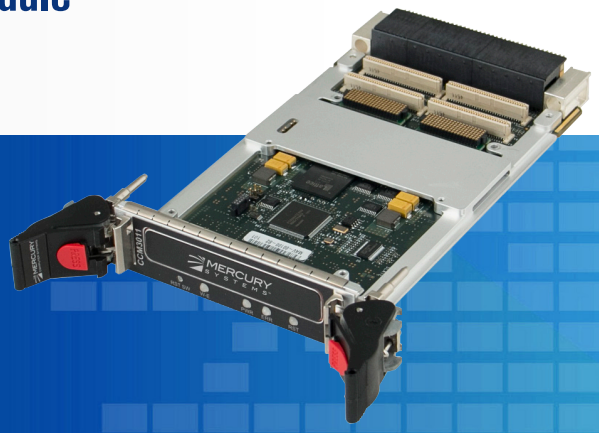
DATASHEET

Ensemble® 3000 Series
CCM3012 3U OpenVPX PMC/XMC Carrier Module

Expanded I/O Capabilities for OpenVPX Platforms



- **PCIe Gen-3 interfaces to OpenVPX data plane**
- **Advanced system management built-in (VITA 46.11)**
- **Air, conduction, Air and Liquid Flow-By packages**

The Ensemble® CCM3012 PMC/XMC carrier is a compact VITA 46 VPX OpenVPXTM 3U module. This carrier brings additional processing capabilities to compliment processor modules such as the Ensemble LDS3506 by providing high-bandwidth access to additional mezzanine sites. The Ensemble CCM3012 connects to processing modules via a Gen-3 PCIe interface, allowing data to flow into a system by a simple expansion of on-board PCIe trees. Available in air-cooled, Air Flow-By™, conduction-cooled and Liquid Flow-By™ options, the Ensemble CCM3012 module can be deployed in a variety of environments with confidence.

The Ensemble CCM3012 is supported by the rich set of features available from the MultiCore Plus® software infrastructure, which allows ease of portability, while offering open software development architecture.

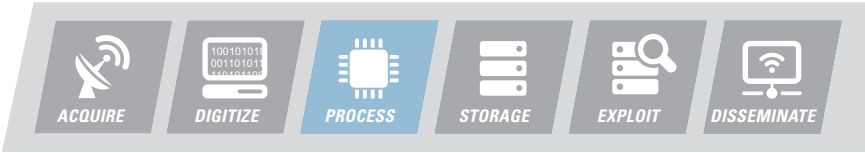
PCIe Gen-3 Interfaces

The Ensemble CCM3012 carrier provides a high-bandwidth PCIe interface to the OpenVPX backplane. The switch connects 16 lanes to the backplane which can be configured as a single x16, two x8s or four x4s. The default is two x8s. In smaller systems, the Ensemble CCM3012 can provide PCIe switching via the on-board 32-port switch. These backplane PCIe interfaces allow a physically distinct processing module to expand its PCIe infrastructure to encompass the additional resources available on the Ensemble CCM3012. The PCIe switch connects an upstream x16 PCIe link to the backplane connector, a downstream x8 PCIe link to the XMC site and a x4 link to the PCI/PCI-X bridge for the PMC site.

Mezzanine Card Flexibility

The standard PMC/XMC site on the Ensemble CCM3012 module can be configured with off-the-shelf mezzanine cards using either PCI-X or PCIe protocols. PMC cards are supported with a PCI/PCI-X interface at up to 133 MHz on each site. XMCs are supported with x8, x4, and x1 PCIe interfaces, linked via the J15 connector per the VITA 42.3 standard. The XMC connectors utilized on the Ensemble CCM3012 are VITA 61 compliant connectors, optimized for high-speed signal integrity as well as rugged operation. The PCIe interfaces are capable of Gen-1, Gen-2, and Gen-3 PCIe data rates. XMC user I/O is mapped to the backplane via the J16 connector, in accordance with the standard VITA 46.9 X12D+X8D pattern for differential signals. Additional single-ended XMC user I/O signals are also available.

