

PCI Express® to 12Gb/s Serial Attached SCSI (SAS) Controller Host Bus Adapters

User Guide

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For a comprehensive list of changes to this document, see the [Revision History](#).

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Chapter 1: Introduction

1.1 Overview

The LSI® PCI Express® (PCIe®) to 12Gb/s Serial Attached SCSI (SAS) host bus adapters (HBAs) provide 4, 8, or 16 serial ports for connection to SAS and Serial ATA (SATA) devices. Each port is capable of 3Gb/s and 6Gb/s SATA link rates and 3Gb/s, 6Gb/s, and 12Gb/s SAS link rates. The design of the LSI 12Gb/s HBAs makes it easy to add SAS to any computer, workstation, or server that has a PCIe bus.

The LSI 12Gb/s HBAs include Flash ROM for storing the firmware and BIOS, and select boards include NVSRAM for storing nonvolatile RAID information.

The LEDs on the HBAs report a heartbeat to easily show the HBA status. The Fusion-MPT™ firmware operates the HBA.

PCI Express Specification, Revision 3.0-compliant HBAs yield a total bandwidth of 16Gb/s for each full-duplex lane.

An LSI controller chip provides the PCIe and SAS functionality of the LSI 12Gb/s HBAs to connect SAS + SATA devices to a computer system through the PCIe host interface. The controller chip on each HBA connects to the PCIe bus and generates timing and protocol in compliance with the PCIe specification. The controller chip provides the SAS connections to the SAS and SATA devices in the computer system.

The following table shows specification information for each LSI 12Gb/s SAS HBA model.

Table 1 LSI 12Gb/s SAS HBA Specification Details

PCIe-to-SAS HBA Model	Controller Chip	PCIe Interface Phys			SAS/SATA Interface Phys			
		x4	x8	x16	x4	x8	x16	x24
LSI SAS 9300-8e	LSI SAS 3008		x			x		
LSI SAS 9300-8i	LSI SAS 3008		x			x		
LSI SAS 9300-4i4e	LSI SAS 3008		x			x		
LSI SAS 9300-4i	LSI SAS 3004		x		x			
LSI SAS 9311-8i	LSI SAS 3008		x			x		
LSI SAS 9311-4i4e	LSI SAS 3008		x			x		
LSI SAS 9311-4i	LSI SAS 3004		x		x			
LSI SAS 9310-8i	LSI SAS 3008		x			x		
LSI SAS 9300-16e ^a	LSI SAS 3008		x				x	
LSI SAS 9300-16i ^a	LSI SAS 3008		x				x	
LSI SAS 9302-16e ^a	LSI SAS 3008			x			x	

a. The HBA uses two LSI SAS 3008 controller chips.

1.2 PCI Express Host Interface Features

This section lists the PCIe host interface features of the LSI SAS 12Gb/s HBAs.

- A single-phy (one lane) link transfer rate up to 8Gb/s in each direction.
- Link widths of x8, x4, and x1. The LSI SAS 9302-16e HBA also supports a link width of x16.

- Automatic downshift.
- A scalable interface.

Table 2 PCIe Aggregate Bandwidth

Lanes	Single Direction	Dual Direction
Single lane (x1)	8 Gb/s	16 Gb/s
Quad lane (x4)	32 Gb/s	64 Gb/s
Eight lane (x8)	64 Gb/s	128 Gb/s
Sixteen lane (x16)	128 Gb/s	256 Gb/s

- Serial, point-to-point interconnections between devices.
 - Reduces the electrical load of the connection
 - Enables higher transmission and reception frequencies
- Lane reversal and polarity inversion.
- Power management.
 - Supports PCI Power Management 1.2
 - Supports active-state power management, including the L0, L0s, and L1 states, by placing links in a power-saving mode when there is no link activity
- A replay buffer that preserves a copy of the data for retransmission in case a cyclic redundancy check (CRC) error occurs.
- PCIe advanced error-reporting capabilities.
- Packetized and layered architecture.
- High bandwidth per pin with low overhead and low latency.
- Software compatibility with PCI and PCI-X[®] software.
 - Leverages existing PCI device drivers
 - Supports the memory, I/O, and configuration address spaces
 - Supports memory read/write transactions, I/O read/write transactions, and configuration read/write transactions
- 4 KB of PCIe configuration address space per device.
- Posted transactions and nonposted transactions.
- Quality-of-service link configuration and arbitration policies
- Traffic Class 0 and one virtual channel.
- Message-signaled interrupts (both MSI and MSI-X), as well as INTx interrupt signaling for legacy PCI support.
- End-to-end CRC and advanced error reporting.

