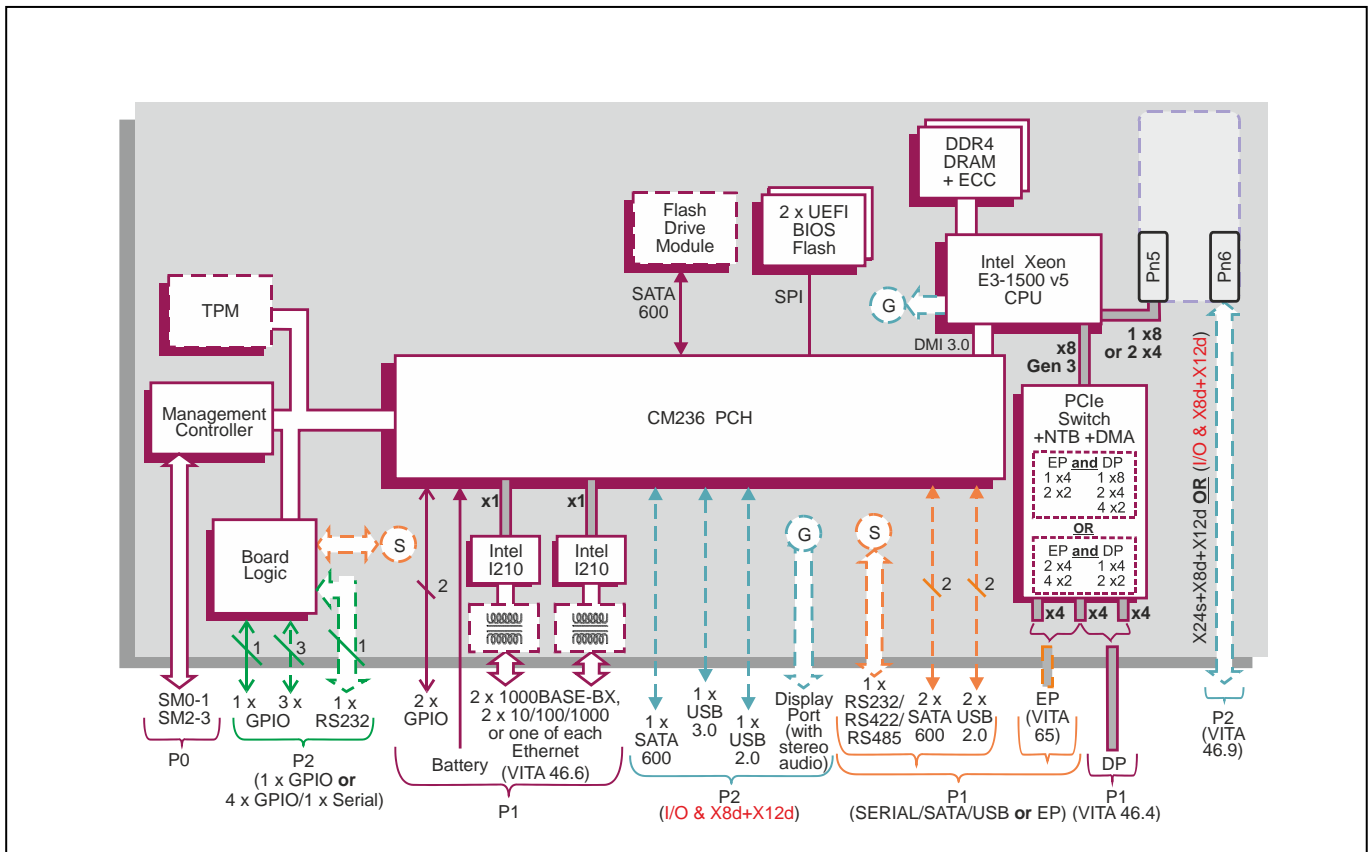# Rugged Conduction-Cooled 3U VPX™ board based on Intel® Xeon® Processor E3-1500 v5 Family

Key Features

TR E5x/msd-RCx is a rugged conduction-cooled 3U VPX™ board optimized for Size, Weight and Power (SWaP). It is designed to work as the system controller in command, control, communicate and compute applications and has a wide range of interface and storage options.

