UTC004

3rd Gen MicroTCA Carrier Hub (MCH), 40GbE/PCIe Gen 3

UTC004

Key Features

- Unified 1 GHz quad-core CPU for MCMC (MicroTCA Carrier Management Controller), Shelf Manager, Clocking, and Fabric management
- Automatic fail-over with redundant UTC004s
- 1GbE base switch with dual 100/1000/10G uplink
- Full Layer 2 or 3 managed Ethernet switches
- Non-blocking PCIe Gen 3, SRIO Gen 2, 10GbE/40GbE, or Crossbar Switch option to AMC fat pipes with options for up to 40GbE uplink
- Low-jitter M-LVDS clock distribution crossbar matrix
- PLL synthesizer for generating any clock frequency disciplined to GPS/SyncE/IEEE1588
- Single module, full size per AMC.0

Benefits

- FPGA fabric option supports arbitrary scatter/gather or shelf-level signal processing
- Front-panel fabric expansion uses standard industry cables with copper or fiber options
- Sophisticated clocking features enabling GPS/IEEE1588/SyncE/NTP Grand Master Clock
- Virtual JTAG capability for remote programming and debugging eases FPGA code development
- VadaTech's Scorpionware® Shelf Management Software included at no additional cost

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The VadaTech UTC004 is the most feature-rich MicroTCA Carrier Hub (MCH) on the market. Its management software is based on VadaTech's robust Carrier Manager and Shelf Manager which have been deployed for years with proven results.

The MCMC manages the Power Modules, Cooling Units, and up to 12 AMCs within the chassis. It also manages the optional PCIe Gen3, SRIO Gen2, 40GbE/10GbE or Crossbar Fat Pipe switches as well as the standard GbE with 10GbE uplink Base Channel switch.

The ethernet switches are managed with an enterprise grade Layer 2 or 3 switching/routing stack and they support synchronous ethernet.

The unit runs Linux on its centralized quad-core CPU and is hot-swappable/fully redundant when used in conjunction with a second instance of the module. The firmware is HPM.2 compliant which allows for easy upgrades.

The UTC004 provides Master JTAG services to the AMCs via the JSM and has advanced clocking features including grand master clock and high-quality clock distribution/synthesis.

