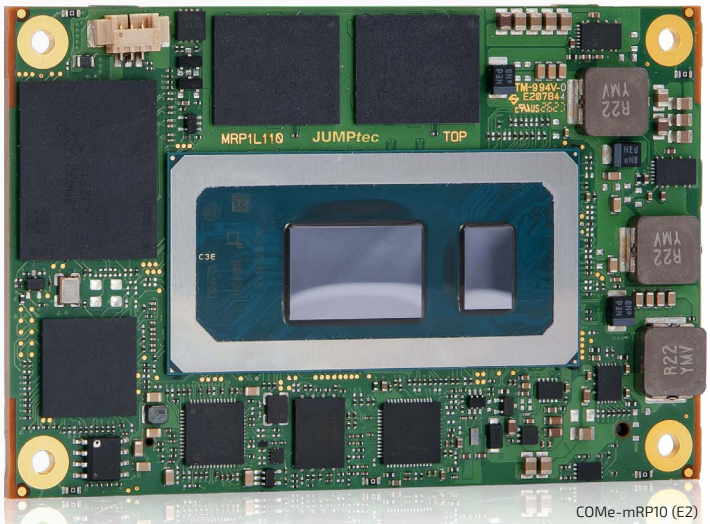


New performance boost

COM Express® mini with 13th Generation Intel® Core™ Technology

JUMPtec® is the world's first company to make 13th generation Intel® Core mobile processors available on COM Express® mini. The new high-performance modules address developers of ultra-compact embedded and edge computers who – despite extremely confined installation situations – require maximum embedded and edge computing performance.



COMe-mRP10 (E2)

JUMPtec®

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Introduction

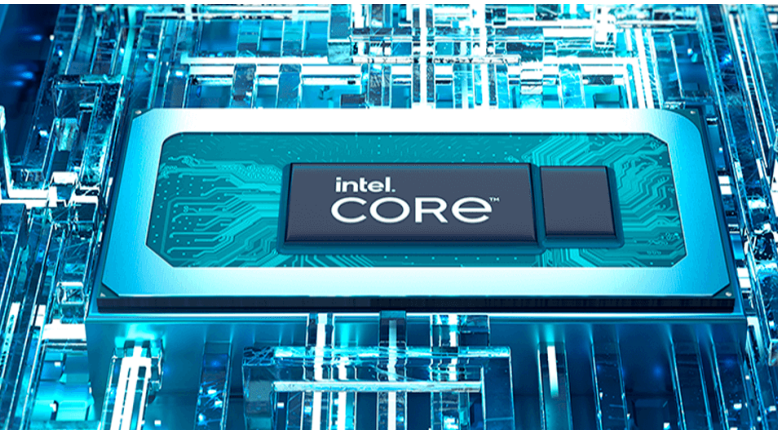
Control, vision, AI analytics and real-time communication with a multitude of instances: Digitalization places enormous requirements on the computing performance of embedded and edge computing systems used in industrial automation, medical engineering, transportation and point-of-sale or network infrastructures and applications for authorities and organizations with security tasks.

Developers of high-performance embedded and edge computing systems are therefore always looking for the very latest in CPU performance and optimum support for the massively parallel tasks associated with image data processing and AI analytics. If an Intel®-based system is required, 13th generation Intel® Core™ mobile processors (code name Raptor Lake P) are currently the measure of all things.

Developed for a smart future

The 13th generation of Intel® Core™ mobile processors was developed specifically with top performance mobile applications in mind. For this purpose, the processors feature hybrid core architecture which offers a high level of energy efficiency. Designed to industrial-grade quality, they also support a wider temperature range and offer long-term availability of 10+ years. Their computing performance, previously unattained in Intel® client systems, is also optimized for AI applications. They also feature the latest technologies and frameworks for AI, virtualization, device management and security.

