Intel® I/O Expansion Modules

Hardware Specification

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Revision 1.2

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Enterprise Platforms and Services Division

Revision History

Date	Revision Number	Modifications
March 2009	1.0	Initial Release.
November 2009	1.1	Added AXXIBQDRIOMOD.
September 2010	1.2	Added new SAS modules and IB QDR modules.

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1. Introduction

The Intel® Server Boards support a variety of Intel® I/O Expansion Module options using x4 PCI Express* Gen2 Mezzanine connectors on the server board. Each mezzanine connector is a 50-pin, surface mount, 0.8 mm pitch header.

The Intel® I/O Expansion Modules are designed to fit Intel® Server Boards. The table below shows the support matrix for the Intel® I/O Expansion Modules.

Table 1. I/O Module Support Matrix

Intel® I/O Expansion Module	Product Code	S5000PAL	S5400SF	S5520UR	S5500WB	S5520HC	S5520SC	S5500BC	SR1680MV	S3420GPRX
Single Connector										
Dual-port Intel 82571EB GbE	AXXGBIOMOD	✓	✓	✓	✓	×	×	×	×	✓
External 4-port SAS (LSI1064e)	AXXSASIOMOD	✓	✓	✓	✓	×	×	×	×	✓
Single-port InfiniBand* (SDR)	AXXIBIOMOD	✓	✓	✓	×	×	×	×	×	×
Double Connector										
Dual-port Intel 82598EB 10GbE*	AXX10GBIOMOD	×	×	✓	✓	×	×	×	✓	×
4-port Intel 82576EB GbE*	AXX4GBIOMOD2	×	×	✓	✓	×	×	×	×	✓
Single-port InfiniBand* (QDR)	AXXIBQDRIOMOD	×	×	✓	×	×	×	×	×	×
Single-port InfiniBand* (QDR)	AXXIBQDRSR169X	×	×	×	✓	×	×	×	×	×
Single-port InfiniBand* (QDR)	AXXIBQDRIOMV	×	×	×	×	×	×	×	✓	×
SAS Controllers										
4-port Internal SAS (LSI1064e)*	AXX4SASMOD	×	×	✓	✓	✓	✓	×	×	✓
4-port Internal SAS HW RAID (LSI1078)*	AXXROMBSASMR	×	×	✓	✓	✓	✓	×	×	✓
8-port 6Gb Integrated RAID (LSI2108)	AXXRMS2MH080	×	×	✓	✓	×	×	×	×	×
4-port/8-port 6Gb RAID (LSI2008)	AXXRMS2LL040 / AXXRMS2LL080	×	×	✓	✓	✓	✓	×	×	✓
4-port/8-port 6Gb RAID (LSI2008)	AXXRMS2AF040 / AXXRMS2AF080	×	×	✓	✓	✓	✓	×	×	✓

The following table details the pin-out of the I/O module connector.

Table 2. 50-pin I/O Module Connector Pin-Out

Pin	Name	Pin	Name
1	3V3_STBY	2	3V3_STBY
3	PE_RST_G2_PM_N	4	GND
5	GND	6	PE0_DUAL_TX_DP<0>
7	GND	8	PE0_DUAL_TX_DN<0>
9	PE0_DUAL_RX_DP<0>	10	GND
11	PE0_DUAL_RX_DN<0>	12	GND
13	GND	14	PE0_DUAL_TX_DP<1>
15	GND	16	PE0_DUAL_TX_DN<1>
17	PE0_DUAL_RX_DP<1>	18	GND
19	PE0_DUAL_RX_DN<1>	20	GND
21	GND	22	PE0_DUAL_TX_DP<2>
23	GND	24	PE0_DUAL_TX_DN<2>
25	PE0_DUAL_RX_DP<2>	26	GND
27	PE0_DUAL_RX_DN<2>	28	GND
29	GND	30	PE0_DUAL_TX_DP<3>
31	GND	32	PE0_DUAL_TX_DN<3>
33	PE0_DUAL_RX_DP<3>	34	GND
35	PE0_DUAL_RX_DN<3>	36	GND
37	GND	38	CLK_100M_LP_PE_P
39	GND	40	CLK_100M_LP_PE_N
41	PE_WAKE_N	42	GND
43	3V3	44	3V3
45	3V3	46	3V3
47	3V3	48	3V3
49	3V3	50	3V3

2. Dual Port GbE I/O Module (AXXGBIOMOD)

The dual Gigabit (Gb) I/O module provides two additional 10/100/1000Mbit external connections. This section provides a high-level description of the implementation of this I/O module.

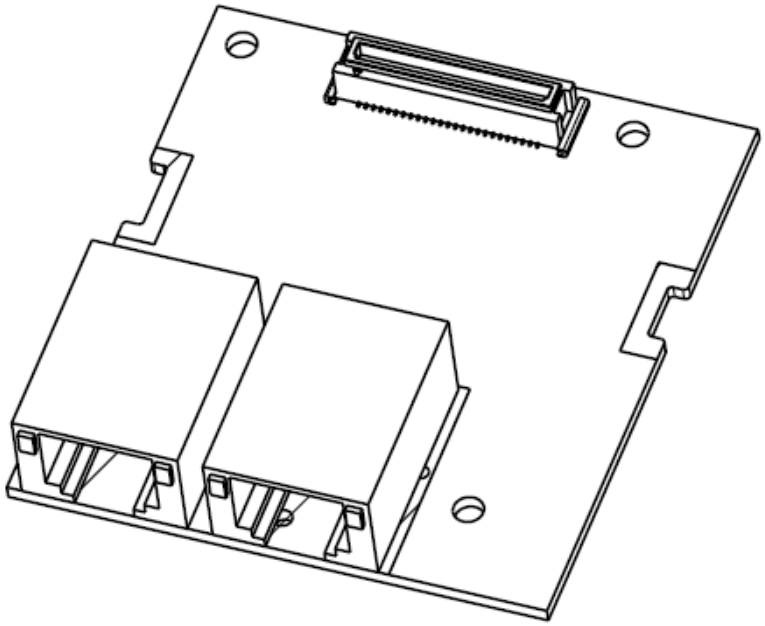


Figure 1. Dual Port GbE I/O Module

2.1 Feature Set

The dual Gb Ethernet I/O module supports the following feature set:

Intel® 82571EB Gb Ethernet Controller

- Dual port
- Ethernet interface for 1000BASE-T, 100BASE-TX, and 10BASE-T
- Can be implemented in a very small area
- Onboard System Management Bus (SMB) ports
- PCI Express* x4 interface

Supports two external Gb Ethernet ports

2.2 Functional Block Diagram

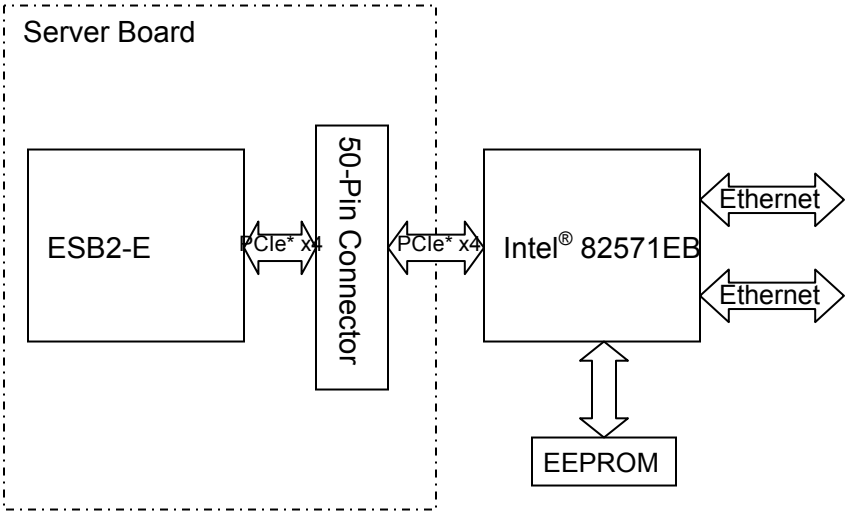


Figure 2. Dual Gb Ethernet I/O Module Block Diagram

2.3 Mechanical Dimensions

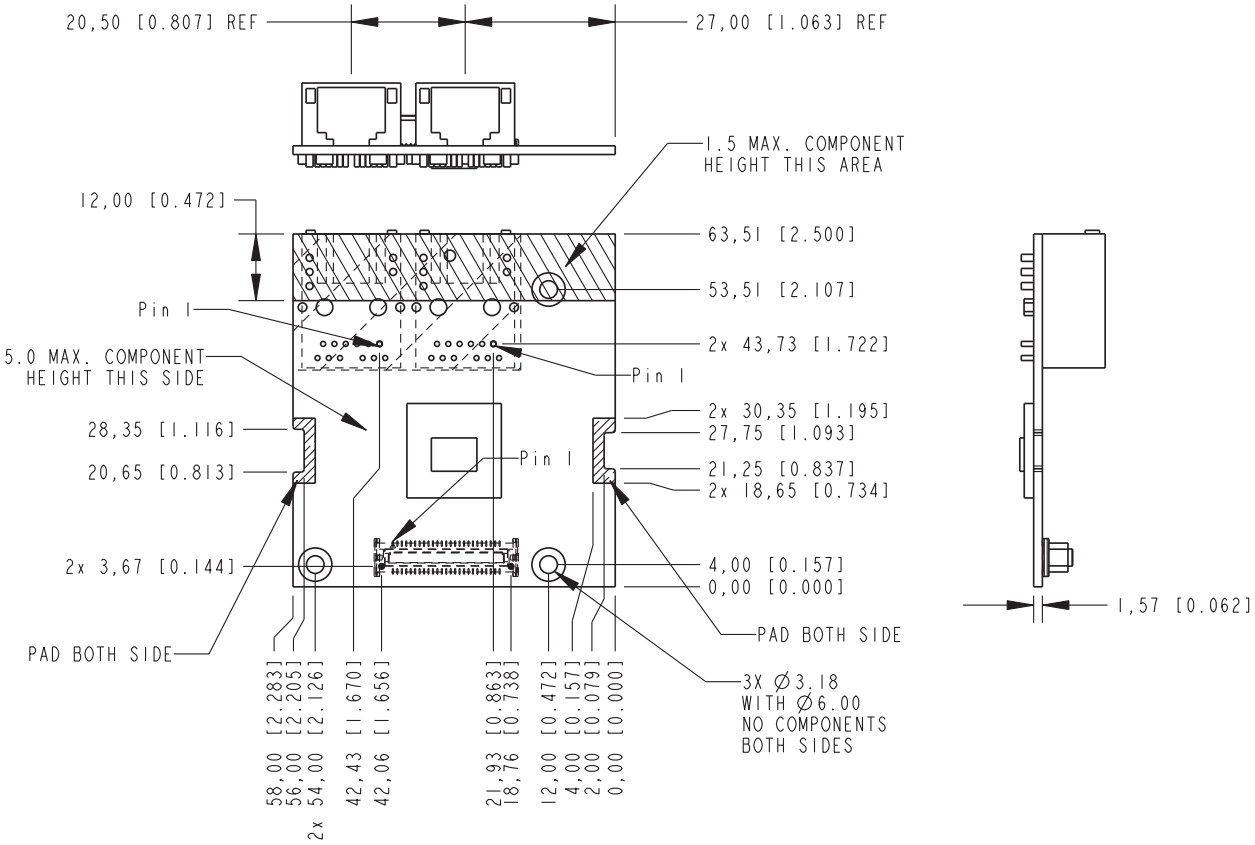


Figure 3. Dual Gb Ethernet I/O Module Dimensions; Top and Side Views

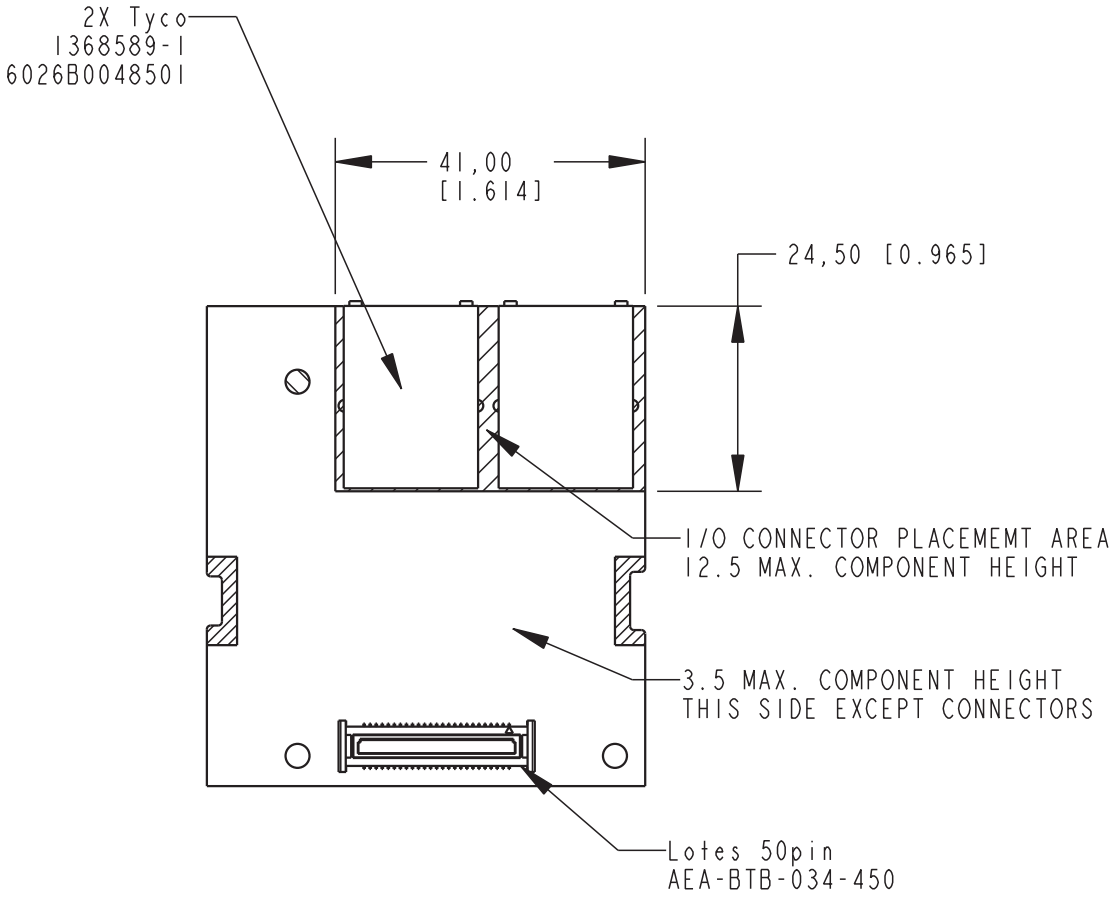


Figure 4. Dual Gb Ethernet I/O Module Dimensions; Bottom View

2.4 Intel® 82571EB Gb Ethernet Controller

The Intel® 82571EB Gb Ethernet Controller is a single, compact component with two fully integrated Gb Ethernet Media Access Control (MAC) and physical layer (PHY) ports. This device uses the PCI Express* architecture (Rev. 1.0a) and also enables a dual-port Gb Ethernet implementation. The Intel® 82571EB Gb Ethernet Controller provides two IEEE 802.3 Ethernet interfaces for 1000BASE-T, 100BASE-TX, and 10BASE-T applications. Both ports also integrate a Serializer-Deserializer (SerDes) to support 1000BASE-SX or 1000BASE-LX (optical fiber) and Gb backplane applications. In addition to managing MAC and PHY Ethernet layer functions, the controller manages PCI Express* packet traffic across its transaction, link, and physical/logical layers.