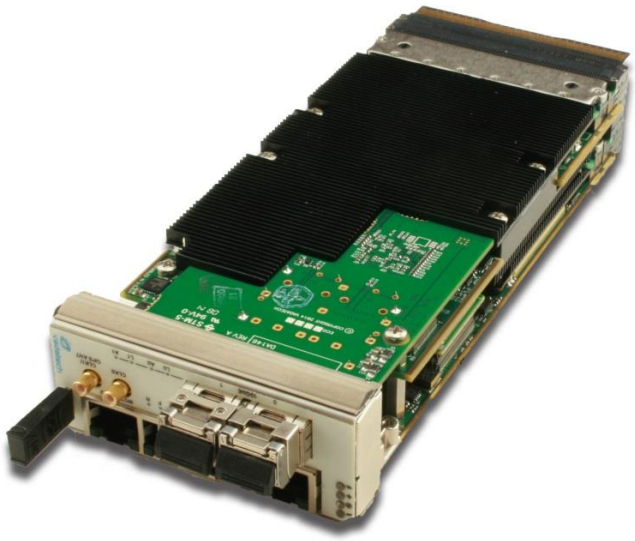

Figure 1: UTC004

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Block Diagram

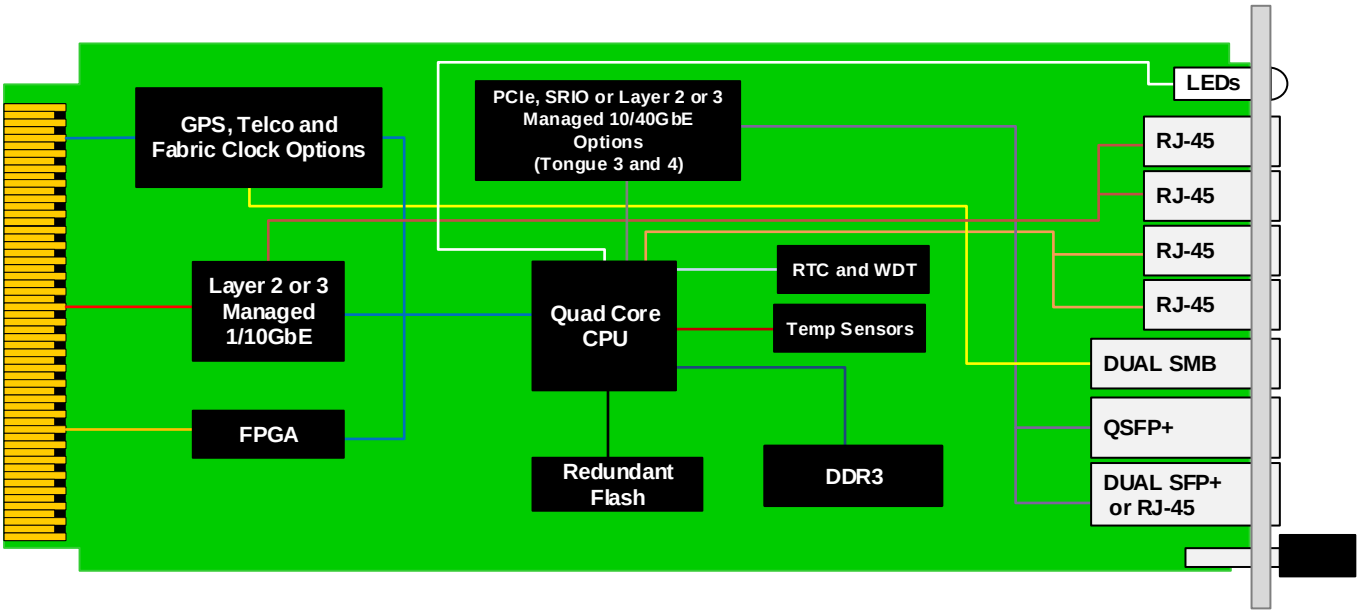

Figure 2: UTC004 Functional Block Diagram

Front Panel

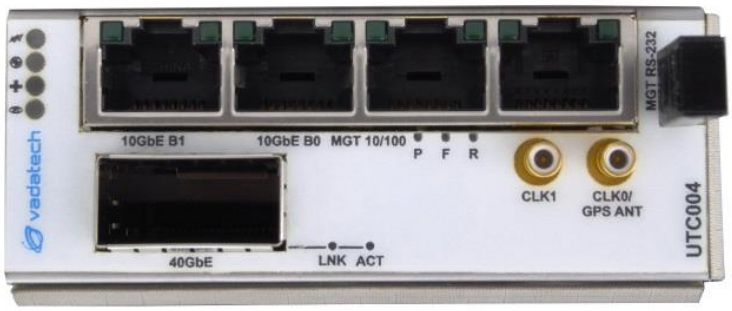

Figure 3: UTC004 Front Panel with QSFP+ (MTCA.1)

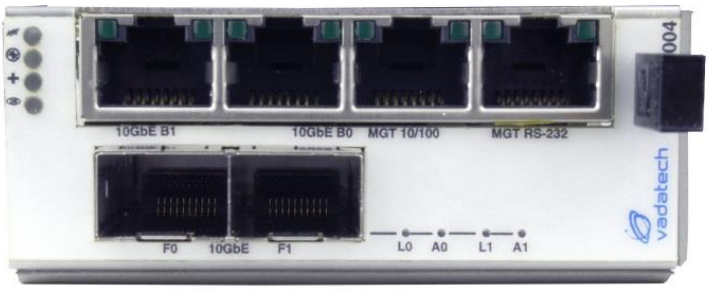

Figure 4: UTC004 Front Panel with Dual SFP+ (MTCA.1)

