



Intel[®] Server Board S5000PAL/S5000XAL and Intel[®] Server Board S5400SF I/O Module

Hardware Specification

Intel order number – D44901-004

Revision 1.2

March 2008

Technical Marketing and Sustaining Engineering

Revision History

Intel® Server Board S5000PAL/S5000XAL and Intel® Server Board S5400SF I/O Module

Revision History

Date	Revision Number	Modifications
September 2006	1.0	Initial release.
May 2007	1.1	Updated illustrations.
March 2008	1.2	Added Intel® Server Board S5400SF as a supported server board.

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1. Introduction

The Intel® Server Board S5000PAL/S5000XAL and Intel® Server Board S5400SF provide an option to add additional I/O functionality through the I/O module connector. This is an internal 50-pin mezzanine style connector placed on a PCI Express* (PCIe*) x4 bus. The following table details the pin-out of the I/O module connector.

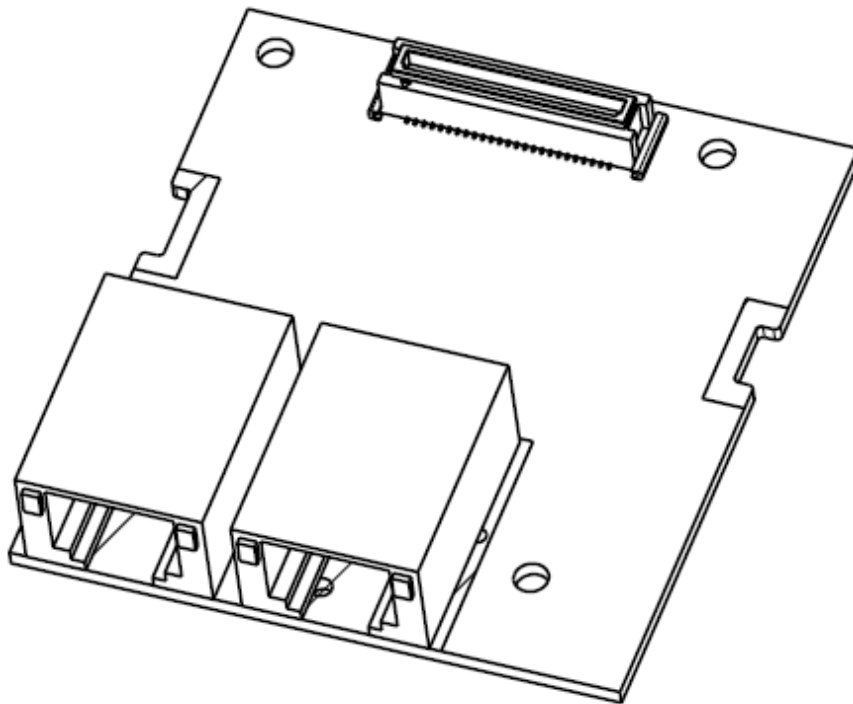
Table 1: 50-pin I/O Module Connector Pin-Out

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

Currently there are three available modules for the I/O module connector: a dual Gigabit Ethernet module, an external SAS module, and an Infiniband* module.

2. Dual Gigabit Ethernet I/O Module

The dual Gigabit 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 into an Intel® Server Board S5000PAL/S5000XAL or an Intel® Server Board S5400SF -based system.



2.1 Feature Set

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

- Intel® 82571EB Gigabit 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 Gigabit Ethernet ports