- Mobile workstation processor performance with enterprise-class graphics capabilities
- Error Correction Code (ECC) memory for high operational reliability
- XMC module site for local I/O expansion
- Local solid state disk module site for rugged storage
- Compatible with popular OpenVPX™ module profiles enabling widespread use in VPX solutions
- Options for use in air-cooled environments

![Concurrent Technologies logo]

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VPX-REDI Embedded Computer Board

- conduction-cooled 3U VPX-REDI™ computing board utilizing a CPU from the Intel® Xeon® processor E3-1500 v5 family
- compatible with several OpenVPX™ module profiles:
  - → MOD3-PAY-2F2U-16.2.3-3
  - → MOD3-PAY-2F1F2U-16.2.1-4
  - → MOD3-PAY-1F2F2U-16.2.2-4
- air-cooled VPX variants available:
  - → see TR E5x/msd datasheet

Central Processor

- 4-core Intel® Xeon® processor E3-1505M v5:
  - → 8 Mbytes Smart Cache, 2.3 GHz
- 4-core Intel® Xeon® processor E3-1505L v5:
  - → 8 Mbytes Smart Cache, 2.0 GHz
- processor supports Intel® HD Graphics P530
- utilizes the Intel CM236 Platform Controller Hub

DRAM

- up to 16 Gbytes soldered DDR4 ECC DRAM:
  - → single bit error correction
  - → dual channel architecture
- accessible from processor or VPX™ fabric

XMC Interface (Build Option)

- 1 x XMC site, in a single VPX slot (VITA 42.0):
  - → build options for P2 rear I/O
  - → 1 x8 or 2 x4 PCI Express® Gen 2 (VITA 42.3) XMC (Switched Mezzanine Card) interface
  - → +5V or +12V powered (factory build option)

XMC P2 I/O plus Additional P2 I/O Option

- P2 factory build options, option 1 (full rear XMC I/O) or option 2 (reduced XMC I/O plus additional P2 I/O)
- XMC build option 1 supports the following:
  - → full rear XMC I/O providing X24s+X8d+X12d
  - → DisplayPort® is not available (board is headless)
- XMC build option 2 supports the following:
  - → reduced rear XMC I/O providing X8d+X12d
  - → 1 x USB 2.0 port and 1 x USB 3.0 port
  - → 1 x SATA600 interface
  - → 1 x DisplayPort™ with audio interface
- XMC rear I/O supports VITA 46.9 pin-mapping

Graphics/Audio Interface

- optional graphics/audio interface supported:
  - → DisplayPort interface, supporting audio and video, via P2 (XMC build option 2)
  - → resolution is dependent on the device driver
- support for Microsoft® DirectX 12 and 11.x
- support for OpenGL 4.x and 5.x under Windows® and Linux®
- support for OpenCL 2.1

Serial Ports

- 1 x RS232/422/485 port accessed via P1 (replaces VPX Expansion Plane PCI Express interface):
  - → supporting Tx, Rx, RTS and CTS in RS232 only
- option for 1 x RS232 port accessed via P2:
  - → supporting Tx, Rx, RTS and CTS
- 16550 compatible UARTs

Other Peripheral Interfaces

- PC RTC, long duration timer, watchdog timer
- up to 4 x USB ports via the rear:
  - → option for 2 x USB 2.0 ports via P1 (replaces VPX Expansion Plane PCI Express interface)
  - → option for 1 x USB 2.0 port and 1 x USB 3.0 port via P2 (XMC build option 2)
- 2 x GPIO signals via P1
- option for up to 4 x GPIO signals via P2 (1 or 4)