Fabric Variations and General Connectivity

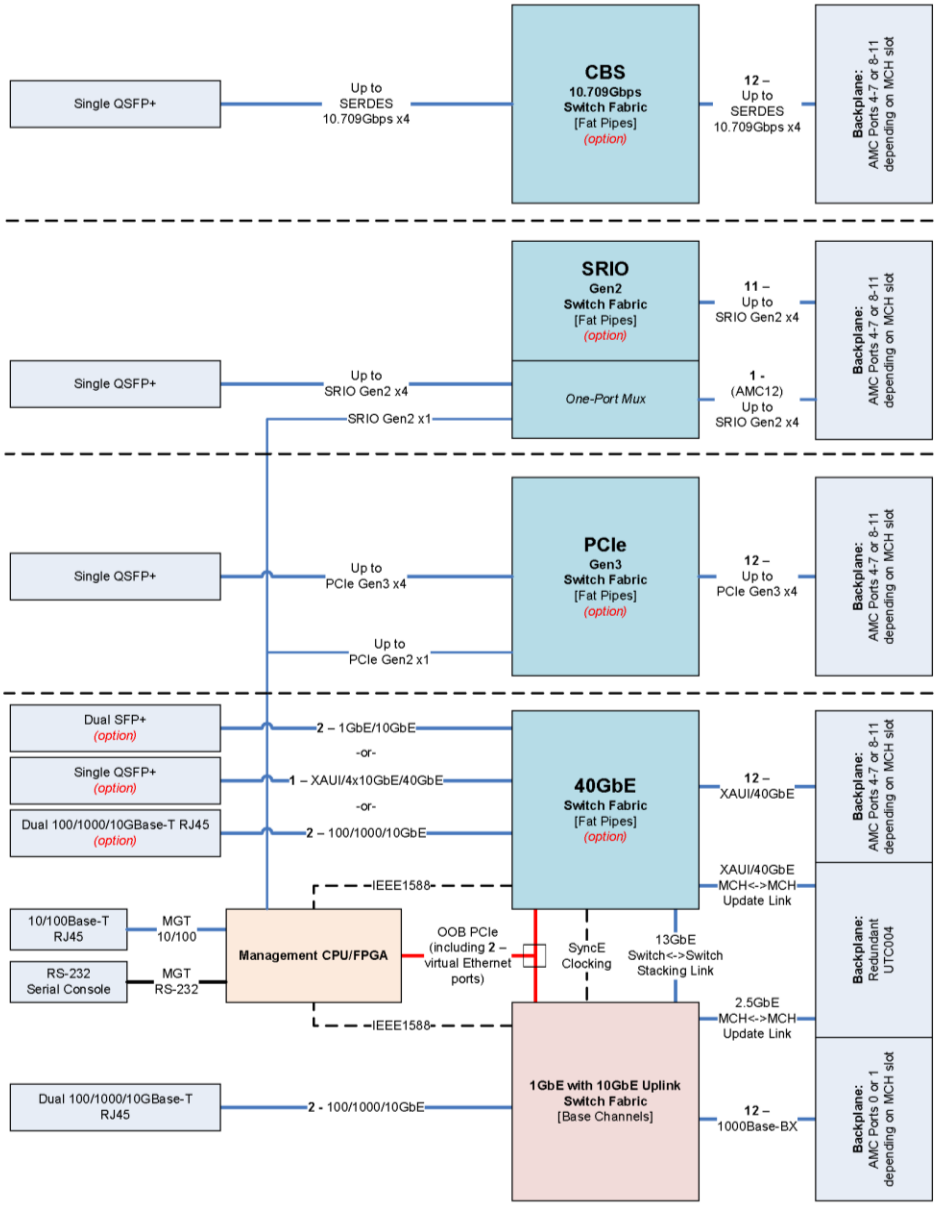

Figure 5: UTC004 Connectivity and Fabric Options

Feature	UTC001/UTC002/UTC003	UTC004
CPU Design/Upgrade Scheme	Up to 4 individual sub-system CPUs	Single quad core
Base/Fat Pipes Ethernet	GbE, 10GbE	GbE, 40GbE
Layer 2 Ethernet Fabrics (Switching)	Yes	Yes
Layer 3 Ethernet Fabrics (Routing)	No	Yes
Built-in GPS Receiver Option	No	Yes
Clock Routing/Synthesis	FPGA matrix/integer dividers	CBS matrix/PLL synthesis
IEEE 1588/NTP Grand Master Clock	No	Yes
Synchronous Ethernet	No	Yes
JTAG Master/Virtual Probe	No	Yes

Table 1: Comparison Table for Previous VadaTech MCH Generations

Architecture

IPMI Carrier Manager, Shelf Manager and Protocol Analyzer

The UTC004 utilizes the same proven standards-compliant IPMI management stack that has been utilized successfully in our previous generation MCH products. It supports carrier manager, shelf manager, and protocol analyzer operations to help facilitate a seamless chassis integration experience. The IPMI stack enables a rich feature set including:

- IPMI v2.0 with IPMI v1.5 compatibility
- SDR, FRU, and SEL storage interfaces (SEL stored in MRAM for high-speed/non-volatile/no-wear-out access)
- Intelligent temperature, voltage, and current sensing
- Shelf cooling policy
- Shelf activation and power management/Automatic fail-over/redundancy management
- Alarm controls
- Event notification and flexible alerting policies
- Backplane E-Keying
- CLI, SNMP, RMCP+, HTTP, and HPI
- IPMB Protocol Analyzer GUI for use on PC
- ScorpionWare GUI system manager integration tool on PC available separately

Base Channel Ethernet Switch

The UTC004 provides includes as standard a GbE base channel switch which includes two 10GbE uplink 100/1000/10G RJ-45 Ports. This switch is fully Layer 2 or Layer 3 managed enabling a comprehensive enterprise-grade routing and switching feature set. It supports Synchronous Ethernet (SyncE) and IEEE1588.

