We simplify the use of embedded technology.
Embedded in your success.

Pure-Play
World’s largest vendor focused on COMs, SBCs and customized designs only.

Roadmap
Most complete roadmap of COM products.

Solid
Stable finance. Strong growth, no debt and solid profit.

Design-In
Proven superior design-in support. Review of customers designs for compliance, thermal and mechanical design to reduce risk and shorten design cycles.

Innovative
Close partnerships to Intel, AMD and NXP. Active player in standardization committees SGET and PICMG.

Logistics
Logistics and stability of supply. Strategy for long lead time components. Flexibility through last time buy process. Proven quality for more than 13 years.
congatec
international partnerships

Technology Partnerships

- Intel Technology Provider
  - Platinum 2019
- Intel IoT Solutions Alliance
  - Associate member
- REAL-TIME SYSTEMS GMBH
- SGeT
  - Founding Member
  - Board Member
- SMARC
  - Specification editor Rev. 2.0, 2.1
- COM HPC
  - New high performance module standard
  - Chairman of the PICMG workgroup
- Wind River Partner
  - SILVER
- COM Express®
  - Design guide editor Rev. 1.0
  - Specification editor Rev. 2.0, 2.1, 3.0
- Founding member
- Specification & design guide editor
Technology Leader

congatec has been driving industry standards since 2005

Product Families

SBCs    SMARC    Qseven    COM Express    Customized
Industries

Industrial Automation
Embedded computer technologies in industrial automation must be designed for high reliability and long-term availability. Challenging environmental conditions also demand highest quality and full ruggedness as well as resistance to electromagnetic interference. At the same time, the IIoT and Industry 4.0 trends place entirely new demands on industrial computer system design. Edge servers, IIoT gateways and Industry 4.0 controllers that synchronize in real time via Ethernet are just some of the major challenges facing the industry today. The consistent application of industry-compatible embedded computing standards and the associated wide scalability enable future-proof and optimized platform concepts as well as simple upgrade options that are suitable even for closed-loop engineering.

IIoT / Industry 4.0
The Industrial Internet of Things and Industry 4.0 trend has notably changed the way embedded computer technologies are used. IoT connectivity is a broad subject that leads to very different solution approaches. Both integrated gateways and dedicated external gateways or edge servers are used. Big data is transferred in full to the cloud to precisely map digital twins, or it is analyzed locally to report only relevant information and status changes. Transmission modes also differ widely, ranging from sporadic connections via side channels such as LPWAN technologies, to broadband connectivity via fixed or mobile networks. OEMs are challenged with choosing which of the diverse options is best for them. In addition, they have to take a wide variety of communication standards and cloud solutions into account, all of which come with their own specific interface requirements. Yet, what OEMs would actually prefer, is to concentrate on the development of the IIoT and Industry 4.0 application, to organize the data exchange with other machines, devices and feeding systems; to collect and evaluate predictive maintenance data; and to develop pay-per-use or feature-based licensing solutions. The end-to-end data path from the system to the application cloud should therefore be supplied by the OEM’s hardware development partner, at least for the transport and communication layers. Real-time communication by Time Sensitive Networking (TSN) is also supported.

Entertainment & Professional Gaming
Embedded computing applications in the entertainment and professional gaming sector range from cost-sensitive systems for lottery, arcade and Pachinko games, to high-end gaming and entertainment systems in gaming centers with the highest graphics and interactive demands. With its scalable and application-ready platforms, the modular embedded computer concept is a perfect match for the requirements of the gaming industry, enabling applications to be upgraded to the latest technologies with higher performance in the shortest possible time and often without costly recertification. Connected professional gaming machines must translate new bandwidths into immersive experiences. At the same time, pressure is growing through tighter regulations. Cost constraints in the low-power segment demand the ability to provide the available system performance more cheaply with each new processor technology. Highly scalable embedded computing designs are crucial for this.

Building Automation
Embedded computer technologies are used widely in building automation, with applications ranging from classic automation and control of complex installations in large premises and factories, to access control and video surveillance systems, to local devices and panel systems for the control of high-quality home automation systems. Key characteristics in all cases are high energy efficiency and a small footprint, coupled with a good price. Smart homes, smart buildings, smart cities and smart grids place new demands on embedded computer technologies for building automation. Seamless gateway connectivity and secure end-to-end communication are required.

Transportation
Embedded computer technologies for use in the transport sector require highest ruggedness, reliability and long-term availability for harsh operating environments, because transport takes place in any weather – from freezing cold to tropical heat. The range of embedded transport applications is as broad as the variety of means of road, rail, water and air transport. Applications can be found in (rail) vehicles, ships and airplanes, on the wayside, or in PoS and kiosk systems at airports, train platforms and bus stops. Autonomous driving, augmented reality navigation, walk-by ticketing, check-in machines for luggage, and wayside servers for smart traffic routing as well as seamless video surveillance during travel and at stops – including personal identification and tracking – are just some of the new transport applications in which embedded computer technologies are ubiquitous.

Medical
Embedded computer technologies for use in the medical sector require highest security and reliability in order to meet the relevant standards and pass the necessary certifications. Applications range from high-performance systems such as stationary tomography (MRT, CRT) and semi-stationary ultrasound and diagnostic devices, to small mobile and ultra-mobile devices for use in diagnostics and care. Medical imaging technologies require artificial intelligence (AI) so that physicians can save time and, for example, compare MRI images taken over several years to detect anomalies more quickly with AI support. Invasive surgery requires real-time imaging with augmented reality. Big data creates the basis for new research results and better treatment of each individual. Device manufacturers want to capitalize on IoT connectivity by implementing new sales models such as pay-per-use and feature-based licensing. Completely new business models are emerging
**Key Technologies**

**Real-Time**
congatec pays special attention to real-time capability during product development. The congatec BIOS/UEFI implementation is of particularly high quality, yielding significantly improved real-time results for OEM customers. By cooperating with OSADL, this real-time capability can be tested over an extremely long time.

**Real-Time Hypervisor**
Hypervisor support from Real-Time Systems makes the embedded computer technologies from congatec even more attractive. It allows multiple operating systems to be installed on a multicore x86 platform without impacting real-time capability. Each sub-application can be implemented with the appropriate operating system – e.g. real-time data acquisition with VxWorks, the user interface with Windows, and a firewall with Linux. Since Real-Time Systems is a wholly owned subsidiary of congatec, the distances between the two companies are very short, which gives OEMs a time advantage in support cases and promotes interdisciplinary solutions.

**Security**
By providing numerous BIOS/UEFI security options and Trusted Platform Module (TPM) support, congatec enables customers to implement a high level of security that is optimized for their specific solution requirements.

**Cloud connectivity**
Thanks to their support of the SGET UIC (Universal Internet Connector) standard, embedded boards and modules from congatec provide off-the-shelf IoT cloud connectivity that’s simple to implement. Because of its modular design, it can be adapted very easily, flexibly and quickly to OEMs’ specific needs. This enables customers to monitor, manage and maintain embedded hardware from congatec in a very flexible manner via customized OEM clouds. Missing UIC components for OEM-specific hardware extensions and application monitoring can be supplemented as necessary.

**Test and Measurement**
To achieve the best results in the test and measurement (T&M) sector, the utilized embedded computer technologies must meet the highest demands in terms of quality and reliability. Further requirements include scalability, operational safety and a long service life as well as long-term availability to protect investments. Advanced graphical user interfaces with touch and gesture control – already indispensable today – continue to gain importance. T&M technology is becoming more and more sophisticated – for example, because the electronics to be tested is operating at ever higher frequencies, which requires increasingly precise T&M technology. Equipping T&M technology with IIoT connectivity presents further challenges for developers. Manufacturers want to monitor and manage their real-time T&M systems remotely and collect big data, while users want to monitor them on central cloud dashboards. Appropriate gateways and firewalls need implementing.

**Digital Signage**
The digital signage market is highly dynamic. It comprises not only simple display systems, but also highly complex multimedia devices that can display digital HDR content on one or more independent screens in increasingly realistic visual as well as acoustic form, and in ever higher 4k UHD resolutions or beyond. The computing power of modern devices makes it easy to analyze target groups in parallel and deliver tailor-made, demand-oriented content. And thanks to ever faster network connectivity, streaming new and interactive content in real time is possible. Solution providers competing for marketing budgets keep inventing new advertising formats, which can quickly make established systems appear obsolete. If you don’t have your finger on the pulse of developments, you risk losing out.

**Smart Grid**
Embedded computer technologies for use in energy technology applications require precise process control even under adverse operating conditions, for example when generating renewable energies with an optimum yield from offshore wind turbines or solar parks in deserts. Power control and load management have always been among the most demanding applications in terms of computing power, response times and reliability. The increase in decentralized power generation makes power distribution management even more complex: Microgrids are created, and virtual grids must be managed. To synchronize several power generators and power consumers, and to manage feeds into the distribution network or microgrid, more and more decentralized control intelligence needs to be integrated. Ultimately, utilities are also benefiting from the IoT trend as it enables them to manage and maintain their assets better, and to offer new services to customers.

**Point of Sale / Kiosk**
PoS, kiosk and vending systems are a fast-growing market that continues to innovate due to the demand for increasingly user-friendly interfaces and more and more cashless payment options. Applications range from small, mobile card readers and payment systems, to fully equipped information terminals, ticketing systems and complex PoS stations, which – if operating outdoors – must provide 24/7 service in all weathers. Some ticketing and vending machines are not yet connected in such a way that they can be updated in real time via central server technologies – for instance, to choose the right train, or to adjust ticket prices to events such as football matches. 24/7 monitoring for predictive maintenance and customer assistance systems are also not yet implemented everywhere. A completely new development is the launch of eMobility charging stations, which integrate new operating and payment concepts such as paying by mobile phone.
Product Line Commons
all product lines feature the congatec embedded philosophy

SBC
- congatec embedded know-how
- Industrial design
- Longevity
- Extended temperature
- Optimized coolings
- Embedded feature set
- Rugged design
- 24/7 operation
- Low power consumption
- Project support
- Lifecycle management
- Customizable HW&SW
- Scalability

COM
- Customizable carrier
- Enhanced scalability
- Engineering support

Customizing
- Design to requirement
- Hardware and BIOS/UEFI

SBCs
COMs
Customized
Real Time Hypervisor

harness the power of today’s multicore processors

The innovative Real-Time Systems Hypervisor permits multiple operating systems - both real-time (RTOS) and general purpose operating systems (GPOS) like Microsoft™ Windows® or Linux - to run concurrently on multicore x86 processors. By utilizing this powerful and cost-effective software solution, designers achieve increased flexibility in system design and remarkable enhancements to functionality and performance - at the same time reducing overall system cost.

