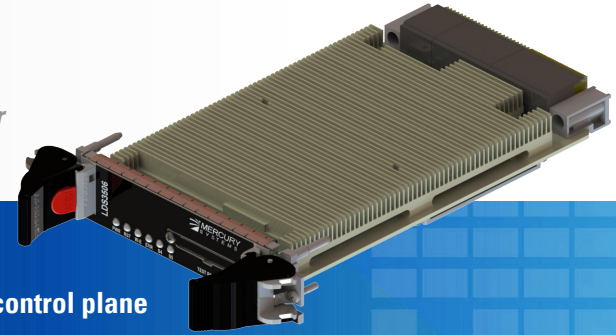


EnsembleSeries™ LDS3506

3U OpenVPX SBC powered by Xeon DE processor with FPGA co-processor



- Intel® Xeon® D Broadwell family server-class processor
- Xilinx® UltraScale™ FPGA with dual x4 PCIe data plane and Ethernet control plane
- Dual 10 Gb/s Ethernet interfaces for sensor I/O or inter-processor communication
- x8 PCIe expansion plane for additional I/O or offload
- Mezzanine site – Software define switch fabrics
- Optional built-in BuiltSECURE System Security Engineering

The EnsembleSeries™ LDS3506 combines Intel's Xeon D family of server-class processors with Xilinx's UltraScale family of FPGA devices. This dense union of best available commercial-item general processing and FPGA resources produces a highly versatile, affordable and interoperable building block for embedded, high-performance compute applications with additional low-latency, refresh and mission capabilities.

The Xilinx's UltraScale FPGA provides a platform for third party IP and Mercury's next-generation software-defined fabric bridge, supporting the paired requirements of flexibility and performance for the PCIe based 3U OpenVPX data plane. By leveraging these elements in combination with Mercury's extensive software and FPGA IP library, the EnsembleSeries LDS3506 becomes a balanced and affordable building block for radar, electronic warfare, and mission processing applications with tight SWaP requirements.

Optional BuiltSECURE

For deployment at the tactical edge and export to allies, the Ensemble-Series LDS3506 family of blades optionally embeds BuiltSECURE technology to counter nation-state reverse engineering with system security engineering (SSE). BuiltSECURE is built-in SSE that enables turn-key or private and personalized security solutions to be quickly

BuiltSECURE™

configured. The extensible nature of Mercury's SSE delivers system-wide security that evolves over time, building in future-proofing. As countermeasures are developed to offset emerging threats, our security framework keeps pace, maintaining system-wide integrity. Please contact us directly for BuiltSECURE configurations.

Intel Xeon D Family Server-Class Processor

The EnsembleSeries LDS3506 features a 64-bit Xeon D family processor that is protected and cooled by Mercury's 5th generation of server-class packaging, which has previously been deployed in the EnsembleSeries HDS6600, HDS6601, HDS6602, and HDS6603 6U OpenVPX processing blades.

The D family of Xeon processors includes a system on chip (SoC) approach, combining the processor and the Intel platform controller hub (PCH) function within a single device. As a solderable BGA, the Xeon D family extends the applicability of the Xeon family in to the compact 3U space. As an example, the D-1548 device delivers up to 512 GFLOPS of processing power, which is a significant performance boost for the 3U form-factor. With two high-speed DDR4-2133 memory controllers, the Xeon processor is able to support up to 16GB of DRAM, with future capabilities of up to 32GB per blade. Significant PCIe interface capabilities are built in to the chip, which enable data interfaces both on-board and off-board.

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..



ACQUIRE



DIGITIZE



PROCESS



STORAGE



EXPLOIT



DISSEMINATE

The integrated on-device PCH functionality enables the LDS3506 to access additional I/O, including USB and SATA on the backplane. The D family of Xeon processors has dual 10 Gigabit Ethernet interfaces, enabling backplane access for sensor data or additional inter-processor communication and support for the AVX 2.0 instruction set. That boosts floating-point algorithm performance and is portable to future Intel architectures.

Integrated FPGA Resources

The EnsembleSeries LDS3506 integrates a Xilinx UltraScale FPGA device with the Intel processor to provide additional data plane functionality and security offload capabilities. The FPGA resources support the full OpenVPX data plane for flexible PCIe configurations, with the ability to enable dual non-transparent bridges (NTB), switching, and high-speed DMA engines in a single device.

In addition to the data plane, the Ethernet control plane is integrated

with the UltraScale device to allow for additional flexibility in configuration and capability. By offloading traditional SBC functionality, including serial interfaces to the FPGA, LDS3506 blades reduce DMS concerns for long-term support of program requirements. Mercury's FPGA development kits are available and support the integration of customer or third party FPGA IP, and to facilitate customer IP development efforts.