Since this processor performance is highly attractive for many applications, 13th generation Intel® Core™ mobile processors are already available on all standard industrial motherboards and SBCs. JUMPtec® has already made them available accordingly as well. However, it is still not possible to meet all requirements with these ready-to-use 'off-the-shelf' products.



Overview of the feature set of 13th generation Intel® Core™ mobile processors

- **Hybrid core architecture**
  The CPU architecture combines up to 6 Performance cores (P-cores) and 8 Efficient cores (E-cores) and therefore enables the cores to be used particularly efficiently in dependency on loads and application scenarios.

- **DDR5 memory**
  Available for the first time, DDR5 offers a bandwidth of up to 5600 MT/s. In addition, the memory capacity is no longer limited to 32 gigabytes per module. There is increased energy efficiency at the same time.

- **In-band ECC**
  Memory and data errors are detected and prevented thanks to ECC (Error Correction Code). That prevents system crashes and ensures maximum reliability.

- **Intel® Iris Xᵉ Graphics Engine**
  The SoC-integrated GPU, with its 96 EUs, delivers top GPGPU performance and brilliant image quality for advanced visual displays – these are also supported by up to four 4K-HDR displays simultaneously.

- **Standard Ethernet with real-time capability**
  The Raptor Lake P series supports real-time communication via time-sensitive networking (TSN) and, with Intel® time coordinated computing (TCC), features its own tools for improved performance of latency-critical applications.

- **PCIe Gen 5 support**
  Up to 32 GT/s provide the biggest bandwidth for maximum flexibility, memory speed, graphics performance and connectivity – making it ideal for applications such as machine vision, robotics and other computing-intensive edge applications.

- **Software and tools**
  The ecosystem features technologies for visualization and artificial Intelligence, including the Intel® OpenVino toolkit, which can be used for developing and optimizing in-house deep learning models quickly and easily.

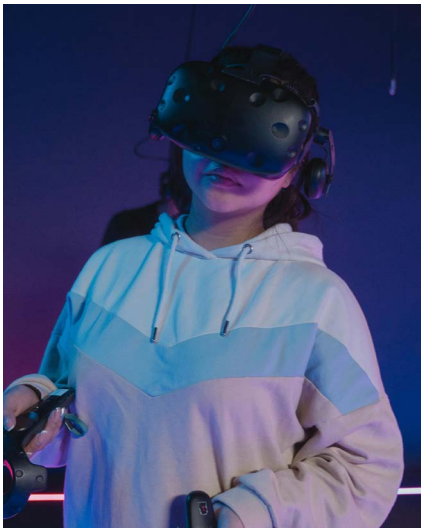
When space is the limiting factor

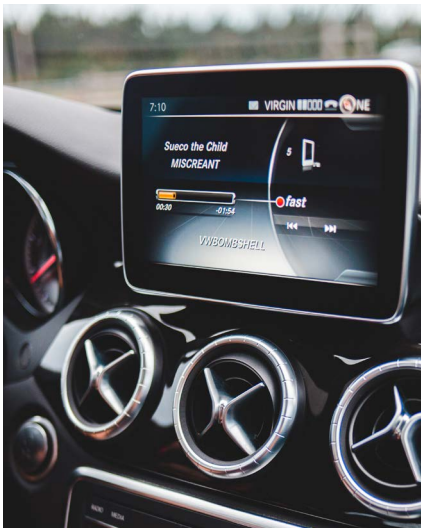
Field of Application

There are a whole host of applications in which every centimeter of extra space for other items of equipment is a genuine gain: For example, control cabinets for industrial plants and machinery often have very small installation depths. Space in the distributor boxes of building automation systems is even more restricted. Systems must – here as well as there – also fit the grid of the integrated top-hat rails. Smart edge gateways also need to take up as little space as possible if they are to be integrated in the industrial brownfield as dedicated systems in existing installations. Small box PCs on medical monitors also ideally need to be as unobtrusive as possible.