**Hard Real-Time Performance: Multiple Operating Systems in Perfect Harmony**
- Combine real-time operating systems like VxWorks®, QNX Neutrino or Real-Time Linux, with e.g. Microsoft™ Windows®
- Operating systems reside simultaneously on an x86 computer while maintaining the hard real-time characteristics of an RTOS
- User-definable boot sequence
- Reboot any operating system anytime without disturbing the execution of other operating systems
- Communication via high performance virtual TCP/IP network and flexible shared memory

**Advantages**
- Reduced system costs and physical size
- Hardware consolidation
- Hard real-time performance
- Maximum flexibility in system functionality
- Increased reliability (MTBF) as no additional hardware is required for additional operating system
- Works seamlessly with COTS and proprietary operating systems
- Proven in thousands of systems worldwide

**About the Hypervisor**
- All operating systems operate completely independent
- User defined startup sequence of operating systems
- Any operating system can reboot without affecting other operating systems
- All operating systems safely separated and protected
- Standard development tools can be used (supplied by the operating system vendors)
- Standard drivers can be used - no special development required
- NUMA (Non-Uniform Memory Access) fully supported
- OS independent drive sharing
COM Advantages when compared to a full custom design

**Concept**
- CPU module with standard PC core functions
- Carrier board with customer specific function & size
- Logical alternative to a chip-down design effort

**Benefits**
- Faster time to market
- Reduced development costs
- Scalable product range
- Allows customer focus on system features
- Faster reaction to market trends
- Second source philosophy
- Minimize inventory cost

<table>
<thead>
<tr>
<th>Module</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qseven</td>
<td>70x70 mm²</td>
</tr>
<tr>
<td>SMARC</td>
<td>82x50 mm²</td>
</tr>
<tr>
<td>COM Express Mini</td>
<td>84x55 mm²</td>
</tr>
<tr>
<td>COM Express Compact</td>
<td>95x95 mm²</td>
</tr>
<tr>
<td>COM Express Basic</td>
<td>125x95 mm²</td>
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</tbody>
</table>
**Lower Costs**
COMs save money. The cost of the development and end product are dramatically reduced when compared with a full custom design. This holds true for the product’s entire life-cycle. COMs provide a cost advantage from the very start.
- Lower engineering cost
- Lower product cost
- Lower cost of life cycle management

**Reduced Risk**
COMs minimize risk. Basic changes during the design phase, or in the middle of a product’s life cycle, are easily managed. Simply plug in the next-generation COM module and continue. COMs allow for easy upgrades.
- Lower design risk
- Lower transition risk

**Improved Flexibility**
COMs are flexible and can meet all performance requirements. The modules support a wide range of performance levels starting from NXP i.MX6 up to the Intel® Xeon® processor, as well as future architectures. The COM standards are well established and are already prepared for the future.
- Scalability
- Performance upgrades are easy
- Technology upgrades are easy

**Time-To-Market Advantage**
COMs put you in a leading position. The use of customized carrier boards reduces necessary engineering effort by separating your design work from the embedded PC technology. Focus on your own core competency.
- Faster time to market
- Faster engineering
- Faster reaction time to market changes

<table>
<thead>
<tr>
<th>Qseven</th>
<th>SMARC 2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>COM Express Type 10</strong></td>
<td><strong>COM Express Type 6</strong></td>
</tr>
<tr>
<td>Gigabit Ethernet</td>
<td>Gigabit Ethernet</td>
</tr>
<tr>
<td>LPC</td>
<td>LPC</td>
</tr>
<tr>
<td>4x PCIe</td>
<td>4x PCIe</td>
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<tr>
<td>HDA</td>
<td>HDA / 2x I2S</td>
</tr>
<tr>
<td>LVDS 2x24 / eDP</td>
<td>LVDS / eDP</td>
</tr>
<tr>
<td>2x MIPI CSI (Flatfoil)</td>
<td>ExpressCard</td>
</tr>
<tr>
<td>DDI</td>
<td>4x SATA</td>
</tr>
<tr>
<td>2x SATA</td>
<td>8x USB 2.0</td>
</tr>
<tr>
<td>8x USB 2.0 / 2x USB 3.0</td>
<td>8x USB 2.0</td>
</tr>
<tr>
<td>8x GPIO / SDIO</td>
<td>8x GPIO / SDIO</td>
</tr>
<tr>
<td>2x SER / CAN</td>
<td>2x SER / CAN</td>
</tr>
<tr>
<td>SPI / I2C</td>
<td>SPI / I2C</td>
</tr>
<tr>
<td>Power</td>
<td>Power</td>
</tr>
</tbody>
</table>

| **COM Express Type 7** |
| Gigabit Ethernet | 2x Gigabit Ethernet |
| LPC / eSPI | 2x Gigabit Ethernet |
| 4x PCIe | eSPI / LPC |
| HDA | 4x PCIe |
| LVDS 2x24 / eDP / MIPI DSI | HDA / 2x I2S |
| 2x MIPI CSI | LVDS / eDP |
| HDMI & DP++ | ExpressCard |
| 1x SATA | 4x SATA |
| 6x USB 2.0 / 2x USB 3.0 | 32x PCIe |
| 12x GPIO / SDIO | 4x PCIe |
| 4x SER / CAN | 4x PCIe |
| SPI / I2C | SPI / I2C |
| Power | Power |
COM Express

the most scalable

COM Express is a PICMG standard that defines a Computer-On-Module, or COM, packaged as a high performance super component with a wide selection of high speed interfaces. congatec is specification editor for the most recent revision 3.0 of this PICMG standard. This version includes the new Type 7 definition that extends the use for COM Express modules to server class applications.
**Thermal Design**

As with Qseven and SMARC, the COM Express definition includes a heatspreader that acts as a thermal interface between the COM Express module and the system’s cooling solution. All heat generating components are thermally conducted to the heatspreader in order to avoid hot spots. The high power heatspreaders and cooling solutions utilize congatec’s patented high efficient flat heat pipes in order to allow for maximum performance and reliability.

**PCI Express**

COM Express offers up to 32 PCI Express lanes. This allows the customer to enhance the performance of their embedded application. PCI Express is a low pin count interface with maximum bandwidth per pin. PCI Express 3.0 supports up to 8 GBit/s per lane and direction.

**Video Output**

Common video outputs for COM Express modules are LVDS for direct flat panel support and up to 3 DDIs (Digital Display Interfaces). Each of the DDI can be switched to TMDS (for DVI or HDMI) or DisplayPort. Type 6 modules also allow for an embedded DisplayPort. Type 7 modules are designed for headless use and do not support direct video outputs.

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**Server Class**

<table>
<thead>
<tr>
<th>Type 7</th>
<th>Type 6</th>
<th>Type 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gigabit Ethernet</td>
<td>Gigabit Ethernet</td>
<td>Gigabit Ethernet</td>
</tr>
<tr>
<td>LPC / eSPI</td>
<td>LPC</td>
<td>LPC / eSPI</td>
</tr>
<tr>
<td>32x PCIe</td>
<td>8x PCIe</td>
<td>4x PCIe</td>
</tr>
<tr>
<td>2x SATA</td>
<td>8x USB 2.0</td>
<td>2x SATA</td>
</tr>
<tr>
<td>4x USB 2.0</td>
<td>8x GPIO / SDIO</td>
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</tr>
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</tr>
<tr>
<td>Power</td>
<td>Power</td>
<td>Power</td>
</tr>
</tbody>
</table>

**Performance Class**

- Gigabit Ethernet
- LPC
- HDA
- LVDS / eDP
- 4x SATA
- 8x USB 2.0
- 8x GPIO / SDIO
- 2x SER / CAN
- SPI & I2C
- Power

**Low Power Class**

- Gigabit Ethernet
- LPC
- 8x PCIe
- LVDS / eDP
- ExpressCard
- 4x SATA
- 8x USB 2.0
- 8x GPIO / SDIO
- 2x SER / CAN
- SPI & I2C
- Power

**Interfaces**

COM Express defines 220/440 interconnect pins between the COM Express module and the carrier board. Older modules based on Type 2 supporting legacy interfaces like PCI are still shipping but are not recommended for new designs.

**Server-on-Module**

The newly introduced Type 7 pinout was generated to enable headless server class applications. It features up to four 10 Gb Ethernet ports, out-of-band management, and up to 32 PCI Express lanes.

**Customization**

Custom features are generated on a customized carrier board which accepts standard COM Express modules.

**Size**

COM Express modules are available at three different sizes. The low power Type 10 modules are implemented utilizing the Mini size while Type 6 modules utilize the Compact and Basic form factors. Type 7 modules are available in Basic size.

**GPIO**

COM Express defines freely usable general purpose inputs and outputs. The PICMG EAPI describes a common software API to control these GPIOs and some other embedded features.
Qseven
the low power COM definition

Targeting next generation ultra mobile embedded processors built using latest mobile chip technologies, the Qseven format complements the low power and small size of these processors. By exploiting the small form factor of the industry’s latest processors, the Qseven format offers good computing performance with onboard Flash and DRAM, delivered in a module measuring only 70 x 70 mm² or 40 x 70 mm².
Qseven® also supports ARM processors for mobile and ultra low power consumption applications. Unlike COM Express® it is not limited to x86 processor technology. One carrier board can be equipped with x86 or ARM Qseven® modules.

Freedom
Qseven® allows for the use of non x86 processor architectures. It also supports the low power mobile ARM processor architecture. Customers have the freedom to use all kinds of Qseven® modules without the need to change the carrier board.

Mobile Applications
Qseven® is an optimized standard targeting towards low power and mobile / ultra-mobile applications.

Low Power
Qseven® is defined for a maximum power consumption of 12 Watts. It is designed to be operated by single 5 Volt DC power and provides all additional signals for battery management. This simple power requirement allows for small mobile solutions powered by compact two cell batteries.

Connector
Qseven® does not require an expensive board-to-board connector. Instead, it utilizes a very affordable MXM2 card slot with 230 pins in a 0.5 mm configuration.

Legacy Free
Qseven is a legacy free standard focused on high speed serial interfaces such as PCI Express and Serial ATA. Qseven omits support for legacy interfaces like EIDE and PCI, in order to provide ideal support for today’s, as well as future, mobile CPUs and chipsets.

Slim Design
When comparing to COM Express Basic, Compact & Mini and SMARC, Qseven enables slimmer mechanical housings.

Compact Size
The module’s dimensions are a mere 70x70 mm². This means it can be easily integrated into size constricted systems.

SGeT e.V.
The Qseven Specification is hosted by the SGeT standardization group. congatec is founding member, board member and Qseven development team member of the SGeT.
SMARC 2.0
for power saving IoT

SMARC 2.0 is perfectly positioned between the two well-established module standards Qseven and COM Express. Compared with the Qseven standard, which allows low-cost entry into the world of computer modules, SMARC offers higher integration and more interfaces – especially more video and camera ports and a second Ethernet connection to support IoT applications.
The technical highlights of SMARC 2.0

The 314 pins of the SMARC 2.0 connector, which is also used for the MXM 3.0 graphics card standard, provide space for up to four video outputs, underlining SMARC 2.0’s particular suitability for multimedia applications.

Connector
SMARC 2.0 utilizes a highly reliable, high speed certified but affordable 314 pin 0.5mm MXM 3 connector.

Extensive video interface options
SMARC 2.0 offers a rich choice of internal and external video interfaces. Two dual-mode DisplayPorts (DP++) are provided for flexible external screen connections via DisplayPort, HDMI or VGA.

For internal displays 2x24 Bit LVDS is implemented. Alternative use is defined to support two independent embedded DisplayPort (eDP) or MIPI Display Serial Interface (DSI)

Two Ethernet interfaces yield greater precision
SMARC 2.0 implements two Gigabit Ethernet ports, which is a particular advantage for IoT or Industry 4.0 applications. Both Ethernet ports provide SDPs (Software Defined Pins) to allow for hardware-based IEEE 1588 Precision Time Protocol (PTP)

Wireless
SMARC 2.0 provides a special area on the module that is dedicated to the placement of the miniature RF connectors to allow for wireless interfaces like WLAN and Bluetooth.

Camera interfaces
SMARC 2.0 provides all signals required to support digital cameras. For this purpose, two serial MIPI CSI (Camera Serial Interface) have been implemented.

Low Power
SMARC 2.0 is defined for low power consumption applications only. It can be operated by 3.3V or 5V DC power and provides all additional signals for battery management.

