

Solution Brief

congatec Compute Modules
Intel Atom® x6000E Series Processors
Intel® Pentium® and Celeron® N and J Series Processors



congatec brings next-gen performance plus real-time computing to compact, industrial form factors

congatec uses Intel Atom® x6000E Series processors plus Intel® Pentium® and Celeron® N and J series processors to bring full-featured computing and IoT services to their SMARC 2.0, Qseven, COMe Mini, COMe compact modules, and Pico-ITX boards¹



“Intel is clearly invested in our partnership and the needs of industrial customers. The new, integrated IoT capabilities on their industrial CPUs are a major advance, but that’s just part of the story. Intel serves at our side on PICMG, devotes engineering resources to open standards, and supports us, and congatec customers, in the factory and in the field. On top of all that—they understand everything it takes—performance, reliability, and stable, long-term roadmaps—to manufacture CPUs for the industrial market.

— Jason Carlson, CEO of congatec

More performance for the industrial edge

In the past, the smallest form-factor modules—SMARC 2.0, Qseven, COMe Mini, and COMe compact—were too small and too power constrained to house processors that could handle heavy computing workloads. Now congatec is bringing high-performance processing, graphics, and I/Os—plus new levels of integrated IoT services—to their smallest modules and some of the most constrained edge applications.

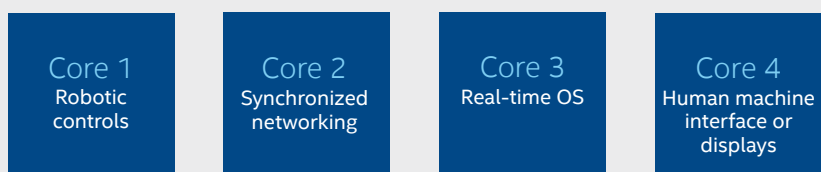
Now one small form factor platform can do the work of many machines

With previous computing modules in this class, a complex, industrial manufacturing system—like a multi-axis robot—might require two, three, or four separate computing modules to perform all of the tasks the system requires. With this new generation of Intel® processors, a single, power-efficient module can support a hypervisor, handle virtualized workloads, and split its cores to support multiple operating systems and dedicated tasks.

For example, a quad-core CPU can be split into four, separate computing systems. Core one might run real-time robotic controls, while core two runs a Linux OS for time sensitive networking and core three runs a real-time operating system. That leaves a fourth core free to run human-machine interfaces or drive multiple 4K displays.

Combining multiple workloads—including a mix of real-time and non-time sensitive systems—on a single computing module can save space and upfront costs. Over the long haul, it also reduces systems administration, simplifies maintenance, and lowers energy costs for operators.

How core splitting works: Sample workloads on a quad-core CPU



With the help of a hypervisor, a single multicore CPU can run as multiple, virtual machines for dedicated tasks.



More IoT features, simplified development and manufacturing

With this generation of modules, congatec is able to offer more IoT-specific services with fewer components and a smaller bill of materials. Intel Atom x6000E processors include the Intel® Programmable Services Engine (Intel® PSE). This ARM coprocessor provides hardware resources for real-time computing, low-DMIPS computing, a microcontroller lite, sensor hub, and network proxies. The Intel PSE also supports remote out-of-band device management.

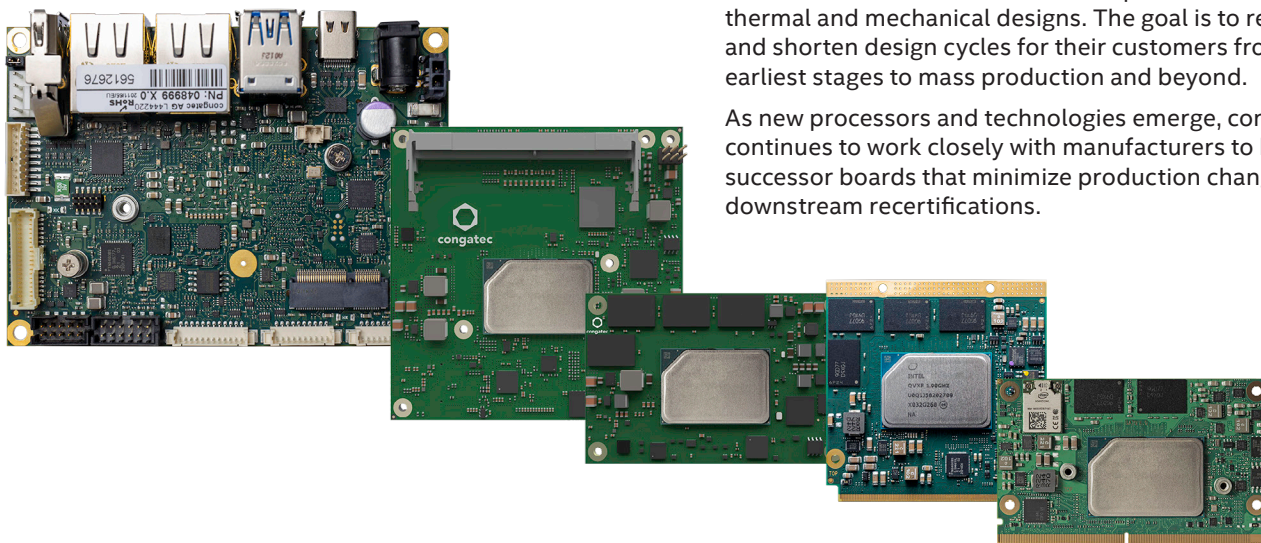
In the past, providing all of these services required additional design, engineering, and hardware. Now these functions are onboard and ready to run.