The Intel® 82571EB Gb Ethernet Controller for PCI Express* is designed for high-performance and low memory latency. The device is optimized to connect to a system Memory Control Hub (MCH) using up to four PCI Express* lanes. Wide internal data paths eliminate performance bottlenecks by efficiently handling large address and data words. Combining parallel and pipelined logic architecture optimized for Gb Ethernet and for independent transmit and receive queues, the controller efficiently handles packets with minimum latency. The controller includes advanced interrupt-handling features and uses efficient ring-buffer descriptor data structures with up to 64 packet descriptors cached on chip. A large 48 Kbyte per port on-chip packet buffer maintains superior performance. Using hardware acceleration, the controller offloads tasks from

the host, such as checksum calculations for Transmission Control Protocol (TCP), User Datagram Protocol (UDP), and Internet Protocol (IP); header and data splitting; and TCP segmentation.

2.5 EEPROM

The Dual Gb Ethernet I/O module provides a SPI serial EEPROM to store configuration and informational data. This includes pre-boot configuration data, MAC addresses, and serial numbers for the 82571EB.

2.6 PCI Express* x4 Connector

The Dual Gb Ethernet I/O module contains one 50-pin connector.

2.7 Ethernet Magjack

The Dual Gb Ethernet I/O module contains two Ethernet Magjacks which are compatible with 10/100/1000 Mbps Ethernet connection.

3. External 4 Port SAS I/O Module (AXXSASIOMOD)

The SAS I/O module provides the availability to connect up to four external SAS ports to an Intel® Server Board. This section provides a high-level description of the implementation of this Intel® I/O Expansion Modules.

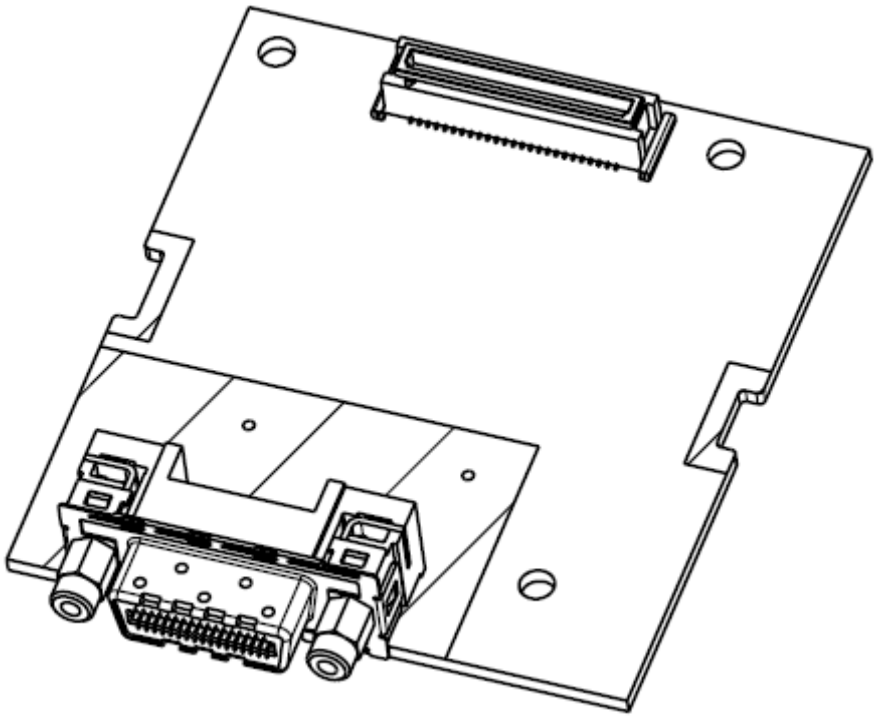


Figure 5. External 4 Port SAS I/O Module (AXXSASIOMOD)

3.1 Feature Set

The SAS I/O module supports the following feature set:

LSI* LSISAS1064E SAS/SATA controller

- Four-port, 3.0 Gbit/s SAS/SATA controller
- Integrated Arm966 microprocessor core
- Compliant with Fusion-MPT* architecture
- x4 PCI Express*

Provides four external SAS/SATA ports for connecting multiple SAS/SATA devices.

3.2 Functional Block Diagram

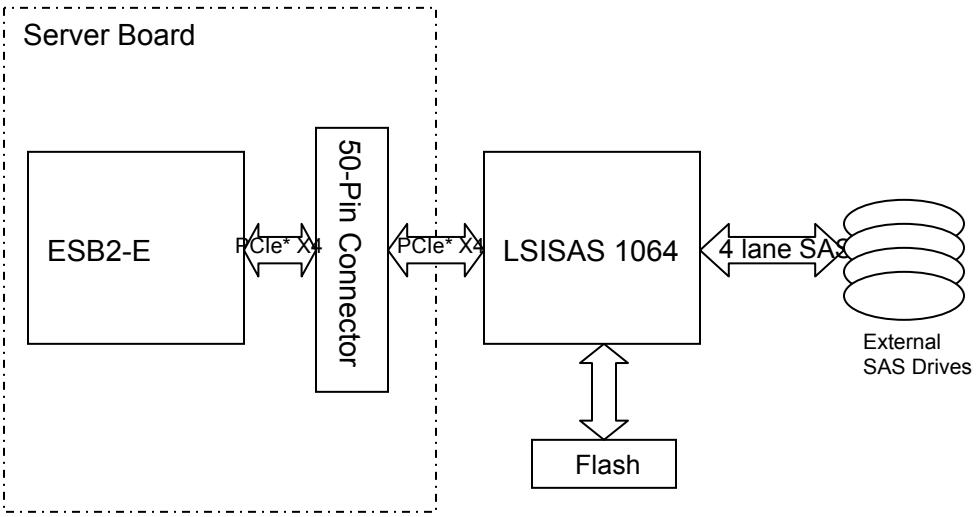


Figure 6. External SAS I/O Module Block Diagram

3.3 Mechanical Dimensions

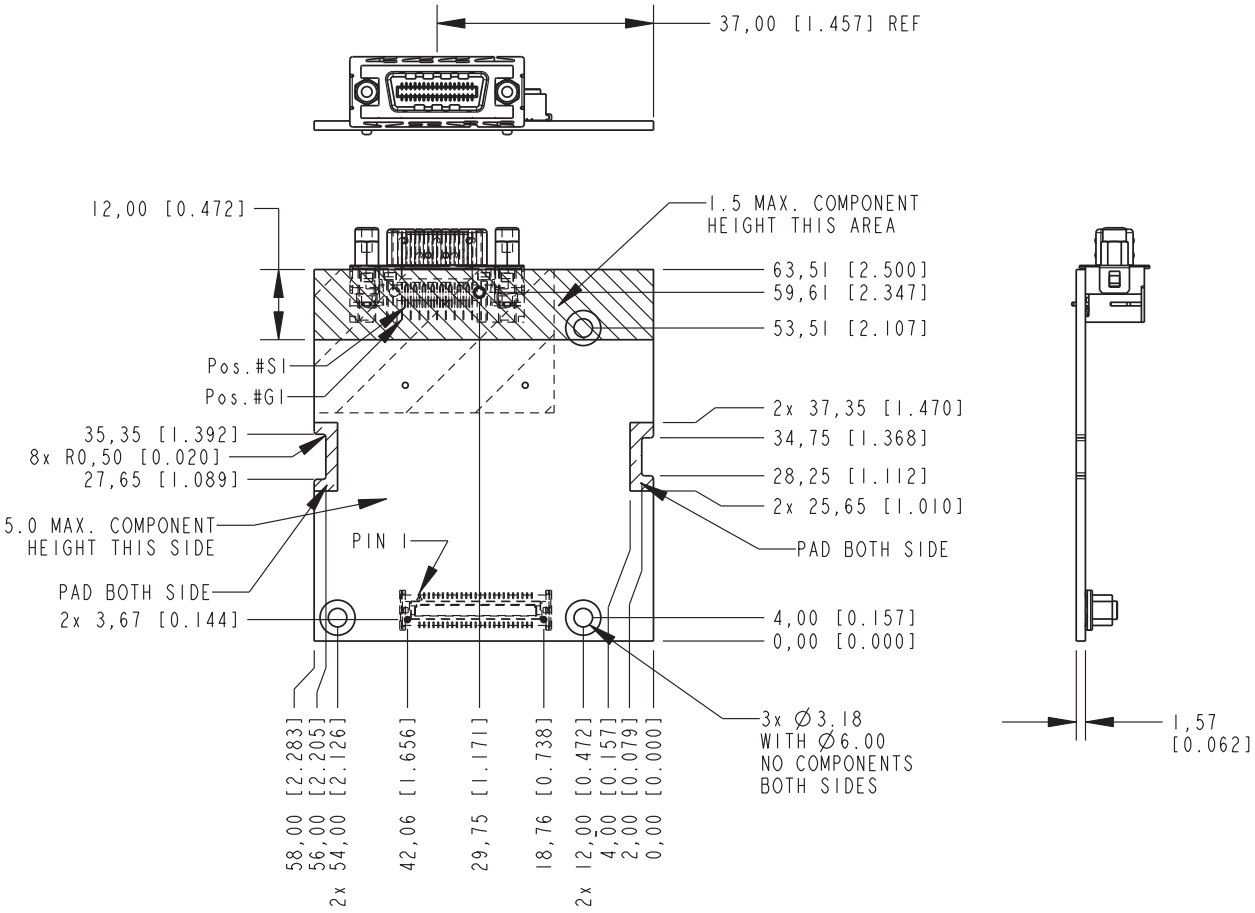


Figure 7. SAS I/O Module Dimensions; Top and Side Views

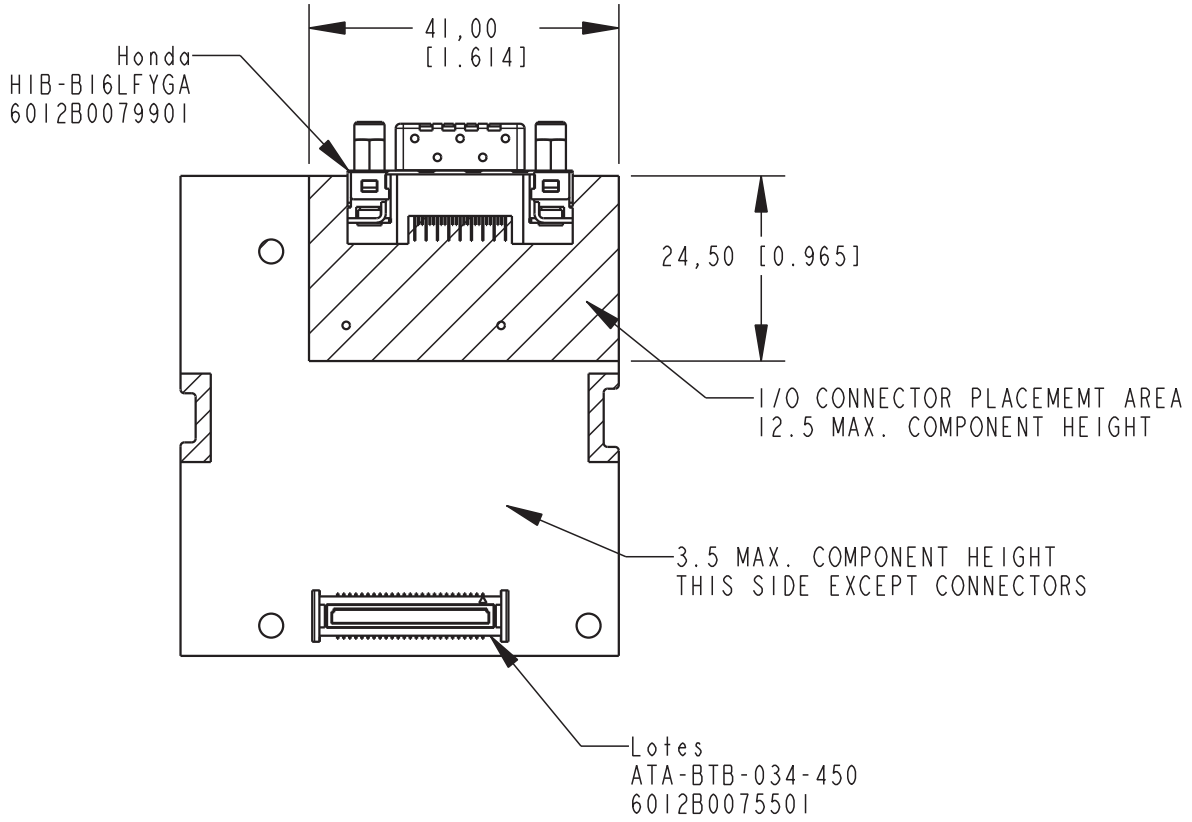


Figure 8. SAS I/O Module Dimensions; Bottom View

3.4 LSI* SAS1064E 3.0 Gbit/s Serial Attached SCSI Controller

Integrated on the SAS I/O module is an LSI* SAS1064E Serial Attached SCSI (SAS) controller. The LSISAS1064E is a four-port, 3.0 Gbit/s SAS/SATA controller compliant with the Fusion-MPT* architecture, and provides a four-lane PCI Express* interface. The point-to-point interconnect feature of the PCI Express* bus limits the electrical load on links, allowing increased transmission and reception frequencies. PCI Express* transmission and reception data rates for each full-duplex interconnect is 2.5 Gbit/s.

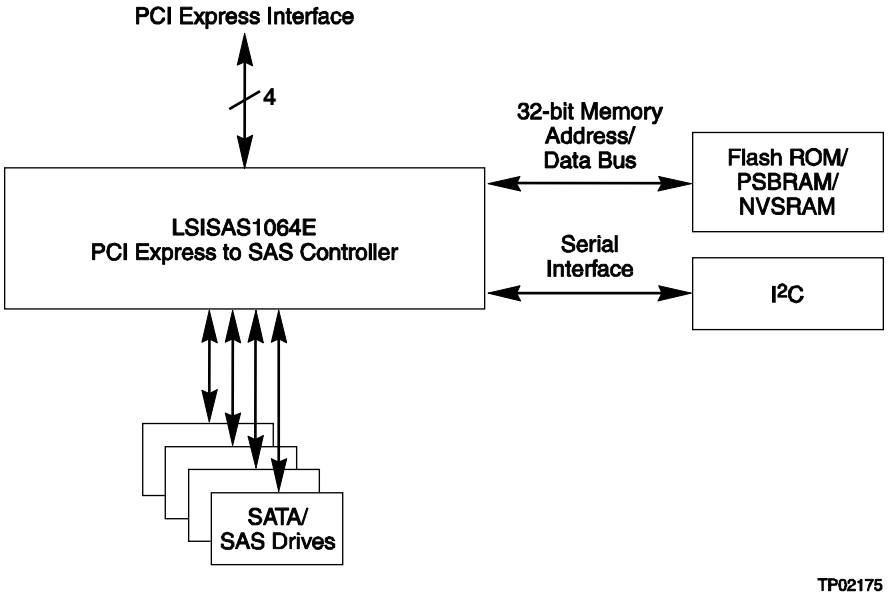


Figure 9. LSI* SAS1064E Block Diagram

PCI Express* implements a switch-based technology to interconnect a large number of devices. Communication over the serial interconnect is accomplished using packet-based communication protocol. Quality of Service (QOS) features provide differentiated transmission performance for different applications. Hot plug/hot swap support enables “always-on” systems. Enhanced error handling features, such as end-to-end CRC (ECRC) and Advanced Error Reporting, make PCI Express suitable for robust, high-end server applications. Hot plug, power management, error handling, and interrupt signaling are accomplished using packet-based messaging rather than sideband signals.

Each of the four SAS PHYs on the LSISAS1064E is capable of SAS/SATA link rates of 3.0 Gbit/s and 1.5 Gbit/s. The user can configure ports as wide or narrow. Narrow ports have one PHY per port. Wide ports have two, three, or four PHYs per port. Each port supports the SSP, SMP, STP, and SATA protocols.