1.3 SAS Features

This section lists the SAS features of the LSI 12Gb/s SAS HBAs.

- Supports serial SCSI protocol (SSP), SATA tunneling protocol (STP), and serial management protocol (SMP) as defined in the *Serial Attached SCSI (SAS) Specification*, version 3.0.
- Supports SATA, as defined in the *Serial ATA Specification*, version 3.0.
- Provides configurable drive spin-up sequencing on a per-phy basis.
- Simplifies cabling with a point-to-point serial architecture.
- Provides smaller and thinner connectors that promote unrestricted airflow.

- Transfers data using SCSI information units.
- Provides compatibility with SATA target devices.
- Supports narrow and wide ports.

Table 3 12Gb/s SAS Bandwidths

Half Duplex	Full Duplex
Narrow port (one lane), 1200 MB/s	Narrow port (one lane), 2400 MB/s
Wide port (two lanes), 2400 MB/s	Wide port (two lanes), 4800 MB/s
Wide port (four lanes), 4800 MB/s	Wide port (four lanes), 9600 MB/s

1.4 Active Cable Management Support

The external-connector HBAs optionally supports active cable management. To enable this feature, download and implement the firmware option labeled SAS93_{xx}_xx_IT_ACM, where _{xx} matches your product. You must enable active cable management for applications with active optical cables.

1.5 LED Management

The internal-connector HBAs offer LED management support for your backplane implementation. This configuration option lets you use the LSI 12Gb/s SAS HBA with backplanes configured for the SGPIO interface. The LSI 12Gb/s SAS HBAs are in accordance with *SFF-8485: Specification for Serial GPIO (SGPIO) Bus, Revision 0.7*.

1.6 Operating System Support

The LSI 12Gb/s SAS HBA supports all major operating systems: Windows®, Linux® Red Hat®, Linux SUSE® Enterprise Server (SLES), and VMware®. The HBA also supports Solaris® 11 Update 2. Refer to <http://go.lsi.com/hbas> for details on the software versions and device driver support.

Chapter 2: Hardware Installation

To install the 12Gb/s SAS HBA, follow these steps:

1. **Unpack the HBA, and inspect it for damage.** Unpack the HBA in a static-free environment. Remove the HBA from the antistatic bag, and carefully inspect the device for damage. If you notice any damage, contact Avago or your reseller support representative.

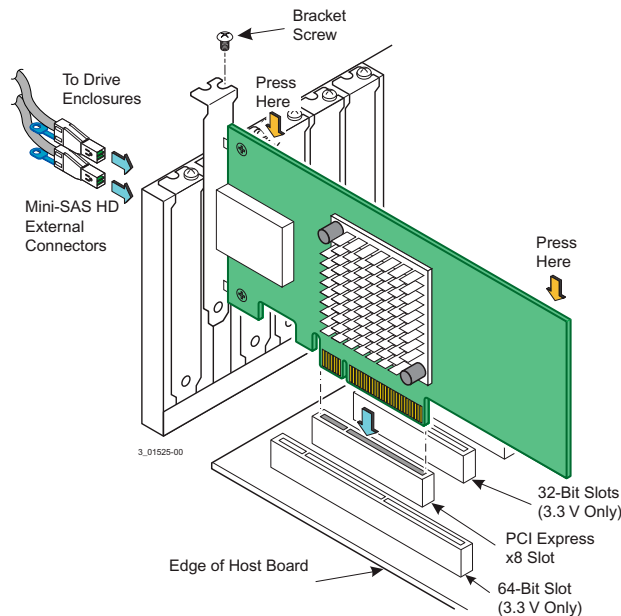
ATTENTION To avoid the risk of data loss, back up your data before changing your system configuration.

2. **Prepare the computer.** Turn off the computer, and disconnect the power cord from the rear of the power supply.

CAUTION Disconnect the computer from the power supply and from any networks to which you will install the HBA, or you risk damaging the system or experiencing electrical shock.

3. **Remove the cover from the chassis.**
4. **Check the mounting bracket on the HBA (system-dependent).** If required for your system, replace the full-height mounting bracket that ships on the HBA with the low-profile bracket supplied.
5. **Insert the HBA into an available slot.** Locate an empty PCIe slot adequate for your board. Remove the blank bracket panel on the rear of the computer that aligns with the empty PCIe slot. Save this bracket screw, if applicable. Align the HBA to a PCIe slot. Press down gently, but firmly, to seat the HBA correctly in the slot. The following figure shows how to insert the HBA into a PCIe slot.

