Caelus

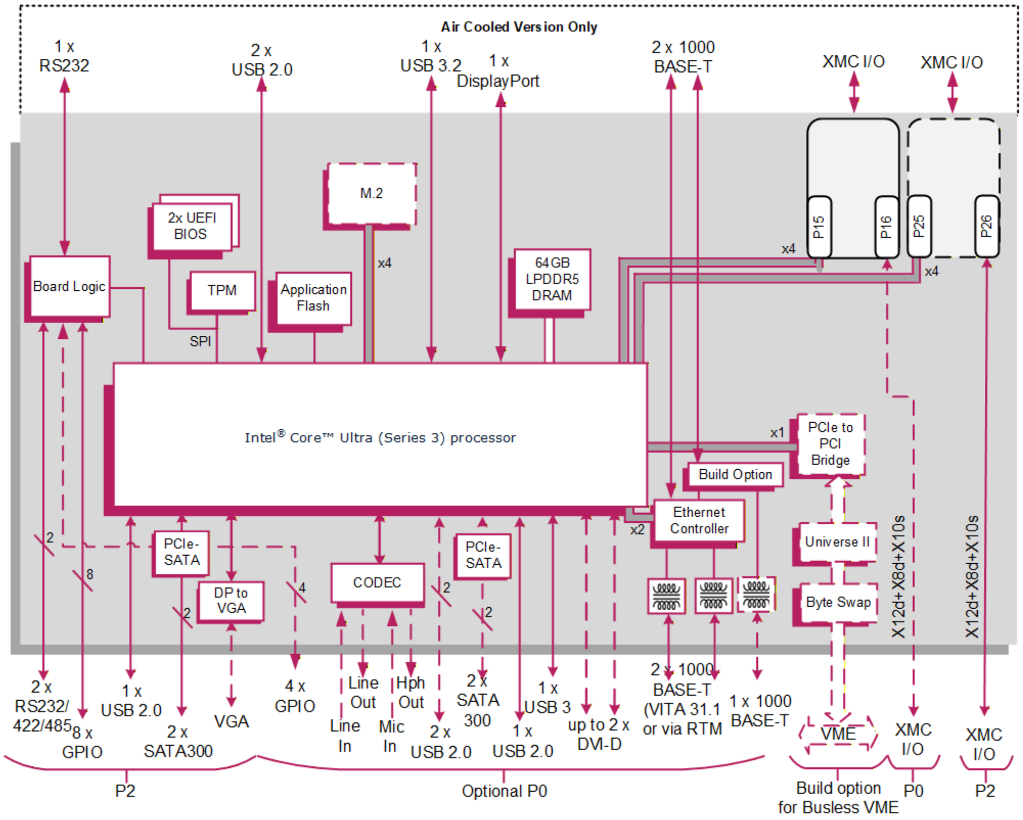
(VP BFx/msd)

Air-cooled/Rugged Conduction-cooled VME board based on 16-core Intel® Core™ Ultra (Series 3) Processor

Key Features

Caelus is a high performance, flexible VMEbus board based on the 16-core Intel® Core™ Ultra (Series 3) Processor. It is designed for high security, long life-cycle applications using the latest operating systems.

- 16-core processor and 64 Gbytes ECC LPDDR5 memory for high performance applications
- Dual or single XMC sites for local expansion
- Wide variety of I/O interfaces including SATA, USB, Ethernet, graphics and serial
- M.2 SSD site for on-board supporting: Type 2242, 2260 or 2280 device
- Board support packages for Linux®, Windows® and VxWorks®
- Option to exclude VMEbus interface is available
- Available in air and conduction-cooled variants



Specification

VME Embedded Computer Board

- 6U VME computing board utilizing a 16-core Intel® Core™ Ultra (Series 3) Processor
- single or dual XMC sites (build options)
- optional Rear Transition Module (RTM)
- Air and conduction-cooled variants available

Central Processor

- 16-core Intel® Core™ Ultra (Series 3) Processor
- Intel® Iris Xe3 Graphics with Intel NPU for acceleration and AI Inferencing

DRAM

- 64 Gbytes soldered LPDDR5 IBECC DRAM:
  - in-band ECC
  - single bit error correction
  - multi key total memory encryption

XMC Interfaces

Air-cooled:

- single or dual XMC interfaces
- XMC I/O site 1:
  - front panel I/O
  - XMC P16 rear I/O (X12d+X8d+X10s) via optional P0 (build option 0)
- XMC I/O site 2 (or additional front I/O):
  - front panel I/O: option for XMC site or extra front panel I/O connectors (USB 3.1/2.0 and Gigabit Ethernet interfaces)
  - rear I/O: none
- XMC PCI Express interfaces:
  - both support x8 PCI Express (Gen 1, Gen 2)
  - XMC site 1 can also support 2 x4 PCI Express
  - both powered from 5V supply