Ultra-compact system designs required

As a consequence, an extremely small design which is also very precise in terms of interfaces is therefore an essential requirement for most particularly space-saving embedded and edge computing systems. Here, the computer-on-modules approach has proved effective as a design principle. It delivers an application-ready building block for the computing core, which provides the required flexibility for exactly the right interface design. Then, all that is left to do is develop an application-specific carrier board, which requires relatively little development work in comparison. Standards such as the COM Express® specification of the manufacturer-independent standards

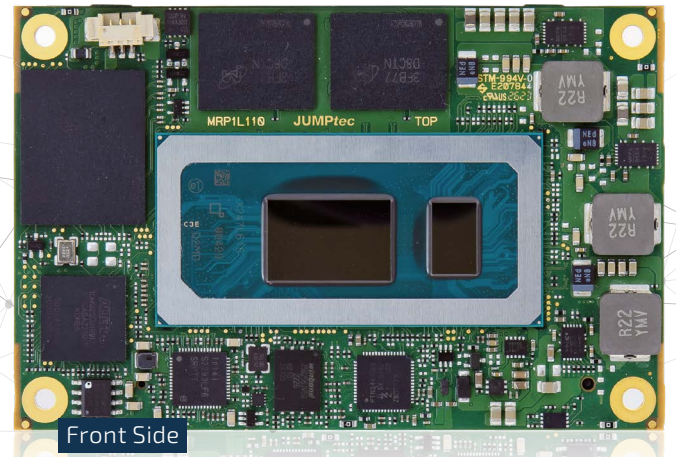




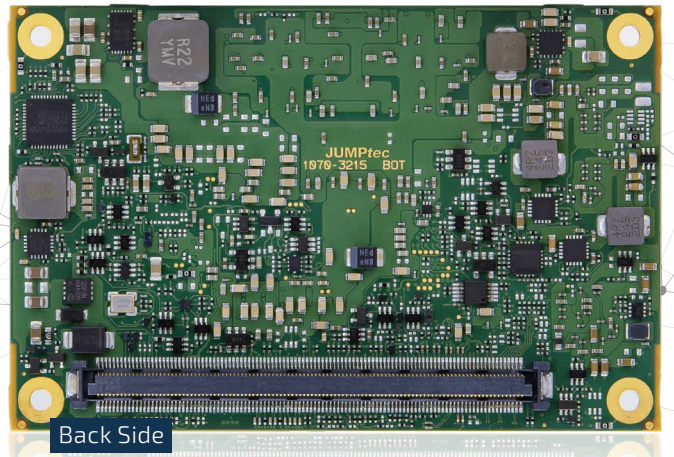
Portable handheld systems and wearable body computers for enhanced situational awareness, augmented reality and even the metaverse need to be constructed in such a way that they are manageable or fit on the body without interfering. Nor is there much space available for charging infrastructure logic or mini base stations for mobile phone networks which need to be installed in lamp posts. In buses, trains and autonomous vehicles there is also a desire to save space when it comes to the implementation of the numerous functions of a smart vehicle, as this space is intended for passengers. Complete industrial PCs on the basis of standard motherboards or SBCs are often too big for applications with such extreme space restrictions as these. In addition, these kinds of boards which are ready for immediate use generally have far too many generic interfaces and not the industrial interfaces required for the application.

organization PICMG, the most widely used in the world, provides investment security in the individual carrier boards because it ensures that pin-compatible modules are offered by many manufacturers. Migration to new processors with higher performance or energy efficiency are also possible in the long term. However, even COM Express® compact modules still have a footprint of 95mm x 95mm. Although this is actually an extremely small format, it is often still far too big for a high-performance IPC core in many cases.