Figure 1 Install an LSI 12Gb/s x8 HBA in a PCIe Slot



NOTE The shape, size, and locations of the components on your HBA and its bracket might vary from this illustration.

6. **Secure the HBA bracket to the system's chassis.** Install the bracket screw, if applicable, or engage the system retention mechanism to secure the HBA to the system's chassis.
7. **Connect the auxiliary power cable to the LSI SAS 12Gb/s SAS HBA if auxiliary power is required with your system design.**

-
8. **Connect SAS cables between the HBA and the SAS backplane or any other SATA or SAS device, the SAS backplane, other SATA or SAS devices, or the SAS enclosure that contains the SATA or SAS devices.**
 9. **Replace the cover and any power cords, and power up the system.** Replace the chassis's cover, reconnect any power cords, and reconnect any network cables. Turn on the power.

The hardware installation of your LSI 12Gb/s SAS HBA is complete.

Chapter 3: Characteristics of the LSI 12Gb/s SAS HBAs

The following sections present the memory, LED, connector, and physical characteristic information for each LSI 12Gb/s SAS HBA.

3.1 LSI SAS 9300-8e HBA Characteristics

3.1.1 Memory

The LSI 12Gb/s SAS HBA provides one 4-M × 16-bit Flash ROM to store the firmware and the BIOS.

3.1.2 LED

The LSI 12Gb/s SAS HBA Heartbeat LED, CR1, blinks green to indicate the HBA is capable of general activity.

3.1.3 Connectors

PCIe Connector (EC1). The LSI 12Gb/s SAS HBA supports a x8 interface. The PCIe host interface connection is through the edge connector, EC1, which provides connections on both the top (EC1 B) and bottom (EC1 A) of the board. The signal definitions and pin numbers conform to the PCIe specification.

SATA+SAS Connector (J6). The LSI 12Gb/s SAS HBA supports SATA and SAS connectors through connectors that are SFF-8644 mini-SAS HD, external connectors.

UART Connector (J2). The UART connector debug port requires a special cable and Avago support to gather detailed Input/Output Controller (IOC) status.

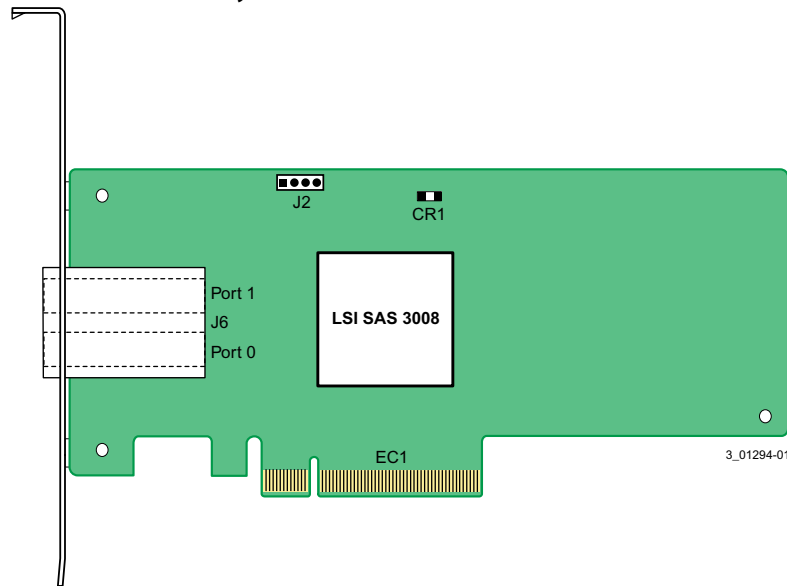
Table 4 LSI SAS HBA UART Pinout

Pin	Function
1	UART0_TX
2	Gnd
3	UART0_RX
4	1.8 V

3.1.4 Physical Characteristics

The LSI 12Gb/s SAS HBA is a 6.6-in. × 2.7-in., low-profile board. The component height on the top and bottom of the LSI 12Gb/s SAS HBA is in accordance with the PCIe specification. The following figure shows the HBA board layout.

Figure 2 LSI SAS 9300-8e HBA Board Layout



- **EC1** – PCIe x8 board edge connector
- **CR1** – Heartbeat LED
- **J6** – SFF-8644 mini-SAS HD, external, right-angle connectors
- **J2** – UART connection

3.2 LSI SAS 9300-8i HBA Characteristics

3.2.1 Memory

The LSI 12Gb/s SAS HBA provides one 4-M × 16-bit Flash ROM to store the firmware and the BIOS.