The SAS interface uses the proven SCSI command set to ensure reliable data transfers, while providing the connectivity and flexibility of point-to-point serial data transfers. The SAS interface provides improved performance, simplified cabling, smaller connectors, lower pin count, and lower power requirements when compared to parallel SCSI. SAS controllers leverage an electrical and physical connection interface that is compatible with Serial ATA technology.

The LSISAS1064E uses the Fusion-MPT* (Message Passing Technology) architecture, which features a performance-based message passing protocol that offloads the host CPU by completely managing all I/Os and minimizes system bus overhead by coalescing interrupts. The proven Fusion-MPT* architecture requires only thin, easy-to-develop device drivers independent of the I/O bus. LSI* Logic provides these device drivers.

3.4.1 Features of the LSI* SAS1064E

SAS and SSP features:

- Each PHY supports 3.0 Gbit/s and 1.5 Gbit/s SAS data transfers
- Provides a serial, point-to-point, enterprise-level storage interface
- Supports wide transfers consisting of 2, 3, or 4 PHYs
- Supports narrow ports consisting of a single PHY
- Transfers data using SCSI information units
- Compatible with SATA target devices

SATA and STP Features:

- Supports 3.0 Gbit/s and 1.5 Gbit/s SATA data transfers
- Supports 3.0 Gbit/s and 1.5 Gbit/s STP data transfers

Usability features:

- Simplifies cabling with point-to-point, serial architecture
- Provides drive spin-up sequencing control
- Provides up to two LED signals for each SAS/SATA PHY to indicate drive activity and faults
- Provides an SGPIO interface

3.5 External Flash Memory

The SAS I/O module provides a non-volatile 2X8Mbit Flash memory device that stores the configuration data and operating firmware executed by the LSI1064E embedded CPU.

3.6 PCI Express* x4 Connector

The SAS I/O Module contains one 50-pin SFF-8470 connector matching the one available on the Intel® S5000PAL Server Board.

3.7 External 4 SAS Connector

The SAS I/O module contains a x4 SAS/SATA connector which allows connections to four external SAS devices. The pin-out of the external SAS connector is detailed in the following table.

Table 3. External SAS x4 Connector Pin-Out

Pin	Name
S1	SAS0_C_RX_DP
S2	SAS0_C_RX_DN
S3	SAS1_C_RX_DP
S4	SAS1_C_RX_DN
S5	SAS2_C_RX_DP
S6	SAS2_C_RX_DN
S7	SAS3_C_RX_DP
S8	SAS3_C_RX_DN
S9	SAS3_C_TX_DN
S10	SAS3_C_TX_DP
S11	SAS2_C_TX_DN
S12	SAS2_C_TX_DP
S13	SAS1_C_TX_DN
S14	SAS1_C_TX_DP
S15	SAS0_C_TX_DN
S16	SAS0_C_TX_DP
1	GND
2	GND
3	GND
4	GND
5	GND
6	GND
7	GND
8	GND
9	GND
10	GND
11	GND

4. InfiniBand* (SDR) Module (AXXIBIOMOD)

The 4X SDR InfiniBand* I/O module is based on the Mellanox InfiniHost* MT25204 device with the integrated Physical Layer SerDes. This card has a single 4X InfiniBand* copper port for connecting InfiniBand* traffic at up to 10Gbps. This section provides a high-level description of the implementation of this I/O module. This module is expected to end-of-life with the S5000PAL/S5400SF server boards, not available for extended life support

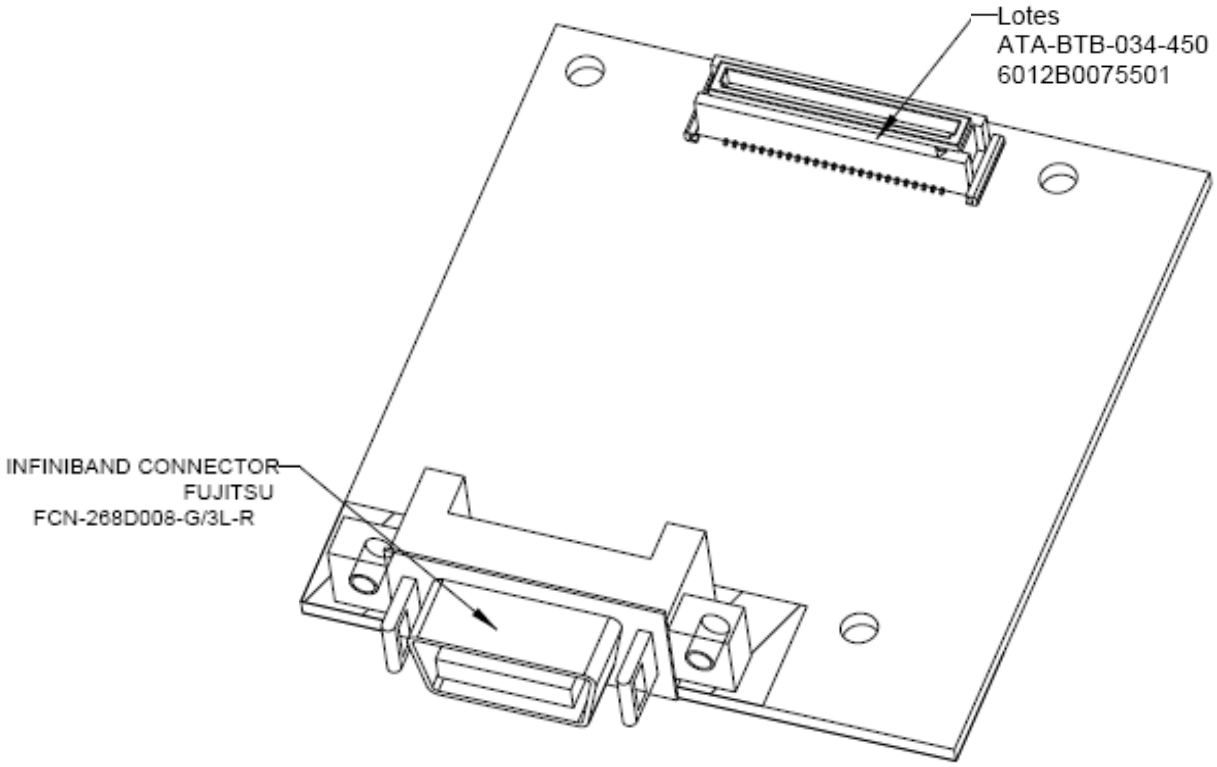


Figure 10. Single InfiniBand* (SDR) Module (AXXIBIOMOD)

4.1 Feature Set

The InfiniBand* I/O module supports the following feature set:

- 3.3V 4x PCI Express* interface
- InfiniHost* Lx MT25204 controller chip with integrated InfiniBand* SerDes
- One 10Gbps copper port (with 4X IB connector)
- 16MBits SPI Flash memory for firmware and configuration
- 32KBytes EEPROM for VPD data
- LEDs for physical and logical link status
- Power supply circuitry that generates 1.8V and 1.2V rails

4.2 Functional Block Diagram

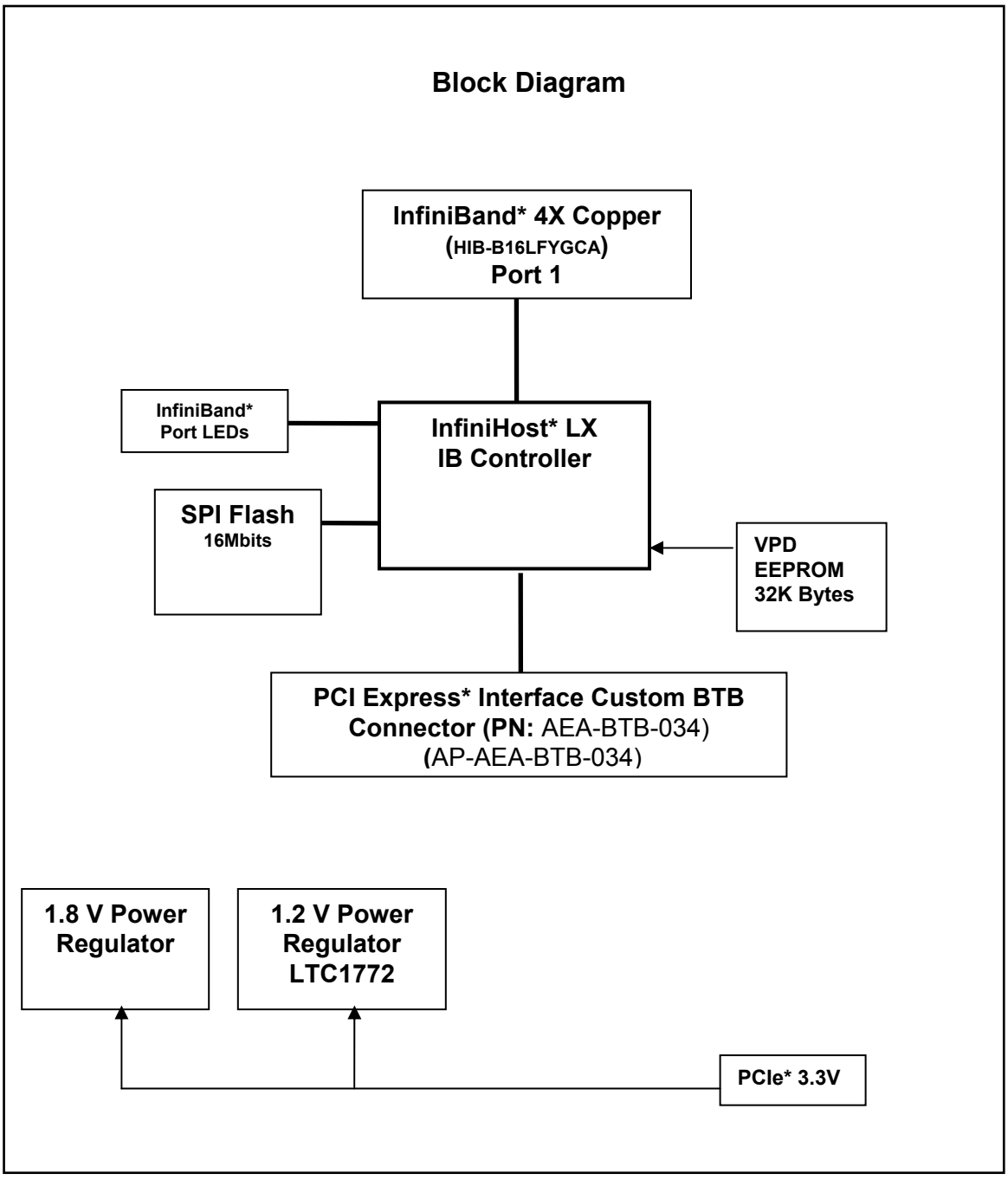


Figure 11. InfiniBand* I/O Module Block Diagram

4.3 Mechanical Dimensions

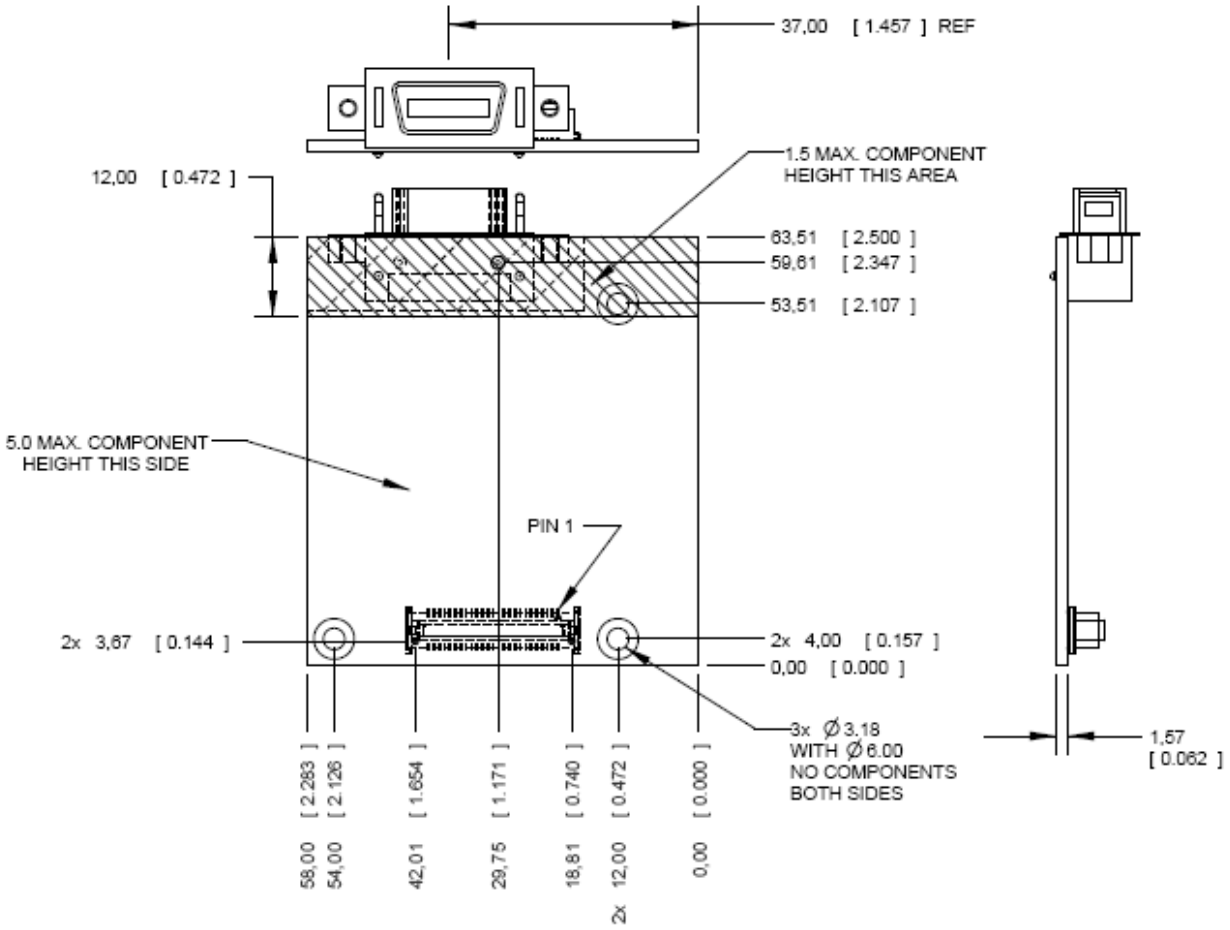


Figure 12. InfiniBand* I/O Module Dimensions; Top and Side Views

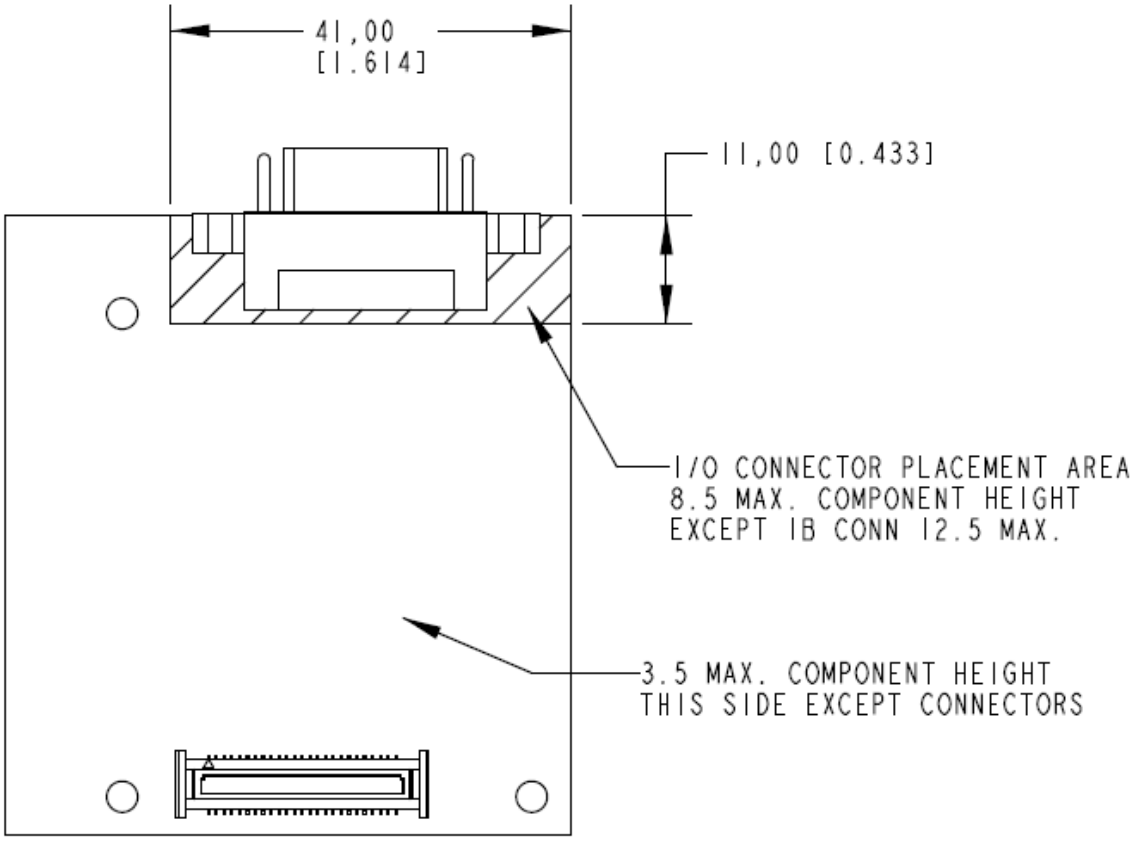


Figure 13. InfiniBand* I/O Module Dimensions; Bottom View

4.4 LED Functionality

The InfiniBand* I/O module has two LEDs for debug only. They are not visible from the rear panel.

