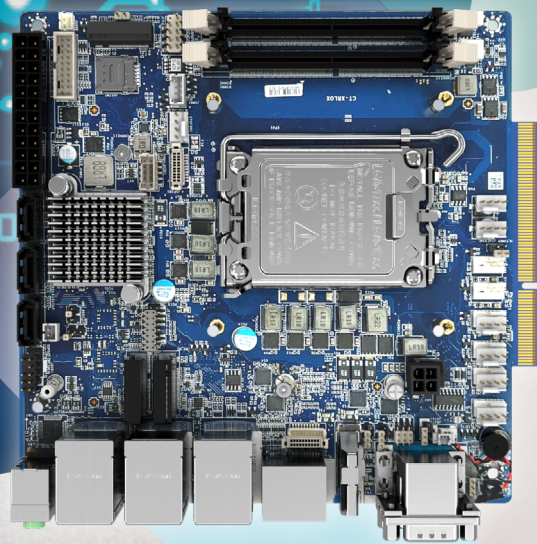# MINI-ITX SERIES

INDUSTRIAL

MOTHERBOARD

REAL-TIME DATA
PROCESSING FOR RUGGED
EDGE COMPUTING

ROBUST MINI-ITX FOR EMBEDDED SOLUTIONS

The CT-XRL02 Mini-ITX motherboard is engineered to set a new benchmark in integrated motherboard solutions. Designed with industrial-grade durability, this Mini-ITX board delivers exceptional performance, robust reliability, and versatile connectivity, making it an ideal choice for a wide range of demanding edge and embedded applications.

Deployment
Ready Solution

Industrial
Grade

Fast Time To
Market

Compact &
Ruggeddized Design

Mini ITX Motherboard with Intel 14th Gen Processors

In today's industrial landscape, advancements in AI, IoT, and edge computing are driving demand for compact, high-performance solutions. The Mini-ITX form factor has emerged as a key choice, offering a balance of performance, scalability, and space efficiency. Industries seek versatile motherboards that handle multiple workloads while ensuring reliability in demanding environments.

Introducing the CT-XRL02, a cutting-edge Mini-ITX industrial motherboard designed to harness the performance of 14th Gen Intel® Raptor Lake processors. As the cornerstone of high-performance systems and IoT markets, the CT-XRL02 supports scalable storage, triple 4K displays, and diverse I/O modules. With versatile M.2 options and PCIe Gen 4 expansion through its unique Goldfinger interface, it ensures seamless integration for OEM system builders. Engineered for challenging environments, the CT-XRL02 offers industrial-grade durability, making it an ideal choice for industrial automation and rugged edge AI applications.

CT-XRL02 Features

- Intel® 14th/13th/12th Gen Processor
- Triple Independent Displays (Up to 4K)
- PCIe x16 Goldfinger for Expansion

- DDR4 3200MHz up to 64GB
- Diverse I/O Connectivity
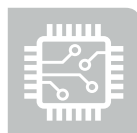- Wide Operating Tempurature

Key Markets and Applications

| Industrial Automation | Rugged Edge AI | Edge Computing | NVR Surveillance | Smart Retail & Kiosks | OEM System Builders |

Edge Workload Ready:
14th Gen Intel® Hybrid P/E Cores Processors

Leveraging Intel's Hybrid-Architecture

Deliver the optimal edge AI performance with the CT-XRL02 Series, featuring the advanced LGA 1700 socket. This zero-insertion force, flip-chip land grid array (FCLGA/LGA) socket with 1700 contact points takes center stage, enabling seamless compatibility for Intel Raptor Lake (14th/13th Gen) and Intel® Alder Lake (12th Gen) processors. Intel's Raptor Lake and Alder Lake CPUs leverage the new Performance Cores (P-core) and Efficient Cores (E-core), delivering unprecedented performance with the new hybrid architecture.
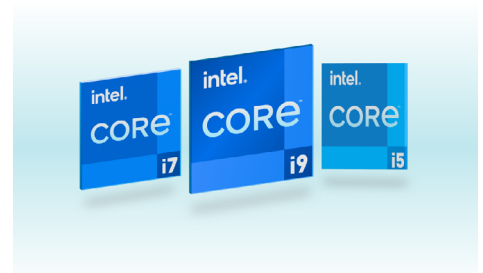
Intel® 14/13/12th Gen Processors