Backwards Compatible
SMARC 2.0 is not compatible with the previous definition SMARC 1.1. The feature set was completely updated, one third of the pin definitions have been changed.

Small Size
The module’s dimensions are a mere 82 x 50 mm². This means it can be easily integrated into size constricted systems.

SGeT e.V.
The SMARC (“Smart Mobility ARCHitecture”) Specification is hosted by the SGeT standardization group founded in 2012. congatec is founding member, board member and SMARC specification editor of the SGeT.
The use of Single Board Computers is an easy and fast way for creating industrial computing applications when there are no or just smaller special functionalities are required. Designing with SBCs can be faster because there's no need to create a customized carrier board.
congatec SBCs

The congatec Single Board Computer implementations offer industrial reliability, embedded features and affordable pricing.

On top of the rich interface selection the congatec SBCs offer many extra features to allow for industrial use:
- Lowest power consumption utilizing embedded mobile CPUs
- Passive and active cooling options
- 24/7 operation
- Ceramic capacitors for extended lifetime
- Extended temperature options for harsh environment
- Long term availability 10+ years
- Customization of hardware and BIOS/UEFI possible
- Extreme flat solutions based on the Thin Mini-ITX standard, max. height of 20mm
- Expandable by PCI Express, Mini PCI Express and M.2 slots
- Enhanced security features with TPM chip

When desktop boards reach their limits then the congatec SBCs are first choice.

Concept
- SBCs are a ready-to-use embedded platforms
- Reliable and rugged designs
- Based on 15+ years of embedded experience
- Long term availability (10+ years)
- Industrial design

Benefits
- Extended temperature range (up to -40° ... +85°C)
- 24/7 operation
- Lowest levels of power consumption
- Rich I/O feature set
- Certified accessories
- Hard- and software customization
congatec Design Services
for customized designs

Existing know-how and infrastructure make it possible for customers to outsource custom designs to congatec. As a single supplier covering the complete range of cost-effective standard solutions to individual customized projects, congatec supports the full range of technology platforms – from x86 to ARM and from standard form factors i.e. COM Express or Pico-ITX to full customized board designs. For customized projects congatec acts as a service provider supporting the specific system designs of customers.

congatec’s Customizing Services
congatec’s embedded customizing support starts at the design phase and includes project management, the development of specific hardware and software, production control, system integration and global logistics, as well as the provision of technical support.

- **Customization**
  - of Single Board Computers
  - of Computer-On-Modules
- **Design**
  - of Carrier Boards
  - of Full Custom Hardware
  - of Cooling Solutions
  - of Mechanics
- **Modification**
  - Special BIOS/UEFI/Firmware features or settings
- **System Integration**
  - including Tests and Certifications
- **Manufacturing**
  - Efficient High Quality Production Services

congatec as Outsourcing Partner

**Overview**
- Mutually define system requirements
- Create product concept
- Provide detailed design including supply chain
- Turnkey delivery for the complete product life cycle

**Benefits**
- Leverages congatec embedded computing expertise
- Improves time to market and reduces development cost
- Simplifies customers supply chain
- congatec manages the entire product life cycle
- Intellectual property remains with the customer

congatec supports customer developments throughout the entire product life cycles. Customers benefit from congatec’s rich experience as a manufacturer of high quality computer modules with synergistic effects leading to reduced development time and cost.
congatec Technical Services
for customized designs

Worldwide Coverage
Engineering and support for standard and customized products in all major regions

Services for the Project Definition Phase
Product Selection Support
SBC, COM or full custom design? Forward looking I/O selection, ...

Design-In Training
Engineering trainings covering all aspects fo carrier board designs

Services for the Design Phase
Design Guides
In depth best practice solutions
Reference Schematics
High level starting point for own designs
Component Selection
Support to find the right functionality, costs, availability, ...
Signal Integrity Simulation
High speed simulation allows layout adjustments before the first prototypes are produced

Schematic Review
Check the design to recognize problems at an early stage
Layout Review
Detailed check and best practice advice from our specialists
BIOS/UEFI/Firmware Customization
Implementation of customized features or settings
Bring-Up Support
congatec engineering support to bring life to the first prototypes quickly

Services for the Validation Phase
Compliance Measurements
Measurement of the signal integrity up to 36 GHz for Rx and Tx signal path
Thermal Solutions
Optimized cooling solutions featuring heat stacks, heat pipes or vapor chambers
Customized Article Handling
Handling of manufacturing and logistics requirements

Support for EMC Measurements
Engineering support to optimize the designs to EMC requirements
MTBF
Reliability calculations based on different standards i.e. Telcordia 3, SN 29500, IEC 61709, ...

Information Sources
Users Guides
Accurate and detailed product related information
Application & Tech Notes
Specific solutions described in detail i.e. benchmarks, power consumption measurements for different CPUs use cases, and details about the enhanced congatec BIOS features

Design Guides
Deep technical “how to” for carrier boards, battery managers, and more
Reference Schematics
Schematics and layout files to be used as a blueprint for your carrier board designs
congatec offers many customization services. Depending on customers’ needs, we can provide the required levels of customization. Starting from BIOS/UEFI special settings up to full custom designs with cooling and mechanical integration. congatec simplifies the use of embedded technology.
We create your customized application ready IoT platform

Combine your IoT application with congatec’s embedded computer know-how. The combination of your application knowledge and congatec’s industrial computing competence results in customized IoT platforms which fits exactly to your requirements.

The congatec IoT platform which is used as base for these individual developments provides unique advantages:

**Wide selection of wireless interfaces**
Compatibility to multiple wireless devices installed in parallel (WiFi, 3G/LTE, LoRA, Zigbee, Sigfox, BLE, NB-IoT, and more) provides best flexibility for all kinds of IoT Applications.

**Rugged mechanics**
The aluminium diecast housing provides best stability and cooling for use in harsh environment.
The fanless design is capable to be used in industrial extended temperature range at low maintenance cost.

**Highest flexibility**
The modular construction of the gateway allows for most flexible configurations.
We create the gateway that fits your demands – ready for brand-labeling.

**Scalable performance**
High performance of the gateway can offer local analysis to reduce the amount of transmitted data packages to the cloud. It utilizes the Qseven Computer-On-Module standard to always provide latest processor technologies.

**Environment friendly**
The IoT platform is designed for lowest power consumption in order to reduce energy cost and to optimize the carbon footprint.

**conga-IoT2**
- Application ready IoT gateway hardware platform
- Based on conga-QAS quad core Intel Atom processor
- Extreme levels of flexibility in terms of processing performance and software integration
- Hosts up to 8 wireless antennas (4x SMA & 4x RP-SMA)
- Connectivity and Expansions
  2x USB 2.0, 1x M.2, 6x miniPCIe, 2x mSATA
- Powered by PoE or 19V DC
- Perfect base for customized system designs
congatec embedded
BIOS / UEFI

Embedded computer users usually require more than the standard functionality of an office computer. congatec has taken these requirements into account when designing BIOS / UEFI functionalities. Based on our large amount of BIOS and UEFI experience, we have implemented the embedded requirements into our powerful congatec BIOS / UEFI platform.

congatec Board Controller
An onboard micro controller fully isolates most of the embedded features, such as system monitoring, multi stage watchdog or the I²C bus, from the x86 core architecture. This results in higher embedded feature performance and higher overall system reliability.

Information
Board Information
The congatec Board Controller provides a rich data set of manufacturing data and board information: serial number, article number, EAN code, manufacturing and repair date, running time meter, boot counter and more.

Setup
OEM Setup Menu Control
The feature allows customers to hide or show setup nodes and to change the descriptions at the BIOS setup screens. Full control for the setup screens is provided to the OEM.

OEM Verb Table
To initialize carrier board HDA codecs at BIOS level.

User Data Memory
congatec modules provide 32 Bytes of non-volatile storage in the EEPROM and a 64 kByte block in the BIOS flash memory. This can be used to store critical and important operating data e.g. system ID, IP address, software key, etc. User Data Memory can be read and/or write locked to prevent unauthorized manipulation or readout.

UEFI Screenshot Driver
This allows saving the current screen of the BIOS setup to a USB flash drive. The resulting .png files can be used for professional system documentation.

OEM BIOS Code
Allows customers to a “do it yourself” integration of their own legacy code into the BIOS BOOT flow. The congatec embedded BIOS calls OEM code at designated schedules. Possible options are before/after OpROM scan, before setup and before boot. This can be used to initialize custom carrier board hardware, to add PCI/PCIe OpROMs and boot loaders, to provide Windows SLP string and SLIC tables for OEM activation, to create own HDA codec verb tables or for other OEM customizations.

OEM BIOS Default Settings
The congatec embedded BIOS allows users to create custom OEM default settings. These settings can be stored as defaults in the flash memory.

BIOS Setup Data Backup
The BIOS configuration settings are held in flash memory to allow battery-less applications.
Interfaces
Fast Mode I²C Bus
The I²C Bus is a simple serial bus interface often used for sensors, converters or data storage in embedded applications. All congatec modules offer a 400 kHz multi-master I²C hardware host controller implementation.

Further congatec BIOS/BC Features
Type based boot device selection, legacy USB support, USB MSD service boot and generic LPC decoding are also supported. Further features include AT mode shutdown configuration (halt, restart), LID & Sleep support and P-State reduction. Some platforms also allow to drive any IRQ over SERIRQ at the GPIO interface.

Monitoring
Multi Stage Watchdog Timer
All congatec modules are equipped with a multi stage watchdog timer supporting different events such as ACPI event, NMI, hardware reset or power button. It can either assert a single event and/or any combination of these events.
Post Watchdog Timer
This feature allows the monitoring of the BIOS POST process. Starts at system power-up and triggers a hardware reset if adjustable timeout (256 ms to 4.5 h) is exceeded before the operating system is started.

Display
Auto-detection
Automatic detection and configuration of an attached flat panel is provided via EPI. EPI is an open standard for easy and direct control of all digital flat panel displays with maximum interchangeability

Customizable Boot Screen
Dark boot, a customized splash screen or a customer logo during POST are the boot screen options which can be set by the customer directly.

Security
Measured Boot with TPM2.0
Full TPM chip support is provided by the BIOS to support features like Bitlocker and Measured Boot.

BIOS write and update protection
Both of these functions are available once the BIOS Password has been set in the BIOS Setup. When enabled, the BIOS cannot be updated or modified, BIOS write and update protection can be temporarily disabled with the congatec System Utility (CGUTIL) (requires BIOS Password). The congatec BIOS password is SHA256 encrypted.

OS Support
32/64 Bit Uniform OS API
The congatec embedded BIOS Features are accessible through the uniform APIs EAPI (a PICMG® definition) and the congatec proprietary CGOS API interface.

OEM SMBIOS/DMI Data
Allows customers to update several SMBIOS strings. This allows for DMI table content control by the OEM customer directly. No 3rd party tools are required.

Optimized Power Management
ACPI Power Management and System Configuration are supported by the congatec BIOS/UEFI according to the ACPI specification.

OEM UEFI DXE Driver / Bootloader
This feature allows customers to integrate their own UEFI DXE driver and bootloaders. The built-in CGOS DXE driver allows for CGOS support (for example to use the I2C bus or initialize the watchdog) in these OEM DXE drivers.

Power Loss and Power-up Control
This feature controls the operation mode after AC power loss and normal power on. Turn on, remain off and last state modes are possible. This feature does not require an installed CMOS battery.

ACPI Battery Management
The congatec ACPI BIOS and Board Controller are designed to support a CMB (Control Method Battery) sub-system. It’s possible to implement customized battery solutions by following the congatec CMB design guide. The solution also supports the commonly used Smart Battery Chargers and solutions with only a battery implemented.