Physical Link LED (Green)

Steady On: Physical link established

Off: Physical link error, poor connection quality, or no physical connection

Activity LED (Yellow)

Steady On: Data transferring to/from the card across the wire (solid stream)

Blinking: Data transferring to/from the card across the wire

Off: Logical link error or no Rx Char detected

4.5 PCI Express* x4 Connector

The InfiniBand* I/O Module contains one 50-pin connector.

4.6 External Connector

The InfiniBand* I/O module contains an x4 InfiniBand* connector which allows a 10 Gbps connection to the InfiniBand* Fabric.

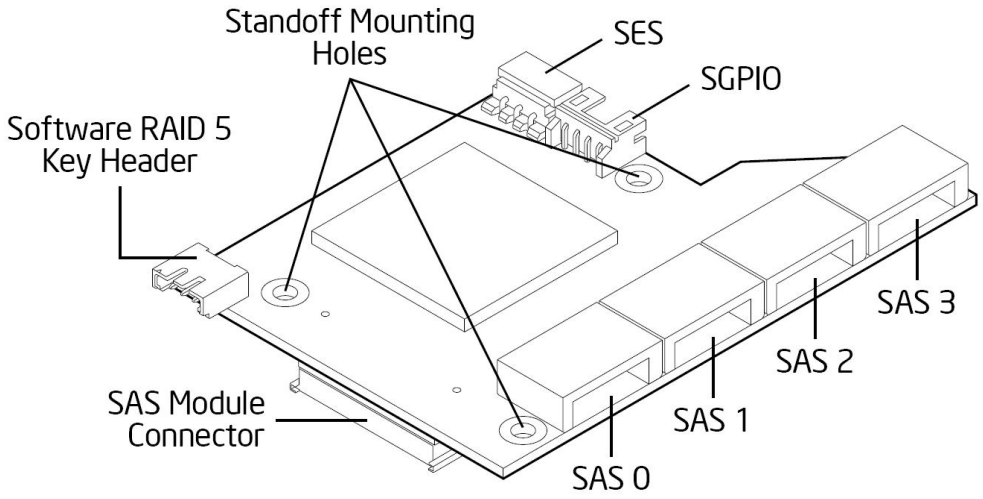
5. Internal 4-port LSI 1064e SAS I/O Module (AXX4SASMOD)

The optional Intel® SAS Entry RAID Module AXX4SASMOD includes a SAS1064e controller that supports x4 PCI Express* link widths and is a single-function PCI Express* end-point device. The SAS controller supports the SAS protocol as described in the Serial Attached SCSI Standard, version 1.0, and also supports SAS 1.1 features. A 32-bit external memory bus off the SAS1064e controller provides an interface for Flash ROM and NVSRAM (Non-volatile Static Random Access Memory) devices.

The optional Intel® SAS Entry RAID Module AXX4SASMOD provides four SAS connectors that support up to four hard drives with a non-expander backplane or up to eight hard drives with an expander backplane.

For more details refer to the *Intel® SAS Entry RAID Module Hardware Specification.*

5.1 Major Component Diagram



Connector	Reference Designators	Connector Type	Pin Count
SAS Connector 0-3	J1B2, J2B1, J3B2, J3B3	Header	7
SES	J2A1	Header	3
SGPIO	J2A2	Header	4
Software RAID 5 Key Header	J1A1	Key holder	3
SAS Module Connector	J3M1	Mezzanine slot	50

Figure 14. Intel® SAS Entry RAID Module AXX4SASMOD Component and Connector

5.2 Functional Block Diagram

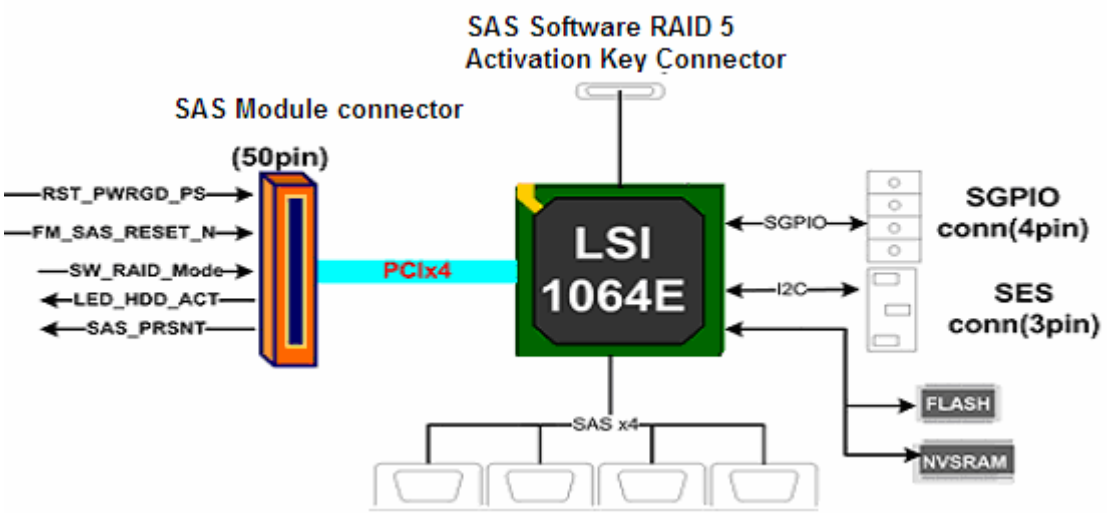


Figure 15. Intel® SAS Entry RAID Module AXX4SASMOD Functional Block Diagram

5.3 Feature Set

LSI* LSISAS1064E SAS/SATA controller

- Four-port, 3.0 Gbit/s SAS/SATA controller
- Integrated Arm966 microprocessor core
- Compliant with Fusion-MPT* architecture
- x4 PCI Express*

Provides 4 SAS/SATA ports for connecting multiple SAS/SATA devices

Intel® Embedded Server RAID Technology II mode provides RAID 0, RAID 1, RAID 10, and RAID 5 support. RAID 5 is available with optional RAID 5 activation key accessory (AXXRAKSW5).

IT/IR RAID mode supports entry hardware RAID 0, RAID 1, RAID 10, RAID 10E, and native SAS pass through mode.

Serial General Purpose Input/Output (SGPIO) connector and SCSI Enclosure Services (SES) support for hard drive backplane LED control

Table 4. AXX4SASMOD Storage Mode

Storage Mode	Description	RAID Types and Levels Supported	Driver	RAID Management Software	RAID Software User's Guide
IT/IR RAID	4 SAS Ports Up to 10 SAS or SATA drives via expander backplanes	Native SAS pass through mode without RAID function. Entry Hardware RAID. RAID 1 (IM mode) RAID 10/10E (IME mode) RAID 0 (IS Mode)	SAS MPT driver (Fully open-source driver) Broad OS support	Intel® RAID Web Console 2	*IT/IR RAID Software User's Guide*
SW RAID	4 SAS Ports Up to 8 SAS or SATA drives via expander backplanes	SW RAID 0/1/10 standard SW RAID 5 with optional AXXRAKSW5	ESRTII Driver Microsoft Windows* and selected Linux* Versions only	Intel® RAID Web Console 2	*Intel® RAID Software User's Guide*

5.4 Mechanical Drawings

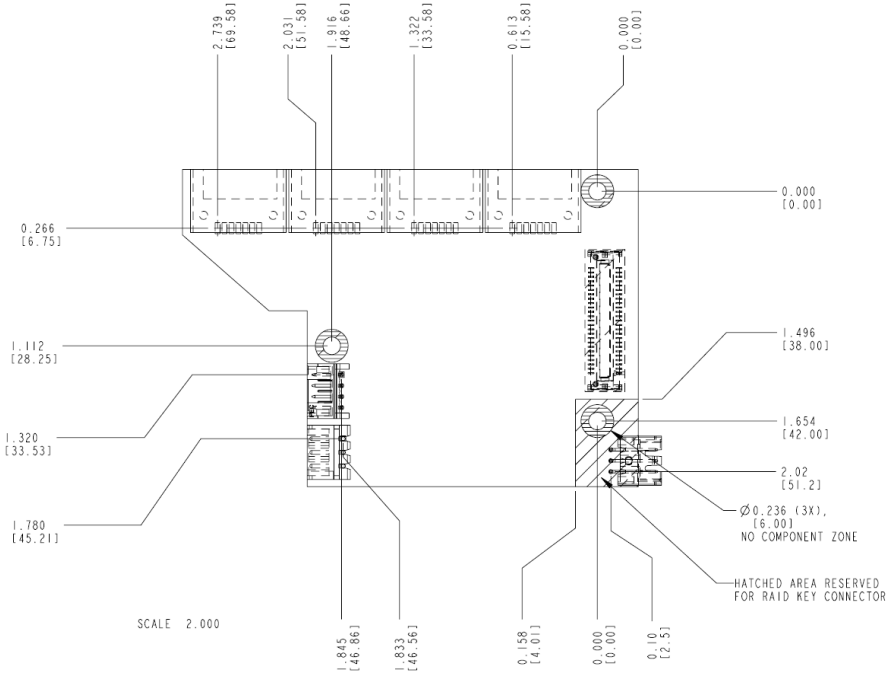


Figure 16. AXX4SASMOD Mechanical Dimensions (Top View)

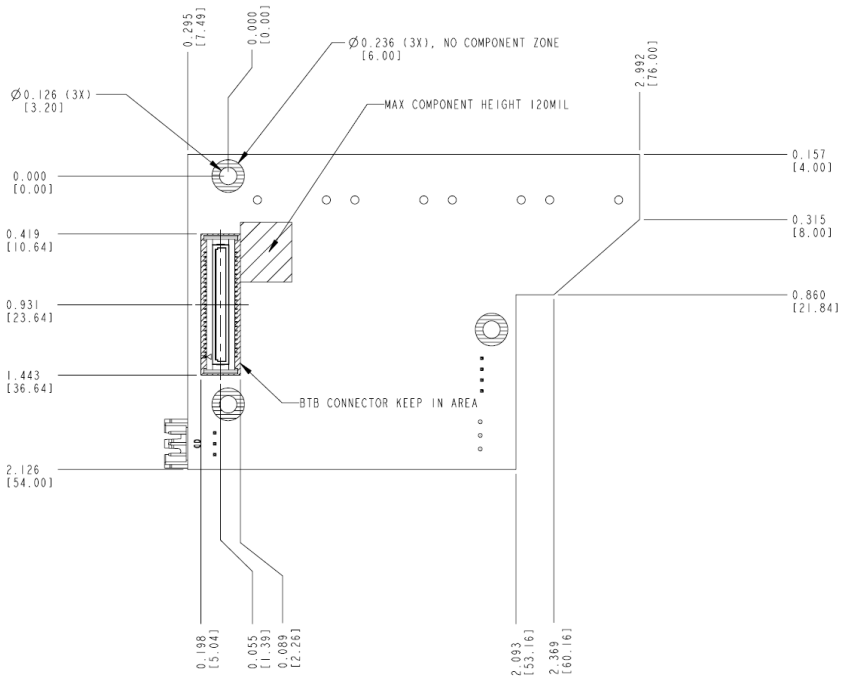


Figure 17. AXX4SASMOD Mechanical Dimensions (Bottom View)

6. Integrated RAID Module SROMBSASMR (AXXROMBSASMR)

The Internal 4-port SAS module based on LSI 1078e* controller supports RAID hardware. For more information, refer to the *Intel® Integrated RAID Controller SROMBSASMR (AXXROMBSASMR) Technical Product Specification*.

6.1 Product Overview

The Intel® Integrated RAID Controller SROMBSASMR supports both enterprise-class serial ATA (SATA) and serial-attached SCSI (SAS) disk drives, which allows customized solutions for performance, reliability, system expansion flexibility, and hard drive capacity. It provides such flexibility and helps lower the total cost of ownership with a standardized server and storage infrastructure.

This RAID controller is designed with four internal SAS/SATA ports through four individual connectors and uses a custom board-to-board 50-pin connector to provide x4 PCI Express* support.

