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Booth 3-241

Redefining Embedded Edge AI

Written by congatec's Industrial Embedded Team

As artificial intelligence migrates from the cloud to the industrial edge, the demands on embedded hardware are reaching new highs. Modern applications, ranging from ultra-portable communication devices and medical diagnostic tools to more powerful autonomous mobile robots (AMRs) or stationary installations in retail, require massive compute power to process real-time data locally. On the other hand, they have different thermal and power requirements. Some require high-performance AI inference (high TOPS) in an ultra-compact, fanless design and completely sealed design, whereas stationary devices may prioritize performance over size and power.

At **congatec**, we are meeting these challenges head-on. We are providing the "right-sized" solution for every Edge AI application by combining the significant performance and computing density increases of the new **Intel® Core™ Ultra Series 3 Processors** with our extensive portfolio of application-ready modules across four different form factors.

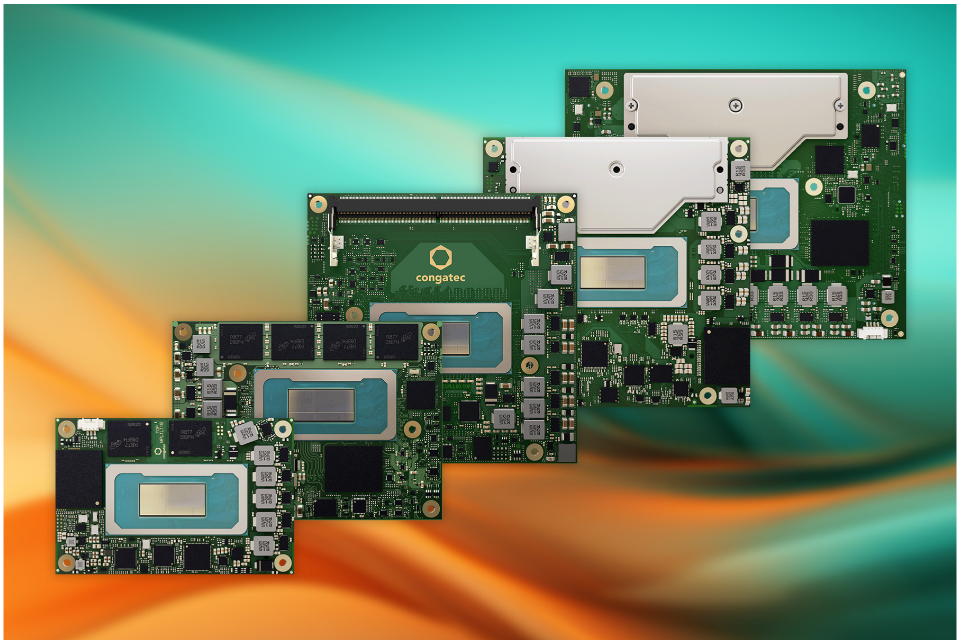
The Engine of Innovation: Intel® Core™ Ultra Series 3 Processors Architecture

The Intel Core Ultra Series 3 Processors architecture represents a strategic pivot in how AI is processed at the edge. As the first client SoC built on the **Intel 18A process**, it introduces revolutionary transistor technologies like **RibbonFET** (gate-all-around) and **PowerVia** (backside-power delivery) that significantly improve performance-per-watt.

Designed to be a "triple-threat" in AI processing, it delivers up to **180 total platform TOPS** through three specialized engines that can be intelligently orchestrated via software like **OpenVINO™**:

- **X^{e}3 GPU (120 TOPS):** A parallel powerhouse for heavy inference, real-time computer vision, and high-bandwidth video analytics.
- **NPU 5 (50 TOPS):** A dedicated, area-efficient engine optimized for sustained, low-power AI tasks and continuous background processing.
- **Hybrid CPU (10 TOPS):** A 16-core architecture (Next-gen P-cores and Next-gen E-cores) that orchestrates AI workflows and handles latency-sensitive tasks.

The congatec Solution: Five Modules for a Seamless AI Journey



To bridge the gap between high-end silicon and real-world industrial deployment, congatec has released five specialized embedded modules based on Intel Core Ultra Series 3 Processors to offer a spectrum of hardware options tailored to specific industrial constraints.

Maximum Performance: conga-HPC/cPTL (COM-HPC Client Size A)

For high-end systems requiring the highest possible bandwidth, the conga-HPC/cPTL is the uncompromising choice.

- **Expansion:** Features **PCI Express Gen5** (up to x8) for lightning-fast data throughput to external sensors or accelerators.
- **Memory:** Utilizes an **LPCAMM2** socket, supporting up to **96GB of LPDDR5x** at speeds up to 7466 MT/s. This high-bandwidth memory is critical for feeding the 120 TOPS GPU and preventing data bottlenecks during complex AI inference.