Intel® P&E Cores Technology

Meeting Edge Processing Performance & Power Efficiency Needs

The heart of these processors lies the groundbreaking P&E cores technology. This innovative hybrid design adopts a two-core strategy. The larger, performance-driven cores (P-core) handle compute-intensive and AI workloads, while the smaller, energy-efficient cores take care of high-density and scale-out workloads in the background. Designed to strike the perfect balance between high performance and energy efficiency, the CT-XRL02 excels across various industrial applications.

Key Advantages

- Intel Thread Director: Optimizes OS workload to cores distribution
- Up to 24 Cores: 8 Performance-cores, 16 Efficient-cores
- Up to 32 Threads: Up to 6.0 GHz
- Increased L2 & L3 Cache: compared to the previous generation

High Capacity DDR4 RAM

Harnessing the stability and efficiency of DDR4 technology, the CT-XRL02 motherboard is optimized to meet the demands of edge AI applications. It supports up to 2x DDR4 SO-DIMM slots with speeds of up to 3200 MHz, providing a maximum capacity of 64GB. The robust architecture of DDR4 ensures consistent and reliable performance, making it ideal for handling intensive AI and edge computing tasks.

- **Substantial Throughput:** DDR4's design ensures high data transfer rates, enabling seamless edge AI operations.
- **Optimized Speeds & Capacity:** Fully compatible with Intel® CPUs, the CT-XRL02 efficiently utilizes DDR4's capabilities to deliver reliable performance for industrial and embedded solutions.
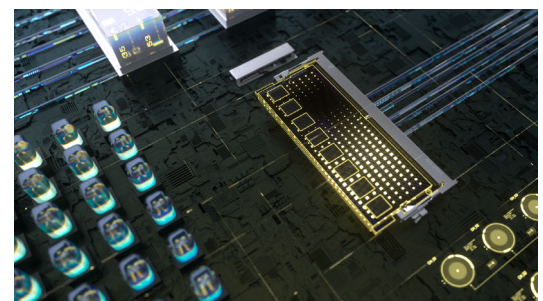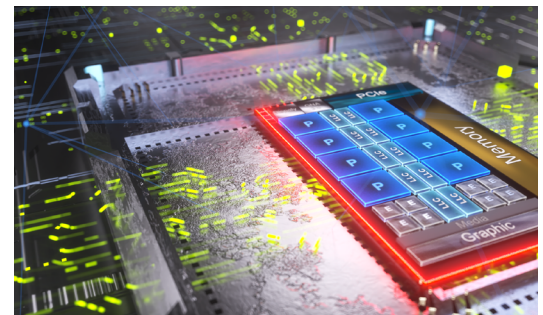
Scalable Storage for Speed and Capacity

Tailored for flexible and scalable storage options to meet the evolving demands of modern computing applications:

- SATA 3.0 Connectivity: Features 3x 6Gb/s SATA 3.0 port (RAID 0/1/5), allowing for fast and reliable additional storage
- M.2 M Key: With PCIe x4 Gen 4, facilitating high-speed storage solutions for NVMe SSD

Triple Real 4K Independent Displays

The CT-XRL02 motherboard, equipped with Intel® UHD Graphics on Xe Architecture, enhances visual experiences by supporting triple 4K independent displays, ideal for various multimedia and monitoring industrial applications. The display options are:

- 1x HDMI: Supports high-definition output up to Real 4K (4096 x 2304 @24Hz)
- 2x DP: Handles ultra-high resolutions up to Real 4K (4096 x 2304 @60Hz)

Robust I/O Connectivity for IoT devices

Designed to meet the complex connectivity needs of modern computing environments. The CT-XRL02 features a comprehensive range of I/O modules to ensure seamless integration and communication with various devices and peripherals. The key I/O modules include:

- 3x Intel® 2.5GbE LAN for reliable, high-speed network connections
- 6x USB 3.2 Gen 2 (10 Gbps)
- 2x USB 3.2 Gen 1 (5 Gbps, Internal), 2x USB 2.0 (Internal)
- 2x COM Ports RS-232/422/485
- 1x 16-bit DIO (8-in/8-out)