6.2 Hardware Architectural Features

Table 5. Hardware Architectural Features

Feature	Intel Integrated RAID Controller SROMBSASMR
RAID Levels	0, 1, 5, 6, 10, 50, 60
Number of devices	Up to 16 devices per controller
Device types	SAS and SATA hard drives
Data transfer rate	300 MB/s per port
PCI bus	50-pin board-to-board connector with x4 PCI Express*
Memory	128 MB ECC DDR2 667 MHz SDRAM Integrated on the controller
Battery backup (optional)	Intel® RAID Smart Battery AXXRSBBU3
SAS/SATA connector	Four internal SAS/SATA connectors
ROC	LSI* 1078 SAS ROC which performs hardware-exclusive OR (XOR) assistance
Weight	46 oz
Serial port	4-pin serial debug (requires transceiver)
Compatible devices	16 physical devices, 64 logical drives, mixed capacity, SAS and SATA hard drives; non-disk devices including expanders
Firmware	4 MB in flash ROM

6.3 Block Diagram

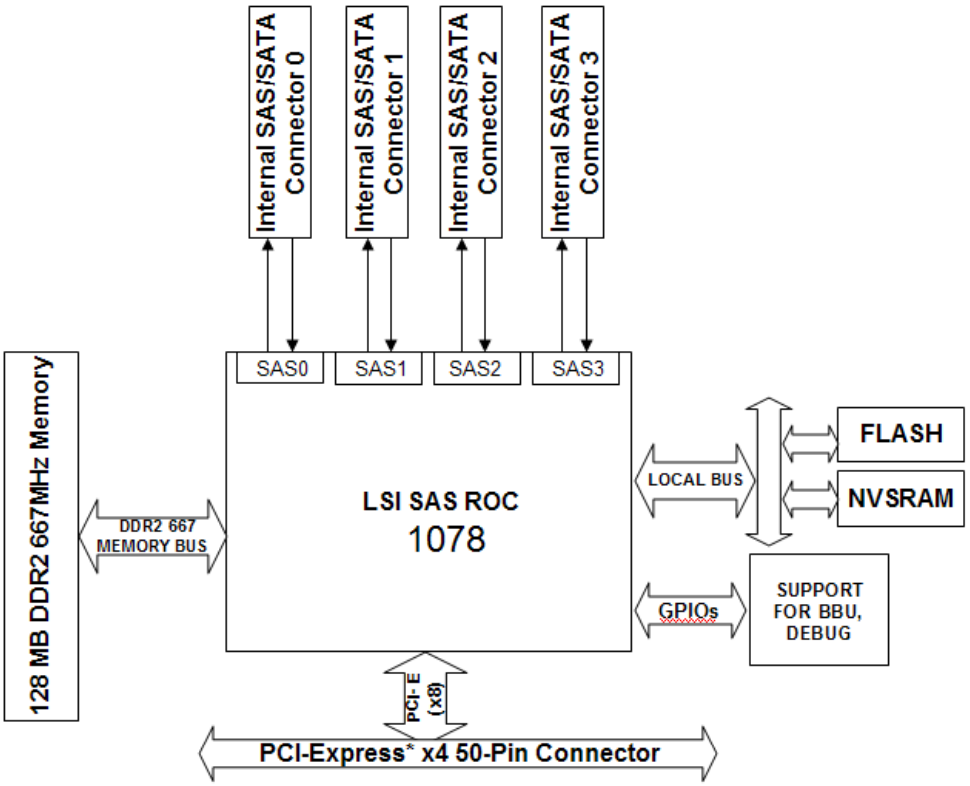


Figure 18. Hardware Block Diagram

6.4 Controller Layout

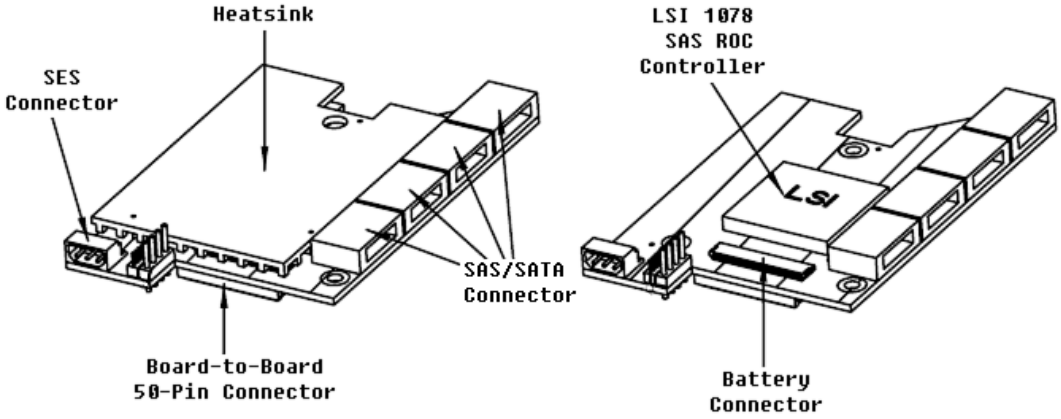


Figure 19. Intel® Integrated RAID Controller SROMBSASMR Physical Layout

6.4.1 Mechanical Drawings

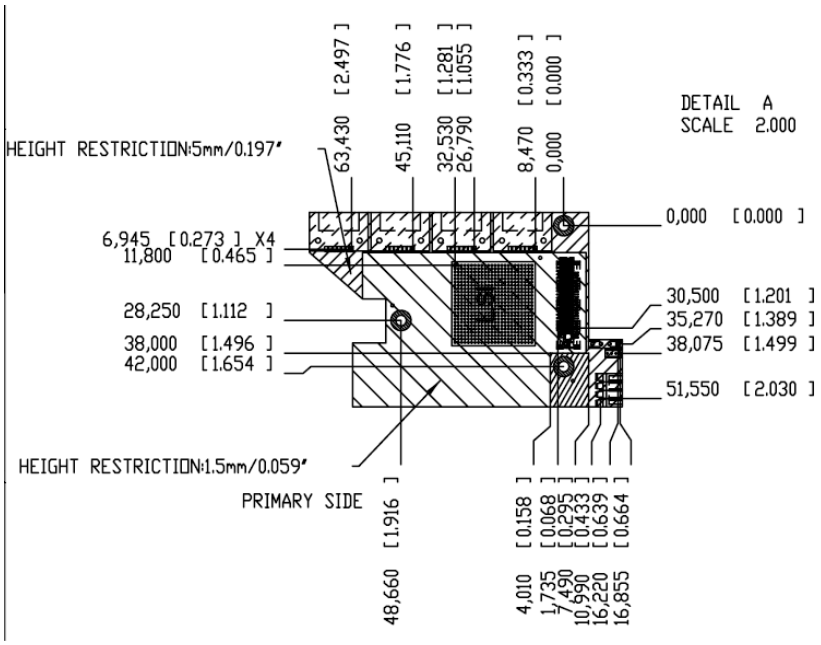


Figure 20. Primary Side

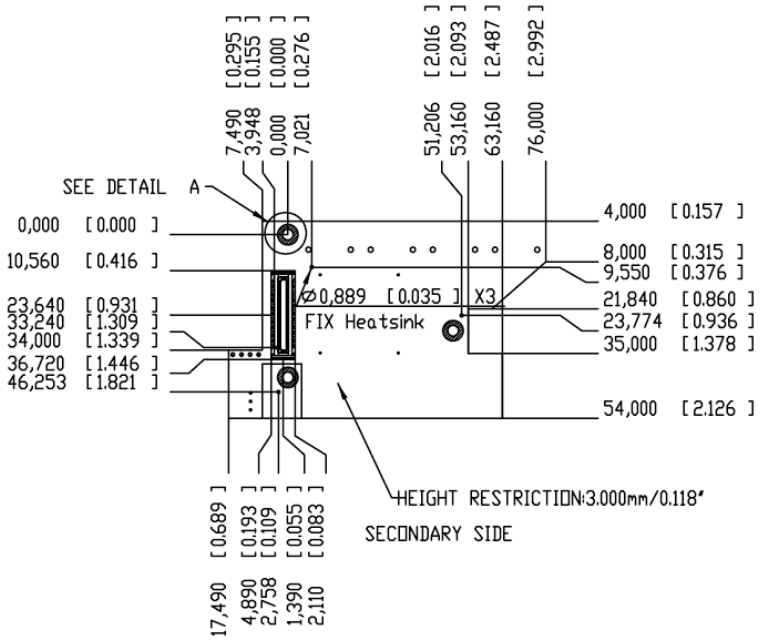
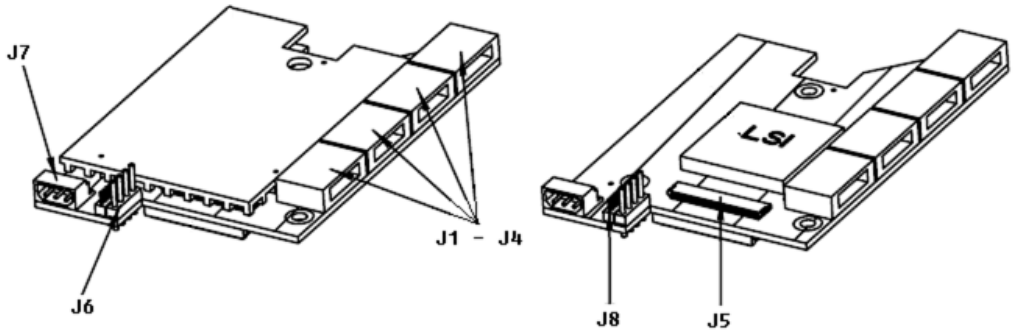


Figure 21. Secondary Side

6.4.2 Jumpers and Connectors



Jumper/Connector	Description	Type	Comments
J1-J4	Internal SAS/SATA Port Connector, Ports 0-3	N/A	Connection to SAS/SATA devices: ▪ J1 = SAS/SATA Port 0 ▪ J2 = SAS/SATA Port 1 ▪ J3 = SAS/SATA Port 2 ▪ J4 = SAS/SATA Port 3
J5	Board-to-board Connector for Battery Backup Unit	20-pin connector	Provides an interface to the daughter card that contains the battery backup unit.
J6	Universal Asynchronous Receiver/Transmitter (UART)	4-pin connector	For factory and debug use
J7	Keyed I2C Connector	3-pin keyed connector	Out-of-band enclosure management (SES2)
J8	Debug Connector	4-pin connector	Reserved

Figure 22. Jumpers and Connectors

7. Quad Port GbE I/O Module (AXX4GBIOMOD2)

The dual Intel® 82576 Gb NIC I/O module provides four additional 1 Gbit external Ethernet connections.

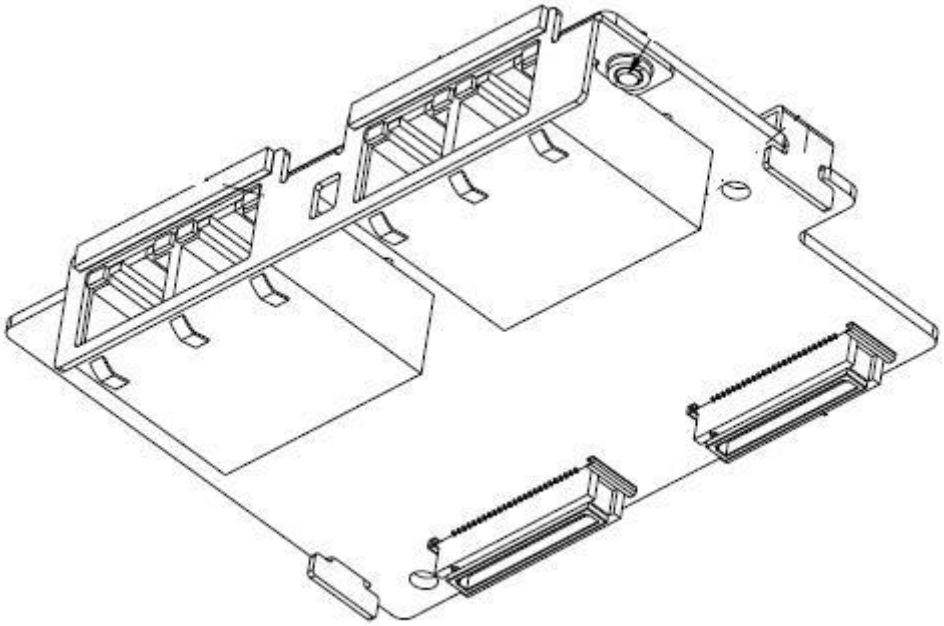


Figure 23. Quad-Port GbE I/O Module (AXX4GBIOMOD2)

7.1 Feature Set

The quad-port Gb Ethernet I/O module supports the following feature set:

Intel® 82576 Gb Ethernet Controller

- Dual Ethernet Interface
  - Support IOAT V3.0
  - Virtualization Ready
  - PCI Express* x4 Gen2 interface

Supports four external 1 Gb Ethernet ports by using two NIC chips.

7.2 Functional Block Diagram

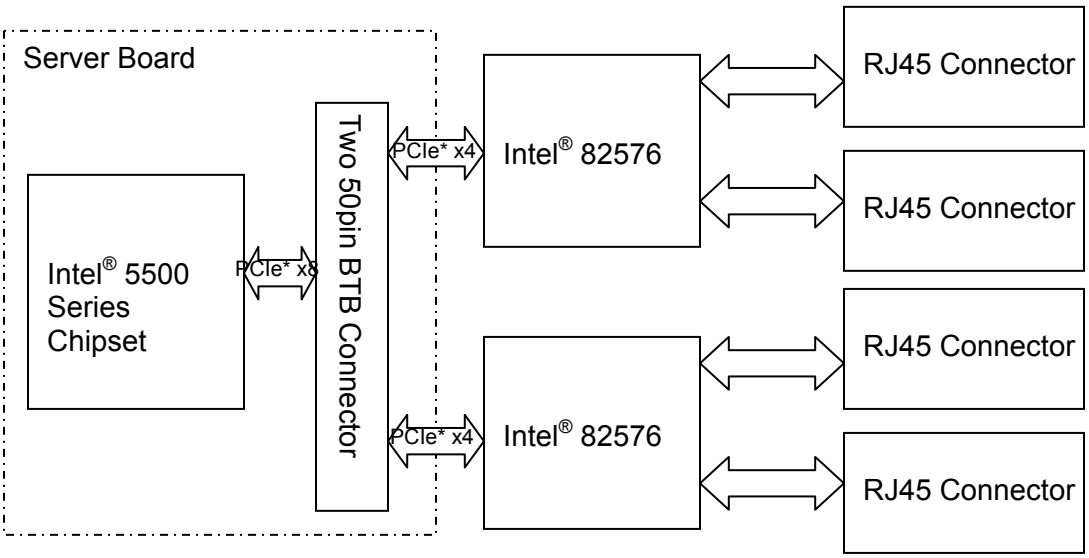


Figure 24. Quad-port Gigabit Ethernet I/O Module Block Diagram

7.3 Mechanical Drawings

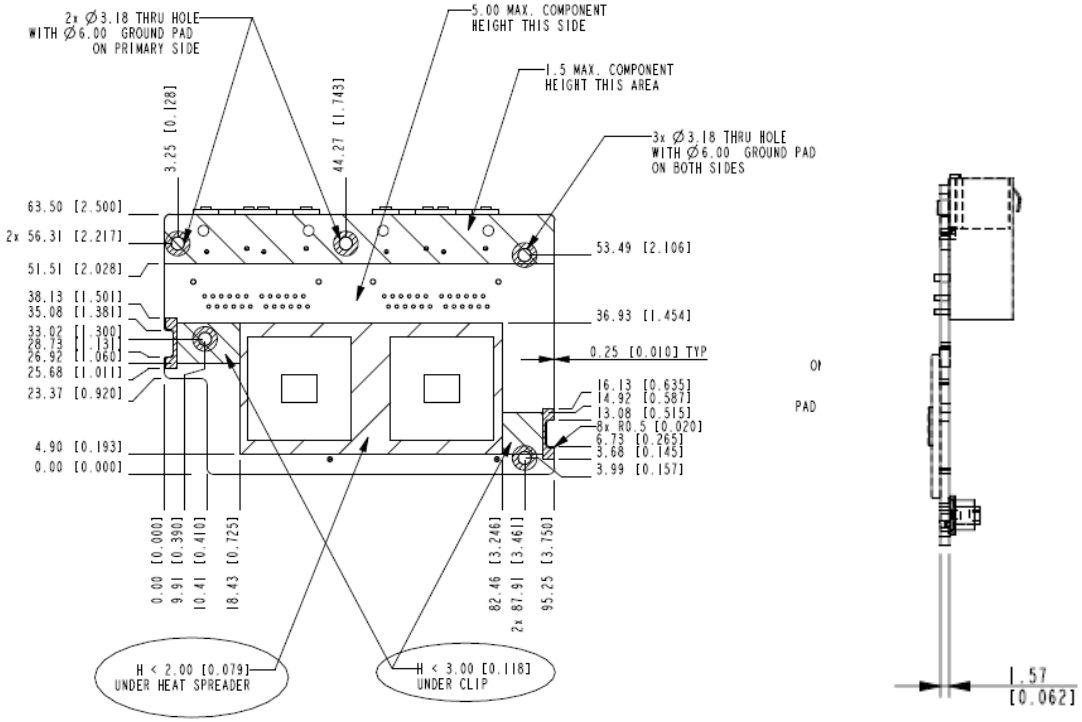


Figure 25. Quad-Port GbE I/O Module Mechanical Drawing

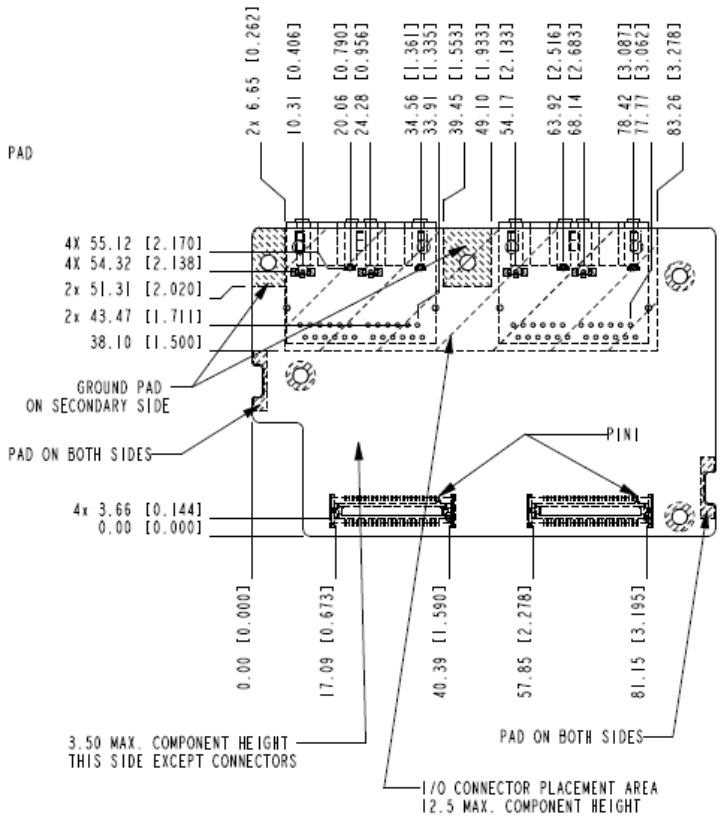


Figure 26. Quad-Port GbE I/O Module Mechanical Drawing

7.4 Intel® 82576 1 Gb Ethernet Controller

The Intel® 82576 1 Gb Ethernet Controller is a single, compact component with two fully integrated 1 Gb Ethernet Media Access Control (MAC).