High-Speed Fabric Interfaces

Dual x4 PCIe interfaces are routed through the on-board FPGA to the OpenVPX data plane. Because these interfaces are not dependent on native Intel processor resources, the EnsembleSeries LDS3506 is capable of providing dual NTB functions across both x4 interfaces instead of a single NTB, to produce highly scalable and flexible data plane configurations. Being FPGA-based, the protocol operating on the data plane can be transformed to other options, including 10 Gigabit Ethernet and Serial RapidIO®, with a simple firmware change.

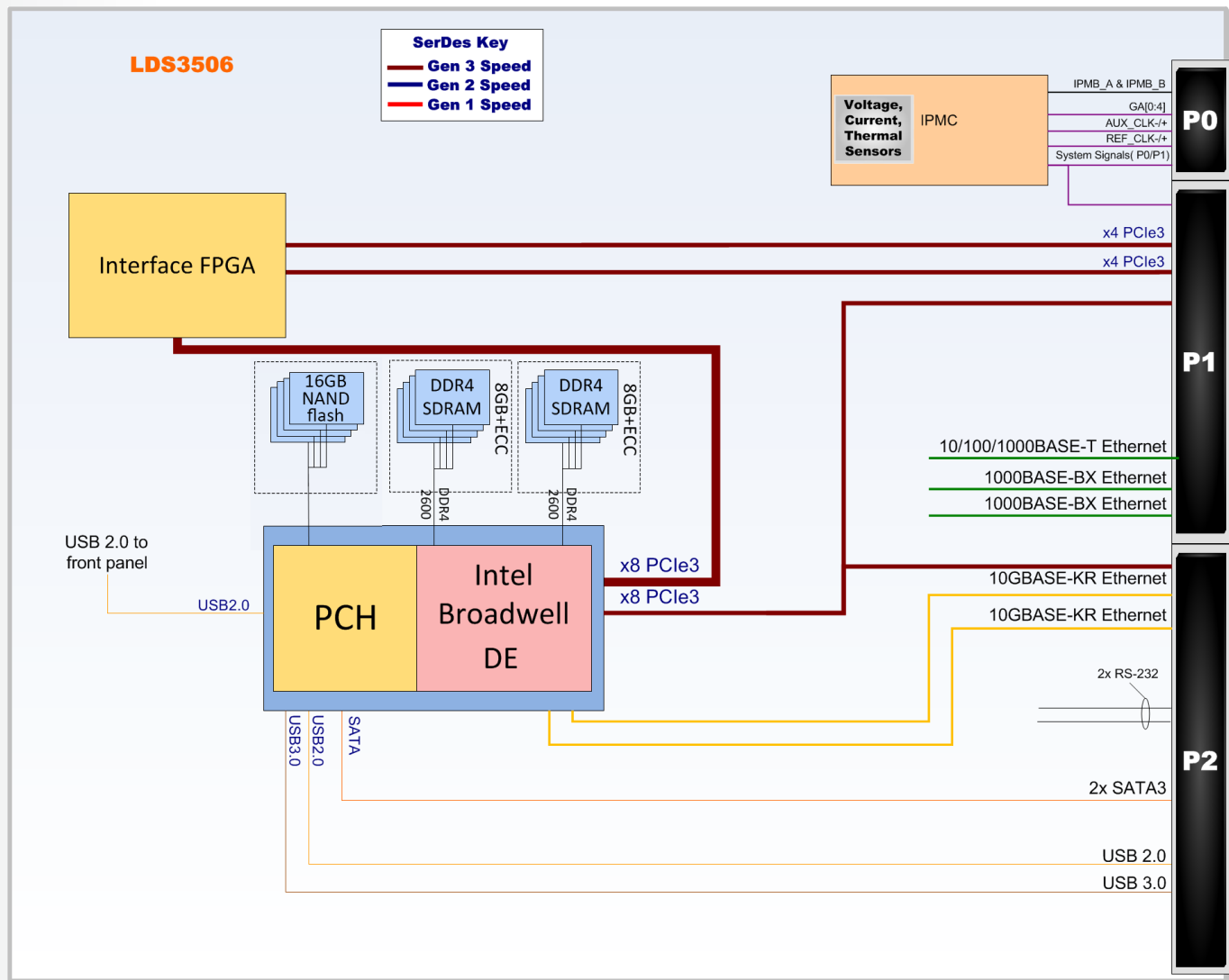


Figure 1 - LDS3506 functional block diagram

PCIe Architecture

The EnsembleSeries LDS3506 supports dual x4 PCIe data plane and a x8 PCIe expansion plane interface to integrate additional 3U modules, including mezzanine carriers, FPGA processing modules, and analog to digital conversion functions.