COM Express® mini Specification



Front Side



Back Side

COMe-mRP10 (E2)

COM Express® mini with Intel® Core™ processors of the 13th generation

For the design of an ultra-space-saving mini computer with dedicated interfaces, JUMPtec® was therefore the very first manufacturer to develop computer-on-modules with the latest processors of the 13th Intel® Core™ processor generation in the COM Express® mini form factor. It integrates processors, memories and processor-specific peripheral interfaces and delivers a previously unattainable level of computing performance for edge AI, machine vision and other smart applications in the ultra-compact 84mm x 55mm format, which is almost as small as a credit card. This therefore saves nearly half the space of the widely used COM Express® compact form factor. In addition, the module – to be consistent with the processors – has been designed for maximum ruggedness and durability in serial industrial use.

Straightforward interchangeability for product series' and upgrades

Thanks to the world's leading and most comprehensive ecosystem of the COM Express® specifications and the pin-compatible design of the COM Express® mini modules, it is possible to achieve product series with different functionalities and computing performance. JUMPtec® currently offers a total of 12 product variants on the basis of 13th generation Intel® Core™ mobile processors for COM Express® mini alone. In addition, upgrades with future processor generations are also possible. This means that the life cycle of a product can be extended if the module is replaced by a successor with even newer processors which then become available. The application-specific carrier board can then normally continue to be used without any changes after replacement of the modules. This cuts out the effort of new developments and therefore time and costs. In addition, it also effectively reduces the design risk and enables maximum return-on-investment with respect to NRE costs.

Predestined for rugged environments

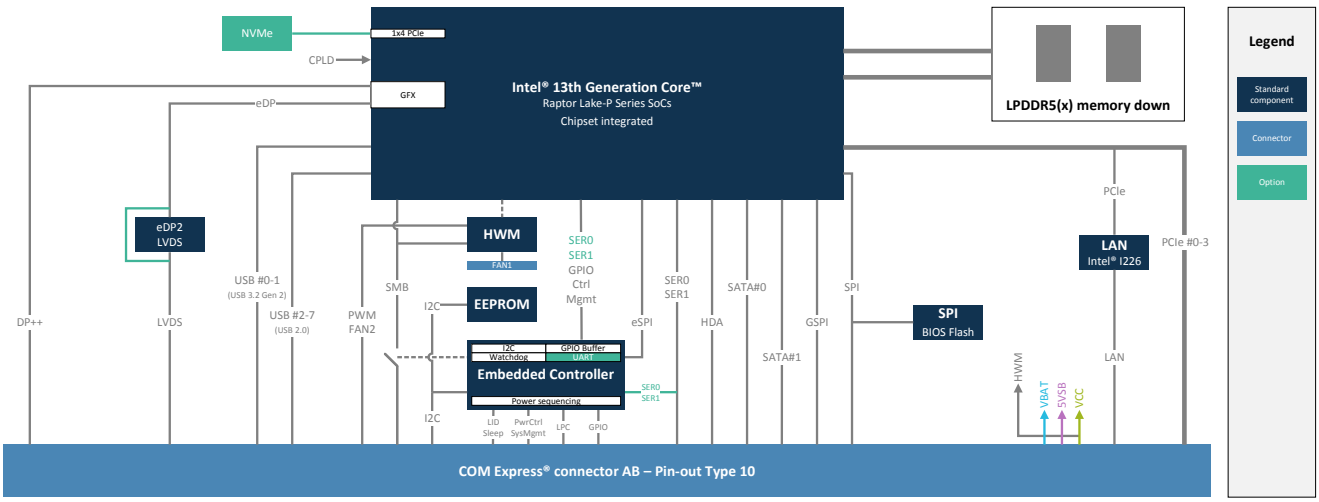
The new COM Express® mini modules are suitable for all applications in which small size with maximum x86 performance is paramount. The additional features of computer-on-modules make them particularly suitable for tough ambient conditions and reliable use in, for example, industrial, transportation and defense applications. For example, the non-volatile NVMe flash memory, LPDDR5(x) memory, TPM chip and a discrete Ethernet controller for maximum speeds in terms of data transmission are soldered onboard. In combination with the U-variants of the processors for a wider temperature range of -40°C to +85°C, this results in extremely rugged and space-saving computer-on-modules which can be integrated in customer-specific carrier boards quickly and easily.