Fat Pipe Fabrics

The UTC004 provides for PCIe fat pipes fabric options:

PCIe Gen3 Switch with front QSFP+ expansion/uplink ports

- Speed setting for 2.5/5/8 Gbps per lane
- Virtual Switch/Multiple domain/Non-transparent port support to enable partitioning of the system with multiple root complexes
- Includes an extra internal port which enables the GPS precision time-stamping engine (accessible from an AMC root complex board)
- 1024 Gbps aggregate bandwidth/non-blocking/cut-through architecture

40GbE Switch with front single QSFP+ or dual SFP+ or dual 100/1000/10G RJ-45 expansion/uplink ports

- Full Layer 2 or 3 management enabling enterprise-grade switching and routing
- Supports Synchronous Ethernet (SyncE) and IEEE1588 to facilitate advanced system synchronization via Ethernet
- 320 Gbps or 640 Gbps aggregate bandwidth options for mixed 10GbE/40GbE and full 40GbE port configurations

SRIO Gen2 x4 Switch with front QSFP+ expansion/uplink port

- Supports 1.25/2.5/3.125/5/6.25 Gbps per lane
- 240 Gbps aggregate bandwidth/non-blocking/cut-through architecture

Cross-Bar Switch with front QSFP+ expansion/uplink port

- Supports unicasting or multi-casting of any input SERDES lane to one or more output SERDES lane
- 771 Gbps aggregate bandwidth/asynchronous/non-blocking architecture passes through any data rate up to 10.709 Gbps
- SERDES protocol agnostic (no packet framing/handling within the switch, only the AMCs need to understand the protocol)

Fabric Clock Option

The UTC004 has the capability to provide a 100 MHz HCSL PCIe Gen3 compliant fabric clock to each AMC. This option enables the recommended synchronous PCIe clocking approach within the chassis when used in combination with the PCIe fabric.