Integrated support for hard real-time computing¹

Hard real-time computing systems consider any missed deadline a system failure. Performing to that standard requires a precise system synchronization task schedule. congatec uses two integrated features on Intel Atom x6000E processors—Intel® Time Coordinated Computing (Intel® TCC) and time-sensitive networking (TSN)¹—to deliver ready-to-run, hard real-time computing.

Making real-time computing a basic feature of their low-power modules simplifies design and manufacturing for device manufacturers. It also creates new possibilities for critical, time-sensitive applications.

The congatec compute module lineup



Ready for 24/7 industrial workloads

congatec components and manufacturing processes equal or exceed activity ratings for Intel processors. Innovative, congatec heat management; their use of ceramic capacitors and other high-quality components; plus strict quality control to produce single-board computers and modules that can run in punishing conditions.

congatec uses the processors' low-power profiles and integrated heat spreaders to engineer completely sealed, passively cooled modules. Manufacturers can use these modules to build dust- and moisture-resistant devices for factory floors, outdoor signage, telecom applications, and other challenging environments.

Stability industrial manufacturers and customers need

The 18-month lifecycles that rule consumer electronics have no place in industrial computing. For example, a healthcare equipment manufacturer can spend two to three years prototyping and certifying the computing elements for an MRI. The last thing they—or any other industrial computer manufacturer—want to hear is that their module supplier decided to end production early.

That's why congatec and Intel both guarantee their products are reliable and available for the long term. For industrial customers, there's simply no other way to be a reliable partner.

Off the shelf or completely customized

The base congatec lineup is just a starting point. In fact, only 20 percent of congatec sales are ready-made components. The other 80 percent are custom designed to meet exacting customer and industry requirements.

congatec provides complete design-in support, including technical reviews of customers' compliance measures and thermal and mechanical designs. The goal is to reduce risk and shorten design cycles for their customers from the earliest stages to mass production and beyond.

As new processors and technologies emerge, congatec continues to work closely with manufacturers to build successor boards that minimize production changes and downstream recertifications.

High-performance I/Os, flexible implementation across form factors

congatec modules port Intel Atom x6000E Series I/Os through RGM II interfaces and standard ports-to-pin headers to give manufacturers maximum flexibility. They provide complete schematics, reference designs, and engineering support so customers can implement I/Os that match their application requirements.

Powerful Intel® UHD Graphics. Flexible, custom interfaces

With options for 16 or 32 execution units, Intel UHD Graphics can drive up to three independent 4K displays. congatec customizes their carrier boards to meet their customers' specifications. Their modules can deliver Intel UHD Graphics via one, two, or three HDMI or DisplayPort.

The platform combines low-power requirements with industrial temperature ratings, so it can operate in fanless, completely sealed form factors. It's an ideal choice for outdoor kiosks, digital drive-throughs and other digital signage exposed to extreme temperatures, dust, and moisture.

Edge AI in a very small package

Expansive, high-speed I/Os plus Intel UHD Graphics and congatec small form factors can deliver AI to space- and power-constrained applications, including industrial use cases that expose equipment to heat, dust, and vibration.

Processing AI workloads on edge devices—instead of shipping workloads to the cloud for processing—reduces latency drastically, which is critical for time-sensitive operations like visual inspection systems in manufacturing, smart industrial controls, and edge AI appliances.

The Intel® Distribution of OpenVINO™ toolkit makes developing high-performance AI software for Intel® hardware faster and easier. With the toolkit, developers can code AI inference applications once and port them to any mix of Intel® architectures—from an Intel Atom x6000E Series COMe Mini at the edge to servers in the cloud.

Security for frontline devices

Embedded devices and industrial controls are installed on remote oil-well heads and telephone poles, in the middle of shopping malls, and along railroad tracks. Often unattended, unguarded, even overlooked, they make tempting targets for hackers and thieves alike.

Intel Atom x6000E Series processors feature hardware-based security measures that proactively help protect IoT edge devices, including:

- Hardware root-of-trust for improved platform integrity
- Hardware-accelerated cryptography
- Improved protection for data & keys
- Trusted execution zones that enable isolated domains at runtime

congatec enables these built-in Intel security capabilities with multiple BIOS/UEFI security configurations and provides Trusted Platform Module (TPM) support, so that customers can implement secure solutions for their specific requirements.