Multiple I/O Options

The EnsembleSeries LDS3506 includes a variety of additional built-in I/O options:

- One 10/100/1000BASE-T Gigabit Ethernet connection routed from the Intel processor to the backplane
- Two 1000BASE-BX SERDES Ethernet connections routed from the Xilinx FPGA to the backplane as per the OpenVPX control plane specification
- Two 10 Gigabit Ethernet (KR) interfaces are routed from the Intel processor to the user I/O space on the backplane
- Two RS-232 serial ports are routed to the backplane
- Backplane USB and SATA interfaces are provided for interfacing to I/O or storage devices as needed
- Multiple GPIO lines act as discrete I/O, usable as I/O or to generate interrupts on the blade
- Multiple additional bused signals enhance the functionality of the EnsembleSeries LDS3506 blade

System Management Plane

Each EnsembleSeries LDS3506 blade implements the advanced system management functionality architected in the OpenVPX standard to enable remote monitoring, alarm management, and hardware revision and health status.

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 the EnsembleSeries LDS3506 blade 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 Field Replaceable Unit (FRU) information
- Be managed remotely by a chassis management controller at the system level

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. VPX is most attractive when paired with the Ruggedized Enhanced Design Implementation standard – REDI (VITA 48). The EnsembleSeries LDS3506 blade is packaged as a 3U conduction-cooled implementation of VPX-REDI, with air-cooled and Air Flow-By™ 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 relatively unskilled 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.

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.

Mercury's OpenVPX Ecosystem

Modern sensor processing subassemblies are customized assemblies of interoperable building blocks built to open standard architectures. Mercury's hardware and software portfolio of building blocks are physically and electrically interoperable as defined by international industrial standards, including OpenVPX.

Additional Features

LDS3506 blades provide all the features typically found on a single-board computer. In addition to the sophisticated management subsystem and fabric interconnect, each EnsembleSeries LDS3506 blade provides users with a toolkit enabling many different application use cases. Features include::

- Thermal and voltage sensors integrated on-board
- Real-time clock with granularity to 1 ms and time measurement of up to 30 years
- General-purpose timers
- Global clock synchronization capabilities via the OpenVPX utility plane clock signals
- Watchdog timer to support interrupt or reset
- Multiple boot paths, include netboot, USB boot, or boot from external SATA

Open Software Environment

Mercury leverages over 35 years of multicomputer software expertise, including recent multicore processor expertise, across its many platforms. This strategy is fully applied to the EnsembleSeries LDS3506 blade. Because the processor, memory, and surrounding technologies are leveraged across product lines, software developed on the LDS3506 blade can interface seamlessly with other Mercury products. The same development and run-time environment is implemented on the LDS3506 blade as on other Mercury platforms across the EnsembleSeries 3000, 5000, and 6000 series.

Specifications

Main processor

Intel 8-core, 64 bit, Xeon D-1548
512 GFLOPS peak performance
AVX 2.0

Optional Processors

Xeon D-1559 or D-1539

Environmental

| VITA - Standard Product Environmental Qualification Levels | | | | | |
|--|--------------------|---|---|--|------------------------------------|
| Rugged Level | | Air-cooled | | | Conduction-cooled |
| | | Commercial L0* | Rugged L1* | Rugged L2* | Rugged L3** |
| 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) |
| | Storage | -40°C to +85°C | -55°C to +85°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 |
| Humidity | Operating* | 10-90%, non-condensing | 5-95%, non-condensing | 5-95%, non-condensing | 5-95%, non- condensing |
| | Storage | 10-90%, non-condensing | 5-95%, non-condensing | 5-95%, non-condensing | 100% condensing |
| Altitude | Operating* | 0-10,000ft | 0-30,000ft | 0-30,000ft | 0-70,000ft |
| | Storage | 0-30,000ft | 0-50,000ft | 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 |
| | Sine | N/A | N/A | N/A | 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, MOTS, BuiltSECURE | | Contact Factory | | | |

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FPGA

Xilinx UltraScale XCKU095

System Memory

8 or 16GB DDR4-2133
16GB SATA NAND Flash

Mechanical

3U OpenVPX, single width (1-inch)

Module packages:

Air-cooled
Conduction-cooled
Air Flow-By

Compliance

OpenVPX System Specification (VITA 65) encompasses:

VITA 46.0, 46.3, 46.4, 46.6, 46.11, and VITA 48.1, 48.2 (REDI) and 48.7
(Air Flow-By)

OpenVPX profile

MOD3-PAY-2F2U

Additional Services

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

* 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.



INNOVATION THAT MATTERS™

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