

EnsembleSeries™ HDS8613

Rugged AdvancedTCA dual Xeon (Haswell) processing blade with AMC mezzanine site



- Dual Intel® 1.8GHz 12-core Xeon® (with Haswell architecture) server-class processors
- Up to 128 GB DDR4-2133 SDRAM
- 40 Gb/s Ethernet or InfiniBand fabric interfaces
- Mezzanine site
- PCIe connectivity to rear transition

The EnsembleSeries™ HDS8613 is Mercury's latest rugged Intel® Xeon® server-class AdvancedTCA® processing blade that delivers the first dual-socket AdvancedTCA blade to break the 1 TFLOP general processing benchmark.

The EnsembleSeries HDS8613 blade is part of Mercury's Xeon server-class ecosystem of building blocks that includes 40 Gb/s Ethernet/InfiniBand switches and FPGA pre-processing modules. These PICMG 3.0 compliant building blocks may be quickly configured and developed in the lab using concurrent engineering disciplines and industry-standard 2, 5, or 14 slot development chassis. Supporting Mercury's Xeon server-class ecosystem is Mellanox's Connect-X3 40Gb/s VPI interfaces, providing sufficient I/O bandwidth to supply the Xeon processors with data to process. Dual Intel Xeon E5-2648L v3 x86 processors, each with 12 cores, the Haswell microarchitecture, and the Wellsburg Bridge (collectively called Grantley) and the support of unrestricted 40Gb/s Ethernet and FDR10 fabric bandwidth deliver scalable and unmatched general processing horsepower. The optimized mechanical cooling technology ensure the highest blade and system MTBF even under full throttle, continuous processing conditions.

Mercury's Xeon server-class AdvancedTCA ecosystem is the most powerful Open System Architecture (OSA) available for general

processing, enabling true on-platform cloud processing at the tactical edge. Eminently suited to radar, electro-optical/infrared (EO/IR) and complex image intelligence (IMINT), artificial intelligence (AI) and sensor fusion applications, this standard 8U AdvancedTCA form-factor blade enables compute capabilities that were never previously possible, adding new functionality and autonomy to modern missions.

Xeon Server-Class Ecosystem

Each EnsembleSeries HDS8613 blade features two Intel 64-bit Xeon (E5-2648L v3) 12-core processors. The HDS8613 is Mercury's fourth generation of Xeon server-class technology and demonstrates a high technology readiness level (TRL). The HDS8613 blades utilizes robust packaging to support two instances of high-pin-count land grid array (LGA) processors in a rugged, embedded form-factor. The dual 12-core processors are linked via two instances of the high-speed, low-latency quick path interconnect (QPI) interface, each with 38 GB/s (bi-directional) data transfer rate, for a total of 76 GB/s of bandwidth between processors. This interconnected processor architecture is optimized for the data movement needed by high performance processing algorithms, such as all-to-all corner turn operations. From a software perspective, this QPI architecture allows the EnsembleSeries HDS8613 to be configured with a single kernel NUMA-aware operating system running across both processor devices.

Mercury Systems is a leading commercial provider of secure sensor and safety-critical processing subsystems. Optimized for customer and mission success, Mercury's solutions power a wide variety of critical defense and intelligence programs.



Each processor is capable of delivering 0.69 TFLOPS (peak), with four high-speed, 17.1 GB/s DDR4-2133 memory channels raw bandwidth each, for a total theoretical peak of 1.38 TFLOPS and 136 GB/s total raw memory bandwidth. HDS8613 blades refine the innovative standing memory fabrication first seen on the 6U EnsembleSeries HDS6600, HDS6601 and HDS6602 to support up to 128 GB of DRAM on-board in a highly rugged configuration. Native Gen3 PCIe support is also featured on this processor, linking the processing resources directly to the I/O sources on the blade. The EnsembleSeries HDS8613 also makes use of the Wellsburg platform controller hub (PCH) chipset, which provides additional I/O bridging between the Intel processor and external devices.

Each Intel E5-2648L v3 processor includes a large 30 MB cache, shared between the cores, allowing many high performance calculations to remain cache resident. This accelerates processing by eliminating the potential latency required to access DRAM to fetch upcoming data. The Haswell bridge family of processors supports the proven AVX2 instruction set, delivering an increase in floating-point algorithm performance that is portable to future Intel architectures. Each core provides the AVX2-capable fused, multiple-add (FMA) vector engine, which is especially valuable for radar processing applications which routinely requires the summing of vast arrays of multiplied numbers. The inclusion of FMA support enables complex radar and similar operations to be performed approximately twice as quickly as before. Fast Fourier transformations (FFTs) and other matrix manipulations are handled more efficiently with Intel's server-class memory and processing optimizations in the Xeon E5 processor family.