Mercury Systems is a leading commercial provider of secure processing subsystems designed and made in the USA. Optimized for customer and mission success, Mercury's solutions power a wide variety of critical defense and intelligence programs.



Reviewed and approved for public release by Mercury's Export Compliance Office. Dated 05/09/2016, reference number 16-003

The Ensemble CCM3012 provides ample power to the PMC/XMC site, allowing the site to support high-powered mezzanines capable of drawing more than 30 watts. By separating these high-powered mezzanines from a module with on-board processing capabilities, the dissipation of thermal energy can be balanced at the system level, maintaining a high MTBF figure and removing the need for costly thermal management designs. The Ensemble CCM3012 supports these cost-saving considerations while simplifying software design, the Ensemble CCM3012 is configured as a simple logical extension of the support software on the neighboring compute module.

System Management Plane

The Ensemble CCM3012 module follows OpenVPX design principles in leveraging the robust, scalable, and well-tested system management infrastructure from the VITA 46.11 architecture. Using the standard I2C bus and IPMI protocol, the on-board, system-management block implements the Intelligent Platform Management Controller (IPMC), in accordance with the VITA 46.11 standard. This allows for the Ensemble CCM3012 module to:

- Report sensor values
- Report and set sensor thresholds, allowing an application to react to voltage or current variations that exceed those thresholds
- Reset the entire module
- Power up/down the entire module
- Retrieve module FRU (field replaceable unit) information
- Be managed remotely by a Chassis Management Controller at the system level, such as implemented on the OpenVPX SFM3010 Module

VPX-REDI

The VPX (VITA 46) standard defines 6U and 3U board formats with a modern high-performance connector set capable of supporting today's high-speed fabric interfaces, such as PCIe. VPX is most attractive when paired with the Ruggedized Enhanced Design Implementation standard – REDI (VITA 48). The Ensemble CCM3012 module is implemented as a 3U conduction-cooled implementation of VPX-REDI, with air-cooled variants in the same VPX form factor available for less rugged environments.

Targeted primarily for harsh-environment embedded applications, VPX-REDI offers extended mechanical configurations supporting higher functional density, such as two-level maintenance (2LM). 2LM allows maintenance personnel to replace a failed module and restore the system to an operational state in a limited time period, minimizing the potential of damage to the board.

Open Software Environment

Mercury leverages over 30 years of multi-computing software expertise, including multicore processor expertise, across its many platforms. This strategy is fully applied to the Ensemble CCM3012 module and includes support for off-the-shelf open software products such as OFED and OpenMPI.