More power, more possibilities

Intel Atom® x6000E Series processors
Intel® Pentium® and Celeron® N and J Series processors

Up to a **1.7x improvement** in single-thread performance, up to a **1.5x improvement** in multithread performance, and up to a **2x performance improvement** in graphics Gen over Gen.²

High-speed, industrial-strength connectivity¹

- Up to eight PCIe 3.0 lanes with six ports
- Up to four USB 3.1 ports
- Up to 10 USB 2.0 ports
- Up to 60 GPIOs
- Up to 3x 2.5GbE time-sensitive networking-enabled MACs
- Industrial use option: Wi-Fi 5/Bluetooth 5 M.2 2230 module rated for extended temperatures (-40°C to ~85°C)

The congatec low-power, compact Intel lineup

congatec uses multiple SKUs from all three processor families to give customers maximum choice and flexibility.

Use conditions	Qseven	COMe Mini	SMARC 2.0	COMe Compact	Pico-ITX
Client Intel® Celeron® and Pentium® N and J Series processors	✓	✓	✓	✓	✓
Embedded Intel Atom® x6000E Series processors	✓	✓	✓	✓	✓
Industrial Intel Atom® x6000RE Series processors	✓	✓	✓	✓	✓

See backup for configuration details. For more complete information about performance and benchmark results, visit www.intel.com/benchmarks.

2. Source: Intel. Claims based on a) SPEC CPU 2006 metric estimates based on Pre-Si projections and b) 3DMark11 estimates based on Pre-Si projections, using Intel® Pentium® J4205 as prior gen.

About congatec

congatec is a rapidly growing technology company focusing on embedded computing products. Their high-performance computer modules are used in a wide range of applications and devices in industrial automation, medical technology, transportation, telecommunications, and many other verticals. congatec is the global market leader in the computer-on-modules segment with an excellent customer base from startups to international, blue-chip companies. Founded in 2004 and headquartered in Deggendorf, Germany, the company reached sales of USD 126 million in 2019. More information is available on the congatec website at congatec.com or via [LinkedIn](#), [Twitter](#), and [YouTube](#).

congatec embedded computers

Get improved performance boosts plus real-time capabilities in a range of form factors, including: SMARC 2.0, Qseven, COMe Mini, COMe compact modules, and Pico-ITX boards.

[Learn more >](#)

Intel Atom® x6000E Series processors

KEY ADVANCES

Integrated Intel® UHD Graphics with up to 32 execution units can drive three independent 4K streams and increases performance up to 2x over the previous generation.²

Support for up to 32 GB of DDR4 and up to 16 GB of LPDDR4/x RAM plus in-band error-correcting code (IB ECC) that can trap errors in standard RAM.

Intel® Time Coordinated Computing (Intel® TCC)¹ and time-sensitive networking for out-of-the-box real-time computing.

Intel® Programmable Services Engine (Intel® PSE) is an independent, integrated ARM-based microcontroller for core IoT functions.

Hardware-based security measures including dedicated cryptography accelerators that speed data encryption without impacting overall system performance.

Remote out-of-band management simplifies onboarding and updating and supports remote power cycling, monitoring, and management even when devices are powered down, sleeping, or unresponsive.

[Learn more >](#)



1. Not all features are available on all SKUs.

2. Source: Intel. Claims based on a) SPEC CPU 2006 metric estimates based on Pre-Si projections and, b) 3DMark11 estimates based on Pre-Si projections, using Intel® Pentium® J4205 as prior Gen.

Configurations:

Performance results are based on projections as of September 1, 2020.

Processor: Intel® Pentium® J6425 PL1=10W TDP, 4C4T turbo up to 3.0 GHz

Graphics: Intel® Graphics Gen 11 graphics

Memory: 16 GB LPDDR4-3200

OS: Windows 10 Pro

Compiler version: IC18

Processor: Intel® Pentium® J4205 PL1=10W TDP, 4C4T turbo up to 2.6 GHz

Graphics: Intel® Graphics Gen 9 graphics

Memory: 16 GB LPDDR4-2400

OS: Windows 10 Pro

Compiler version: IC18

Performance numbers are Pre-Si projections and are subject to change. Results reported may need to be revised as additional testing is conducted. The results depend on the specific platform configurations and workloads utilized in the testing, and may not be applicable to any particular user's components, computer system, or workloads. The results are not necessarily representative of other benchmarks.

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Statements in this document that refer to future plans or expectations are forward-looking statements. These statements are based on current expectations and involve many risks and uncertainties that could cause actual results to differ materially from those expressed or implied in such statements. For more information on the factors that could cause actual results to differ materially, see our most recent earnings release and SEC filings at www.intc.com.

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Software and workloads used in performance tests may have been optimized for performance only on Intel® microprocessors.

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Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates. See backup for configuration details. No product or component can be absolutely secure.

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Not all features are available on all SKUs.

Not all features are supported in every operating system.

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Your costs and results may vary.

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