Technical features of COMe-mRP10 (E2)

Technical Information

COMPLIANCE	COM Express® Mini Pin-out Type 10
DIMENSIONS (H x W)	84 x 55 mm
CPU	Intel® 13th Generation Core™ family
CHIPSET	Integrated SoC
MAIN MEMORY	Dual-Channel LPDDR5(x) memory down up to 32 GByte
GRAPHICS CONTROLLER	Intel® Iris® Xᵉ Graphics on i7/i5 processors Intel® UHD Graphics on i3/Pentium® processors
ETHERNET CONTROLLER	Intel® I226LM/I226IT
ETHERNET	Up to 2.5Gb Ethernet with TSN support (depending on SKU)
STORAGE	2x SATA 6Gb/s
FLASH ONBOARD	Up to 1 TByte NVMe SSD (on request)
PCI EXPRESS®	4x PCIe 3.0
DISPLAY	DDI1: DP++, LVDS: Single Channel 18/24bit
USB	2x USB 3.2 Gen2 (incl. USB 2.0) + 6x USB 2.0
SERIAL	2x serial interface (RX/TX only)
AUDIO	Intel® High Definition Audio
OTHER FEATURES	(G) SPI, LPC, SMB, Fast I²C, Staged Watchdog, RTC
SPECIAL FEATURES	POSCAP capacitors
FEATURES ON REQUEST	vPRO (AMT/TXT/AES Support), eDP instead of LVDS, NVMe SSD
POWER MANAGEMENT	ACPI 6.0
POWER SUPPLY	4.75 V – 20 V Wide Range, Single Supply Power
BIOS	AMI Aptio V
OPERATING SYSTEM	Windows® 10, Linux, VxWorks (project based)
TEMPERATURE	Commercial temperature: 0 °C to +60 °C operating, -30 °C to +85 °C non-operating Industrial temperature: -40 °C to +85 °C operating, -40 °C to +85 °C non-operating
HUMIDITY	93 % relative Humidity at 40 °C, non-condensing (according to IEC 60068-2-78)

Block Diagram

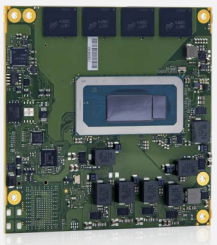


Maximum flexibility for edge applications

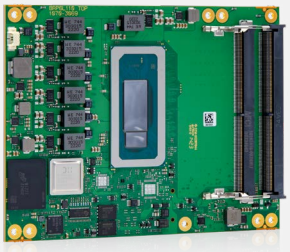
In addition to the extremely rugged and space-saving computer-on-modules of the COM Express® mini series, JUMPtec® also offers the latest Intel® Core mobile processors of the 13th generation in the COM Express® basic (125mm x 95mm), COM Express® compact (95mm x 95mm) and COM-HPC® client size A (95mm x 120mm) form factors as well. This means that developers can choose the ideal level of functionalities and interfaces that they require for their individual applications. JUMPtec® is the only supplier to date to offer the Intel® Core mobile processors of the 13th generation in all form factors.

JUMPtec® solutions with 13th Gen Intel® Core™ mobile processors

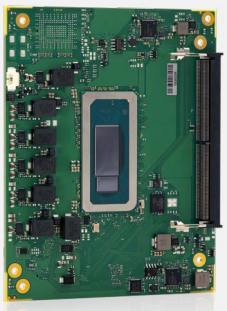
COM Express® mini form factor
JUMPtec® COMe-mRP6 (E2)
(pin-out Type 10 compliant)



COM Express® compact form factor
JUMPtec® COMe-cRP6 E2
(pin-out Type 6 compliant)



COM Express® basic form factor
JUMPtec® COMe-bRP6 (E2)
(pin-out Type 6 compliant)



COM-HPC® client size A
JUMPtec® COMh-caRP
(95 x 120 mm)