Hardware Health Monitoring
The congatec BIOS and board controller have routines implemented to monitor critical components implemented. This allows for extensive fan control and standard temperature sensors for CPU, module and voltage monitoring. The flexible sensor/actuator assignment allows for easy customization.

Hardware Health Monitoring
LVDS Backlight Control
The backlight intensity can be set in BIOS setup or modified during run time by using the CGOS API and ACPI methods from the operating systems. External DACs and potentiometers are supported. Connections are supported utilizing the I2C or PWM signals.

OEM EDID for LVDS Panel
Allows creation of customized EDID data for any LVDS flat panel and add it to the list of predefined types.

Secure Boot with OEM Platform Key
UEFI Secure Boot is about making sure only properly signed and verified images are executed. The main overall reason for UEFI Secure Boot is to prevent any unauthorized software from being loaded in the pre-boot space. The congatec embedded BIOS allows to integrate OEM Platform Keys establishing a trust relationship between the platform owner and the platform firmware.

Optimizations for Real Time Operation
The congatec BIOS includes features to optimize the module behavior for best real time operation. CPU and GPU clocks can be fixed and turbo modes / SpeedStep / C-states can be disabled. Further options include PCIe/DMI ASPM disable, Passive cooling disable and support for exclusive IRQ.

Board Support Packages
congatec offers advanced BSPs, which include both the latest tested drivers from silicon vendors and the congatec specific drivers for accessing all of our additional embedded BIOS and module features.

congatec System Utility
All embedded BIOS features are accessible through the use of a congatec utility. This includes all manufacturing and statistical information; e.g. serial number, running hours, boot counter etc. BIOS default settings, bootlogo and flat panel configurations can easily be programmed using this flexible and powerful tool.
Server-On-Modules
embedded high performance computing

The power saving Intel® Xeon processors and the brand new EPYC 3000 series from AMD allow for scalable server performance on COM Express modules. The type 7 pinout enables further server class features i.e. 10 Gigabit Ethernet and extra PCI Express lanes.
conga-B7AC

conga-B7XD

conga-B7E3

**Formfactor**

<table>
<thead>
<tr>
<th></th>
<th>COM Express® Basic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>95 x 125 mm², Type 7</td>
</tr>
</tbody>
</table>

**CPU**

<table>
<thead>
<tr>
<th></th>
<th>Intel® Atom™ Processor C3000 Family (&quot;Deverton&quot;)</th>
<th>Intel® Xeon® Processor D-1500 Family (&quot;Broadwell DE&quot;)</th>
<th>AMD EPYC™ Embedded 3000 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Atom™ C3958 16x 2.0 GHz, Cache 16MB, 31W</td>
<td>Xeon® D-1577 16x 1.3/2.1 GHz, Cache 24MB, 45W</td>
<td>EPYC3451, 16 Cores, 2.1/3.0 GHz, Cache 32MB, 100W</td>
</tr>
<tr>
<td></td>
<td>Atom™ C3858 12x 2.0 GHz, Cache 12MB, 25W</td>
<td>Xeon® D-1567 12x 2.1/2.7 GHz, Cache 18MB, 65W</td>
<td>EPYC3401, 16 Cores, 1.8/3.0 GHz, Cache 32MB, 85W</td>
</tr>
<tr>
<td></td>
<td>Atom™ C3758 8x 2.2 GHz, Cache 16MB, 25W</td>
<td>Xeon® D-1548 8x 2.0/2.6 GHz, Cache 12MB, 45W</td>
<td>EPYC3351, 12 Cores, 1.9/3.0 GHz, Cache 32 MB, 80W</td>
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<tr>
<td></td>
<td>Atom™ C3558 4x 2.2 GHz, Cache 8MB, 16W</td>
<td>Xeon® D-1527 8x 2.2/2.7 GHz, Cache 6MB, 35W</td>
<td>EPYC3301, 12 Cores, 2.0/3.0 GHz, Cache 32MB, 45W</td>
</tr>
<tr>
<td></td>
<td>Atom™ C3538 4x 2.1 GHz, Cache 8MB, 15W</td>
<td>Pentium™ D-1509 2x 1.5 GHz, Cache 3MB, 19W</td>
<td>EPYC3251, 8 Cores, 2.5/3.1 GHz, Cache 16MB, 55W</td>
</tr>
<tr>
<td></td>
<td>Pentium™ D-1508 2x 2.2/6.6 GHz, Cache 3MB, 25W</td>
<td>Pentium™ D-1508 2x 2.2/6.6 GHz, Cache 3MB, 25W</td>
<td>EPYC3201, 8 Cores, 1.5/3.1 GHz, Cache 16MB, 30W</td>
</tr>
</tbody>
</table>

**Intel® Atom™  C3958 16x 2.0 GHz, Cache 16MB, 31W**

**Intel® Xeon® D-1577 16x 1.3/2.1 GHz, Cache 24MB, 45W**

**AMD EPYC™ Embedded 3000 Series**

**Operating temperature commercial:** 0 .. +60°C

**Operating temperature industrial:** -40 .. +85°C

**DRAM**

|  | 3 SO-DIMM sockets for DDR4 memory modules up to 48 GByte 2133 MT/s ECC or non-ECC |
|  | 3 SO-DIMM sockets for DDR4 memory modules up to 48 GByte 2400 MT/s ECC or non-ECC |
|  | 3 SO-DIMM sockets for DDR4 memory modules up to 96 GByte 2666 MT/s ECC or non-ECC |

**Chipset**

|  | Integrated in SoC |

**Ethernet**

|  | 4x 10GBe with KR Interface support |
|  | 2x 10GbE Intel I210 Ethernet Controller |
|  | 4x 10GbE BaseKR, 1x GbE Intel I210 Ethernet Controller |

**Serial ATA**

|  | 2x |

**PCI EXPRESS® Gen 3.0 / 2.0**

|  | 12x / 8x |
|  | 24x / 8x |
|  | up to 32x Gen 3.0, depending on CPU version |

**USB 3.1 / 2.0**

|  | 2x / 4x |
|  | 4x / 4x |

**Other**

|  | LPC, SPI, I²C, 2x UART, SMBus, NC-SI |

**Mass Storage**

|  | eMMC 5.0 onboard flash up to 128 GByte (optional) |
|  | Up to 1 TByte onboard NVMe storage |

**congatec Board Controller**

- Multi Stage Watchdog
- non-volatile User Data Storage
- Manufacturing and Board Information
- Board Statistics
- BIOS Setup
- Data Backup
- PC bus (fast mode, 400 kHz, multi-master)
- Power Loss Control

**Embedded BIOS Feature**

- AMI-Aptio UEFI BIOS, congatec Embedded BIOS

**Security**

- Intel® Quick Assist Technology
- Hardware integrated encryption engine

**Power Management**

- ACPI 5.0 compliant, Smart Battery Management

**Operating Systems**

- Microsoft® Windows Server 2016, 212, 2012 R2, 2008 R2 SP1
- Microsoft® Windows 10 Enterprise
- Microsoft® Windows 8.1 64b
- RHEL 6.6 & 7.1
- SUSE 11 SP4 & 12 SP1
- Fedora 22
- Ubuntu 14.10
- CentOS 6.6 & 7.1 FreeBSD
- VMware
- Hyper-V
- ESXi

**Humidity**

|  | Operating: 10 .. 90°C r.H. non cond |
|  | Storage: 5 .. 95% r.H non cond |
The low power product category features multiple Generations of the Intel® Atom™ processors, G and Gx Series CPUs from AMD and latest high end ARM processors from NXP. Multiple form factors i.e. Qseven, SMARC 2.0, COM Express Mini / Compact and the SBC form factors Pico-ITX and Thin Mini-ITX.
## conga-SMX8X, conga-QMX8X, conga-SMX8, conga-QMX8, conga-QMX6

<table>
<thead>
<tr>
<th>Formfactor</th>
<th>SMARC 2.0, 82 x 50 mm²</th>
<th>Qseven, 70 x 70 mm²</th>
<th>SMARC 2.0, 82 x 50 mm²</th>
<th>Qseven, 70 x 70 mm²</th>
<th>SMARC 2.0, 82 x 50 mm²</th>
<th>Qseven, 70 x 70 mm²</th>
</tr>
</thead>
</table>

### CPU

- **NXP i.MX8 QuadXPi** 4x Cortex-A35 + 1x M4F  
- **NXP i.MX8 DualXPi** 2x Cortex-A35 + 1x M4F  
- **NXP i.MX8 DualX** 2x Cortex-A35 + 1x M4F

- **NXP i.MX8 QuadMax** 2x Cortex A72 + 4x A53 + 2x M4  
- **NXP i.MX8 QuadPlus** 1x Cortex A72 + 4x A53 + 2x M4  
- **NXP i.MX8 DualMax** 2x Cortex A72 + 2x M4

### DRAM

- Up to 4 GByte onboard LPDDR4 memory  
- max. 8 GByte LPDDR4 up to 3200 MT/s by SOC  
- max. 2 GByte DDR3 1066 MT/s

### Ethernet

- Up to 2x Gbit optional with IEEE 1588  
- 1x Gigabit optional with IEEE 1588  
- 1x Gigabit

### Serial ATA

- 1x
- 1x
- 1x (NXP i.MX6 Dual & Quad)

### PCI EXPRESS

- 1x Gen. 3.0  
- 2x Gen.3.0  
- 2x Gen.3.0  
- 1x Gen. 2.0

### USB 3.0/2.0

- 1x USB 3.0  
- 5x USB 2.0 (shared with 1x USB OTG Client)  
- 5x USB 2.0 (shared with 1x USB OTG Client)

### Other U/Os

- SDIO | SPI | CAN | M2 1216 WiFi module optional  
- SDIO | 2x SPI | 3x UART | 2x FlexCAN | GPIO | MIPI-CSI  
- SDIO | 2x SPI | 3x UART | 2x FlexCAN | GPIO | MIPI-CSI

### Mass Storage

- Onboard Solid State Drive (eMMC) up to 64 GByte optional pseudo SLC  
- Onboard Solid State Drive (eMMC) up to 64 GByte optional (on board MicroSD socket)  
- Onboard Solid State Drive (eMMC) up to 32 GByte (optional) on board MicroSD socket

### Sound

- 2x I²S, 1x Tensilica® HiFi 4 DSP  
- 1x I²S, 1x Tensilica® HiFi 4 DSP  
- 1x I²S

### Graphics

- Integrated GT7000Lite multimedia GPU  
- VPU up to 4K h.265 dec / 1080p h.264 enc/dec  
- 3D Graphics with up to 4 high performance vertex shaders and 16 execution units  
- up to 2 independent displays  
- OpenGL ES 3.1  
- Vulkan VX extensions  
- OpenCL 1.2 EP  
- OpenVG 1.1

### Video Interface

- 2x LVDS (2x 24 bit)  
- HDMI 1.3  
- 2x LVDS (2x 24 bit)  
- 2x LVDS (2x 24 bit)  
- 2x LVDS (2x 24 bit)  
- 1x MIPI-DSI  
- 2x LVDS (2x 24 bit)  
- 2x LVDS (2x 24 bit)  
- 2x LVDS (2x 24 bit)  
- HDMI

### Boot loader

- U-Boot boot loader

### Power Management

- through original NXP Power Management IC (PMIC)

### Operating Systems

- Linux, Yocto, Android  
- Android | Microsoft® Windows Embedded Compact 7 | Linux | BSPs with OS drivers and tools

