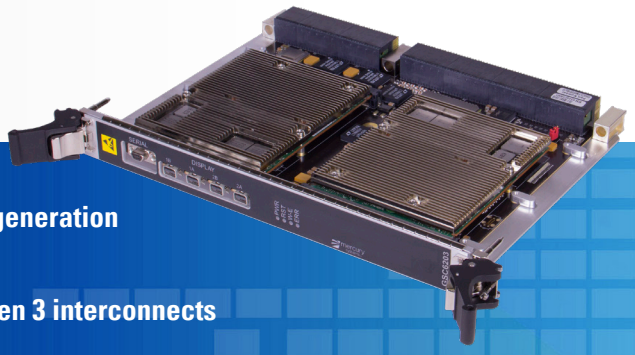
DATASHEET

EnsembleSeries™ GSC6203

6U OpenVPX GPU co-processor powered by dual NVIDIA Pascal GPUs



- **Increased performance NVIDIA Pascal processor from the previous generation**
- **New, ruggedized MXM for mission critical deployments**
- **Up to 17.8 TFLOPS of processing, 32GB of GDDR5 memory and PCIe Gen 3 interconnects**
- **Application development with OpenCL, NVIDIA CUDA**
- **Advanced mechanical packaging enables successful rugged deployment of MXMs**

The EnsembleSeries™ GSC6203 co-processor is a 6U OpenVPX carrier module that integrates two high-performance NVIDIA GPUs for applications that benefit from massively parallel processing on streams of high–bandwidth data delivering some of the highest GFLOP processing performance as well as the highest GFLOP/Watt performance efficiency in the industry.

Meeting Today's Processing Demands

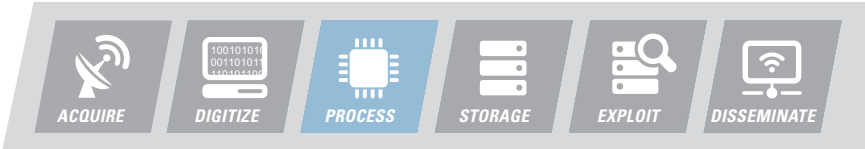
Commercial and defense applications such as radar, electro-optical/infrared (EO/IR), artificial intelligence (AI), electronic warfare (EW) and sensor fusion applications generate large amounts of raw sensor or network data that need to be processed in real-time to extract actionable intelligence. Each new generation of sensor arrays ushers in increased warfighter capabilities driving new demands on sensor processing. By offloading compute-intensive operations to GPUs such as fast Fourier transforms (FFTs), matrix multiplication, constant false alarm rate (CFAR), QR decomposition (QRD), video codecs (H.264, JPEG2000), pattern recognition or deep packet inspection, system architects can engineer solutions that can meet today's processing demands — with room to scale for higher performance requirements in the future while preserving significant IP investment. The Pascal architecture solution also provides accelerated neural network and AI performance for deep learning and cognitive and adaptive algorithms. With the ability to target the GPU directly from an FPGA or other sensor ingest point, the GSC6203 functions as a key enabler for the most challenging sensor processing problems facing our industry.

The EnsembleSeries GSC6203 accelerators are Mercury's 4th generation 6U dual GPU module, backed with a history of field-proven deployments in a number of defense programs since 2008. Updates to the EnsembleSeries GSC6203 include a new MXM format that offers higher performance Pascal processing (NVIDIA P5200E) in a more rugged mechanical design of MXM. The NVIDIA P5200E boosts performance to 8.9 TFLOP per GPU (17.8 TFLOP per module), increases memory to 16GB per GPU (32GB per module) and higher internal memory speeds. The new mechanical design of the module and the MXM are manufactured to IPC-A-610 CLASS 3 and IPC 6012 CLASS 3 specifications and compliant with IPC J-STD-001 soldering standards.

Pascal P5200 GPU

The EnsembleSeries GSC6203 GPU module is powered by NVIDIA's Pascal generation of professional graphics cards. The P5200E MXM delivers 2560 CUDA cores, 8.9 TFLOPS (single precision), and 16 GB GDDR5 per GPU (32 GB per GSC6203) for 230 GB/s of memory bandwidth. The PCIe 3.0 x16 interface provided by the GPU card provides high throughput for streaming data both to and from the GPU memory.

Mercury Systems is the better alternative for affordable, secure processing subsystems designed and made in the USA. These capabilities make us the first commercially based defense electronics company built to meet rapidly evolving next-generation defense challenges.



EnsembleSeries GSC6203 Advancements

GSC6203 are an upgrade to the prior generation (EnsembleSeries GSC-6202) with advanced MXM technology support for improved performance and increased mechanical ruggedization. The leverage of the previous GPU carrier design saved significant engineering development time and cost, allowing programs to deploy with the latest, highest performing embedded GPU technology as soon as they are available.