The Intel® 82576 supports X4 PCI-Express Gen2 connection, and support I/OAT V3.0 (Input/Output Acceleration Technology). These give the device a high-performance and low-host memory access latency feature. In addition, the wide internal data path eliminates performance bottlenecks by efficiently handling large address and data words. To further optimize the latency from system level, the PCI-Express* x8 interface is directly connected to IOH.

7.5 EEPROM

The Quad Port Gb Ethernet I/O module provides a SPI serial EEPROM to store configuration and informational data. This includes pre-boot configuration data, MAC address, and serial numbers for the 82576.

7.6 PCI Express* x8 Connector

The I/O module contains two 50-pin connectors to provide X8 PCI Express* Gen2 interface. They mate with I/O module connector available on the Intel® Server Boards S3420GPRX, S5520UR and S5500WB.

7.7 Gbit Ethernet Connector

The Quad Port Gb Ethernet I/O module contains four 1 Gbit Ethernet Magjack connectors.

8. Dual Port 10GbE I/O Module (AXX10GBIOMOD)

The dual 10 Gb I/O module provides two 10 Gbit external Ethernet connections. This section provides a high level description of the implementation of this I/O module.

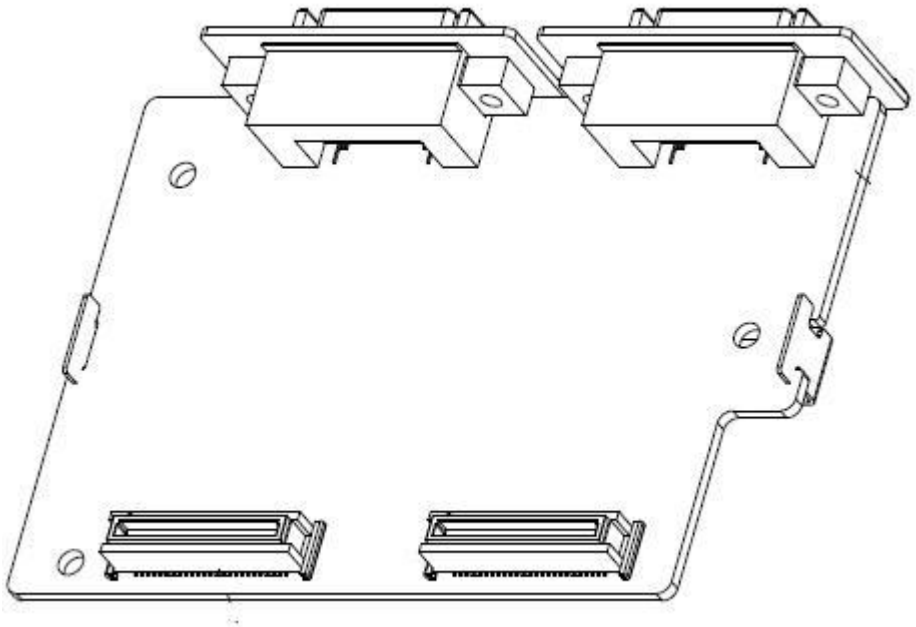


Figure 27. Dual Port 10GbE I/O Module

8.1 Feature Set

The dual 10 Gb Ethernet I/O module supports the following feature set:

Intel® 82598EB 10 Gb Ethernet Controller

- Dual CX4 port
- Support IOAT V2.0
- Virtual Queue for Virtualization
- Can be implemented in small form factor for 10 Gbit Ethernet function
- PCI Express* x8 Gen2 interface

Supports two external CX4 10 Gb Ethernet ports

Support active cable (copper-fiber optic-copper)

8.2 Functional Block Diagram

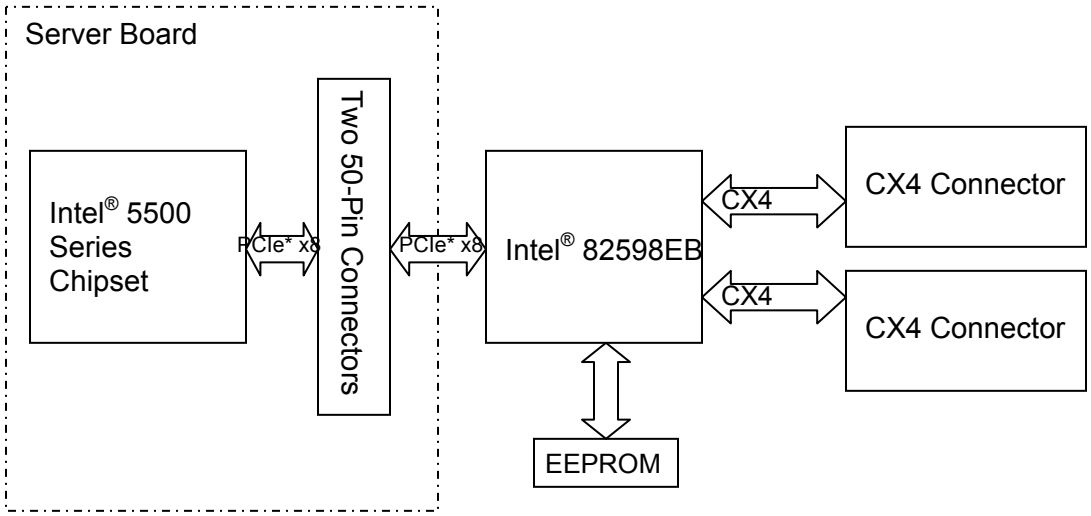


Figure 28. Dual 10 Gb Ethernet I/O Module Block Diagram

8.3 Mechanical Drawings

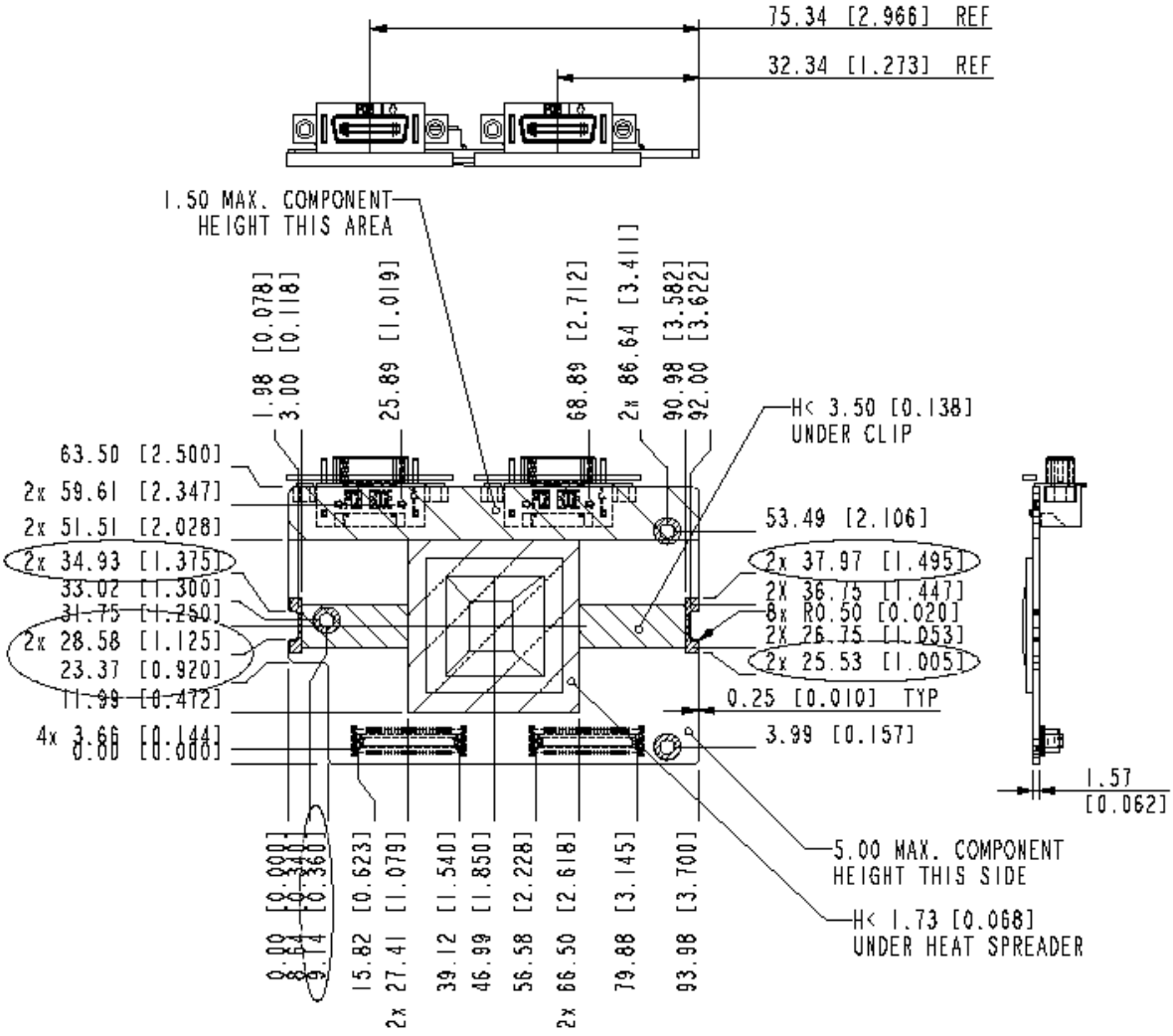


Figure 29. Dual 10 Gb Ethernet I/O Module Dimensions: Top and Side Views

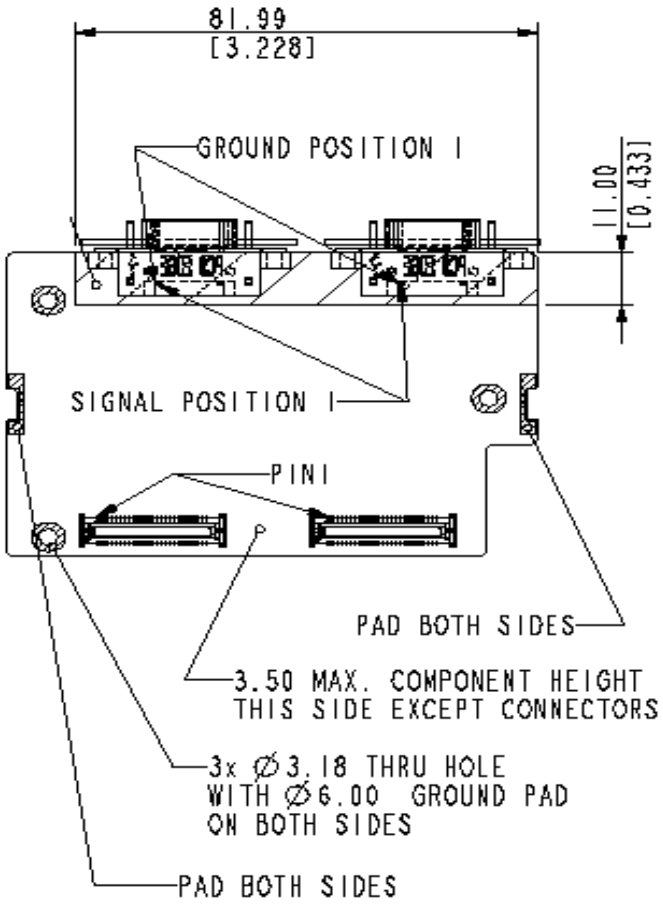


Figure 30. Dual 10 Gb Ethernet I/O Module Dimensions: Bottom View

8.4 Intel® 82598 10 Gb Ethernet Controller

The Intel® 82598EB 10 Gb Ethernet Controller is a single, compact component with two fully integrated 10 Gb Ethernet Media Access Control (MAC) and XAUI ports.

The Intel® 82598EB is a follow-on design to the prior generations of Intel® 1Gbit, 10 Gbit Ethernet controllers. It provides new features and retains many of its predecessors' features.

The Intel® 82598EB supports X8 PCI-Express Gen2 connection and I/OAT V2.0 (Input/Output Acceleration Technology). These give the device a high-performance and low-host memory access latency feature. In addition, the wide internal data path eliminates performance bottlenecks by efficiently handling large address and data words. The parallel and pipelined logic combined architecture is optimized for Ethernet and independent transmit and receive queues, this means the 82598EB can process the packet with minimum latency. To further optimize the latency from system level, the PCI-Express* x8 interface is connected to IOH directly.

8.5 EEPROM

The Dual Gb Ethernet I/O module provides a SPI serial EEPROM to store configuration and informational data. This includes pre-boot configuration data, MAC addresses, SMBus Address, and serial numbers for the 82598EB.

8.6 PCI Express* x8 Connector

The Dual 10 Gb Ethernet I/O module contains two 50-pin connectors to provide x8 PCI Express* Gen2 interface. They mate with I/O module connector available on the Intel® Server Boards S5520UR and S5500WB.

8.7 CX4 Ethernet Connector

The Dual Gb Ethernet I/O module contains two CX4 10 Gbit Ethernet connectors compatible with 10 Gbit Ethernet CX4 connections. The CX4 port embeds the feature which can support active cable (copper-fiber optic – copper), so it enlarges the distance of the 10 Gbit Ethernet connections from 10 m up to 100 m.

9. InfiniBand* (QDR) I/O Modules

The 4X InfiniBand* QDR I/O module is based on the Mellanox InfiniHost* MT25408 device with the integrated Physical Layer SerDes. This card has a single 4X InfiniBand* copper port for connecting InfiniBand* traffic at up to 40Gbps. This section provides a high-level description of the implementation of this I/O module.