### Temperature

- Operating commercial: 0°C ... +60°C  
- Operating industrial: -40°C ... +85°C  
- Storage: -40°C ... +85°C

### Humidity

- Operating: 10% ... 90% r. H. non cond.  
- Storage: 5% ... 95% r. H. non cond.
<table>
<thead>
<tr>
<th>conga-PA5</th>
<th>conga-IA5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formfactor</td>
<td>Pico-ITX 72 x 100 mm²</td>
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<tr>
<td>CPU</td>
<td>5th Gen. Intel® Atom™ / Celeron® / Pentium® processors (“Apollo Lake”)</td>
</tr>
<tr>
<td></td>
<td>commercial versions 0 .. +60°C operating temperature</td>
</tr>
<tr>
<td></td>
<td>Intel® Atom™ x7-E3950 4x 1.6/2.0 GHz, L2 cache 2MB, 12W TDP</td>
</tr>
<tr>
<td></td>
<td>Intel® Atom™ x5-E3940 4x 1.6/1.8 GHz, L2 cache 2MB, 9.5W TDP</td>
</tr>
<tr>
<td></td>
<td>Intel® Atom™ x5-E3930 2x 1.3/1.8 GHz, L2 cache 1MB, 6.5W TDP</td>
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<tr>
<td></td>
<td>Intel® Celeron® N3350 2x 1.1/2.4 GHz, L2 cache 1MB, 6W TDP</td>
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</tr>
<tr>
<td>DRAM</td>
<td>max 8GB onboard LPDDR4 with up to 2400 MT/s</td>
</tr>
<tr>
<td></td>
<td>Support for 2x SO-DIMM Socket, max. 8 GB dual channel up to DDR3L-1866 MT/s</td>
</tr>
<tr>
<td>Ethernet</td>
<td>2x Intel® I210 (industrial) / I211 (commercial) Gigabit Ethernet Controller</td>
</tr>
<tr>
<td>Serial ATA</td>
<td>1x Sata III</td>
</tr>
<tr>
<td>PCI EXPRESS®</td>
<td>1x miniPCIe shared with mSATA Full Size</td>
</tr>
<tr>
<td>USB 3.0/2.0</td>
<td>internally 2x / externally 2x</td>
</tr>
<tr>
<td>Other I/O</td>
<td>1x USB 3.0 Type C</td>
</tr>
<tr>
<td></td>
<td>externally 2x / 2x internally 1x / 1x USB 3.0 OTG</td>
</tr>
<tr>
<td>Sound</td>
<td>Intel® High Definition Audio</td>
</tr>
<tr>
<td>Graphics</td>
<td>Intel® HD Graphics 500</td>
</tr>
<tr>
<td>Video Interface</td>
<td>1x 24-bit Dual Channel LVDS (optional eDP)</td>
</tr>
<tr>
<td></td>
<td>1x DisplayPort++</td>
</tr>
<tr>
<td></td>
<td>1x Backlight (Power, control)</td>
</tr>
<tr>
<td></td>
<td>2x DisplayPort++</td>
</tr>
<tr>
<td></td>
<td>1x LVDS (2x24 bit)</td>
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<tr>
<td></td>
<td>1x Embedded DisplayPort</td>
</tr>
<tr>
<td></td>
<td>1x Backlight (Power, control)</td>
</tr>
<tr>
<td>congatec Board Controller</td>
<td>Multi Stage Watchdog</td>
</tr>
<tr>
<td>Embedded BIOS Feature</td>
<td>AMI Aptio® UEFI 2.x firmware</td>
</tr>
<tr>
<td></td>
<td>Display Auto Detection</td>
</tr>
<tr>
<td>Security</td>
<td>Optional discrete “Trusted Platform Module” (TPM). It is capable of calculating efficient hash and RSA algorithms with key lengths up to 2,048 bits and includes a real random number generator. Security sensitive applications such as gaming and e-commerce will benefit also with improved authentication, integrity and confidentiality levels</td>
</tr>
<tr>
<td>Power Management</td>
<td>1x internal DC-In (12V)</td>
</tr>
<tr>
<td></td>
<td>1x external DC-In (12V)</td>
</tr>
<tr>
<td>Operating Systems</td>
<td>Microsoft® Windows 10</td>
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<tr>
<td>Temperature</td>
<td>Operating commercial: 0 .. +60°C</td>
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<tr>
<td></td>
<td>Operating industrial: -40 .. +85°C</td>
</tr>
<tr>
<td></td>
<td>Storage: -40 .. +85°C</td>
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<tr>
<td>Humidity</td>
<td>Operating: 10 .. 90 % r. H. non cond.</td>
</tr>
<tr>
<td></td>
<td>Storage: 5 .. 95 % r. H. non cond.</td>
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<tr>
<td>conga-SA5</td>
<td>conga-QA5</td>
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<tr>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td><strong>Formfactor</strong></td>
<td>SMARC Specification 2.0 82 x 50 mm²</td>
</tr>
<tr>
<td><strong>CPU</strong></td>
<td></td>
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<td>**5th Gen. Intel® Atom™ / Celeron® / Pentium® processors (“Apollo Lake“)”</td>
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<td></td>
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<tr>
<td></td>
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<tr>
<td><strong>industrial versions</strong> -40 .. +85°C operating temperature</td>
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<td>Intel® Celeron® N3350 2x 1.1/2.4 GHz, L2 cache 1MB, 6W TDP</td>
</tr>
<tr>
<td><strong>DRAM</strong></td>
<td>max 8GByte onboard LPDDR4 2400 MT/s</td>
</tr>
<tr>
<td><strong>Chipset</strong></td>
<td>Integrated in SoC</td>
</tr>
<tr>
<td><strong>Ethernet</strong></td>
<td>2x Intel® I210 (industrial) /I211 (commercial) GBE</td>
</tr>
<tr>
<td><strong>Serial ATA</strong></td>
<td>1x</td>
</tr>
<tr>
<td><strong>PCI EXPRESS® Gen. 2.0</strong></td>
<td>3x</td>
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<tr>
<td><strong>USB 3.0/2.0</strong></td>
<td>2x / 4x</td>
</tr>
<tr>
<td><strong>Other I/O</strong></td>
<td>SDIO, SPI, PC, UART, 2x MIPI-CSI, WiFi/Bluetooth (optional)</td>
</tr>
<tr>
<td><strong>Mass Storage</strong></td>
<td>eMMC 5.0 onboard flash up to 128 GByte</td>
</tr>
<tr>
<td><strong>Sound</strong></td>
<td>Intel® High Definition Audio</td>
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<tr>
<td><strong>Graphics</strong></td>
<td>Intel® HD Graphics Gen. 9</td>
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<tr>
<td><strong>Video Interface</strong></td>
<td>LVDS 2x 24</td>
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<tr>
<td><strong>congatec Board Controller</strong></td>
<td>Multi Stage Watchdog</td>
</tr>
<tr>
<td><strong>Embedded BIOS Feature</strong></td>
<td>AMI Aptio® UEFI 2.x firmware</td>
</tr>
<tr>
<td><strong>Security</strong></td>
<td>Optional discrete “Trusted Platform Module” (TPM)</td>
</tr>
<tr>
<td><strong>Power Management</strong></td>
<td>ACPI 5.0 compliant, Smart Battery Management</td>
</tr>
<tr>
<td><strong>Operating Systems</strong></td>
<td>Microsoft® Windows 10</td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td>Operating commercial: 0 .. +60°C Storage: -40 .. +85°C</td>
</tr>
<tr>
<td><strong>Humidity</strong></td>
<td>Operating: 10 .. 90 % r. H. non cond. Storage: 5 .. 95 % r. H. non cond.</td>
</tr>
</tbody>
</table>

**LOW POWER CLASS**
**Formfactor**
- Qseven, 70 x 70 mm²

**CPU**
- 3rd Gen. Intel® Atom™ / Celeron® processors ("Bay Trail")
  - commercial versions 0 .. +60°C operating temperature
    - Intel® Atom™ E3845 4x 1.91 GHz, L2 cache 2MB, 10W TDP
    - Intel® Atom™ E3827 2x 1.75 GHz, L2 1MB, 8W TDP
  - industrial versions -40 .. +85°C operating temperature
    - Intel® Atom™ E3845 4x 1.91 GHz, L2 2MB, 10W TDP

**DRAM**
- max. 8 GByte dual channel DDR3L 1333MT/s
- max. 8 GByte onboard ECC DDR3L 1333 MT/s
- max. 8 GByte dual channel DDR3L 1333MT/s

**Chipset**
- Integrated in SoC

**Ethernet**
- Gigabit Ethernet Intel® i210
- Intel® i218LM GbE Phy

**Serial ATA**
- 2x

**PCI EXPRESS® Gen. 2.0**
- 3x

**USB 3.0/2.0**
- 1x / 6x 1x / 7x

**Mass Storage**
- eMMC 4.5 onboard flash up to 64 GByte (optional)

**Sound**
- Intel® High Definition Audio

**Graphics**
- Intel® HD Graphics Gen. 7

**Video Interface**
- LVDS 2x 24 | 1x HDMI/DisplayPort
- LVDS 1x 24 bit | 1x DisplayPort/HDMI

**congatec Board Controller**
- Multi Stage Watchdog | non-volatile User Data Storage | Manufacturing and Board Information | Board Statistics | I²C bus (fast mode, 400 kHz, multi-master) | Power Loss Control

**Embedded BIOS Feature**
- AMI Aptio® UEFI 2.x firmware | OEM Logo | OEM CMOS Defaults | LCD Control | Display Auto Detection | Backlight Control | Flash Update

**Security**
- LPC interface for TPM on Carrier Board
- Optional discrete "Trusted Platform Module" (TPM)

**Power Management**
- ACPI 5.0 compliant, Smart Battery Management

**Operating Systems**

**Temperature**
- Operating commercial: 0 .. +60°C
- Operating industrial: -40 .. +85°C

**Humidity**
- Operating: 10 .. 90 % r. H. non cond.
- Storage: 5 .. 95 % r. H. non cond.
### conga-TCA3

**Formfactor**
- OM Express® Compact
- 95 x 95 mm², Type 6

### conga-PA3

**Formfactor**
- Pico-ITX
- 72 x 100 mm²

### conga-IA3

**Formfactor**
- Thin Mini-ITX
- 170 x 170 x 20 mm³

### CPU

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency</th>
<th>L2 Cache</th>
<th>TDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel® Atom™ E3845</td>
<td>4x 1.91 GHz</td>
<td>2MB</td>
<td>10W</td>
</tr>
<tr>
<td>Intel® Atom™ E3826</td>
<td>2x 1.46 GHz</td>
<td>1MB</td>
<td>7W</td>
</tr>
<tr>
<td>Intel® Celeron J1900</td>
<td>4x 2.0 GHz</td>
<td>2MB</td>
<td>10W</td>
</tr>
<tr>
<td>Intel® Celeron N2930</td>
<td>4x 1.83 GHz</td>
<td>2MB</td>
<td>7.5W</td>
</tr>
<tr>
<td>Intel® Atom™ E3827</td>
<td>2x 1.75 GHz</td>
<td>1MB</td>
<td>8W</td>
</tr>
<tr>
<td>Intel® Atom™ E3815</td>
<td>1x 1.46 GHz</td>
<td>512kB</td>
<td>5W</td>
</tr>
<tr>
<td>Intel® Celeron N2807</td>
<td>2x 1.58 GHz</td>
<td>1MB</td>
<td>4.5W</td>
</tr>
</tbody>
</table>