Key features across all modules:

- 13th Gen Intel® Core™ mobile processor with up to 96 execution units (EUs) of Intel® Iris® Xᵉ graphics[2]
- Up to 64 GB LPDDR5(x)[5] non-ECC memory soldered down (up to 64 GB DDR5 non-ECC memory via 2x SODIMM sockets on COM Express® basic), IBECC on dedicated SKUs
- Select offerings (E2 versions) of each sizhe with industrial-grade temperature range (-40°C to 85°C)
- Up to 4x 4K independent display support (up to 2x 4K on COM Express® mini) or 1x 8K
- Optional support for Intel® vPro® platform, TPM, NVMe SSD onboard
- Support for USB-C (optional), LVDS/eDP, up to 2.5 GbE with TSN, WOL, SATA 6 GB/s, USB 3.2 Gen 2, and audio and common features, including SPI, I2C, and SMB

COM Express® mini vs. COM-HPC® Mini

When it comes to maximum performance in the smallest possible format, developers of edge applications and mobile systems will be faced by a choice between two form factors in future: COM Express® mini and COM-HPC® Mini. Both specifications were developed by the manufacturer-independent standards organization PICMG. The COM Express® specification has been around since 2005. COM-HPC® Mini, on the other hand, is brand new and the official release of the 1.0 specification is due shortly.

The COM Express® Standard - Soon to be Histroy?

The "mini" in both names implies that both are playing in about the same footprint league. In technological terms, therefore, the following question arises: Does it still make any sense to apply a standard which is now 18 years old? Is there perhaps a risk that there will soon only be COM-HPC® Mini modules? Any concerns here can be easily dispelled with reference to the even older ETX standard. Even after more than 20 years, modules for this standard can still be bought, even though the successor standard COM Express® has already been available for many years as well. The situation with COM Express® specifications will be similar or even more enduring. After all, in the high-performance embedded computing sector they currently account for the greatest market share of computer-on-modules by far, and computer-on-modules are generally the most widely used design principle in embedded computing. More COMs are installed in embedded systems than SBCs and motherboards. In addition, the switch from parallel PCI and ISA to serial PCIe had a greater impact than the higher frequencies for PCIe made possible by COM-HPC®.

Such a major flagship - packed with countless customer-specific designs - does not switch course overnight. After all, OEMs have invested considerable NRE costs. These have to produce further returns-on-investment. The only reason to switch would be technological, and technological progress is also possible with COM Express® mini. Ultimately, the latest processor technology is available with the current COM. Moreover, the connector recently became qualified for the use of the ultra-high-speed PCIe Gen 4 interfaces. The modules on the basis of the latest Intel® Core processors of the 13th generation mean that 16 GT/s or around 2 GB/s per lane, i.e., double the previous level of performance, are now available to OEMs for the first time. Only absolute high-end solutions for high-performance computing, artificial Intel®ligence, machine learning, virtual reality or gaming can really use this level of data throughput and it is only these that will switch to COM-HPC® Mini. However, developers will then also have to accept the fact that COM-HPC® Mini requires around

44% more space. In addition, thanks to the miniaturization of processor architectures, the embedded computing market can expect further new low-power high-performance processors which, on a highly integrated basis, will offer even greater computing performance for COM Express® mini. Ultimately, it is also not possible to rule out the potential for connectors to be available in a few years' time in COM-HPC® quality, which then provide 220 pins and would therefore secure the continued existence of COM Express® as well. Conservative as the embedded industry's customers are, this may well be a way for OEM customers to further secure their investments.