9.1 Support Matrix

Table 6. Support Matrix Data

Product Code	MM#	S5520UR	S5500WB	SR1680MV
AXXIBQDRIOMOD	902559	Yes	No	No
AXXIBQDRSR169X	909786	No	Yes	No
AXXIBQDRIOMV	904810	No	No	Yes

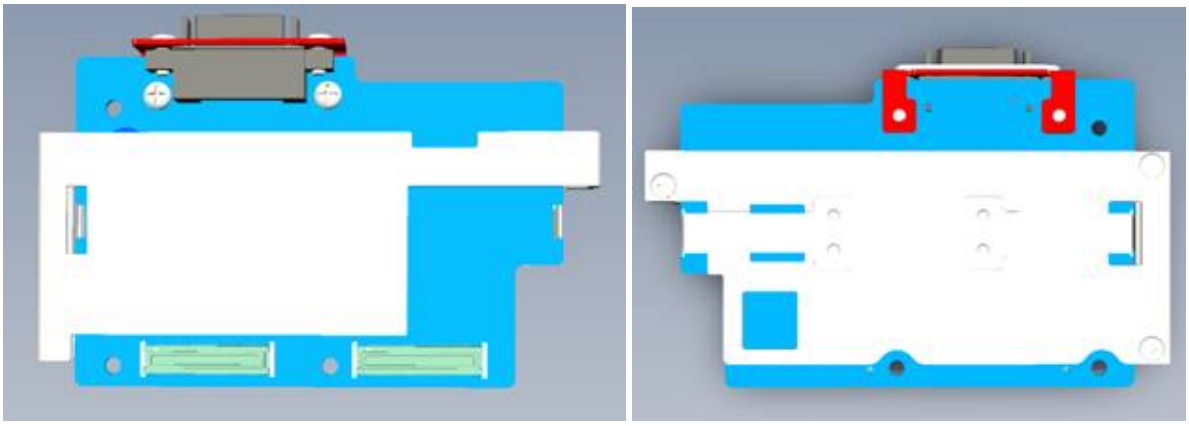


Figure 31. AXXIBQDRIOMO

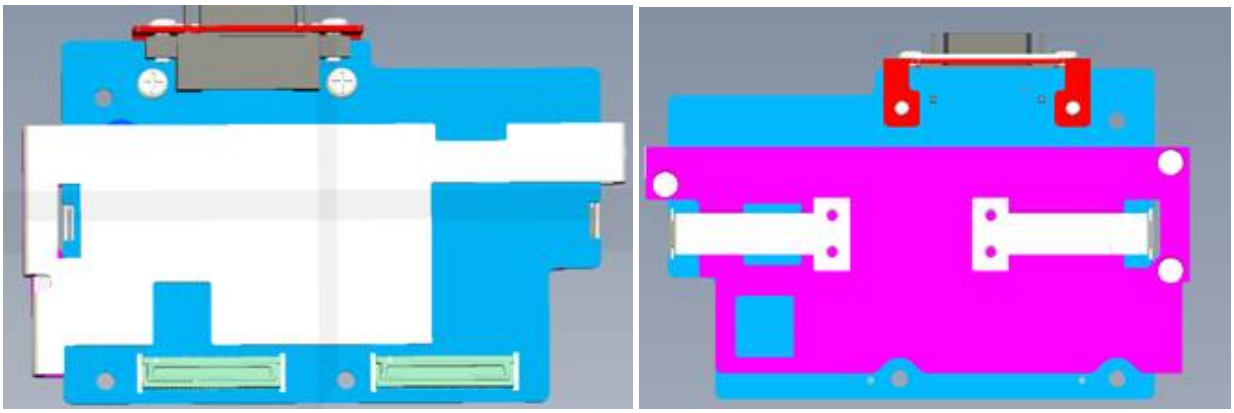


Figure 32. AXXIBQDRSR169X

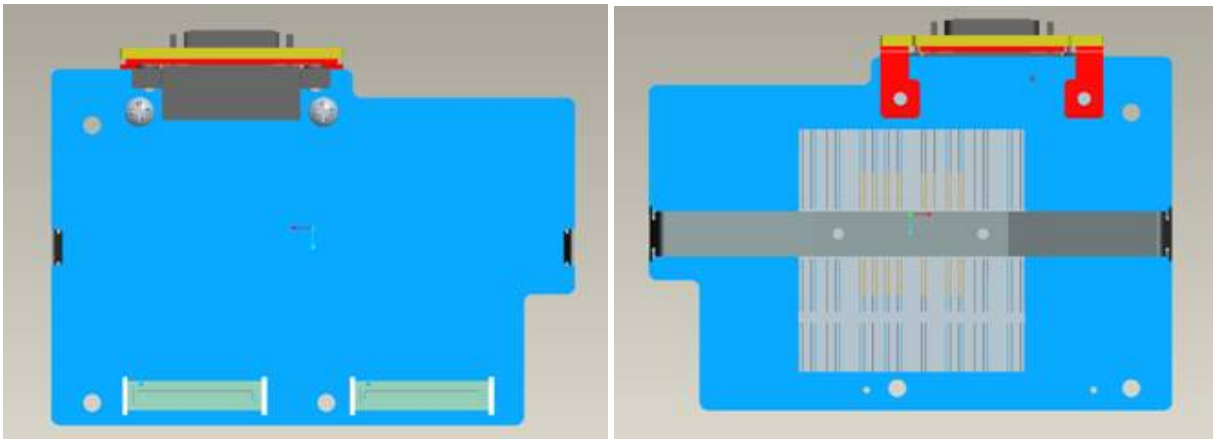


Figure 33. AXXIBQDRIOMV

9.2 Feature List

The InfiniBand* QDR I/O module supports the following feature set:

8x PCI Express* Gen2 interface

InfiniHost* MT25408 controller chip with integrated InfiniBand* SerDes

One 40Gbps copper port (with 4X IB connector)

16MBytes SPI Flash memory for firmware and configuration

LEDs for physical and logical link status

Power supply circuitry that generates 1.2V, 1.8V and 1.2V rails

9.3 Functional Block Diagram

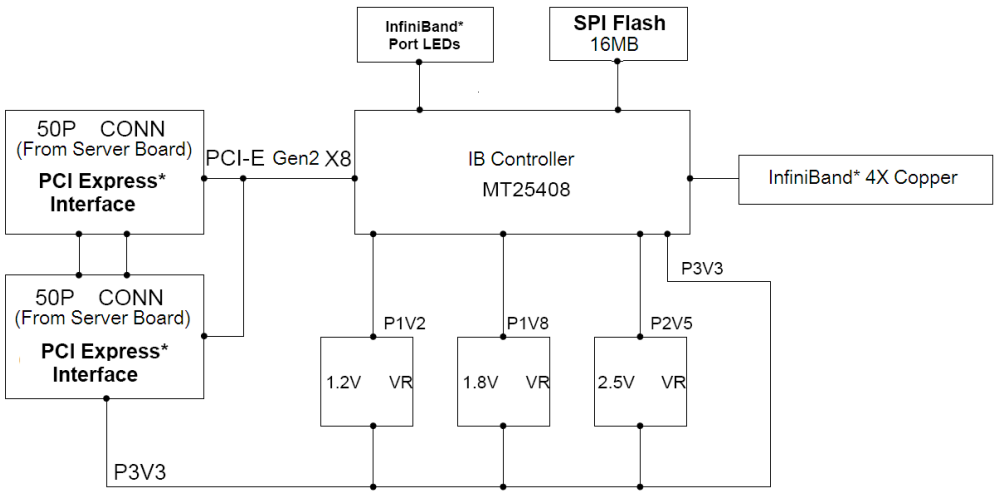


Figure 34. InfiniBand* (QDR) I/O Module Block Diagram

9.4 LED Functionality

The InfiniBand* I/O module has two debug LEDs. They are not visible from the rear panel.

Physical Link LED (Green)

Steady On: Physical link established
Off: Physical link error, poor connection quality, or no physical connection

Activity LED (Yellow)

Steady On: Data transferring to/from the card across the wire (solid stream)
Blinking: Data transferring to/from the card across the wire
Off: Logical link error or no Rx Char detected

9.5 PCI Express* x4 Connector

The InfiniBand* I/O Module contains two 50-pin connectors

9.6 External Connector

The InfiniBand* I/O module contains an x4 InfiniBand* connector which allows a 40 Gbps connection to the InfiniBand* Fabric.

10. Intel® Integrated RAID Module RMS2MH080

The Inte|® Integrated RAID Module RMS2MH080 is an intelligent custom board-to-board PCI Express* 2.0 compliant interface RAID adapter with an integrated LSI* SAS2108 RAID-On-Chip chipset, providing both a SAS controller and RAID engine. With 512MB RAM built onto the board and eight independent ports supporting 6-Gbps and 3 Gbps SAS data transfers using two SFF-8087 mini multi-lane connectors, this controller supports up to 32 enterprise-class SAS or SATA devices and 64 logical drives. The PCI Express* connector fits into a 50 pin connector capable of performance up to 5 Gbps per lane. Support for intelligent XOR RAID levels 0, 1, 5, 6, 10, 50, and 60. For more details see the *Intel® Integrated RAID Module RMS2MH080 (AXXRMS2MH080) Hardware User's Guide*.

10.1 Technical Specifications

Table 7. RMS2MH080 Specifications

Specification	Intel® Integrated RAID Module RMS2MH080
Processor	LSI* 2108 Integrated RAID on Chip 800MHz
Operating voltage	+3.3 V
Interface to host	Custom board-to-board x8 PCI Express* 2.0 compliant interface
SATA Bus Speed	Up to 6 Gbps per port, point-to-point
SAS/SATA ports	2x4 internal ports, 16 devices
Physical and virtual drive support	16 drivers per controller and 64 logical devices
Firmware	8 MB in reflashable flash ROM
Compatible devices	•2.5-inch and 3.5-inch SAS or SATA II drives including SSD drives •Non disk devices including expanders •Can support drives of mixed capacity
Cabling	Small thin cables that do not restrict airflow and Shared connectors for multiple drives
Redundant configuration	32 KB NVRAM and config-on-disk (COD)
Enclosure Management	In-band and out-of-band
Enclosure Support	Assumes one SEP per enclosure

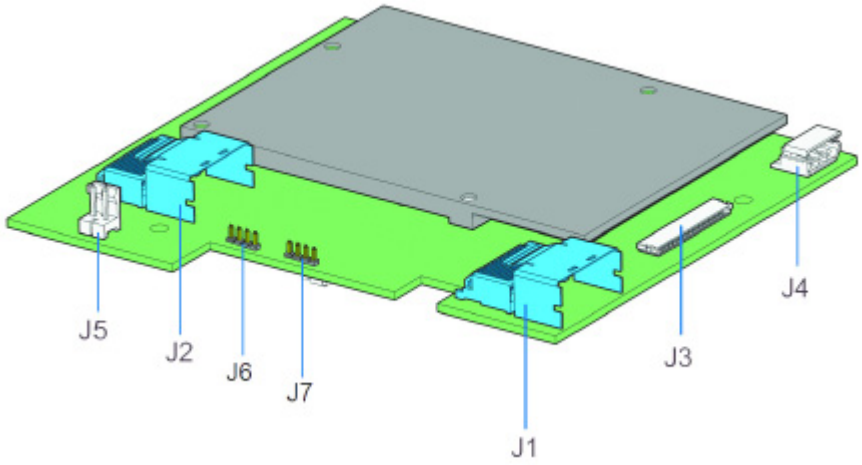


Figure 35. RMS2MH080 Card Layout

Jumper	Description	Type	Comments
J1 – J2	Internal mini SAS Port Connectors, Ports 0-3 and 4-7		Connection to SAS/SATA devices: • J1 = SAS_A (Port 0-3) • J2 = SAS_B (Port 4-7)
J3	Board-to-board connector for Battery Backup Unit	20-pin connector	Provides an interface to the daughter card that contains the battery backup unit.
J4	Keyed I2C Connector	3-pin keyed connector	Out-of-band enclosure management (SES2).
J5	RAID Premium Feature Key Header	2-pin connector	Enables support for RAID Premium Feature.
J6	UART debug header	4-pin connector	Factory use only (may be removed in future)
J7	Bootstrap CONFIG header	4-pin connector	Factory use only (may be removed in future)

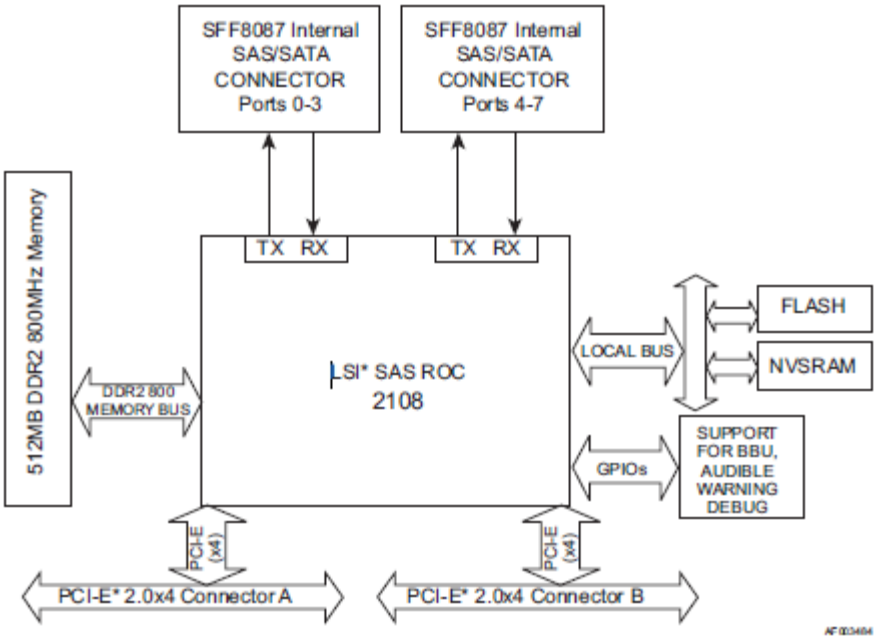


Figure 36. RMS2MH080 Block Diagram

11. Integrated RAID Module RMS2AF040 & RMS2AF080

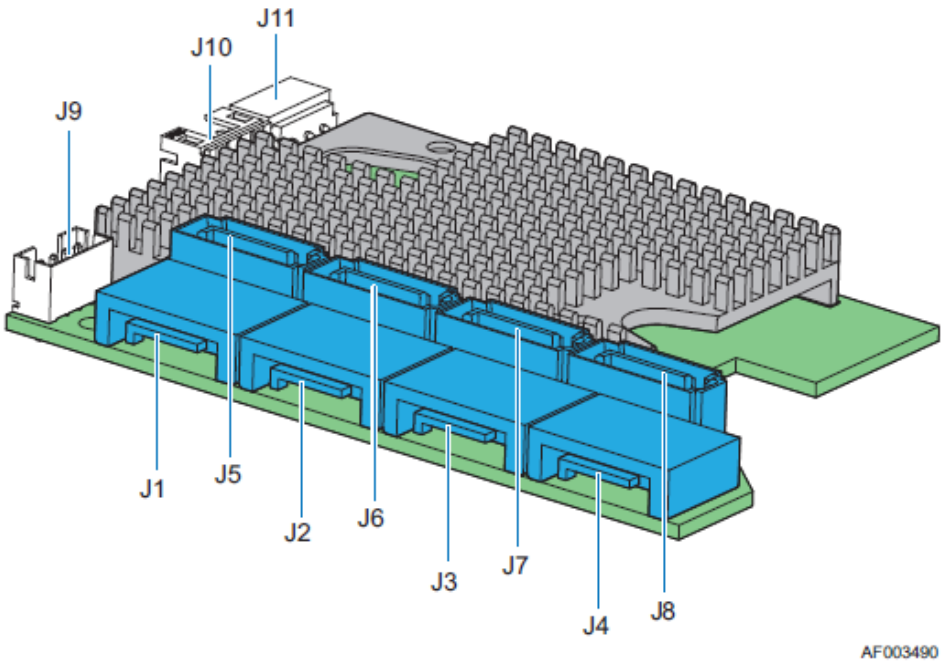
The Intel® Integrated RAID Module RMS2AF040 and RMS2AF080 are intelligent custom board-to-board PCI Express* 2.0 compliant interface RAID adapters with an integrated LSI* LSISAS2008 Processor Chip, providing both a SAS controller and RAID engine. With four (RMS2AF040) or eight (RMS2AF080) independent ports supporting 6 Gbps and 3 Gbps SAS data transfers using four or eight individual SAS/SATA connectors, this controller supports up to 32 enterprise-class SAS or SATA devices and 64 logical drives. The PCI Express* connector fits into a 50 pin connector capable of performance up to 5 Gbps per lane. Support for intelligent XOR RAID levels 0, 1, 5, 10, and 50. For more details see the *Intel® Integrated RAID Module RMS2AF040 (AXXRMS2AF040) and RMS2AF080 (AXXRMS2AF080) Hardware User's Guide*.