Line Out/Mic In · 3x 2.5 GbE LAN · 2x DP · 2x COM Ports · 6x USB 3.2 Gen 2 · HDMI
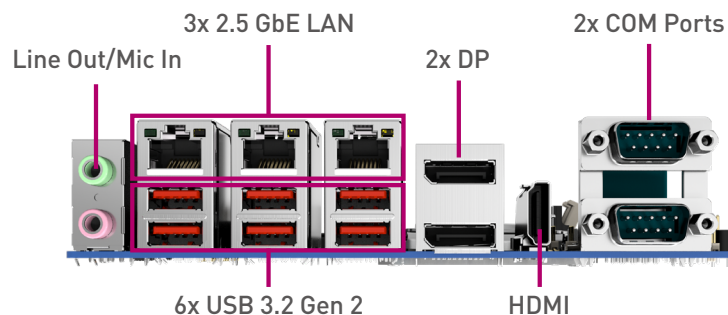
Wireless 4G/5G Connectivity

With its M.2 expansion, the CT-XRL02 offers versatile wireless connectivity to meet modern networking demands. The M.2 B-Key supports 4G/5G with a Nano SIM Socket, making it ideal for IoT networks and real-time data communication. Additionally, the M.2 E-Key enables seamless Wi-Fi and Bluetooth connectivity, ensuring reliable short-range communication.

- M.2 B-Key for 4G/5G
- M.2 E-Key for WiFi 6E/Bluetooth

# Advanced PCIe Gen 4 Expansion via Golden Finger and Riser Cards

The CT-XRL02 features PCIe Gen 4 Gold Finger expansion, offering an unique customizable solution for OEM system builders. Supporting optional riser cards kits, the CT-XRL02 allows configurations such as PCIe x16 or PCIe x8/x8 for maximum flexibility. This expansion capability ensures scalability and performance for demanding industrial and IoT applications.

PCIe Gen 4 offers:

- Speeds will reach up to 16 GT/s of data transfer and 2GB/s of bandwidth per lane. (2x Faster compare to PCIe Gen 3)
- Supports modern GPUs, NVMe SSDs, AI accelerators, and network cards with faster read/write and data processing capabilities.
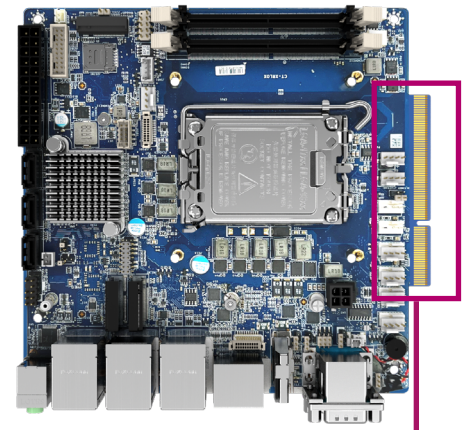
Goldfinger Expansion
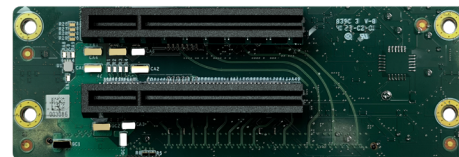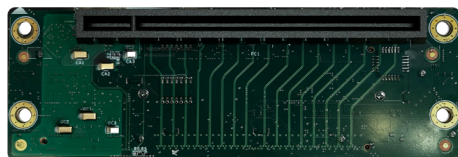
| CT-XRL02-1E16-P (Optional)	CT-XRL02-2E8-P (Optional)
Mini ITX, LGA 1700 Socket, Q670E CH (I225-V) 6x USB, 2xDP, HDMI with PCIe Gen4 X16 Riser card Kit	Mini ITX, LGA 1700 Socket, Q670E CH (I225-V) 6x USB, 2xDP, HDMI with Dual PCIe Gen4 X8 Riser card kit.