2.2 Functional Block Diagram

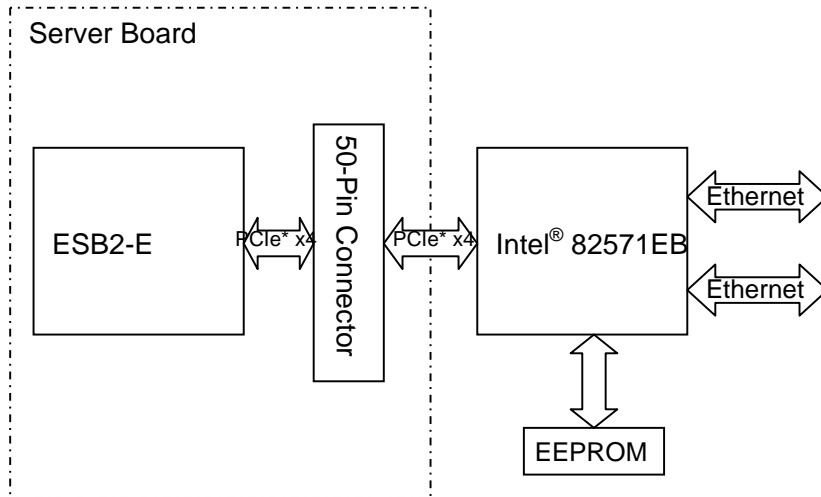


Figure 1. Dual Gigabit Ethernet I/O Module Block Diagram

Dual Gigabit Ethernet I/O Module

Intel® Server Board S5000PAL/S5000XAL and Intel® Server Board S5400SF I/O Module

2.3 Mechanical Dimensions

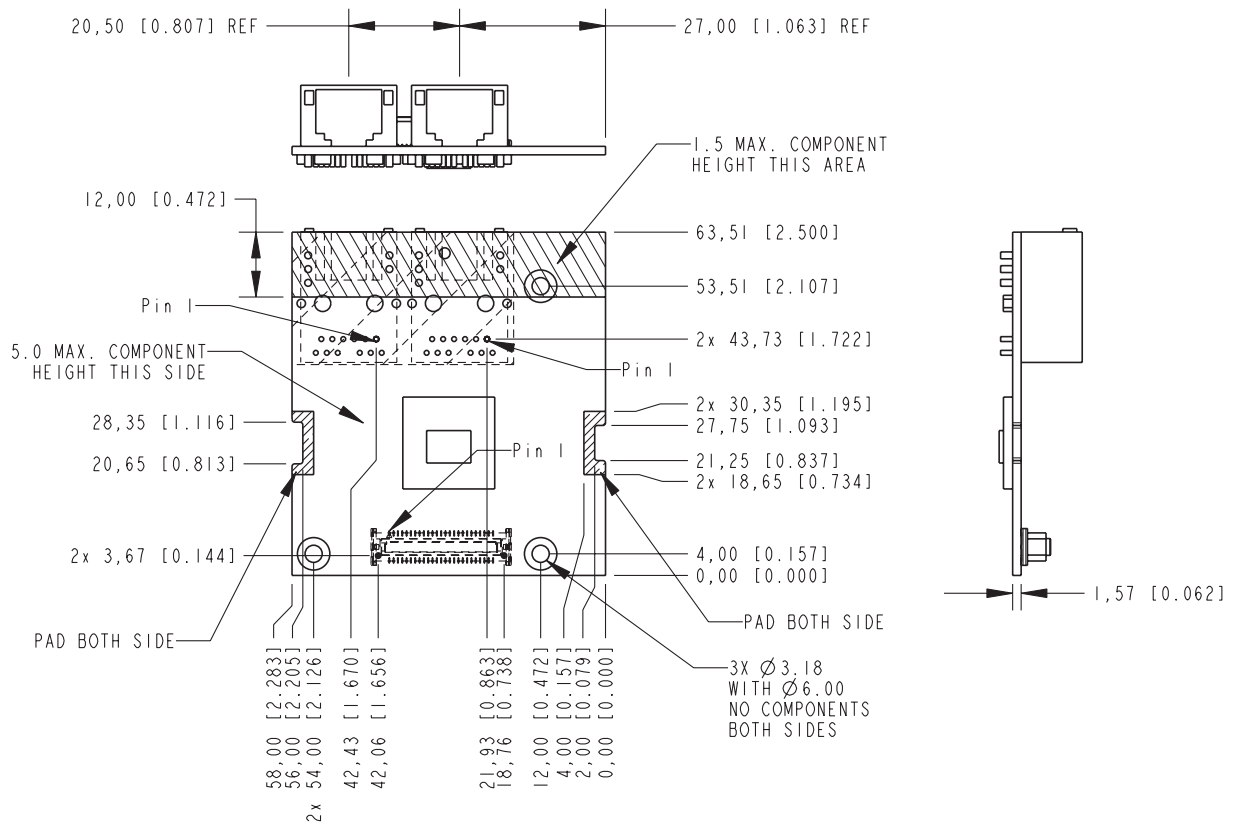


Figure 2: Dual Gigabit Ethernet I/O Module Dimensions; Top and Side Views

Dual Gigabit Ethernet I/O Module

Intel® Server Board S5000PAL/S5000XAL and Intel® Server Board S5400SF I/O Module

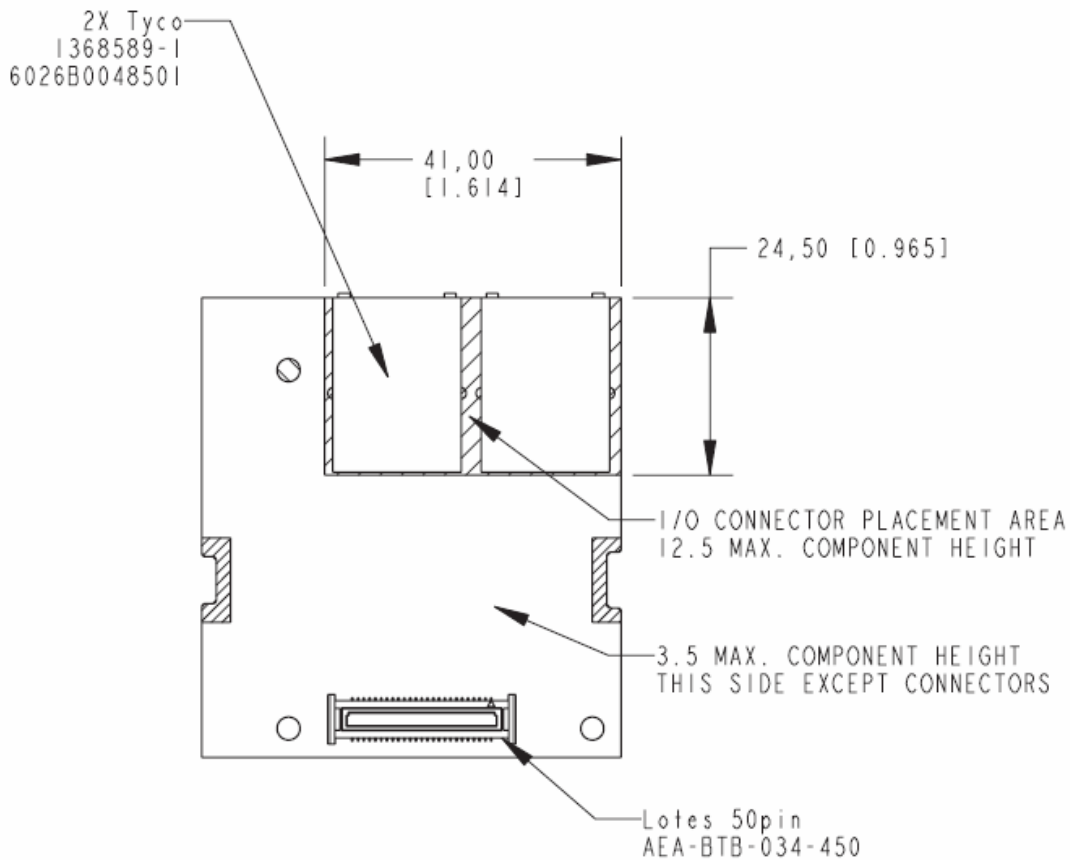


Figure 3: Dual Gigabit Ethernet I/O Module Dimensions; Bottom View

2.4 Intel® 82571EB Gigabit Ethernet Controller

The Intel® 82571EB Gigabit Ethernet Controller is a single, compact component with two fully integrated Gigabit 