11.1 Technical Specifications

Table 8. RMS2AF0#0 Specifications

Specification	Intel® Integrated RAID Module RMS2AF040 and RMS2AF080
Processor	LSI* LSISAS2008 PCI* Express-SAS/SATA I/O Processor chip, 150MHz
Operating voltage	+3.3 V
Interface to host	Custom board-to-board x8 PCI Express* 2.0 compliant interface
SATA Bus Speed	Up to 6 Gbps per port, point-to-point
SAS/SATA ports	Four internal ports for RMS2AF040 and eight internal ports for RMS2AF080
Physical and virtual drive support	Up to 64 physical drives including up to 16 physical drives in up to 16 RAID arrays per controller. Drives not configured as part of a RAID array can be configured as “pass through” drives in Non-RAID mode.
Firmware	16 MB in reflashable flash ROM
Compatible devices	2.5-inch and 3.5-inch SAS or SATA II drives including SSD drives Non disk devices including expanders Can support drives of mixed capacity
Cabling	Small thin cables that do not restrict airflow and Shared connectors for multiple drives
Redundant configuration	32 KB NVRAM and config-on-disk (COD)
Enclosure Management	In-band and out-of-band SES2; out-of-band SGPIO
Enclosure Support	Assumes one SEP per enclosure

11.2 Intel® Integrated RAID Module RMS2AF0x0 Characteristics



Jumper	Description	Type	Comments
J1 – J8	Internal SAS/SATA Port Connectors, Ports 0-7		Connection to SAS/SATA devices: • J1 = SAS/SATA Port 0 • J2 = SAS/SATA Port 1 • J3 = SAS/SATA Port 2 • J4 = SAS/SATA Port 3 • J5 = SAS/SATA Port 4 • J6 = SAS/SATA Port 5 • J7 = SAS/SATA Port 6 • J8 = SAS/SATA Port 7 J5 - J8 (Ports 4 - 7) are only available on Intel® RAID Module RMS2AF080
J9	Keyed SGPIO Connector	4-pin keyed connector	Enclosure management (SGPIO) for Ports 4-7 The connector is not available on Intel® RAID Module RMS2AF040
J10	Keyed SGPIO Connector	4-pin keyed connector	Enclosure management (SGPIO) for Ports 0-3
J11	Keyed I2C Connector	3-pin keyed connector	Out-of-band enclosure management (SES2)

Figure 37. RMS2AF080 Card Layout

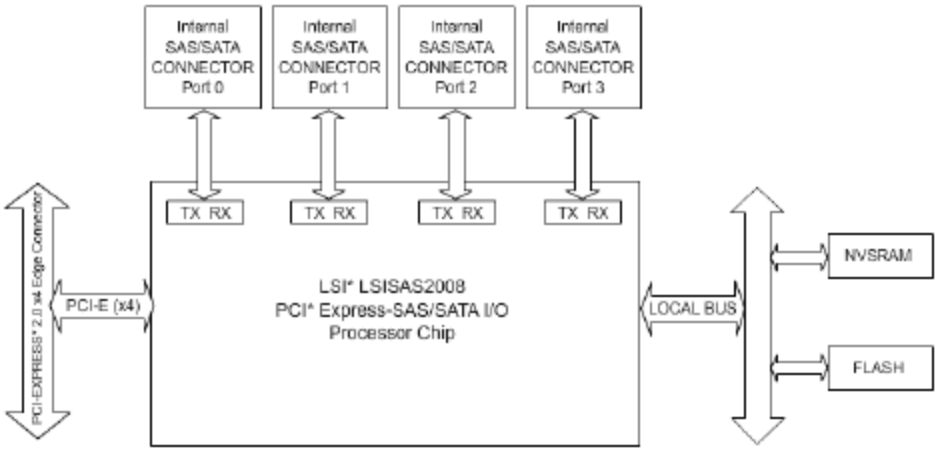


Figure 38. RMS2AF040 Hardware Block Diagram

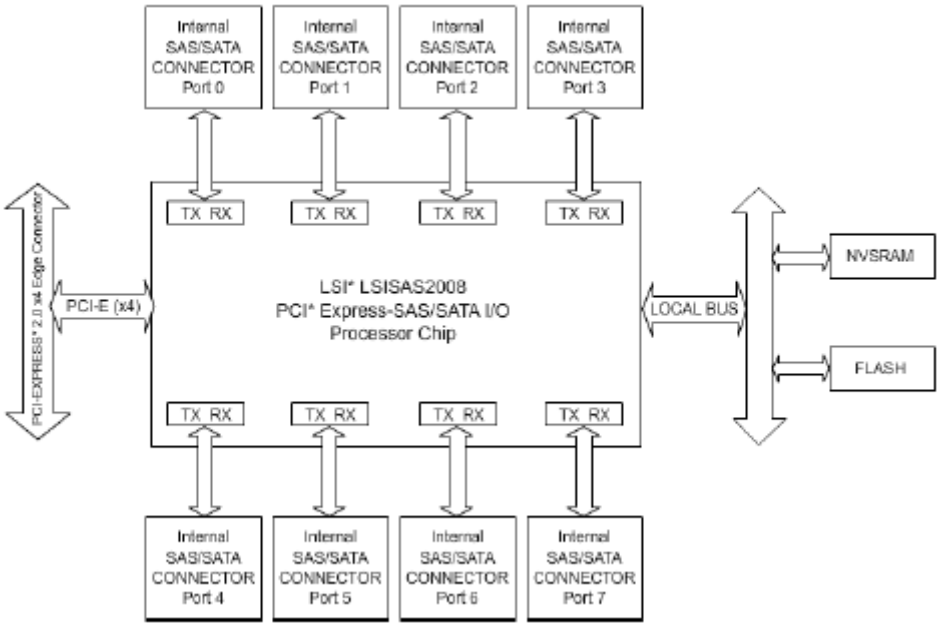


Figure 39. RMS2AF080 Hardware Block Diagram

12. Integrated RAID Module RMS2LL040 & RMS2LL080

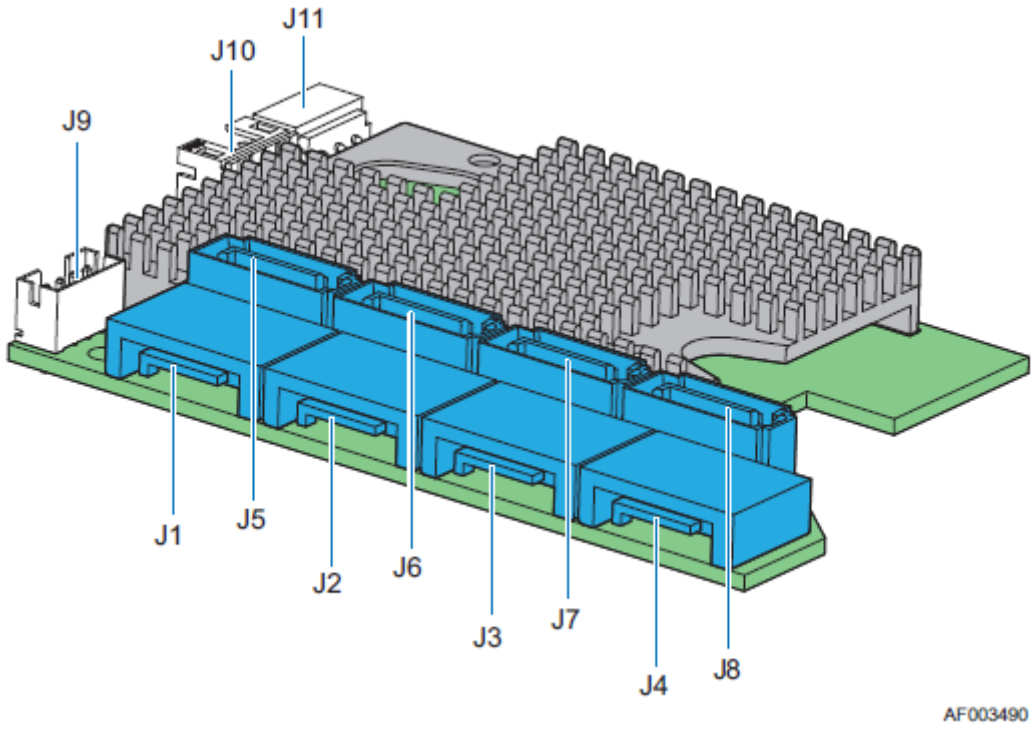
The Intel® RAID Module RMS2LL040 and RMS2LL080 are intelligent custom board-to-board PCI Express* 2.0 compliant interface RAID adapters with an integrated LSI* LSISAS2008 Processor Chip, providing both a SAS controller and RAID engine. With four (RMS2LL040) or eight (RMS2LL080) independent ports supporting 6-Gbps and 3 Gbps SAS data transfers using four or eight individual SAS/SATA connectors, this controller supports up to 32 enterprise-class SAS or SATA devices and 64 logical drives. The PCI Express* connector fits into a 50 pin connector capable of performance up to 5 Gbps per lane. Includes support for RAID levels 0, 1, and 1E. For more details see the *Intel® Integrated RAID Module RMS2LL040 (AXXRMS2LL040) and RMS2LL080 (AXXRMS2LL080) Hardware User's Guide*.

12.1 Technical Specifications

Table 9. RMS2LL0#0 Specifications

Specification	Intel® Integrated RAID Module RMS2LL040 and RMS2LL080
Processor	LSI* LSISAS2008 PCI* Express-SAS/SATA I/O Processor chip, 150MHz
Operating voltage	+3.3 V
Interface to host	Custom board-to-board x8 PCI Express* 2.0 compliant interface
SATA Bus Speed	Up to 6 Gbps per port, point-to-point
SAS/SATA ports	4 internal ports for RMS2LL040 and 8 internal ports for RMS2LL080
Physical and virtual drive support	Up to 64 physical drives including up to 16 physical drives in up to 16 RAID arrays per controller. Drives not configured as part of a RAID array can be configured as “pass through” drives in Non-RAID mode.
Firmware	16 MB in reflashable flash ROM
Compatible devices	•2.5-inch and 3.5-inch SAS or SATA II drives including SSD drives •Non disk devices including expanders •Can support drives of mixed capacity
Cabling	Small thin cables that do not restrict airflow and Shared connectors for multiple drives
Redundant configuration	32 KB NVRAM and config-on-disk (COD)
Enclosure Management	In-band and out-of-band SES2; out-of-band SGPIO
Enclosure Support	Assumes one SEP per enclosure

12.2 Intel® Integrated RAID Module RMS2LL0x0 Characteristics



Jumper	Description	Type	Comments
J1 – J8	Internal SAS/SATA Port Connectors, Ports 0-7		Connection to SAS/SATA devices: • J1 = SAS/SATA Port 0 • J2 = SAS/SATA Port 1 • J3 = SAS/SATA Port 2 • J4 = SAS/SATA Port 3 • J5 = SAS/SATA Port 4 • J6 = SAS/SATA Port 5 • J7 = SAS/SATA Port 6 • J8 = SAS/SATA Port 7 J5 - J8 (Ports 4 - 7) are only available on Intel® RAID Module RMS2LL080
J9	Keyed SGPIO Connector	4-pin keyed connector	Enclosure management (SGPIO) for Ports 4-7 The connector is not available on Intel® RAID Module RMS2LL040
J10	Keyed SGPIO Connector	4-pin keyed connector	Enclosure management (SGPIO) for Ports 0-3
J11	Keyed I2C Connector	3-pin keyed connector	Out-of-band enclosure management (SES2)

Figure 40. Intel® Integrated RAID Module RMS2LL0x0 Characteristics

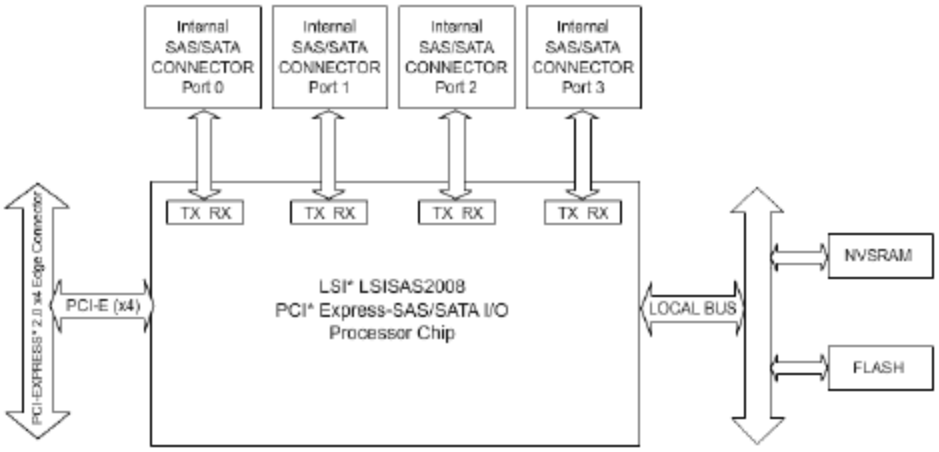


Figure 41. RMS2LL040 Hardware Block Diagram

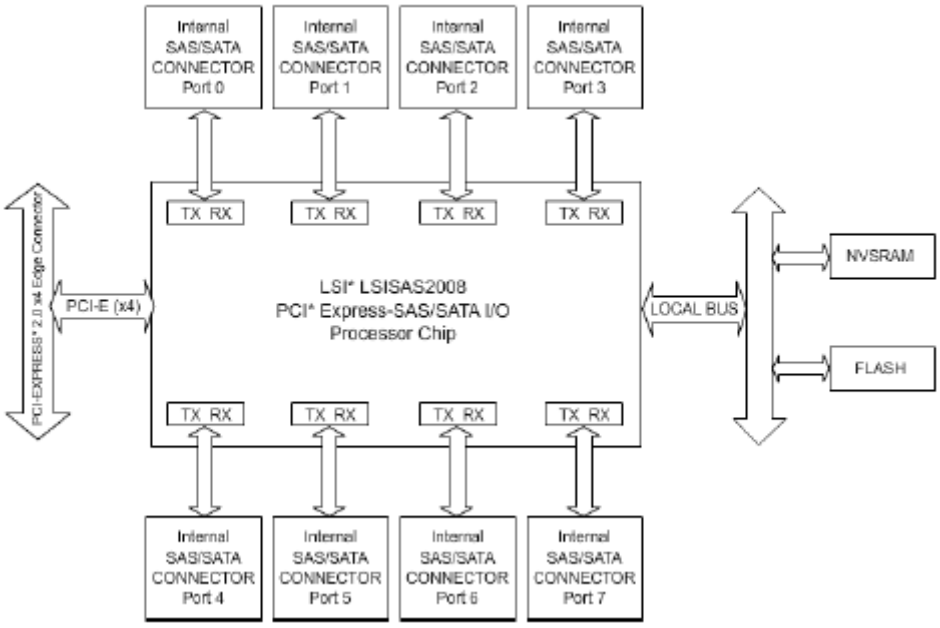


Figure 42. RMS2LL080 Hardware Block Diagram