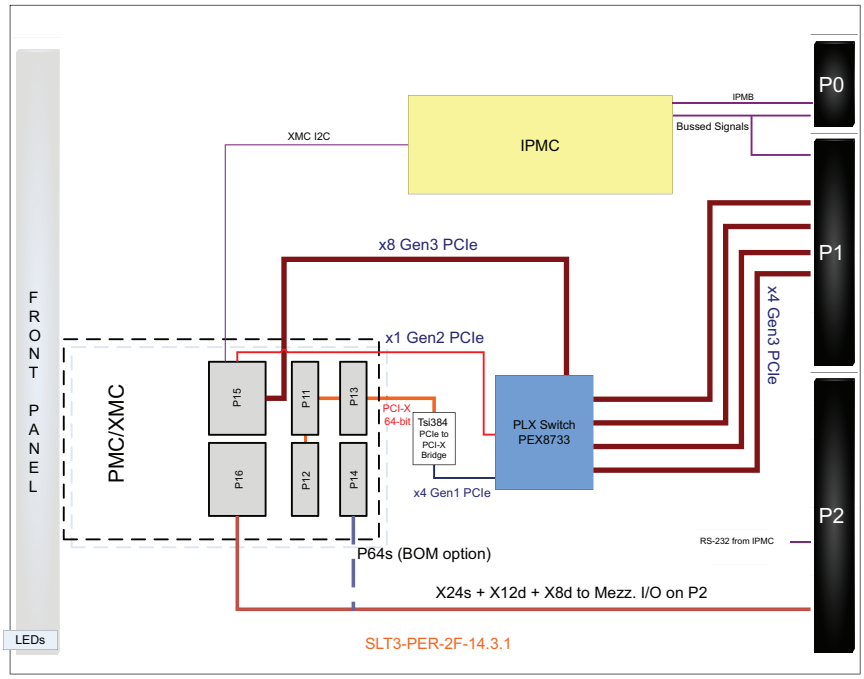


Figure 1 - CCM3012 functional block diagram

Mercury Sensor Processing Ecosystem

Sensor chain awareness is having the technical expertise and resources to design and build capable, compatible solutions along the whole sensor processor chain. From RF/microwave, digital/analog signal manipulation to dense, size, weight, and power (SWaP) optimized processing resources to actionable intelligence dissemination; Mercury's rugged compute subassemblies leverage the best commercial-item technology, enabling prime contractors to win more business. Modern sensor compute subassemblies are customized assemblies of interoperable building blocks built to open standards. Mercury's hardware and software portfolio of building blocks are physically and electrically interoperable as defined by international industrial standards, including VITA's OpenVPX standards.

Rugged air cooling, Air Flow-By

Air- and conduction-cooled subsystems rely on filtration to remove contaminants from their cooling air streams. Mercury's Air Flow-By™ technology eliminates filtration with the most elegant cooling solution available within a sealed and rugged package. Fully compliant to VITA standards (including VITA 48.7), Air Flow-By maintains OpenVPX's 1-inch pitch requirement, is highly resilient to liquid and particle contamination, boosts SWaP, reduces operating temperature, extends MTBF by an order of magnitude and enables embedded deployment of the most powerful and reliable processing solutions.

System bandwidth – the effect of interconnect performance

Bandwidth is critical and especially applicable to switch fabric resources which dictate the responsiveness of the entire subsystem. All modular solutions, including OpenVPX, are to some degree interconnect-bound; they are restricted by the limitations of the best industry interconnect technology. To address this, Mercury fabricates system interconnections with innovative technology which mitigates insertion-loss and cross-talk while maintaining full OpenVPX compliance. The result and significant system performance boost is especially discernible as subsystems scale larger and data rates increase.

Specifications

Module Specifications

One PMC/XMC site
On-board 32-lane Gen-3 PCIe switch
Backplane PCIe interface to data plane
System management capabilities in accordance with VITA 46.11
Air-cooled, conduction-cooled, Air Flow-By and Liquid Flow-By packages

PMC-X/XMC Sites

PMC-X sites 1
PCI-X-to-PCIe bridge - Connects PMC sites to on-board PCIe switch
PCI support 33 and 66 MHz
PCI-X support 66, 100, and 133 MHz
PCIe XMC sites per VITA 42.3
Supports x8, x4, or x1 PCIe interfaces from XMC to on-board PCI Express switch
XMC user-defined I/O from J16 to backplane
Differential signals per VITA 46.9 X12D+X8D pattern
X24s signals VITA-46.9 mapping from XMC J16 site to VPX P2

Management plane

I2C interface to backplane
On-board IPMC
Voltage, current, and temperature sensors

I/O

RS-232 serial interface from IPMC to backplane interface
Support for PCIe resets per OpenVPX standard

Specification Compliance

OpenVPX System Specification (VITA 65)

VITA 46.0, 46.3, 46.4, 46.6, 46.11, and VITA 48.1, 48.2 (REDI)