From a performance perspective, the P5200E Pascal MXM GPUs provides over 30% performance improvement, enabling lower latency processing and more effective algorithm offload. The GPU is equipped with 20% more cores along with higher memory bandwidths when compared to the P5000 GPU.

The mechanically enhanced GPU module can survive more challenging environments than ever before. With MXMs designed from the ground up with military based processes, the module can now reliably achieve -40 to +85 C temperatures, 30-40G shock and 10G vibration. Some of the advancements that make this possible are:

- Component de-rating meets or exceeds NASA and Rome Labs specifications for reliability
- High-grade PCB material
- ENIG PCB surface plating
- Conformal coating options
- Hard gold used on the MXM card edge
- Additional MXM mounting holes

The module, including MXMs, are developed in North America with a trusted supply chain.

Open Software Environment

Mercury leverages over 35 years of multicomputer software expertise across its many platforms, including the latest multicore processors found in GPUs. This strategy is fully applied to the EnsembleSeries GSC6203 accelerators. Because the processor, memory and surrounding technologies are leveraged across product lines, software developed on the GSC6-203 can interface seamlessly with other Mercury products.

EnsembleSeries GSC6203 accelerators interface with Intel modules running Red Hat® Linux®. Several software development environments are available for GSC6203 accelerators:

- NVIDIA CUDA: A parallel computing architecture that is accessible to software developers through industry standard programming languages.
- OpenCL: An open-source standard for cross-platform and parallel programming.

System Management

EnsembleSeries GSC6203 accelerators implements the advanced system management functionality architected in the VITA 46.11 specification to enable remote monitoring, event management, and hardware revision and health status. Using the standard I2C bus and intelligent platform management controller (IPMC) protocol, the on-board system management block implements the IPMC.

This allows the EnsembleSeries GSC6203 accelerators to:

- Read sensor values
- Read and write sensor thresholds, allowing an application to react to thermal, voltage or current variations that exceed those thresholds
- Reset the entire module
- Power up/down the entire module
- Retrieve module field replaceable unit (FRU) information
- Be managed remotely by a chassis management controller at the system level, such as implemented on EnsembleSeries 6U OpenVPX switches

VPX-REDI

The VPX (VITA 46) standard defines 6U boards with a modern, high-performance connector capable of supporting today's high-speed fabric interfaces. VPX is most attractive when paired with the ruggedized enhanced design Implementation standard – REDI (VITA 48). EnsembleSeries GSC6203 accelerators are implemented as 6U VPX-REDI conduction-cooled (VITA 48.2), Air Flow-By™ (VITA 48.7), or Liquid Flow-Through (VITA 48.4) with an air-cooled variant available in the same VPX form-factor 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 potential damage to the module.

Technical Specifications

GPGPU

Two NVIDIA GPU P5000 Pascal architecture MXMs designed specifically for embedded GPU applications

- 5120 total processing cores (2560 per MXM)
- 17.8 peak theoretical single-precision TFLOPS (8.9 peak theoretical TFLOPS per MXM)
- x32 total PCIe 3.0 lanes (x16 PCIe 3.0 per MXM)
- 32 GB total GDDR5 Memory (16 GB per MXM)
- 256-bit memory interface (128 GB per MXM)
- 460 GB/s memory bandwidth (230 GB/s per MXM)

4 Display Port display outputs (2 outputs per MXM)

- To front-panel (air-cooled only) and OpenVPX backplane

2 analog VGA display outputs (one per MXM)

- To front-panel (air-cooled only) and OpenVPX backplane

64-Lane Configurable PCIe Switch

Configurable switch allows for multiple system-level configurations in terms of non-transparent bridging and enumeration

x16 PCIe 3.0 connections to each MXM site (32 lanes total)

x32 PCIe 3.0 total connections to backplane

- x16 PCIe 3.0 OpenVPX P2 expansion plane
- x16 PCIe 3.0 OpenVPX P5 expansion plane

IPMI (System Management)

On-board IPMI controller

Voltage and temperature monitor

Geographical address monitor

Power/reset control

On-board CPLD, FRU EEPROM interfaces

OpenVPX Multi-Plane Architecture

System management via IPMB-A and IPMB-B link on P0 management plane

Dual full x16 or dual x8 PCIe on P2 and P5 expansion plane

4 DisplayPort display outputs on P6 mezzanine I/O plane

2 analog VGA outputs on P3 mezzanine I/O plane

Mechanical

6U OpenVPX (air-cooled, Air Flow-By, conduction-cooled, or Liquid Flow Through)

1.0" pitch, single-slot

OpenVPX and VPX-REDI

Module's Enhanced Mechanical Features:

- Component de-rating meets or exceeds NASA and Rome Labs specifications for reliability
- High-grade PCB material
- ENIG PCB surface plating

MXM Enhanced Mechanical Features

- Conformal coating options
- Hard gold used on card edge
- Additional mounting holes

Power Consumption

Typically 150W per accelerator, power is configurable

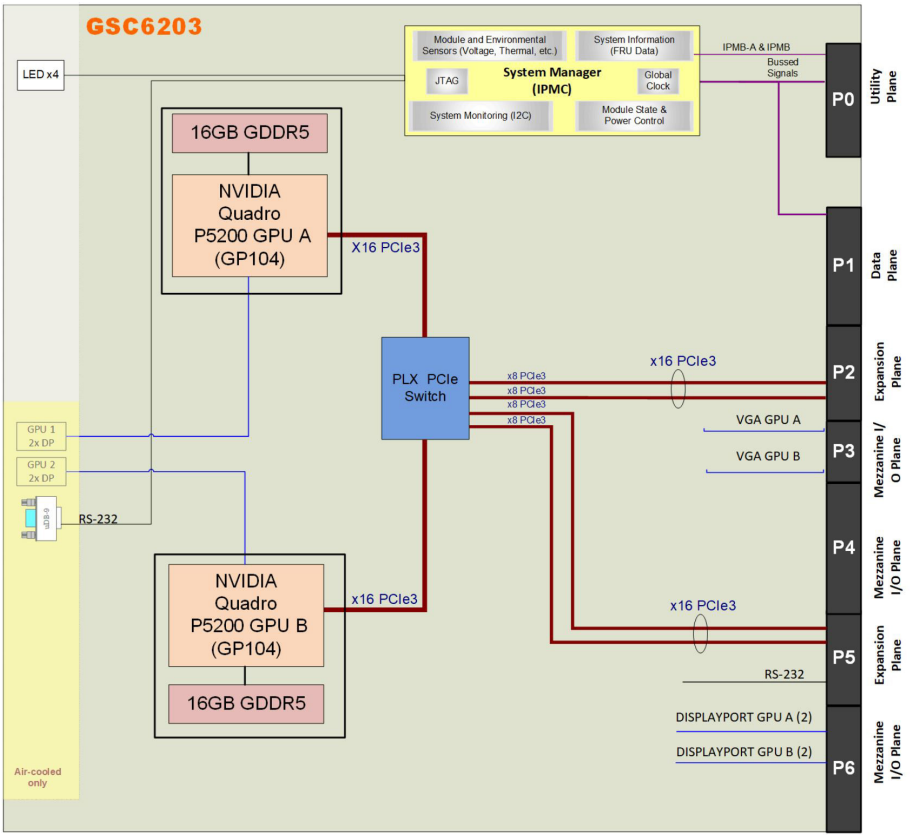


Figure 1. GSC6203 functional block diagram

Environmental

		VITA - Standard Product Environmental Qualification Levels					
		Air-cooled			Conduction-cooled	Air Flow-By	Liquid Flow-Through
Rugged Level		Commercial L0*	Rugged L1*	Rugged L2*	Rugged L3**	Rugged L4*	Rugged L6***
Temperature	Operating	0°C to +40°C (at air intake)	-25°C to +55°C (at air intake)	-45°C to +70°C (at air intake)	-40°C to +71°C (at module edge)	-40°C to +55°C (at air intake)	-40°C to +71°C
	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	-55°C to +125°C
	Max Rate of Change	N/A	5°C/min	10°C/min	10°C/min	10°C/min	10°C/min
Humidity	Operating*	10-90%, non-condensing	5-95%, non-condensing	5-95%, non-condensing	5-95%, non-condensing	5-95%, non-condensing	5-95%, 100% condensing
	Storage	10-90%, non-condensing	5-95%, non-condensing	5-95%, non-condensing	100% condensing	100% condensing	5-95%, non-condensing
Altitude	Operating*	0-10,000ft	0-30,000ft	0-30,000ft	0-70,000ft	0-70,000ft	0-70,000ft
	Storage	0-30,000ft	0-50,000ft	0-70,000ft	0-70,000ft	0-70,000ft	0-70,000ft
Vibration	Random	0.003 g2/Hz; 20-2000 Hz, 1 hr/axis	0.04 g2/Hz; 20-2000 Hz, 1 hr/axis	0.04 g2/Hz; 20-2000 Hz, 1 hr/axis	0.1 g2/Hz; 5-2000 Hz, 1 hr/axis	0.1 g2/Hz; 5-2000 Hz, 1 hr/axis	0.1 g2/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	10G peak; 5-2000 Hz, 1 hr/axis
	Shock	z-axis: 20g; x and y-axes: 32g; (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		
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

*** Dependant upon flow rate and coolant

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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