High Speed Fabric Interfaces

The EnsembleSeries HDS8613 continues the Mercury tradition of combining the processing power of Intel processors with high speed switched fabric interfaces. Each EnsembleSeries HDS8613 blade features Mellanox's ConnectX-3 host adaptors for fabric channel communications. Bridging between the native Gen3 PCIe interfaces on the Intel processors and the AdvancedTCA fabric channel, the ConnectX-3 can be configured to support InfiniBand (DDR, QDR or FDR-10) or 10/40 Gb/s Ethernet as the data protocol. This approach scales the fabric channel bandwidth up to a peak theoretical rate of up to 5 GB/s per port, or 10 GB/s aggregate across the entire dual-port fabric channel. By scaling the fabric channel bandwidth to match the increase in processing performance, the EnsembleSeries HDS8613 architecture ensures that the processor is never starved for data.

By utilizing the Mellanox ConnectX-3 device and innovative OpenVPX™ interconnect technology the EnsembleSeries HDS8613 is a model for open architecture, high performance computing throughout the embedded industry. Mercury OpenVPX subsystems feature robust signal rates that comfortably exceed the margin of the channel to surpass the rate of modern fabrics, delivering the fastest compute solution in the industry with future proof performance headroom.

System Management

The EnsembleSeries HDS8613 blade implements the advanced system management functionality inherent to the AdvancedTCA standard to enable remote monitoring, alarm management, hardware revision and health status. Using the standard IPMI-A and IPMI-B bus, intelligent platform management controller (IPMC), and IPMI protocol, the on-board system management block implementation is designed to comply with PICMG 3.0. This allows the HDS8613 blades 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 blade
- Power up/down the entire blade
- Retrieve blade field replaceable unit (FRU) information

AMC Mezzanine Configurability

The EnsembleSeries HDS8613 brings additional I/O and/or storage capabilities to bear with its configurable AMC/XMC mezzanine site. With the ability to support any standard AMC or XMC module, the HDS8613 is both powerful and configurable, with the ability for user customization built into the foundation of the product architecture.

Additional Features

Each EnsembleSeries HDS8613 blade provides all the features typically found on an avionics-class, single-board computer. In addition to the sophisticated management subsystem and fabric interconnect, the HDS8613 blade provides users with a toolkit enabling many different application features including:

- Thermal and voltage sensors integrated on-board
- Real-time clock with accuracy better than 10ppm<1second per day
- General purpose timers
- Global clock synchronization capabilities via utility plane clock signals
- Watchdog timer to support interrupt or reset
- Multiple boot paths, include netboot, USB boot, boot from SATA, or from the on-board 8GB flash device

Additionally, dual x16 Gen3 PCIe interfaces are presented to the Zone 3 user defined rear transition, allowing for integration of both local and external PCIe devices into the general-purpose processing complex.

Open Software Environment

Mercury leverages over 35 years of multi-computing software expertise, including multicore processor expertise, across its many platforms. This strategy is fully applied to the EnsembleSeries HDS8613 blade. The same Linux® development and run-time environment is implemented on the HDS8613 blade as on other Intel based Mercury modules across the EnsembleSeries 3000 and 6000 Series. Off-the-shelf open software such as OFED and OpenMPI are fully supported by the Mellanox ConnectX-3 fabric channel.

Mercury Sensor Processing Ecosystem

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 AdvancedTCA.

Mercury AdvancedTCA subsystems are designed from a suite of open architecture building blocks that are combined and scaled to meet a broad range of sophisticated sensor chain processing requirements. Mercury subsystems may include analog, digital and mixed-signal receiver modules, single-board computers and signal processing payload modules. Payloads may have acquisition, digitization, processing, and exploitation and dissemination elements and include FPGA, CPU, GPU or ADC/DAC technology.