### Chipset
- Integrated in SoC

### DRAM
- Support for 2x SODIMM Socket, max. 8GB
- Dual channel up to DDR3L-1333

### Ethernet
- 1x Gbit LAN Intel® i210
- 1x Gbit LAN | Intel i211 (210 for industrial version)
- 2x Gbit LAN | 2x Intel i211

### Serial ATA
- 2x SATAII
- 1x SATA II | 1x mSATA II
- 2x SATA II | 1x mSATA II

### PCI EXPRESS Gen. 2.0
- 5x
- 2x miniPCIe Half Size, one shared with mSATA
- 1x PCIe x1 Slot | 1x mPCIe Full/Half Size
- 1x mPCIe Half Size

### USB 3.0/2.0
- 1x / 8x
- 2x / 2x (1x Client)
- 1x USB 3.0-2.0 with multi-pin connector
- External 2x / 2x
- Internally 2x / 2x

### Other I/O
- SDIO, GPIO, SPI, LPC, I²C
- 1x RS-232
- 1x micro SD slot
- Feature connector
- 2x RS232 internal
- 8 Bit GPIO internal
- 1x micro SD slot

### Sound
- Intel® High Definition Audio
- Audio In/Out SPDIF OUT
- Audio In/Out
- 1x Front Panel HD Audio

### Graphics
- Intel HD Graphics Generation 8

### Video Interface
- LVDS 2x 24 bit
- 2x DisplayPort/HDMI/DVI
- 1x 24-bit Dual Channel LVDS
- 1x DisplayPort++
- 1x VGA
- 1x LVDS (2x24 bit)
- 1x Embedded DisplayPort
- 1x Backlight (Power, control)

### congatec Board Controller
- Multi Stage Watchdog
- Non-volatile User Data Storage
- Manufacturing and Board Information
- Board Statistics
- PCI bus (fast mode, 400 kHz, multi-master)
- Power Loss Control

### Embedded BIOS Feature
- AMI Aiptek® (UEFI) BIOS
- SM-BIOS
- BIOS Update
- Logo Boot
- Quiet Boot
- HDD Password

### Security
- Optional discrete “Trusted Platform Module” (TPM)

### Power Management
- ACPI 5.0 compliant, Smart Battery Management
- 1x internal DC-In (12V)
- 1x external DC-In (12V)
- 1x internal DC-In (12-24V)
- 1x opt. battery header for battery manager (SBM3)
- 1x external DC-In 12-24V

### Operating Systems

### Temperature
- Operating commercial: 0 .. +60°C
- Operating industrial: -40 .. +85°C

### Humidity
- Operating: 10 .. 90 % r. H. non-cond.
- Storage: 5 .. 95 % r. H. non-cond.
Embedded in your success.
<table>
<thead>
<tr>
<th>conga-QG</th>
<th>conga-TCG</th>
<th>conga-QAF</th>
<th>conga-BAF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oseven</td>
<td>COM Express Compact, Type 6</td>
<td>Oseven</td>
<td>COM Express Basic, Type 2</td>
</tr>
</tbody>
</table>

### CPU

<table>
<thead>
<tr>
<th>AMD Embedded GX-Series SOC</th>
<th>AMD Embedded G-Series Processors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Formfactor</strong></td>
<td><strong>Commercial operating temperature 0°C .. +60°C</strong></td>
</tr>
<tr>
<td>70 x 70 mm²</td>
<td>G-T56N 2x 1.6 GHz, 18W TDP</td>
</tr>
<tr>
<td><strong>CPU</strong></td>
<td>G-T40N 2x 1.0 GHz, 9W TDP</td>
</tr>
<tr>
<td>COM Express Compact, Type 6</td>
<td>G-T44R 1.2 GHz, 9W TDP</td>
</tr>
<tr>
<td>95 x 95 mm²</td>
<td>G-T40E 2x 1.0 GHz, 6W TDP</td>
</tr>
<tr>
<td><strong>Qseven</strong></td>
<td><strong>Industrial operating temperature -40°C .. +85°C</strong></td>
</tr>
<tr>
<td>70 x 70 mm²</td>
<td>GX-209HA 2x 1.0 GHz, 9W TDP</td>
</tr>
</tbody>
</table>

### DRAM

<table>
<thead>
<tr>
<th>max. 8 GByte ECC DDR3L 1333 MHz</th>
<th>max. 8 GByte DDR3L ECC 1600 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chipset</strong></td>
<td>max. 4 GByte DDR3L, 1066 MT/s</td>
</tr>
<tr>
<td>Integrated in SoC</td>
<td>Single channel up to 2x 4 GByte DDR3 So-DIMM 1066 MT/s</td>
</tr>
<tr>
<td><strong>Ethernet</strong></td>
<td><strong>Chipset</strong></td>
</tr>
<tr>
<td>Gigabit Ethernet</td>
<td>Integrated in SoC</td>
</tr>
<tr>
<td>Gigabit Ethernet</td>
<td>AMD A55E Controller Hub</td>
</tr>
<tr>
<td>Gigabit Ethernet</td>
<td>AMD A55E Controller Hub</td>
</tr>
</tbody>
</table>

### Serial ATA

<table>
<thead>
<tr>
<th>2x</th>
<th>2x</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Serial ATA</strong></td>
<td>4x SATA, 1x EIDE</td>
</tr>
<tr>
<td>2x / 8x</td>
<td>6x PCIe, 1x PCI</td>
</tr>
</tbody>
</table>

### USB 3.0/2.0

<table>
<thead>
<tr>
<th>1x / 5x</th>
<th>2x / 8x</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>USB 3.0/2.0</strong></td>
<td>- / x8</td>
</tr>
<tr>
<td>2x / 8x</td>
<td>- / x8</td>
</tr>
</tbody>
</table>

### Other I/O

<table>
<thead>
<tr>
<th>SDIO, SDCard, UART, LPC, IP</th>
<th>IP, SM, SD/MMC, LPC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Other I/O</strong></td>
<td>1x</td>
</tr>
</tbody>
</table>

### Mass Storage

<table>
<thead>
<tr>
<th>Silicon Motion FerriSSD® up to 64GB</th>
<th>Onboard SATA Solid State Drive up to 32 GByte (optional)</th>
</tr>
</thead>
</table>

### Sound

<table>
<thead>
<tr>
<th>High Definition Audio Interface</th>
<th>High Definition Audio Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sound</strong></td>
<td><strong>Chipset</strong></td>
</tr>
<tr>
<td>Integrated AMD Radeon™ HD 8000E, DirectX®11.1 graphics with UVD 3.0, Dual Simultaneous Display Support</td>
<td>Integrated AMD Radeon™ HD 6250</td>
</tr>
</tbody>
</table>

### Graphics

<table>
<thead>
<tr>
<th><strong>Graphics</strong></th>
<th><strong>Chipset</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>LVDS 2x 24</td>
<td>LVDS 2x 24</td>
</tr>
<tr>
<td>HDMI</td>
<td>HDMI</td>
</tr>
<tr>
<td>DisplayPort</td>
<td>DisplayPort</td>
</tr>
</tbody>
</table>

### Video Interface

<table>
<thead>
<tr>
<th>Multi Stage Watchdog</th>
<th>Multi Stage Watchdog</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>congatec Board Controller</strong></td>
<td><strong>congatec Board Controller</strong></td>
</tr>
<tr>
<td>non-volatile User Data Storage</td>
<td>non-volatile User Data Storage</td>
</tr>
<tr>
<td>Manufacturing and Board Information</td>
<td>Manufacturing and Board Information</td>
</tr>
<tr>
<td>Board Statistics</td>
<td>Board Statistics</td>
</tr>
<tr>
<td>PC bus (fast mode, 400 kHz, multi-master)</td>
<td>PC bus (fast mode, 400 kHz, multi-master)</td>
</tr>
<tr>
<td>Power Loss Control</td>
<td>Power Loss Control</td>
</tr>
</tbody>
</table>

### Embedded BIOS Feature

<table>
<thead>
<tr>
<th>AMI-Aptio 4 MByte Flash BIOS with congatec Embedded BIOS features</th>
<th>AMI-Aptio 4 MByte Flash BIOS with congatec Embedded BIOS features</th>
</tr>
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<tr>
<td><strong>congatec Board Controller</strong></td>
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</tbody>
</table>

### Power Management

<table>
<thead>
<tr>
<th><strong>Power Management</strong></th>
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</tr>
</thead>
<tbody>
<tr>
<td>ACPI 3.0 compliant</td>
<td>ACPI 3.0 compliant</td>
</tr>
<tr>
<td>Smart Battery Management</td>
<td>Smart Battery Management</td>
</tr>
</tbody>
</table>

### Operating Systems

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
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<tbody>
<tr>
<td><strong>Operating Systems</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Temperature

<table>
<thead>
<tr>
<th>Operating commercial: 0 °C .. +60°C</th>
<th>Operating industrial: -40 °C .. +85°C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temperature</strong></td>
<td><strong>Temperature</strong></td>
</tr>
<tr>
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<td>Operating commercial: 0 °C .. +60°C Storage: -40 °C .. +85°C</td>
</tr>
</tbody>
</table>

### Humidity

<table>
<thead>
<tr>
<th>Operating: 10 % .. 90 % non cond.</th>
<th>Storage: 5 % .. 95 % non cond.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Humidity</strong></td>
<td><strong>Humidity</strong></td>
</tr>
</tbody>
</table>

### Operating Environment

<table>
<thead>
<tr>
<th>Operating: 10 % .. 90 % non cond.</th>
<th>Storage: 5 % .. 95 % non cond.</th>
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<tbody>
<tr>
<td><strong>Temperature</strong></td>
<td><strong>Humidity</strong></td>
</tr>
<tr>
<td>Operating commercial: 0 °C .. +60°C Storage: -40 °C .. +85°C</td>
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</table>

### Environment

<table>
<thead>
<tr>
<th>Operating: 10 % .. 90 % non cond.</th>
<th>Storage: 5 % .. 95 % non cond.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Environment</strong></td>
<td><strong>Environment</strong></td>
</tr>
<tr>
<td>Operating commercial: 0 °C .. +60°C Storage: -40 °C .. +85°C</td>
<td>Operating commercial: 0 °C .. +60°C Storage: -40 °C .. +85°C</td>
</tr>
</tbody>
</table>
Performance Class
fast and energy efficient