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 Gigabit Ethernet implementation. The Intel 82571EB Gigabit 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 Gigabit 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 Gigabit 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 Gigabit 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

Dual Gigabit Ethernet I/O Module

Intel® Server Board S5000PAL/S5000XAL and Intel® Server Board S5400SF I/O Module

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 Gigabit 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

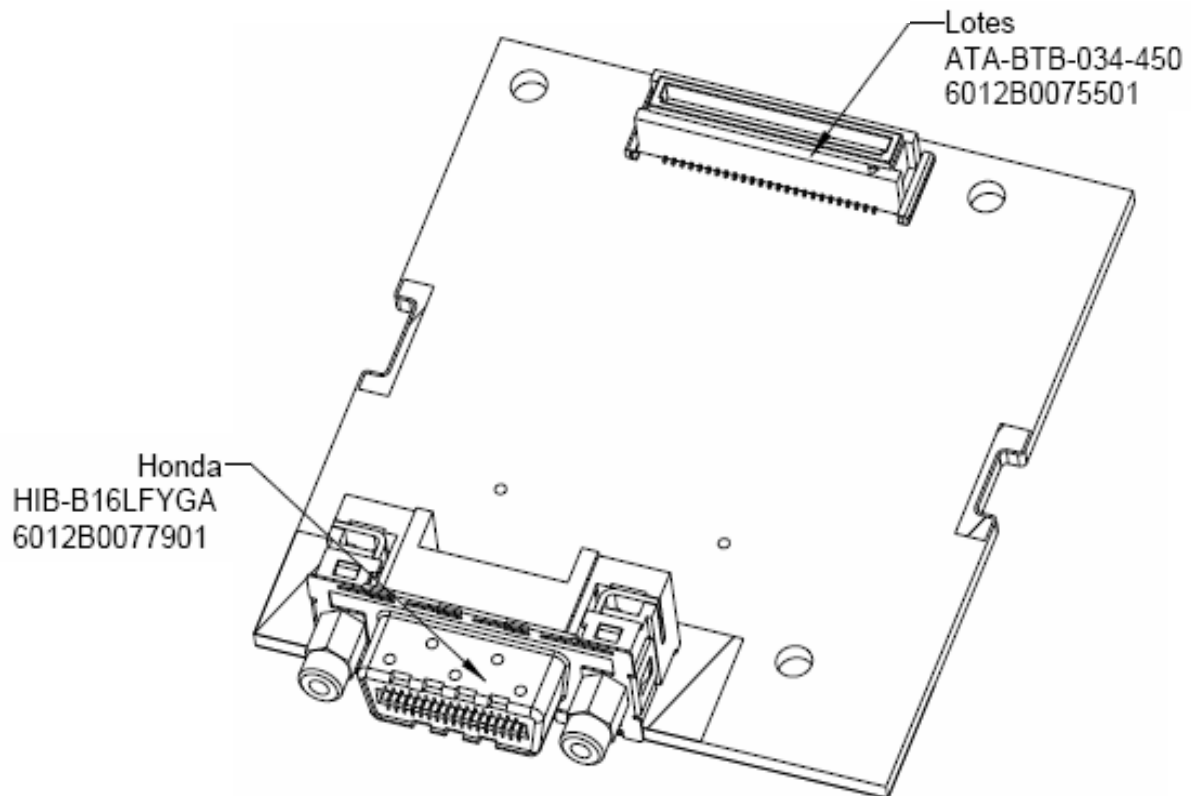
The Dual Gigabit Ethernet I/O module contains one 50-pin connector matching the one available on the Intel® Server Board S5000PAL/S5000XAL and Intel® Server Board S5400SF.