GPS and General Purpose Clocks

The MTCA specification defines a set of clocks for telecom and non-telecom applications. The VadaTech UTC004 has the most sophisticated clocking distribution in the market to meet the most stringent requirements such as wireless infrastructure, high speed A/D, etc. The UTC004 supports the following GPS and general-purpose clocking features:

- MTCA.4-compliant low-jitter/low-skew backplane crossbar clock routing matrix for CLK1/CLK2/CLK3 for all AMCs
- Clock disciplining with arbitrary clock frequency output and holdover (Stratum-3 option) including 1PPS regeneration and holdover
- Flexible integration and synchronization between GPS, IEEE1588/SyncE, and NTP clocking enabling Grand Master clock functionality
- 'Any Frequency' high-quality clock generation/jitter cleaning for up to two user clocks
- Supports hitless automatic clock failover for improved reliability
- Optional built-in GPS receiver enables direct time/clock synchronization to the GPS satellite constellation

The UTC004 supports flexible front panel clock port ordering options:

- Two DC-coupled LVCMOS Inputs/Outputs, or two AC-coupled Sine-wave Inputs, or one of each
- Built-in GPS receiver for time/location/clock synchronization plus a DC-coupled LVCMOS Input/Output

GPS Receiver Enabled Features

The UTC004 can be ordered with a GPS Receiver option. The receiver disciplines an onboard high-quality DPLL which is phase/frequency aligned to the atomic clocks in the GPS satellite constellation. The onboard clock synthesis/jitter cleaning capability can be utilized to convert this frequency into any frequency desired while still remaining locked to the GPS atomic clocks.

When the GPS Receiver option is purchased the UTC004 has the capability to re-transmit the incoming GPS data via Ethernet to other nodes in the network in the Trimble TSIP binary protocol format. This GPS data is also sent out the front panel GPS RS-232 serial port in the standard NMEA format for use by external equipment. When the GPS Receiver option is purchased along with the PCIe Fat Pipes fabric, the MCH also provides a precision PCIe Timestamping Engine capability to a PrAMC PCIe Root Complex on the backplane. This engine appears as a PCIe device to the AMC card and a device driver is available which will allow the AMC card to read all GPS status including position, velocity, status, etc., in addition to precision timestamps, time trigger, and time event interrupt functionalities.

IEEE1588 PTP AND NTP Grand Master Clock

The UTC004 can provide Ethernet time services to the chassis networks on both the GbE and 40GbE fabric ports. It can be subordinate to an external PTP or NTP master server or when the GPS receiver option is purchased can act as a Grand Master clock utilizing the precision timing information provided via the GPS receiver and onboard disciplined oscillator.

Synchronous Ethernet

The UTC004 provides a Synchronous Ethernet (SyncE) on the GbE and 40GbE fabric ports. With this feature, ports on the 1G and/or 40G Ethernet switches can be designated as master or slave ports and the Ethernet fabrics within the chassis can be synchronized from end-to-end with external equipment. This feature utilizes advanced telecom-grade network synchronization PLLs to provide exceptional SyncE performance.

JTAG Master/JTAG via Ethernet Virtual Probe

The UTC004 provide JTAG Master Capability to send out configuration data streams via the chassis JTAG Switch Module (JSM) to configure arbitrary JTAG Slave devices on AMC cards. Virtual Probe services are also available to provide JTAG via Ethernet for Xilinx FPGAs. This allows for standard development tools such as Xilinx iMPACT/ChipScope to treat the MCH/JSM combination as if it was a standard JTAG probe. This approach frees the developer from having to attach JTAG probes directly to the AMC or JSM which can be difficult when systems are already fully assembled. It also allows for remote debugging across long distances when required without the need to install additional JTAG equipment on-site.