Compact Bandwidth: conga-HPC/mPTL (COM-HPC Mini)

The conga-HPC/mPTL targets users developing space-constrained systems that still require modern high-speed I/O.

- **Design:** Despite its tiny 95x70 mm footprint, it supports up to 16 cores and integrated **PCIe Gen5**.
- **Reliability:** Features **onboard LPDDR5x** (up to 32GB) and an **onboard NVMe SSD** (up to 128GB), creating a highly integrated, shock-and-vibration resistant solution for edge robotics.

Efficient Upgrades: conga-TC1000 & conga-TC1000r (COM Express Type 6)

For customers looking to upgrade existing carrier board designs with Intel Core Ultra Series 3 Processors' AI capabilities, congatec provides two distinct COM Express Compact modules:

- conga-TC1000: An efficient "drop-in" upgrade for legacy systems, supporting up to **128GB of DDR5 SODIMM** memory.
- conga-TC1000r (Rugged): This variant is specifically designed for harsh environments. It replaces traditional SODIMMs with **LPCAMM2 LPDDR5x** memory (up to 96GB) for maximum stability and memory bandwidth. It also supports a **wide range power supply (8.5V – 20V)** and the **industrial temperature range** (-40°C to +85°C).

The AI Micro-Specialist: conga-MC1000 (COM Express Mini Type 10)

Measuring just 55x84 mm, the conga-MC1000 brings the full "triple-engine" AI power to the smallest possible form factor. With up to 32GB of **soldered LPDDR5x** and Intel® Arc™ Graphics, it enables complex edge AI capabilities in handheld devices and communication gateways.

Bridging Software and Hardware: The aReady. Ecosystem

Hardware is only half the battle. To truly unlock the potential of Intel Core Ultra Series 3 Processors' triple AI engines, developers need a seamless way to integrate them into complex industrial environments. This is why congatec has introduced the aReady. strategy—a holistic ecosystem of pre-validated building blocks designed to make your application "ready" for the real world.

While the core of the concept is the application Computer-on-Module, the true value for Edge AI emerges when you combine congatec's specialized software building blocks:

- **Workload Consolidation with congatec's Hypervisor:** The firmware integrated hypervisor allows you to partition the Intel Core Ultra Series 3 Processor cores, running high-performance AI inference on one segment while keeping mission-critical real-time control tasks strictly separated on another. This eliminates the need for multiple hardware units and reduces system count, complexity, and cost.
- **Seamless IIoT Connectivity:** Software building blocks for IIoT simplify the secure flow of data from your edge devices to the cloud. Enabling remote management and control of the device itself and supporting industrial protocols like OPC UA and MQTT out-of-the-box, these blocks ensure your AI-generated insights are delivered where they are needed most.
- **Ready-to-Run OS Options:** To further accelerate development, congatec's modules can be delivered with pre-installed and fully licensed Ubuntu Pro, ctrlX OS or Kontron OS. This "boot-and-go" experience helps to relieve you of the burden of driver integration and security patching, letting your team focus entirely on your core IP.

By decoupling the low-level system integration from the application layer, the aReady. approach ensures that the 180 TOPS of Intel Core Ultra Series 3 Processors' power is not just a theoretical specification, but a functional tool ready for immediate deployment.

Built for the Real World: Industrial Readiness

Industrial Edge AI doesn't have the luxury of a climate-controlled data center. Our Intel Core Ultra Series 3 Processors' modules are engineered for reliability in the toughest conditions:

- **Ruggedized Memory**: By implementing **LPCAMM2** (both soldered and screwed variants), we ensure that high-speed memory remains stable even under extreme vibration—a common failure point in mobile robotics.
- **Thermal Flexibility:** The architecture supports power envelopes from **15W for fanless designs** to **over 65W** for performance-optimized systems, allowing for a single module design to scale across an entire product line.
- **Long-Term Reliability:** With industrial-grade 24/7 operation support and 10+ year availability, these modules are built for mission-critical deployments where downtime is not an option.

Conclusion: Redefining the Edge

The synergy between Intel's 18A silicon and congatec's modular embedded hardware design creates a future-proof foundation for the next generation of intelligent machines. By localizing AI operations, manufacturers gain lower latency, enhanced data privacy, and a significant reduction in total cost of ownership.

Ready to start your Edge AI journey? Visit our product pages to compare technical specifications or contact a congatec expert to find the right form factor for your next innovation.

Partner Name

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