2.7 Ethernet Magjack*

The Dual Gigabit Ethernet I/O module contains two Ethernet Magjack connectors which are compatible with 10/100/1000 Mbps Ethernet connection.

3. SAS I/O Module

The SAS I/O module provides the availability to connect up to four external SAS ports to an Intel® Server Board S5000PAL/S5000XAL or an Intel® Server Board S5400SF -based system. This section provides a high level description of the implementation of this I/O module.



3.1 Feature Set

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

- LSI* LSI SAS1064E 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 external SAS/SATA ports for connecting multiple SAS/SATA devices

3.2 Functional Block Diagram

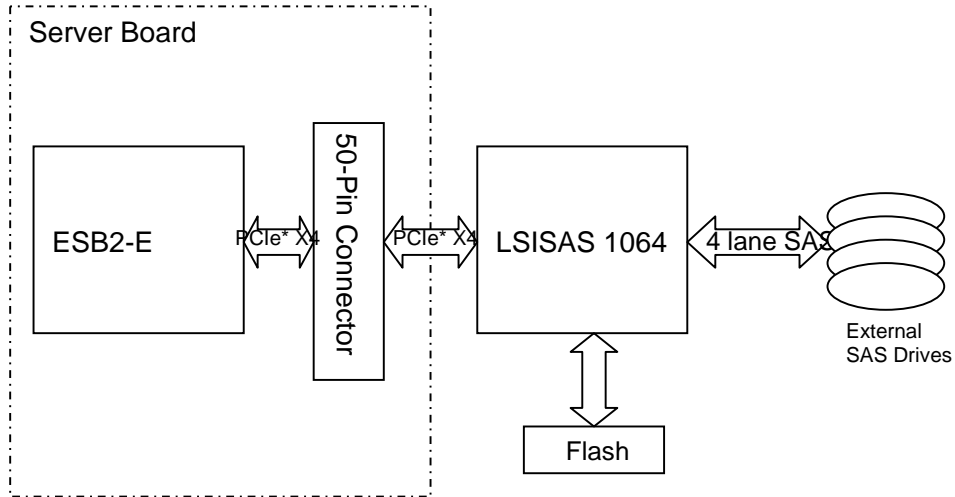


Figure 4. SAS I/O Module Block Diagram

3.3 Mechanical Dimensions

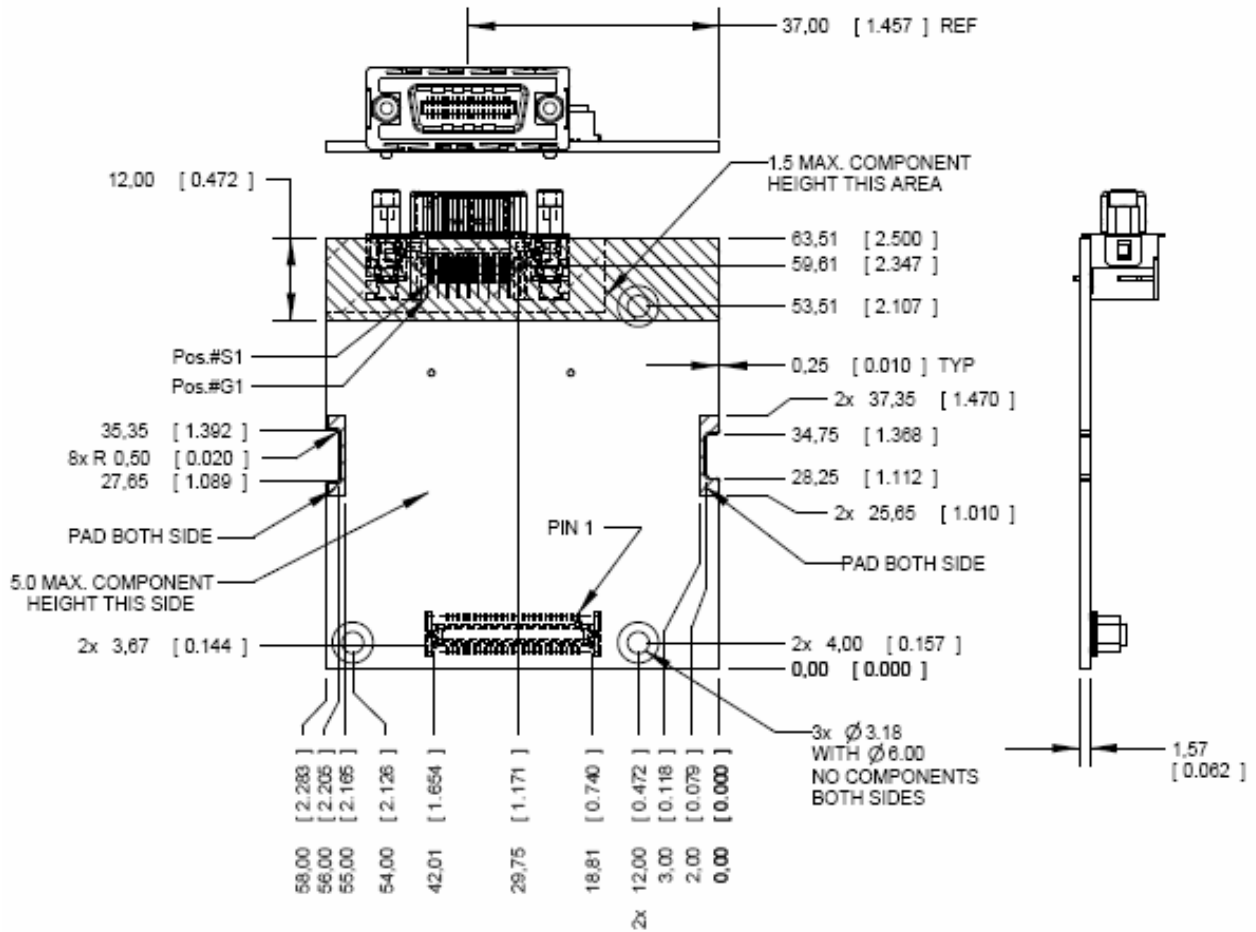


Figure 5: SAS I/O Module Dimensions; Top and Side Views

SAS I/O Module

Intel® Server Board S5000PAL/S5000XAL and Intel® Server Board S5400SF I/O Module

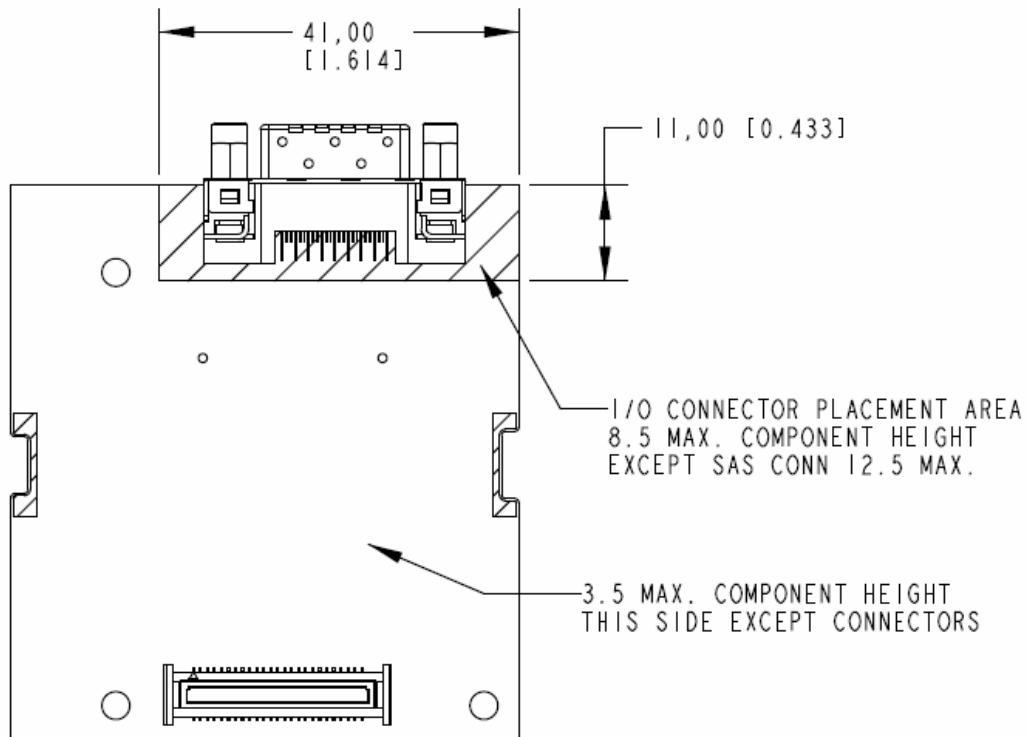
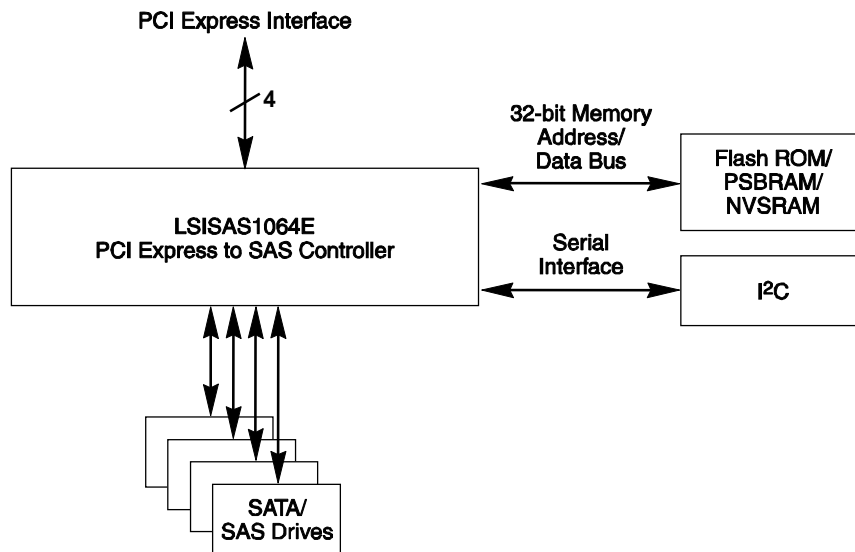


Figure 6: SAS I/O Module Dimensions; Bottom View

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 that is 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.