Specifications

Architecture		
Physical	**Dimensions**	Single module, full-size
		Width: 2.89” (73.5 mm)
		Depth 7.11” (180.6 mm)
Type	**Controller**	MicroTCA Carrier Hub
Standards		
MTCA	**Type**	MTCA.0 Revision 1
AMC	**Type**	AMC.0
Module Management	**IPMI**	IPMI v2.0
		HPM v1.0
ATCA	**Type**	PICMG 3.0 Revision 2.0
Configuration		
Power	**UTC004**	Option load dependent (as the MCMC and Shelf only < 4W)
Environmental	**Temperature**	See Ordering Options
		Storage Temperature: –40° to +85°C
	Vibration	Operating 9.8 m/s^2 (1 G), 5 to 500 Hz on each axis
	Shock	30Gs each axis
	Relative Humidity	5 to 95% non-condensing
Front Panel	**Interface Connectors**	RS-232 console port (RJ-45) for serial console and option for GPS NMEA serial data in/out
		Out-of-band LAN 10/100 from MCMC/Shelf Manager (RJ-45)
		Two in-band 100/1000/10G from Base Switch Fabric (RJ-45)
		Two CLK IN/OUT (SMB); CLK IN becomes GPS ANT IN with GPS receiver option
		Expansion for PCIe Gen 3, SRIO Gen 2, 40GbE, CBS: QSFP+, dual SFP+, Dual RJ-45
	LEDs	IPMI management control
		LNK/ACT, OOB PCIe error, ACTIVE MCMC, GPS receiver status, Clock: Ref Good, Freq Lock, Phase Lock, additional LEDs per each fat pipes fabric type
	Mechanical	Hot-swap ejector handle with +/-15KV ESD protection
Other		
MTBF	MIL Hand book 217-F@ TBD hrs	
Certifications	Designed to meet FCC, CE and UL certifications, where applicable	
Standards	VadaTech is certified to both the ISO9001:2015 and AS9100D standards	
Warranty	Two (2) years, see VadaTech Terms and Conditions	

INTEGRATION SERVICES AND APPLICATION-READY PLATFORMS

VadaTech has a full ecosystem of OpenVPX, ATCA and MTCA products including chassis platforms, shelf managers, AMC modules, Switch and Payload Boards, Rear Transition Modules (RTMs), Power Modules, and more. The company also offers integration services as well as pre-configured Application-Ready Platforms. Please contact VadaTech Sales for more information.