Mass Storage Interfaces

- 2 x SATA interfaces via P1 (replaces VPX Expansion Plane PCI Express interface):
  - → 1 x SATA600 interface
  - → 1 x SATA300 interface
- 1 x SATA600 interface via P2 (XMC build option 2)
- 1 x SATA600 interface for an optional on-board Flash Drive Module

VPX Control Plane, Ethernet

- configurable Control Plane (VITA 46.6)
- P1 factory build option for 2 x 1000BASE-BX ports (IEEE802.3z)
- alternative P1 factory build options for 2 x 10/100/1000 Mbps Ethernet ports or 1 x 1000BASE-BX and 1 x 10/100/1000 Mbps Ethernet ports (with or without magnetics)

VPX Data/Expansion Planes, PCI Express

- configurable PCI Express (PCIe®) VPX Data Plane fabric interface (VITA 46.4):
  - → a) 1 x8, 2 x4, 4 x2 or b) 1 x4, 2 x2 PCIe ports
- P1 build options for either:
  - → PCIe Expansion Plane interface (VITA 65) supporting a) 1 x4, 2 x2 or b) 2 x4, 4 x2 PCIe
  - → 1 x Serial, 1 x SATA600, 1 x SATA300 and 2 x USB 2.0 ports
- PCIe interfaces support Gen 1, Gen 2 and Gen 3
- PCIe switch supports two non-transparent ports for multi-processing configurations
- 4 channel DMA engine for fast data block moves
- switch ports can be configured by the VPX Switch Configuration Tool, see separate datasheet
- switch supported by Fabric Interconnect Networking software (FIN-S), see separate datasheet
- support for PCIe backplane common clock options

System Management

- IPMI via SM0-3, accessing:
  - → voltages monitor, CPU temperature monitor and board temperature monitor
- Baseboard Management Controller (BMC)

Optional Built-In Test (BIT) Support

- Power-on BIT, Initiated BIT, Continuous BIT

Board Security Features

- option for Trusted Platform Module (TPM 2.0)
- option for Sanitization Utility Software Package
- option for proprietary board-level security features

Software Support

- supports Linux®, Windows® and VxWorks®

Firmware Support

- UEFI 2.4 boot firmware (BIOS):
  - → UEFI 2.4 support
  - → includes Compatibility Support Module
  - → implements Secure Boot
- implements Intel® Boot Guard
- LAN boot firmware included

Non-Volatile Memory

- 8 Mbytes of BIOS Flash EPROM, dual devices

Safety

- PCB (PWB) manufactured with flammability rating of UL94V-0

Electrical Specification

- typical current consumption for 4-core Intel Xeon processor E3-1505L v5 with 16 Gbytes DRAM:
  - → +5V @ 2.3A
  - → +3.3V @ 4.1A; +3.3V AUX @ 0.3A
- +12V AUX and -12V AUX routed to XMC site

Environmental Specification

- conduction-cooled (VITA 48.2)
- operating temperature at card edge:
  - → VITA 47 Class CC4, -40°C to +85°C
- non-operating temperature:
  - → VITA 47 Class C4, -55°C to +105°C
- operating altitude:
  - → -1,000 to 50,000 feet (-305 to 15,240 meters)
- relative humidity:
  - → 5% to 95%, non-condensing

Mechanical Specification

- 3U VPX form-factor (VITA 46.0, VITA 48.0): 3.9 inches x 6.3 inches (100mm x 160mm)
- slot widths (VITA 48.0):
  - → 0.8 inches VPX-REDI Type 2, RCT-Series
  - → 0.85 inches VPX-REDI Type 1, RCS-Series, Type 1 Two Level Maintenance (VITA 48.2)
- connectors to VITA 46.0 for P0, P1 and P2
- operating mechanical:
  - → shock - VITA 47 Class OS2, 40g
  - → random vibration - VITA 47 Class V3, 0.1g²/Hz

Optional VPX Fabric Switch

- board is compatible with FR 331/x06-RCx VPX Switch or FR 341/x06-RCx VPX Switch