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Figure 7: 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 that are independent of the I/O bus. LSI* Logic provides these device drivers.

SAS I/O Module

Intel® Server Board S5000PAL/S5000XAL and Intel® Server Board S5400SF I/O Module

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 Gbits/s and 1.5 Gbits/s SATA data transfers
- Supports 3.0 Gbits/s and 1.5 Gbits/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 connector matching the one available on the Intel® Server Board S5000PAL/S5000XAL and the Intel® Server Board S5400SF.

3.7 External 4 SAS Connector

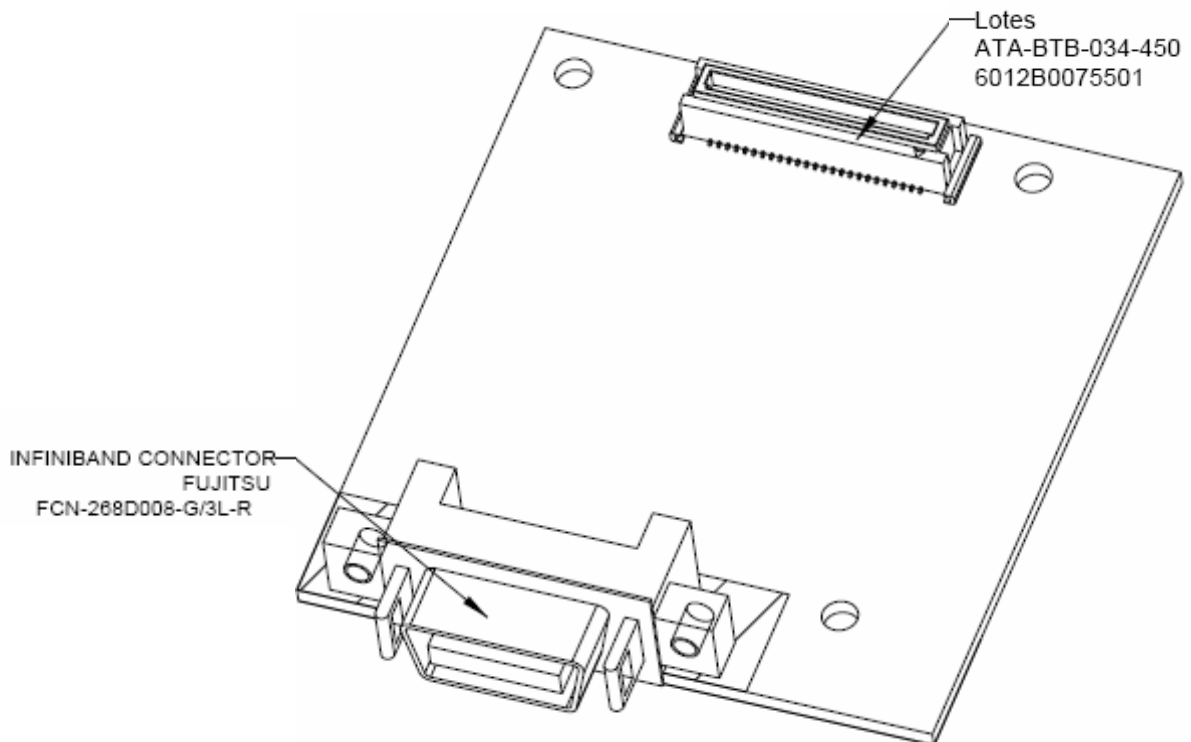
The SAS I/O module contains a x4 SAS/SATA connector which allows connections to four external SAS devices. The pin-out of the external SAS connector is detailed in the table below.

Table 2: 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* I/O Module

The 4X SDR InfiniBand* I/O module is based on Mellanox* InfiniHost* MT25204 device with the integrated Physical Layer SerDes. This board can be used with an Intel® Server Board S5000PAL/S5000XAL or an Intel® Server Board S5400SF -based system to enable an Infiniband connection to an InfiniBand Fabric. 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.



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)
- 16MBytes 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