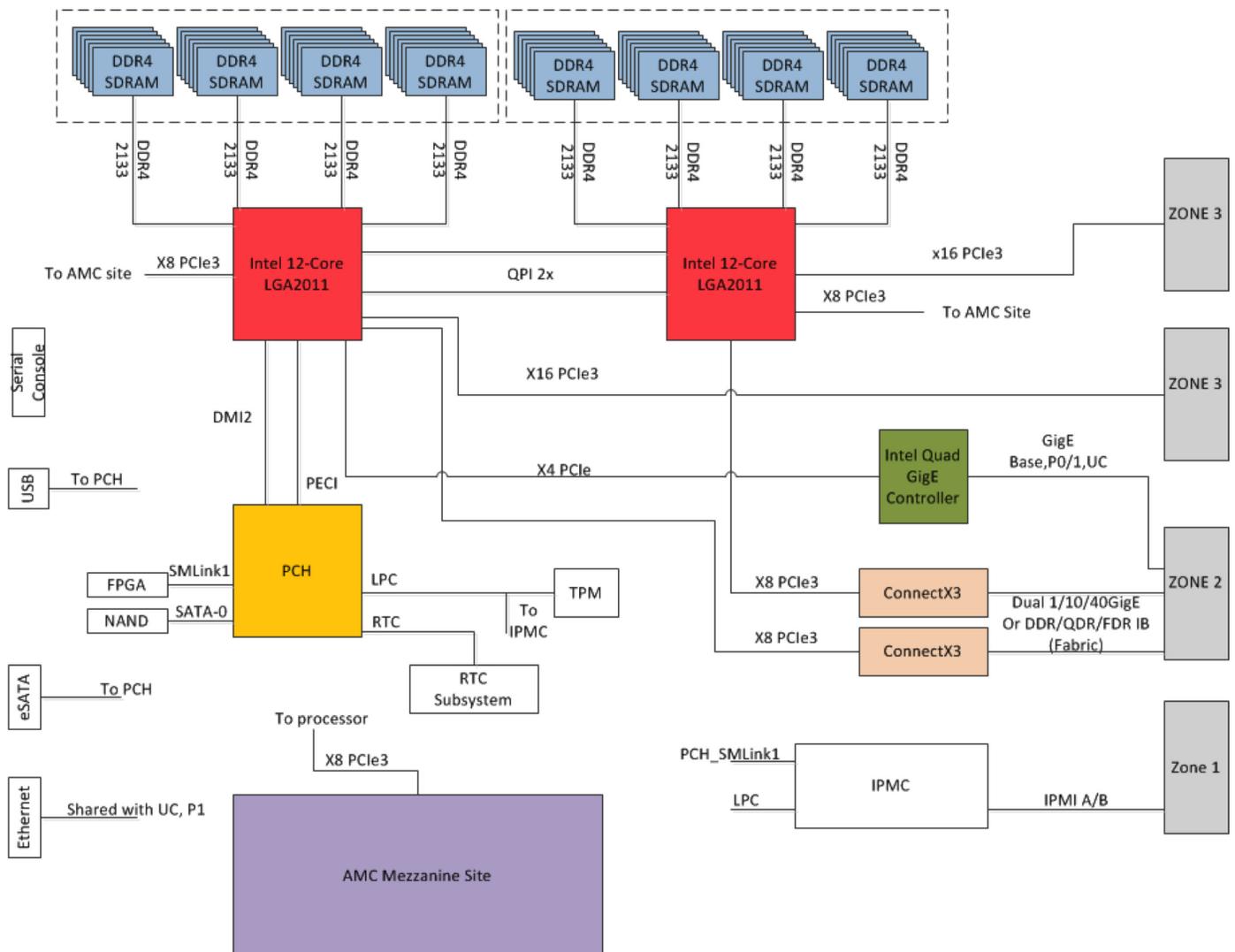


Figure 1 - EnsembleSeries HDS8613 Functional Block Diagram

Specifications

Processors

Dual Intel 1.8GHz 12-core E5-2648L v3 (Wellsburg Bridge) server-class processors
 Haswell architecture with Fused Multiple-Add and AVX2
 Peak performance 1.38 TFLOPS per blade
 Threads per core 2
 QPI interface between processors
 38 GB/s bi-directional (76 GB/s between processors)
 Dual Integrated x16 Gen3 PCIe interface

Memory

Up to 128GB DDR4-2133 with ECC
 Raw memory bandwidth: 68 GB/s per processor

BIOS

SPI flash: Dual 16 MB partitions
 NAND flash: 8 GB, SATA interface

Fabric Channel

Mellanox ConnectX-3 VPI host adapter
 Support DDR/QDR/FDR10 InfiniBand or 40 Gb/s Ethernet protocols

Mechanical

8U AdvancedTCA PICMG 3.0
 1.2" slot pitch
 Power consumption:
 ~75W per processor
 ~200W per module

Environmental

		Standard ATCA Product Environmental Qualification Levels	
Cooling Method		Air-cooled	
Ruggedness		ATCA Rugged Level A1	ATCA Rugged Level A2
Temperature	Operating*	0°C to +40°C	-5°C to +40°C
	Storage	-40°C to +70°C	-40°C to +85°C
Humidity	Aggravated	10-95%, non-condensing	
Altitude	Operating*	0-10,000ft	
	Storage	0-30,000ft	
Vibration	Sine	0.5G Sine, 5-100 Hz, .25 Octave/min, 1 hr/axis	1G Sine, 5-100 Hz, .25 Octave/min, 1 hr/axis
	Shock	z-axis: 10g; x and y-axes: 10g; (11ms 1/2-sine pulse, 3 positive, 3 negative)	z-axis: 10g; x and y-axes: 30g; (11ms 1/2-sine pulse, 3 positive, 3 negative)
Required Flow Rate		Contact Factory	

* Customer must maintain required cfm level. Consult factory for the required flow rates. Reduced max ambient operating temperature or increased airflow may be required to maintain full operation at altitude.

Additional Services			
Optional Environmental Screening and Analysis Services		Standard Module, Optional Services	
<ul style="list-style-type: none"> • Cold Start Testing • Cold Soak Testing • Custom Vibration • CFD Thermal Analysis • Finite Element Analysis 	<ul style="list-style-type: none"> • Safety Margin Analysis • Temperature Cycling • Power Cycling • Environmental Stress Screening 	<ul style="list-style-type: none"> • Engineering Change Order (ECO) Notification • ECO Control • Custom Certificate of Conformity (CofC) • Custom UID Labeling 	<ul style="list-style-type: none"> • Alternate Mean Time Between Failure (MTBF) Calculations • Hazmat Analysis • Diminished Manufacturing Sources (DMS) Management • Longevity of Supply (LOS) • Longevity of Repair (LOR)
Contact factory for additional information			

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