This performance category features multiple Generations of the Intel Core processors and the latest graphic output oriented CPUs from AMD. Multiple form factors i.e. COM Express Compact / Basic and Thin Mini-ITX and JUKE 3.5” boards are supported.
<table>
<thead>
<tr>
<th><strong>conga-TC370</strong></th>
<th><strong>conga-JC370</strong></th>
<th><strong>conga-IC370</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Formfactor</strong></td>
<td>COM Express® Compact</td>
<td>3.5” Juke Board</td>
</tr>
<tr>
<td><strong>CPU</strong></td>
<td>95 x 95 mm², Type 6</td>
<td>146 x 102 mm²</td>
</tr>
<tr>
<td></td>
<td><strong>8th Generation Intel® Core™ Mobile Low Power U-Processors with up to 4 cores (“Whiskey Lake”)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intel® Core™ i3-8145U</td>
<td>1.4 GHz to 3.9 GHz (Burst)</td>
</tr>
<tr>
<td></td>
<td>Intel® Core™ i7-8565U</td>
<td>1.6 GHz to 4.6 GHz (Burst)</td>
</tr>
<tr>
<td><strong>Chipset</strong></td>
<td>COM Express® Compact</td>
<td>Thin Mini-ITX</td>
</tr>
<tr>
<td></td>
<td>95 x 95 mm², Type 6</td>
<td>170 x 170 x 20 mm³</td>
</tr>
<tr>
<td><strong>DRAM</strong></td>
<td>Integrated Intel® 300 Series</td>
<td>Dual channel DDR4 up to 2,400 MT/s</td>
</tr>
<tr>
<td><strong>Ethernet</strong></td>
<td>Intel® Gigabit Ethernet i219</td>
<td>Intel i219</td>
</tr>
<tr>
<td><strong>Serial ATA</strong></td>
<td>M.2 key M size 2280</td>
<td>2x</td>
</tr>
<tr>
<td>**PCI EXPRESS®</td>
<td>M.2 key B size 2280</td>
<td>M.2 key E size 2230</td>
</tr>
<tr>
<td><strong>USB 3.1/2.0</strong></td>
<td>M.2 key B size 2242 with microSIM</td>
<td>add-on socket</td>
</tr>
<tr>
<td><strong>Other I/O</strong></td>
<td>2x Gen. 2</td>
<td>8x</td>
</tr>
<tr>
<td><strong>Mass Storage</strong></td>
<td>optional eMMC 5.1 on board mass storage</td>
<td>PCIe x4</td>
</tr>
<tr>
<td><strong>Expansion Sockets</strong></td>
<td>M.2 key E size 2230</td>
<td>M.2 key E size 2230</td>
</tr>
<tr>
<td><strong>Internal Connectors</strong></td>
<td>SATA/eSATA/SATA-DOM + power</td>
<td>SATA/eSATA/SATA-DOM + power</td>
</tr>
<tr>
<td><strong>External Connectors</strong></td>
<td>Dual USB 2.0</td>
<td>USB 2.0</td>
</tr>
<tr>
<td><strong>Sound</strong></td>
<td>Intel® High Definition Audio</td>
<td>Intel® High Definition Audio Interface</td>
</tr>
<tr>
<td><strong>Graphics</strong></td>
<td>Intel® Gen. 9 Graphics</td>
<td>Intel® Gen. 9 Graphics</td>
</tr>
<tr>
<td><strong>Video Interface</strong></td>
<td>24 EU</td>
<td>24 EU</td>
</tr>
<tr>
<td><strong>congatec Board Controller</strong></td>
<td>Multi Stage Watchdog</td>
<td>non-volatile User Data Storage</td>
</tr>
<tr>
<td><strong>Embedded BIOS Feature</strong></td>
<td>PC bus (fast mode, 400 kHz, multi-master)</td>
<td>Power Loss Control</td>
</tr>
<tr>
<td><strong>Operating Systems</strong></td>
<td>Microsoft® Windows 10 (64bit only)</td>
<td>Microsoft® Windows 10 IoT Enterprise (64bit only)</td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td>Operating: 0 ... 60°C</td>
<td>Storage: -20 ... +70°C</td>
</tr>
<tr>
<td><strong>Humidity</strong></td>
<td>Operating: 10 ... 90% r.H.</td>
<td>Storage: 5 ... 95% r.H.</td>
</tr>
</tbody>
</table>
### Hardware Specifications

#### Formfactor
- **conga-TS370**: COM Express® Basic 95 x 125 mm², Type 6
- **conga-TS175**: COM Express® Compact 95 x 95 mm², Type 6
- **conga-TC175**: Thin Mini-ITX 170 x 170 x 20 mm³
- **conga-IC175**: Thin Mini-ITX 170 x 170 x 20 mm³

#### CPU
- **8th Gen. Intel® Core™ / Xeon® processors** (*Coffee Lake*):
  - Intel® Xeon® E-2176M, 6x 4.4/2.7 GHz, Cache 12MB, 45W (35W cTDP)
  - Intel® Core™ i7-8850H, 6x 4.3/2.6 GHz, Cache 9MB, 45W (35W cTDP)
  - Intel® Core™ i5-8400H, 4x 4.2/2.5 GHz, Cache 8MB, 45W (35W cTDP)
- **7th Gen. Intel® Core™ / Celeron® processors** (*Kabylake*):
  - Intel® Xeon® E3-1505MV5 4x 3.0/4.0 GHz, Cache 8MB, 45W (35W cTDP)
  - Intel® Core™ i7-7820EQ 4x 3.0/3.7 GHz, Cache 8MB, 45W (35W cTDP)
  - Intel® Core™ i5-7440EQ 4x 2.9/3.6 GHz, Cache 6MB, 45W (35W cTDP)
  - Intel® Core™ i3-7100E 2x 2.9 GHz, Cache 3MB, 35W TDP
- **Intel® Core® i7-7600U** 2x 3.9 / 2.8 GHz, Cache 4MB, 15W TDP, 7.5W cTDP
- **Intel® Core® i5-7300U** 2x 3.5/2.6 GHz, Cache 3MB, 15W TDP, 7.5W cTDP

#### DRAM
- max. 32 GByte DDR4
- Intel® Xeon® with ECC optional

#### Chipset
- Mobile Intel® PCH-H QM370

#### Ethernet
- Intel® i219LM GbE Phy.

#### Serial ATA
- 4x

#### PCI EXPRESS®
- 8x PCIe Gen. 3.0, 1x 16 (PEG)

#### USB 3.0/2.0
- 4x USB 3.1 Gen 2 10 GBS / 8x

#### Other I/O
- SPI, LPC, SM, 2xSerial, GPIO/SDIO, PC

#### Sound
- Digital High Definition Audio Interface with support for multiple audio codecs

#### Video Interface
- LVDS 2x 24 bit/eDP, VGA

#### Graphics
- Intel® Gen9 HD Graphics

#### congatec Board Controller
- Multi Stage Watchdog
- non-volatile User Data Storage
- Manufacturing and Board Information
- Board Statistics
- BIOS Setup
- Data Backup
- PC bus (fast mode, 400 kHz, multi-master)
- Power Loss Control

#### Embedded BIOS Feature
- AMI-Aptio UEFI BIOS, congatec Embedded BIOS

#### Security
- discrete TPM 2.0 installed

#### Power Management
- ACPI 4.0 with Battery support
- Optional discrete “Trusted Platform Module” (TPM)

#### OS
- Microsoft® Windows 10 (64bit only)
- Microsoft® Windows 10 IoT Enterprise (64bit only)
- Linux

#### Temperature
- Operating: 0 .. +60°C
- Storage: -20 .. +80°C

#### Humidity
- Operating: 10 .. 90% r. H. non cond
- Storage: 5 .. 95% r. H. non cond.
### Formfactor
- **conga-TS170**: COM Express® Basic 95 x 125 mm², Type 6
- **conga-TC170**: COM Express® Compact 95 x 95 mm², Type 6
- **conga-IC170**: Thin Mini-ITX 170 x 170 x 20 mm³

### CPU
- **6th Gen. Intel® Core™ / Celeron® processors (“Skylake”)**
  - Intel® Xeon® E3-1578LV5 4x 2.0/3.4 GHz, 8MB, 45W
  - Intel® Xeon® E3-1558LV5 4x 1.9/3.3 GHz, 8MB, 45W
  - Intel® Xeon® E3-1515MV5 4x 2.8/3.7 GHz, 8MB, 45W
  - Intel® Xeon® E3-1505MV5 4x 2.8/3.7 GHz, 8MB, 45W
  - Intel® Xeon® E3-1505LV5 4x 2.0/2.8 GHz, 8MB, 25W
  - Intel® Core™ i7-6820EQ 4x 2.8/3.5 GHz, 8MB, 45W
  - Intel® Core™ i7-6822EQ 4x 2.0/2.8 GHz, 8MB, 25W
  - Intel® Core™ i5-6440EQ 4x 2.7/3.7 GHz, 6MB, 45W
  - Intel® Core™ i5-6442EQ 4x 1.9/2.7GHz, 6MB, 25W
  - Intel® Core™ i3-6100E 2x 2.7 GHz, 3MB, 35W
  - Intel® Core™ i3-6102E 2x 1.9 GHz, 3MB, 25W
  - Intel® Celeron® G3900E 2x 2.40 GHz, 2MB, 35W
  - Intel® Celeron® G3902E 2x 1.6 GHz, 2MB, 15W
  - Intel® Core® i7-6600U 2x 2.6 /3.4 GHz, Cache 4MB, 15W TDP
  - Intel® Core® i5-6300U 2x 2.4/3.0 GHz, Cache 3MB, 15W TDP
  - Intel® Core® i3-6100U 2x 2.3 GHz, Cache 3MB, 15W TDP
  - Intel® Celeron® 3955U 2x 2.0 GHz, Cache 2MB, 15W TDP

### DRAM
- max. 32 GByte DDR4
- Intel® Xeon® and Intel® Core with ECC optional
- Up to 32 GByte dual channel DDR4 memory

### Chipset
- Mobile Intel 100 Series Chipset
- Integrated PCH-LP

### Ethernet
- Intel® I219LM GbE Phy
- Dual Gbit LAN
- 1x Intel® 219LM GbE AMT 11
- 1x Intel i211

### Serial ATA
- 3x

### PCI EXPRESS®
- 8x PCIe Gen. 3.0, 1x 16 (PEG)
- 8x PCIe Gen. 3.0
- PCIe x4 Slot (Gen.3)
- 1x Full/Half-size Mini PCIe Slot with micro SIM slot

### USB 3.0/2.0
- 4x / 8x
- 4x / 8x externally 4x / -
- internally - / 4x

### Other I/O
- SPI, LPC, SM, 2xSerial, GPIO/SDIO, I2C
- MIPI-CSI (Flatfoil), SM, IP, GPIO/SDIO, 2xSerial, LPC
- R5232 internal | 8 Bit GPIO internal | M.2 Type B (2230/2242)
- Integrated Sensor Hub

### Sound
- Digital High Definition Audio Interface with support for multiple audio codecs
- Audio In/Out
- 1x Internal stereo speaker
- 1x Digital Microphone (SPDIF)
- 1x Front Panel HD Audio

### Graphics
- Intel® Gen9 HD Graphics

### Video Interface
- LVDS 2x 24 bit/eDP, VGA
- 3x DisplayPort/HDMI/DVI
- LVDS 2x 24 bit/eDP, VGA
- 2x DisplayPort/HDMI/DVI
- 2x DisplayPort +
- 1x LVDS (2x24 bit)
- 1x Embedded DisplayPort
- 1x Backlight (Power, control)

### congatec Board Controller
- Multi Stage Watchdog | non-volatile User Data Storage | Manufacturing and Board Information | Board Statistics | BIOS Setup | Data Backup | Integrated I²C   | LPC

### Embedded BIOS Feature
- AMI-Aptio UEFI BIOS, congatec Embedded BIOS

### Security
- Optional discrete “Trusted Platform Module” (TPM)

### Power Management
- ACPI 4.0 with Battery support
- internal/external DC-In (12-24V)
- 1x opt. battery header for battery manager SBM