Environmental

		Environmental Qualification Levels					
		Air-cooled			Air Flow-By	Conduction-cooled	Liquid Flow-By
		Commercial L0	Rugged L1	Rugged L2	Rugged L4	Rugged L3	Rugged L5
Ruggedness		•	••	••	•••	•••	•••
Moisture/dust protection		•	••	••	•••	•••	•••
Typical cooling performance		~140W*	~140W*	~150W*	~200W*	~150W**	300W+***
Temperature	Operating*	0°C to +40°C	-25°C to +55°C	-45°C to +70°C	-40°C to +60°C	-40°C to +71°C	-40°C to +71°C***
Operating temperature maximum rate of change		N/A	5°C/min	10°C/min	10°C/min	10°C/min	
Temperature	Storage	-40°C to +85°C	-55°C to +85°C	-55°C to +125°C	-55°C to +125°C	-55°C to +125°C	
Humidity	Operating*	10-90%, non-condensing	5-95%, non-condensing	5-95%, non-condensing	5-95%, non-condensing 100% condensing	5-95%, non-condensing 100% condensing	
	Storage	10-90%, non-condensing	5-95%, non-condensing	5-95%, non-condensing	5-95%, non-condensing 100% condensing	5-95%, non-condensing 100% condensing	
Altitude	Operating*	0-10,000ft	0-30,000ft	0-30,000ft	0-30,000ft	0-70,000ft	
	Storage	0-30,000ft	0-50,000ft	0-70,000ft	0-70,000ft	0-70,000ft	
Vibration	Random	0.003 g^2/Hz; 20-2000 Hz, 1 hr/axis	0.04 g^2/Hz; 20-2000 Hz, 1 hr/axis	0.04 g^2/Hz; 20-2000 Hz, 1 hr/axis	0.1 g^2/Hz; 5-2000 Hz, 1 hr/axis	0.1 g^2/Hz; 5-2000 Hz, 1 hr/axis	
	Sine	N/A	N/A	N/A	10G peak; 5-2000 Hz, 1 hr/axis	10G peak; 5-2000 Hz, 1 hr/axis	
	Shock	z-axis: 20g; x and y-axes: 32g; (11ms ½-sine pulse, 3 positive, 3 negative)	z-axis: 50g; x and y-axes: 80g; (11ms 1/2-sine pulse, 3 positive, 3 negative)	z-axis: 50g; x and y-axes: 80g; (11ms 1/2-sine pulse, 3 positive, 3 negative)	z-axis: 50g; x and y-axes: 80g; (11ms 1/2-sine pulse, 3 positive, 3 negative)	z-axis: 50g; x and y-axes: 80g; (11ms 1/2-sine pulse, 3 positive, 3 negative)	
Salt/Fog		N/A	Contact Factory	Contact Factory	10% NaCl	10% NaCl	
VITA 47		Contact Factory					

* Customer must maintain required cfm level. Consult factory for the required flow rates.

** Card edge should be maintained below 71°C

Storage Temperature is defined per MIL-STD-810F, Method 502.4, para 4.5.2, where the product under non-operational test is brought to an initial high temperature cycle to remove moisture. Then the unit under non-operational test will be brought to the low storage temperature. The low temperature test is maintained for 2 hours. The product is then brought to the high storage temperature and is maintained for 2 hours. The product is then brought back to ambient temperature. All temperature transitions are at a maximum rate of 10°C/min. One cold/hot cycle constitutes the complete non-operational storage temperature test. This assumes that the board level products are individually packaged in accordance with ASTM-D-3951 approved storage containers. These tests are not performed in Mercury shipping containers, but in an unrestrained condition. Please consult the factory if you would like additional test details.

All products manufactured by Mercury meet elements of the following specifications: MIL-STD-454, MIL-STD-883, MIL-HDBK-217F, and MIL-I-46058 or IPC-CC-830, and various IPC standards. Mercury's inspection system has been certified in accordance with MIL-I-45208A.

Additional Services

Optional Environmental Screening and Analysis Services		Standard Module, Optional Services	
• Cold Start Testing	• Safety Margin Analysis	• Engineering Change Order (ECO) Notification	• Alternate Mean Time Between Failure (MTBF) Calculations
• Cold Soak Testing	• Temperature Cycling	• ECO Control	• Hazmat Analysis
• Custom Vibration	• Power Cycling	• Custom Certificate of Conformity (CofC)	• Diminished Manufacturing Sources (DMS) Management
• CFD Thermal Analysis	• Environmental Stress Screening	• Custom UID Labeling	• Longevity of Supply (LOS)
• Finite Element Analysis			• Longevity of Repair (LOR)
Contact factory for additional information			

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INNOVATION THAT MATTERS™

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