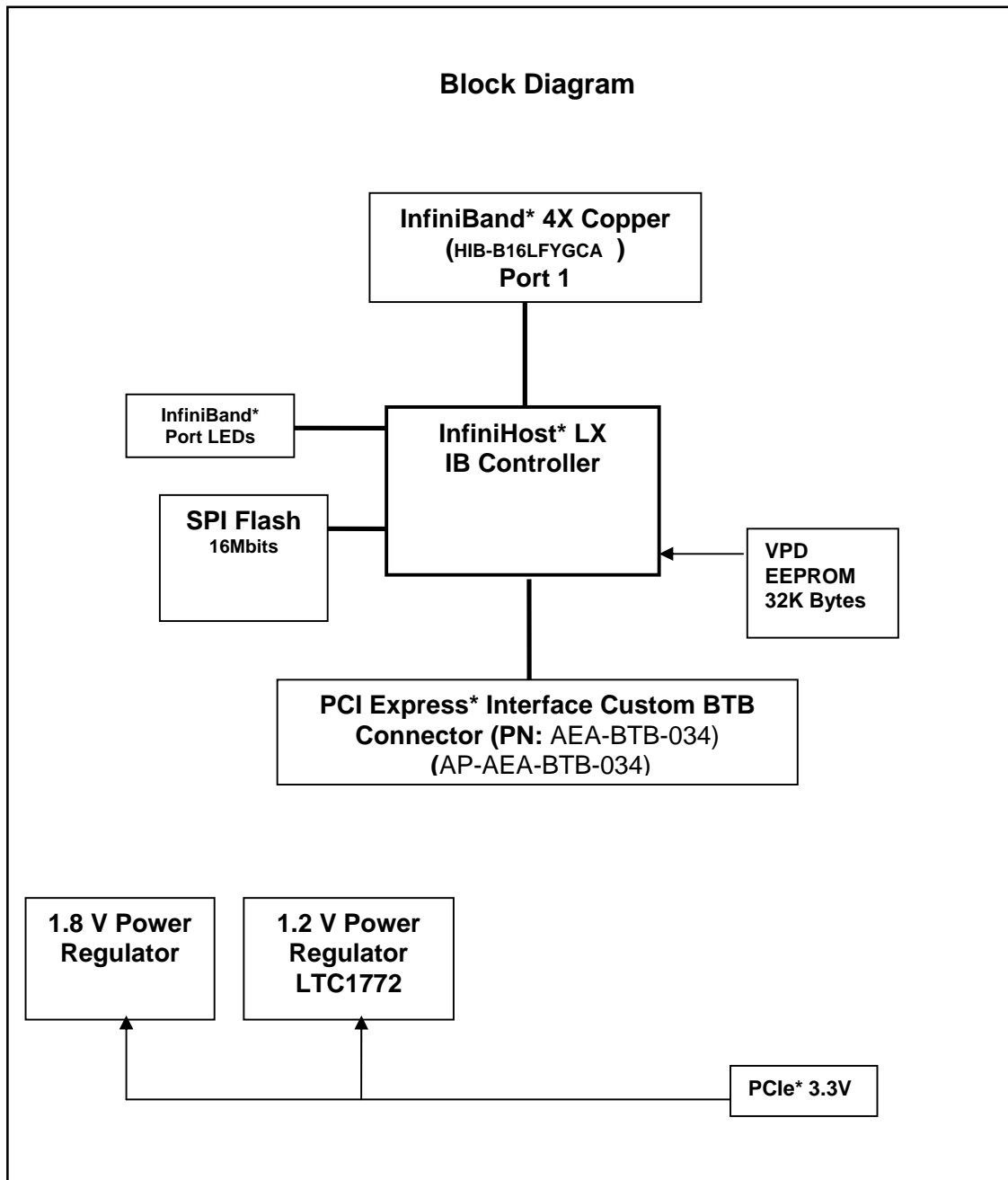


Figure 8. InfiniBand® I/O Module Block Diagram

4.3 Mechanical Dimensions

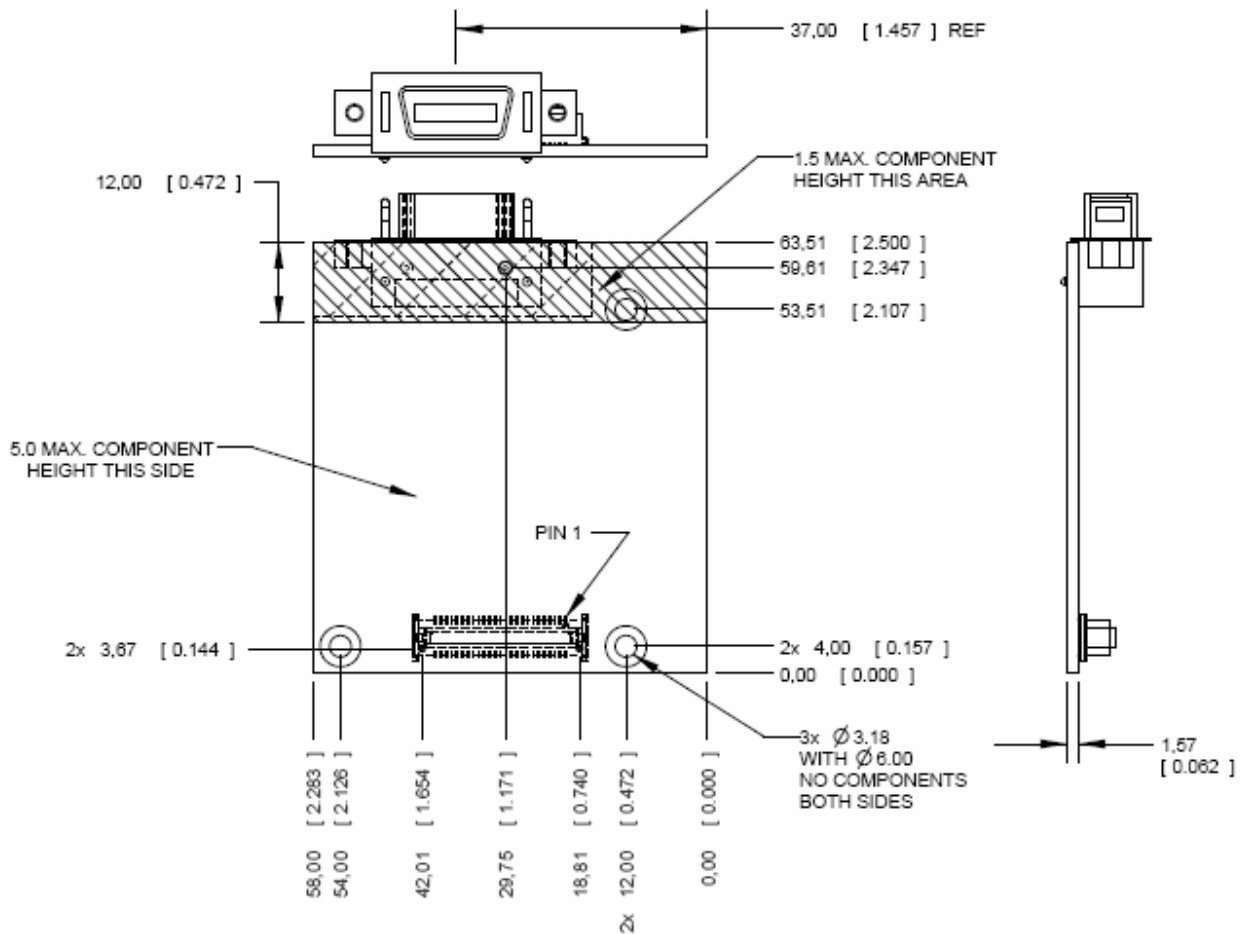


Figure 9: InfiniBand* I/O Module Dimensions; Top and Side Views

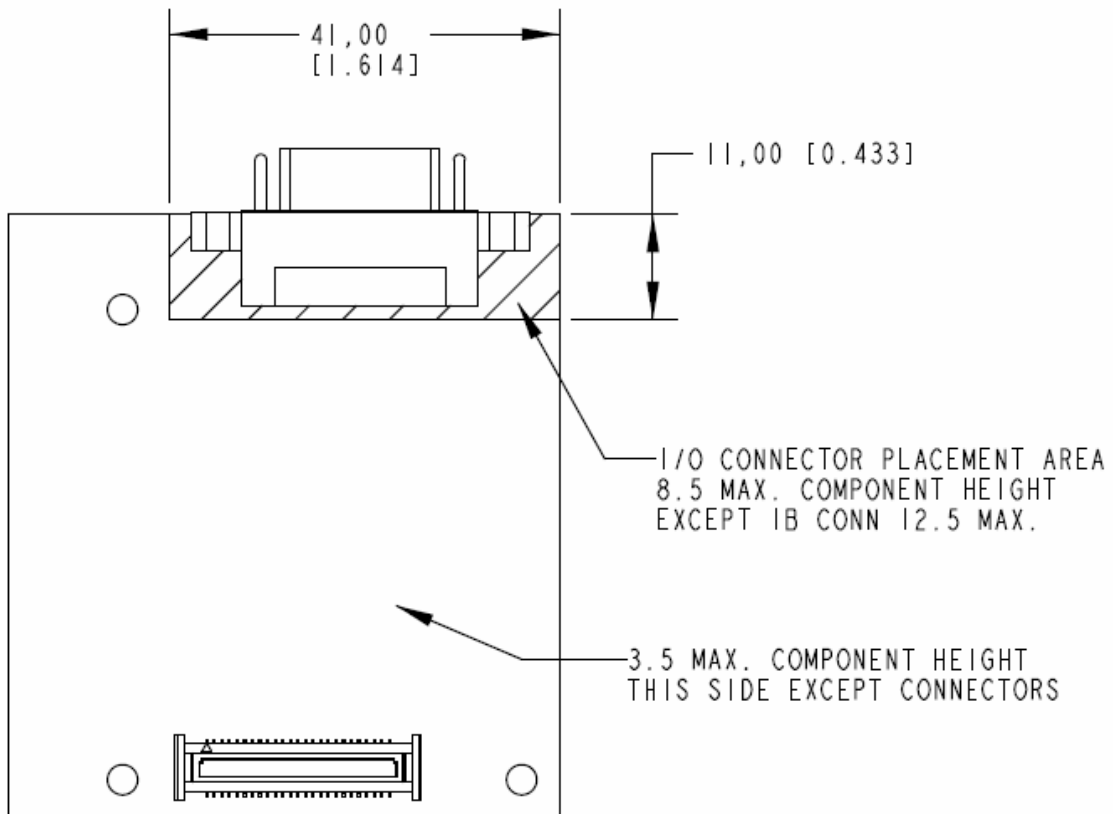


Figure 10: InfiniBand* I/O Module Dimensions; Bottom View

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

InfiniBand* I/O Module

Intel® Server Board S5000PAL/S5000XAL and Intel® Server Board S5400SF I/O Module

4.5 PCI Express* x4 Connector

The InfiniBand* I/O Module contains one 50-pin connector matching the one available on the Intel® Server Board S5000PAL/S5000XAL and the Intel® Server Board S5400SF.

4.6 External Connector

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

Reference Documents

See the following documents for additional information:

- Intel® Server Board S5000PAL/S5000XAL Technical Product Specification
- Intel® Server Board S5400SF Technical Product Specification