### Operating Systems

### Temperature
- Operating: 0 ... +60°C
- Storage: -20 ... -80°C

### Humidity
- Operating: 10 ... 90% r. H. non cond
- Storage: 5 ... 95% r. H non cond.
<table>
<thead>
<tr>
<th><strong>conga-TR4</strong></th>
<th><strong>conga-TR3</strong></th>
<th><strong>conga-IT6/COMe</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Formfactor</strong></td>
<td>COM Express® Basic, (95 x 125 mm²), Type 6 Connector Layout</td>
<td>Carrier Board on Mini-ITX Formfactor 170 x 170 mm²</td>
</tr>
<tr>
<td><strong>AMD® Embedded V1000 Processors</strong></td>
<td>AMD® Embedded RX-Series Processors</td>
<td>depending on module</td>
</tr>
<tr>
<td><strong>CPU</strong></td>
<td>V1807B, 4x 3.35/3.75 GHz, Cache 2MB, 35..54W</td>
<td>V1807B, 4x 3.35/3.75 GHz, Cache 2MB, 35..54W</td>
</tr>
<tr>
<td><strong>DRAM</strong></td>
<td>max. 32 GByte DDR4 with ECC</td>
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</tr>
<tr>
<td><strong>Chipset</strong></td>
<td>Integrated in SOC</td>
<td>Integrated in SOC</td>
</tr>
<tr>
<td><strong>Ethernet</strong></td>
<td>Intel GbE Controller i211</td>
<td>2x GbE RJ45 (1x from COMe Type 6 module</td>
</tr>
<tr>
<td><strong>Serial ATA</strong></td>
<td>2x</td>
<td>2x</td>
</tr>
<tr>
<td><strong>PCI EXPRESS® Gen. 3.0 / 2.0</strong></td>
<td>4x / 4x</td>
<td>- / 3x</td>
</tr>
<tr>
<td><strong>PEG</strong></td>
<td>1x (x8)</td>
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</tr>
<tr>
<td><strong>USB</strong></td>
<td>4x USB 3.1 / 8x USB 2.0</td>
<td>4x USB 3.0 / 8x USB 2.0</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>PC bus, SD, SPI, LPC Bus, SM-Bus, 2x UART</td>
<td>Express Card, GPIO, SDIO</td>
</tr>
<tr>
<td><strong>Sound</strong></td>
<td>Digital High Definition Audio Interface with support for multiple audio codecs</td>
<td>Audio In/Out</td>
</tr>
<tr>
<td><strong>Graphics</strong></td>
<td>Radeon™ Vega Graphics Core (GFX9)</td>
<td>Integrated AMD Radeon™ 10000 Graphics</td>
</tr>
<tr>
<td><strong>Video Interface</strong></td>
<td>LVDS 2x 24 bit, 3x DisplayPort/HDMI/DVI</td>
<td>LVDS 2x 24 bit</td>
</tr>
<tr>
<td><strong>congatec Board Controller</strong></td>
<td>Multi Stage Watchdog</td>
<td>non-volatile User Data Storage</td>
</tr>
<tr>
<td><strong>Embedded BIOS Feature</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Security</strong></td>
<td>“Trusted Platform Module” (TPM)</td>
<td>Optional discrete “Trusted Platform Module” (TPM)</td>
</tr>
<tr>
<td><strong>Power Management</strong></td>
<td>ACPI 5.0 with Battery support</td>
<td></td>
</tr>
<tr>
<td><strong>Operating Systems</strong></td>
<td>Microsoft® Windows 10</td>
<td>Microsoft® Windows 10</td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td>Operating commercial: 0…+60°C</td>
<td>Operating: 0…+60°C</td>
</tr>
<tr>
<td><strong>Humidity</strong></td>
<td>Operating: 10…90% r. H. non cond.</td>
<td>Operating: 10…90% r. H. non cond.</td>
</tr>
</tbody>
</table>
### conga-TS97

**Formfactor**
COM Express® Basic 95 x 125 mm², Type 6

**CPU**
- Intel® Core™ i7-5850EQ 4x 2.7/3.4 GHz, 47-37W TDP
- Intel® Core™ i7-5700EQ 4x 2.6/3.4 GHz, 47-37W TDP
- Intel® XEON® E3-1278LV4 4x 3.4 GHz, 47W TDP
- Intel® XEON® i7-5850EQ 4x 1.8/3.2 GHz, 47W TDP

**DRAM**
max. 32 GByte DDR3L 1600 MHz

**Chipset**
Intel® QM87 and HMB6

**Ethernet**
Intel® I218-LM GbE Phy

**Serial ATA**
4x

**PCI EXPRESS® Gen. 2.0**
7x & 16 (PEG Port) 4x

**USB 3.0 / 2.0**
4x / 8x 2x / 8x externally 4x / - internally - / 4x

**Sound**
Digital High Definition Audio Interface

**Graphics**
Intel® HD Graphics

**Video Interface**
LVDS 2x 24 bit, VGA 3x DisplayPort/HDMI/DVI

**congatec Board Controller**
Multi Stage Watchdog | non-volatile User Data Storage | Manufacturing and Board Information | Board Statistics | BIOS Setup | Data Backup | PC bus (fast mode, 400 kHz, multi-master) | Power Loss Control

**Embedded BIOS Feature**
AMI-Aptio UEFI BIOS, congatec Embedded BIOS

**Security**
Optional discrete "Trusted Platform Module" (TPM)

**Power Management**
ACPI 4.0 with Battery support

**Operating Systems**

**Temperature**
Operating: 0...+60°C  Storage: -20...+80°C

**Humidity**
Operating: 10...90% r.H, non cond Storage: 5...95% r.H, non cond.
COM Cooling Solutions

Cooling solutions for COM Express

The specifications for Qseven, COM Express and SMARC include heatspreader definitions, the mechanical thermal interface. All the heat generated by power consuming components such as chipsets and processors is transferred to the system’s cooling via the heatspreader. This can be achieved by either a thermal connection to the casing, a heat pipe or a heat sink.

congatec’s smart cooling pipes pave the way for unlimited performance growth for COM Express modules

High Performance Cooling

The congatec heatspreaders and cooling solutions for the high performance modules are feature heatpipes in order to boost performance and reliability. A copper block is mounted on the chip to absorb heat and to mitigate the effects of thermal peaks. Between the chip and the copper block, a phase-change material is placed to improve the heat transmission. To account for different component heights and manufacturing tolerances, the copper block is spring loaded to apply an optimized pressure to the silicon dye. The copper block and the cooling fins or heat plate are connected by flexible flat heatpipes.

The heat pipe is attached directly to the cooling blocks on the chip and the heatspreader plate. As a result, more heat is transported from the processor environment to the heatspreader, hot spots are cooled more quickly and therefore the processor is optimally cooled.

Cooling solutions for Qseven and SMARC
SBC Cooling Solutions

Slim cooling solutions for Thin Mini-ITX boards

Active cooling solution for full Thin Mini-ITX compliant solutions at max height of 20 mm. Highly reliable, servo controlled fan. Leaf springs for best thermal contact to the CPU. Installed phase change material for optimized heat transfer allows for best turbo boost performance. Solid mechanics with retention frame mounted at the rear side of the board enable high shock and vibration levels.

Passive cooling solution for full Thin Mini-ITX compliant solutions at max height of 20 mm. Installed phase change material for optimized heat transfer allows for best burst performance. Spring loaded screws for best thermal contact to the CPU. Solid mechanics with retention frame at the rear side of the board enables high shock and vibration levels. No movable parts for highest reliability.

Heat spreader and passive cooling solution for Pico-ITX boards

The CPU as heat generating component is placed on the bottom side of the Pico-ITX board. This allows for a heat spreader concept for conduction cooled systems. The heat spreader with its installed phase change material and copper block for heat transient buffering is preinstalled with 2 screws to the Pico-ITX board. This combination can be mounted to a metal housing or to any other system cooling device.

Evaluation Carrier

the base design for your own carrier board

Evaluation Carrier Boards
congatec provides evaluation carrier boards for all supported Computer-On-Module standards. This allows for a quick start of new designs. These carrier boards route all the COM signals to standard interface connectors.

Documentation
The schematics and board data of the evaluation carrier boards are freely available and can be used as a blue print to create own customized designs.

conga-X7EVAL
Evaluation carrier board for COM Express Type 7 modules.

conga-TEVAL
Evaluation carrier board for COM Express Type 6 modules.

conga-MEVAL
Evaluation carrier board for COM Express Type 10 modules.

conga-SEVAL
Evaluation carrier board for SMARC 2.0 modules.

conga-QEVAL
Evaluation carrier board for Qseven modules.
**Starter Kits**

all tools in a box to start your rapid development

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**conga-QKit**
This complete kit provides the ability to start evaluating Qseven® modules immediately. Available for ARM (with conga-QMX6) and x86 (with conga-QA5).

**conga-SKit**
This complete kit provides the ability to start evaluating SMARC modules immediately. Available for ARM (with conga-SMX8) and x86 (with conga-SA5).

**conga-CAM/MIPI ARM**
This complete kit provides the ability to connect Baserl MIPI cameras based on conga-i.MX8.

**conga-CAM/MIPI**
This complete kit provides the ability to setup 2 MIPI cameras based on conga-PA5.
## Legacy Products

These products already have successors utilizing newer processor technology but are still in production to serve customers which require long time stable supply.

### COM Express / Qseven

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Available until</th>
</tr>
</thead>
<tbody>
<tr>
<td>conga-T577</td>
<td>COM Express Basic Type 6 based on 3rd Gen. Intel Core processors (&quot;Ivy Bridge&quot;)</td>
<td>2022</td>
</tr>
<tr>
<td>conga-T567</td>
<td>COM Express Basic Type 6 based on 2nd Gen. Intel Core processors (&quot;Sandy Bridge&quot;)</td>
<td>2021</td>
</tr>
<tr>
<td>conga-BS77</td>
<td>COM Express Basic Type 2 based on 3rd Gen. Intel Core processors (&quot;Ivy Bridge&quot;)</td>
<td>2022</td>
</tr>
<tr>
<td>conga-BS67</td>
<td>COM Express Basic Type 2 based on 2nd Gen. Intel Core processors (&quot;Sandy Bridge&quot;)</td>
<td>2021</td>
</tr>
<tr>
<td>conga-QA6</td>
<td>Qseven based on Intel® Atom™ E600 Processors</td>
<td>2022</td>
</tr>
<tr>
<td>conga-BAF</td>
<td>COM Express Basic Type 2 based on AMD Fusion G-Series</td>
<td>2022</td>
</tr>
<tr>
<td>conga-QA4</td>
<td>Qseven based on 4th Gen Intel® Atom™ Processors (&quot;Brazeel&quot;)</td>
<td>2023</td>
</tr>
<tr>
<td>conga-MA4</td>
<td>COM Express Mini Type 10 based on 4th Gen Intel® Atom™ Processors (&quot;Braswell&quot;)</td>
<td>2023</td>
</tr>
<tr>
<td>conga-TCA4</td>
<td>COM Express Compact Type 6 based on 4th Gen Intel® Atom™ Processors (&quot;Braswell&quot;)</td>
<td>2023</td>
</tr>
<tr>
<td>conga-TS87</td>
<td>COM Express Basic Type 6 based on 4th Gen. Intel Core processors (&quot;Haswell&quot;)</td>
<td>2021</td>
</tr>
<tr>
<td>conga-TC87</td>
<td>COM Express Compact Type 6 based on 4th Gen. Intel Core processors (&quot;Haswell&quot;)</td>
<td>2021</td>
</tr>
</tbody>
</table>

### XTX/ETX

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Available until</th>
</tr>
</thead>
<tbody>
<tr>
<td>conga-XAF</td>
<td>XTX based on AMD Fusion G-Series</td>
<td>2022</td>
</tr>
<tr>
<td>conga-XLX</td>
<td>ETX based on AMD Geode LX800 processors</td>
<td>2021</td>
</tr>
<tr>
<td>conga-EAF</td>
<td>ETX based on AMD Fusion G-Series</td>
<td>2022</td>
</tr>
<tr>
<td>conga-ELX</td>
<td>ETX based on AMD Geode LX800 processors</td>
<td>2021</td>
</tr>
<tr>
<td>conga-ELXeco</td>
<td>ETX based on AMD Geode LX800 processors</td>
<td>2021</td>
</tr>
</tbody>
</table>
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