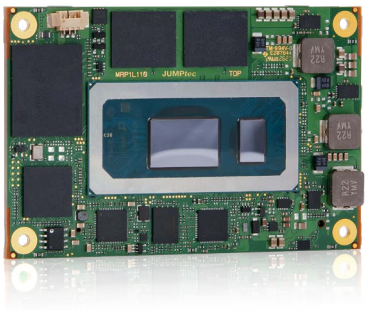
COM Express® mini: Smallest format with comprehensive connectivity

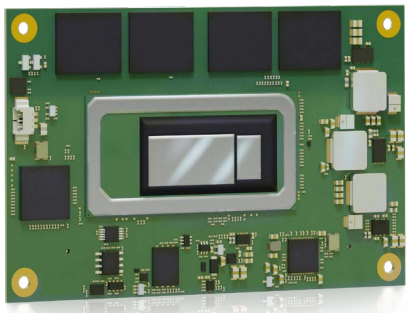
Measuring just 84mm x 55mm, COM Express® mini modules offer impressive connectivity on a minimum footprint. They also offer comprehensive scalability of the performance of Intel® Atom processors up to the latest 13th Raptor Lake P generation. Here, 220 pins are available via the connector for numerous interfaces such as LVDS/DisplayPort, USB, SATA and 1x GbE Ethernet. For customer-specific extensions there are also up to 4x PCIe lanes – in the latest new module variants up to PCIe Gen4.

COM-HPC® Mini: Bigger, faster and even more connectivity

The next size up form factor COM-HPC® Mini has a module size of 95mm x 70mm, which uses 44% more space than COM Express® mini. However, for this the connector also offers 400 pins, meaning that significantly more and in many cases also faster interfaces are offered. This includes two 10 GbE interfaces and 16 PCIe lanes up to PCIe Gen5 and USB 4. COM-HPC® also supports functionality for functional safety (FuSA).

Technical Information





	COM EXPRESS® MINI	COM-HPC® MINI
SIZE	84 mm x 55 mm	95 mm x 70 mm
CONNECTOR	1x 220 pin	1x 400 pin
ETHERNET	1x NBase-T (max. 1Gb)	2x NBase-T (max 10Gb) 2x SGMII (shared with PCIe lanes 3 and 4)
PCIE	4x PCIe (max Gen4)	16x PCIe (max Gen5) (some lanes shared with SATA and SGMII)
GRAPHICS	1x DDI 1x single LVDS (option with eDP)	2x DDI (shared with USB 4) 1x eDP
SATA	2x SATA	2x SATA, shared with PCIe lane 6 and 7
USB	2x USB 3.2 (makes use of 2x USB2.0) 8x USB 2.0	4x USB 4 , 4x USB 3.2 Gen 2x2, 2x USB 3.2 (USB3/4 makes use of 4x USB 2.0) 8x USB 2.0
SERIAL	2x UART (option CAN interface on one)	2x UART + 1x CAN
FUSA	no	yes
MIPI	2x MIPI-CSI via Flatfoil connector (COM.0 R3.1)	2x MIPI-CSI via Flatfoil connector
OTHERS	eSPI/LPC, SPI (BIOS), SMB, I2C, 8x GPIO, HDA	eSPI, 2x SPI, SMB, 3x I2C, 12x GPIO, Soundwire/HDA

“

COM Express® mini offers all interfaces requiring ultra-compact systems. COM-HPC® Mini allows you to implement much more. However, it also requires much more space.