Ordering Options

UTC004 – ABC-DEF-GHJ-K00

A = Fabric Switch (Fat Pipes)	D = Front Panel Clocking *5	G = JTAG Virtual Probe	K = Ethernet Switch Management
0 = None (Base channel switch only) *1 1 = PCIe Gen 3 w/ QSFP+ Uplink 2 = SRIO Gen 2 w/ QSFP+ Uplink *2 3 = 40GbE w/ 2x SFP+ Uplink 4 = 40GbE w/ 2x 10GBase-T RJ45 Uplink 5 = 40GbE w/ QSFP+ Uplink 6 = Cross Bar Switch w/ QSFP+ Uplink 7 = 10GbE w/ 2x SFP+ Uplink (Layer 2 managed only) 8 = 10GbE w/ QSFP+ Uplink (4 x 10GbE, Layer 2 managed only) 9 = PCIe Gen3 (PEX9765) w/QSFP+ Uplink *8	0 = None (Backplane clocking only) 1 = Dual LVCMOS Clock In/Out 2 = Sine Wave In + LVCMOS In/Out 3 = Built-in GPS receiver + LVCMOS In/Out 4 = Dual Sine Wave In 5 = GPS receiver + Sine Wave In 6 = Sine Wave In (up to 17dBm) +TTL/LVCMOS In	0 = No JTAG Virtual Probe 1 = JTAG Virtual Probe Included	0 = Reserved 1 = VadaTech stack Routing and Switching (protocols) 2 = Reserved
B = Included TXCVRs Modules for Fabric Switch *3	**E = Fabric B Ports Configuration *6**	**H = MicroTCA Form Factor**	
0 = No TXCVRs 1 = SFP+ modules (10GBASE-SR) *4 2 = SFP+ modules (10GBASE-LR) *4 3 = SFP+ modules (1Gb LC/SX) *4 4 = SFP+ modules (1Gb LC/LX) *4 5 = SFP+ modules (1000 Base-T) *4 6 = QSFP+ module	0 = None (Fabric B Ports not connected) 1 = Fixed 100 MHz HCSL fabric clock for PCIe routed to backplane CLK3/FCLKA channels 2 = General-purpose M-LVDS clock matrix routed to backplane CLK3/FCLKA channels	0 = MTCA.0 (Base specification, Air-cooled) 1 = MTCA.1 (Rugged, Air-cooled) 2 = MTCA.2 (Hardened, Air/conduction-cooled) 3 = MTCA.3 (Hardened, Conduction-cooled)	
C = 40GbE Switch Aggregate Bandwidth	**F = Clock Holdover Stability**	**J = Temperature Range and Coating**	
0 = Switch not 40GbE 1 = 320 Gbps (mix 10GbE/40GbE) *4 2 = 640 Gbps (full 40GbE) *4	0 = Standard (XO) 1 = Stratum-3 (TCXO)	0 = Commercial (–5° to +55°C), No coating 1 = Commercial (–5° to +55°C), Humiseal 1A33 Polyurethane 2 = Commercial (–5° to +55°C), Humiseal 1B31 Acrylic 3 = Industrial (–20° to +70°C), No coating 4 = Industrial (–20° to +70°C), Humiseal 1A33 Polyurethane 5 = Industrial (–20° to +70°C), Humiseal 1B31 Acrylic 6 = Extended, Humiseal 1A33 Polyurethane (–40 to +85°C) *7 7 = Extended, 1B31 Acrylic (–40 to +85°C) *7	

Notes:

***1** A base channel GbE with 10GbE uplink switch is always included regardless of the fabric switch (fat pipes) option.

***2** When the SRIO expansion port is activated by software configuration the AMC 12 slot will not have SRIO due to port multiplexing.

***3** When 'No TXCVRs' is selected any available SFP+/QSFP+ cages are shipped empty and will be the customer's responsibility to procure separately. SFP+ or QSFP+ selection for Option "B" are limited by the selection of fabric switch front panel I/O type in Option "A".

***4** This option is only applicable when selecting a 40GbE fabric switch option in Option "A".

***5** Backplane M-LVDS clock routing and related PLL clocking features are provided regardless of the front panel clock option. When GPS (D=3) is selected, additional GPS related features become available such as precision GPS time-stamping via PCIe, GPS data transmission via Ethernet, and GPS serial NMEA data 'Y' cable is provided.

***6** The Fabric B Ports configuration should be matched to the Ordering Options for CLK3 routing/terminations on the chassis backplane. E=1 is recommended for PCIe fabric applications, otherwise E=2 is recommended for maximum clocking flexibility. E=0 should only be selected if clock routing at the MCH connector would conflict with existing SAS/SATA routing on the backplane. These options correspond with the MCH backplane connector pin-out variations described in the MTCA standard.

***7** Conduction cooled; temperature is at edge of module. Consult factory for availability.

***8** Using advanced features of the PCIe switch (e.g. CPU to CPU DMA transfer, endpoint sharing) requires a management processor, which VadaTech supports on a PrAMC. Contact sales for product details.

Related Products

AMC720

- Intel® Xeon™ E3 processor
- Up to 16 GB of DDR3 w/ ECC and 32 GB Flash
- PCIe Gen2

UTC010

- Dual -36V DC to -75V DC input, 792W (available in 396W)
- Hot-swappable with support for power module redundancy
- Dual IPMI bus

VT884

- Twelve mid-size single module AMC slots (option to have double modules)
- Dual MicroTCA Carrier Hubs
- PinoutPlus™ support, 2nd tongue on all AMC slots

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