Optional CT-XRL02 Model with Riser Card Kit

Enhanced Security with Discrete TPM 2.0 Support

The CT-XRL02 motherboard integrates discrete TPM (Trusted Platform Module) 2.0 support, providing enhanced security for sensitive data. With compliance with the latest industry security standards, the dTPM 2.0 support on the CT-XRL02 makes it a highly reliable choice for applications in security-conscious sectors.
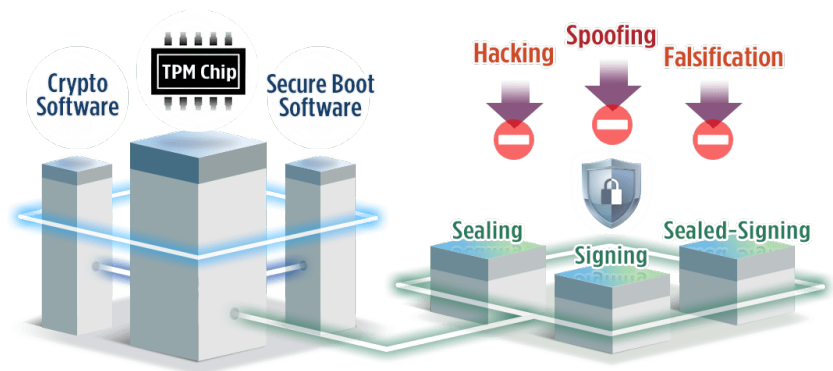

Operating System Support

Compatible with a range of operating systems, catering to various user preferences and application requirements. This flexibility ensures seamless integration into diverse computing environments.

- Fully supports Microsoft Windows 10/11 IoT Enterprise LTSC
- Offers additional support for Linux Ubuntu 20.04/22.04 LTSC

Industrial-Grade Durability

The CT-XRL02 motherboard is a testament to resilience in industrial environments, carefully crafted to ensure unwavering reliability under challenging conditions. Its standout features include:

- Extended Operating Temperature: 0°C to 60 °C
- Precision-Selected Industrial Components
- CE and FCC Class A Certified
- Wide voltage input 12V to 36V
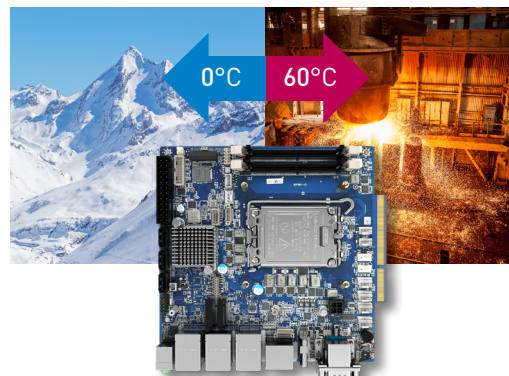
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CALIFORNIA(HQ)
ILLINOIS
GERMANY
TAIWAN
MALAYSIA

NEW

CT-XRL02

Mini ITX industrial Motherboard

Model	CT-XRL02
Processor	14/13/12th Gen. Intel Raptor Lake-S / Alder Lake-S Processor (Max 65W)
Memory	2 x 260-pin DDR4 SO-DIMMs 3200 MHz (Non-ECC) 64 GB Max
Display	2x DP (Real 4K) 1x HDMI (Real 4K)
LAN	3x Intel 2.5GbE LAN
USB & Serial	6x USB 3.2 Gen 2 (Rear) 2x USB 3.2 Gen 1 (5Gbps, Internal), 2x USB 2.0 (Internal) 2x COM Ports RS-232/422/485 1x 16-bit DIO (8-in/8-out)
Storage	3x SATA 3.0 (RAID 0/1/5) 1x M.2 M Key (2242/2280, PCIe x4 Gen 4) for NVMe SSD
Expansion	1x M.2 E Key (2230, PCIe x1) for WiFi 6E/Bluetooth 1x M.2 B Key (3042, PCIe x1) for 4G/5G 1 x PCIe x16 Gen4 via PCB customized 200-pin Golden Finger (Support riser card, one x16 or two x8 via BIOS setting)
Operating System	Windows 10/11 Linux Ubuntu 20.04/22.04 LTSC
Operating Temperature	0°C to 60°C
dTPM	TPM 2.0
Dimension	170mm x 170mm