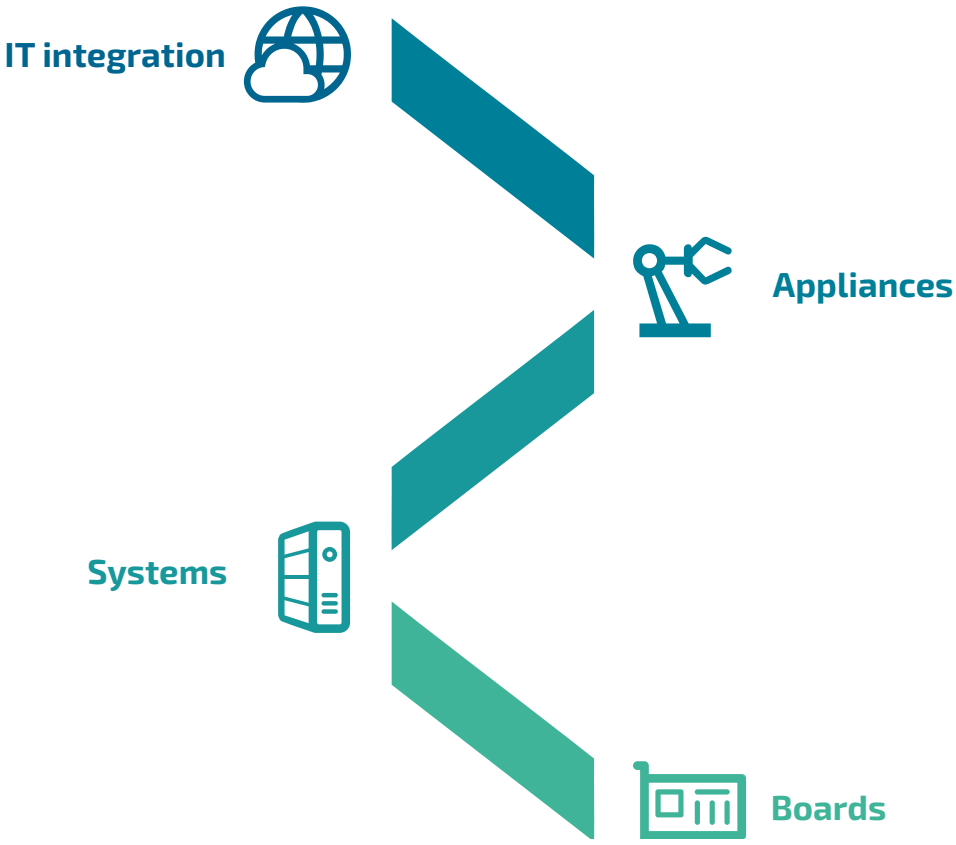
Ultimately, which of the options is most suitable is dependent on the planned application and required functionality – JUMPtec® will be glad to assist you with your individual selection for your project!

”

Comprehensive support and services

Whichever form factors OEM developers choose:
With all JUMPtec® computer-on-modules, they benefit from over 35 years of know-how and experience in all aspects of the development of system platforms on the basis of computer-on-modules. This includes support when it comes to the selection and design-in of the modules, reviews of circuit diagrams of individual carrier boards to support for development, tests and approval procedures. Customers can also count on access to resources, tools and middleware for the fast and straightforward development of their application software, for the integration of devices in IoT networks and general issues such as device and update management, security and life cycle management.

Tell us about your requirements for your embedded systems. Our experts will be glad to provide you with support when it comes to the selection and integration of exactly the right computer-on-modules and the complete life cycle of your products.



Choose from a broad standard embedded computer portfolio › Use application specific computer systems and HMIs › Benefit from a professional engineering team › Tailor the software products and toolkits to your applications › Get project support for local IT and cloud solutions

› Use proven building blocks for your needs:

- Security SW for IoT solutions and private cloud offering
- New business model development
- Engineering & project support
- Embedded & public cloud services
- Strong embedded computer portfolio
- Customization tailored to your needs

About JUMPtec®

JUMPtec specializes in the design of standard and highly customized Computer-on-Modules and embedded computing solutions. As a majority-owned subsidiary of congatec GmbH, JUMPtec and congatec benefit from their combined strengths in technological experience and excellence , global reach and their leading roles in the modular computing market.

With a clear focus on innovation, quality, and scalability, JUMPtec enables customers to move quickly from prototyping to mass production. The company continues to offer its well-established product portfolio, including COM-HPC®, COM Express® and SMARC® modules – ensuring continuity and reliability for existing customers.

JUMPtec® serves a diverse range of markets, providing innovative solutions tailored to the unique needs of each industry. Find out more about our offering!

More at: **www.jumptec.com**

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