Conduction-cooled:

- dual XMC interfaces
- XMC I/O site 1:
  - XMC P16 rear I/O (X12d+X8d+X10s) via optional P0 (build option 0)
- XMC PCI Express interfaces:
  - both support x8 PCI Express (Gen 1, Gen 2)
  - XMC site 1 can also support 2 x4 PCI Express
  - both powered from 5V supply

Ethernet Interfaces

Air-cooled:

- up to 4 x Gigabit Ethernet interfaces:
  - implemented by an Intel® I350-AM4 LAN controller via a x2 PCI Express® port (Gen 2)
- 1 x Gigabit Ethernet interface via front panel RJ45
- 2 x Gigabit Ethernet interfaces via optional P0:
  - via P0 to optional RTM or utilize VITA 31.1 (Gigabit Ethernet for VME64x backplanes)
- 1 x Gigabit Ethernet interface as a build option:
  - via P0 (build option 2a only)
  - or via front panel RJ45 (build option 2b only)
  - (disables XMC site 2):
  - on-board magnetics (50V isolation via P0)

Conduction-cooled:

- up to 3 x Gigabit Ethernet interfaces:
  - implemented by an Intel® I350-AM4 LAN controller via a x2 PCI Express® port (Gen 2)
- 2 x Gigabit Ethernet interfaces via optional P0:
  - utilizes VITA 31.1 (Gigabit Ethernet for VME64x backplanes)
- 1 x Gigabit Ethernet interface as a build option:
  - via P0 (build option 2a only)
  - on-board magnetics (50V isolation via P0)

Mass Storage Interfaces

Air-cooled:

- up to 4 x external SATA300 interfaces:
  - 2 x SATA via P2
  - 2 x SATA (build option 1) via optional P0
- 1 x M.2 SSD site for optional on-board supporting:
  - Type 2242, 2260 or 2280 device
  - x4 PCIe interface (M-key)
  - NVM Express® (NVMe™) logical device interface
  - NVMe 1.3 compatible
  - device can be fitted simultaneously with XMC modules fitted
  - 2242 device can be fitted with 2.5-inch SATA drive fitted
- 2 x SATA600 interfaces for optional on-board:
  - SATA Flash Drive Module
  - 2.5-inch SATA drive (disables XMC Site 2)

Conduction-cooled:

- up to 4 x external SATA300 interfaces:
  - 2 x SATA via P2
  - 2 x SATA (build option 1) via optional P0
- 1 x M.2 SSD site on-board supporting:
  - Type 2242 device only
  - x4 PCIe interface (M-key)
  - NVM Express® (NVMe™) logical device interface
  - NVMe 1.3 compatible
  - 2242 device can be fitted simultaneously with XMC module fitted to XMC site 2
- 2 x SATA600 interfaces for optional on-board:
  - SATA Flash Drive Module
  - 2.5-inch SATA drive (disables XMC Site 2)

Serial Interfaces

Air-cooled:

- 3 x serial channel interfaces:
  - 1 x RS232 accessed via 60-way high density connector on front panel
  - 2 x RS232/422/485 accessed via P2
- 16550 compatible UARTs

Conduction-cooled:

- 2 x serial channel interfaces: 2 x RS232/422/485 accessed via P2
- 16550 compatible UARTs

Stereo Audio

- Intel® High Definition Audio interface with CoDeC (build options 1 & 2) via optional P0:
  - line level stereo input and output
  - line level microphone input
  - headphone output

Graphics Interfaces

Air-cooled:

- up to 4 x external SATA300 interfaces: 1 x DVI-D interface (build option 1) or
- 2 x DVI-D interfaces (build option 2) via optional P0:
  - up to 1920 x 1200 @ 16M colors
- 1 x DisplayPort® V1.2 interface via 60-way high density connector on front panel:
  - up to 1920 x 1200 @ 60Hz
  - resolution is dependent on the device driver
- 1 x VGA interface (build option) via P2:
  - up to 1920 x 1200 @ 16M colors
  - embedded DisplayPort to VGA converter
- support for Microsoft® DirectX 12, OpenGL 4.5 under Windows® and Linux® and OpenCL 2.1

Conduction-cooled:

- 1 x DVI-D interface (build option 1) or 2 x DVI-D interfaces (build option 2a) via optional P0:
  - up to 1920 x 1200 @ 16M colors
- 1 x VGA interface (build option) via P2:
  - up to 1920 x 1200 @ 16M colors
  - embedded DisplayPort to VGA converter
- support for Microsoft® DirectX 12, OpenGL 4.5 under Windows® and Linux® and OpenCL 2.1

Other Peripheral Interfaces

Air-cooled:

- PC Real Time Clock
- watchdog timer; 32-bit Long Duration Timer with processor interrupt ability; chipset timer
- 3 x USB 2.0 ports:
  - 2 x USB 2.0 via 60-way connector on front panel
  - 1 x USB 2.0 via P2
- up to 4 x USB ports accessed via optional P0
  - 1 x USB 2.0 port and 1 x USB 3.1 (Gen 1) port
  - 2 x USB 2.0 ports (build option 1)
- option for 1 x USB 3.1 (Gen 1) and USB 2.0 ports accessed via USB connector on front panel (disables XMC site 2)
- 8 x GPIO signals via P2 plus 4 x GPIO signals
- (build option 2) via optional P0:
  - supports processor interrupt capability
- Write Protect (build option 2) and External Reset (build option 2) via optional P0

Conduction-cooled:

- PC Real Time Clock
- watchdog timer; 32-bit Long Duration Timer with processor interrupt ability; chipset timer
- 1 x USB 2.0 via P2
- up to 4 x USB ports accessed via optional P0:
  - 1 x USB 2.0 port and 1 x USB 3.1 (Gen 1) port
  - 2 x USB 2.0 ports (build option 1)
- 8 x GPIO signals via P2 plus 4 x GPIO signals
- (build option 2a) via optional P0:
  - supports processor interrupt capability
- Write Protect (build option 2a) and External Reset (build option 2a) via optional P0

Flash EPROM

- dual 64 Mbyte BIOS SPI Flash EPROMs
- UEFI boot firmware (BIOS):
  - UEFI 2.7 support
  - implements Secure Boot
- implements Intel Boot Guard
- optional Fast Boot solution using the
  - Intel Firmware Support Package (FSP)
- LAN boot firmware included

Software Support

- support for Linux®, Windows® and VxWorks®

Board Security Packages

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

Firmware Support

- UEFI 2.7 boot firmware (BIOS):
  - implements Secure Boot
- implements Intel® Boot Guard
- optional Fast Boot solution using the Intel® Firmware Support Package (FSP)
- LAN boot firmware included

Optional Built-In Test (BIT) Support

- Power-on BIT (PBIT), Initiated BIT (IBIT), Continuous BIT (CBIT)

Safety

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

VME Interface

- P1 and P2 connectors compatible with VME64x
- implemented using Universe™ II device
- VME Master/Slave
- A32/A24/A16/D64/D32/D16/D8(EO)/MBLT
- fast hardware byte swapping
- auto system controller detect
- full interrupter / interrupt handler support
- bus error interrupt support
- build option for busless VME interface:
  - SYSRESET, SYSFAIL, ACFAIL, GAx
  - VMEbus daisy chain

Electrical Specification

- typical current figure for processor
- 64 Gbytes DRAM:
- +5V @ TBD
- +12V @ TBD; -12V @ TBD; 3.3V not required
- +12V and -12V routed to both XMC sites

Environmental Specification

Air-cooled:

- operating temperature:
  - 0°C to +55°C (N-Series)
- extended operating temperatures based upon processor’s performance/power factory build option:
  - -25°C to +70°C (E-Series)
  - -40°C to +70°C (K-Series)
  - -40°C to +85°C (K-Series)
- non-operating temperature: -40°C to +85°C
- 5% to 95% Relative Humidity, non-condensing:
  - K-Series includes humidity sealant

Conduction-cooled:

- operating temperature (at card edge) based upon processor’s performance/power factory build option:
  - VITA 47 Class CC4, -40°C to +85°C
  - conduction-cooled
- 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)
- 5% to 95% Relative Humidity, non-condensing

Mechanical Specification

Air-cooled:

- 6U form-factor
- single slot, width 0.8-inch (20.3mm)
- utilizes 160-way connectors for P1 and P2
- optional P0 connector
- IEEE 1101.10 VME64x handles, alternatively with option for VME32 handles
- shock: 20g, 11ms, ½ sine
- vibration: 5Hz-2000Hz at 2g, 0.38mm peak displacement

Conduction-cooled:

- 6U form-factor
- single slot, width 0.8 inch (20.3mm)
- utilizes 160-way connectors for P1 and P2
- optional P0 connector
- operating mechanical:
  - shock - VITA 47 Class OS2, 40g
  - random vibration - VITA 47 Class V3, 0.1g²/Hz