3.2.2 LED

The LSI 12Gb/s SAS HBA Heartbeat LED, CR1, blinks green to indicate the HBA is capable of general activity.

3.2.3 Connectors

PCIe Connector (EC1). The LSI 12Gb/s SAS HBA supports a x8 interface. The PCIe host interface connection is through the edge connector, EC1, which provides connections on both the top (EC1 B) and bottom (EC1 A) of the board. The signal definitions and pin numbers conform to the PCIe specification.

SATA+SAS Connector (J1). The LSI 12Gb/s SAS HBA supports SATA and SAS connectors through connectors that are SFF-8643 mini-SAS HD, internal connectors.

UART Connector (J6). The UART connector debug port requires a special cable and Avago support to gather detailed IOC status.

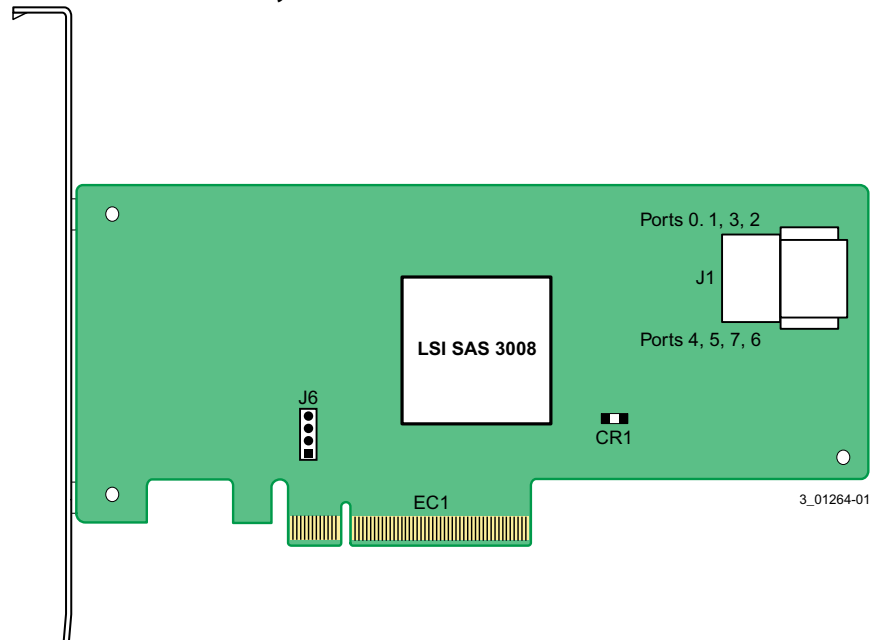
Table 5 LSI SAS HBA UART Pinout

Pin	Function
1	UART0_TX
2	Gnd
3	UART0_RX
4	1.8 V

3.2.4 Physical Characteristics

The LSI 12Gb/s SAS HBA is a 6.0-in. × 2.7-in., low-profile board. The component height on the top and bottom of the LSI 12Gb/s SAS HBA is in accordance with the PCIe specification. The following figure shows the HBA board layout.

Figure 3 LSI SAS 9300-8i HBA Board Layout



- **EC1** – PCIe x8 board edge connector
- **CR1** – Heartbeat LED
- **J1** – SFF-8643 mini-SAS HD, internal, right-angle connectors
- **J6** – UART connection

3.3 LSI SAS 9300-4i4e HBA Characteristics

3.3.1 Memory

The LSI 12Gb/s SAS HBA provides one 4-M × 16-bit Flash ROM to store the firmware and the BIOS.

3.3.2 LED

The LSI 12Gb/s SAS HBA Heartbeat LED, CR1, blinks green to indicate the HBA is capable of general activity.

3.3.3 Connectors

PCIe Connector (EC1). The LSI 12Gb/s SAS HBA supports a x8 interface. The PCIe host interface connection is through the edge connector, EC1, which provides connections on both the top (EC1 B) and bottom (EC1 A) of the board. The signal definitions and pin numbers conform to the PCIe specification.

SATA+SAS Connectors (J1 and J7). The LSI 12Gb/s SAS HBA supports SATA and SAS connectors through connector J1, which is an SFF-8643 mini-SAS HD internal connector, and connector J7, which is an SFF-8644 mini-SAS HD external connector.

UART Connector (J6). The UART connector debug port requires a special cable and Avago support to gather detailed IOC status.

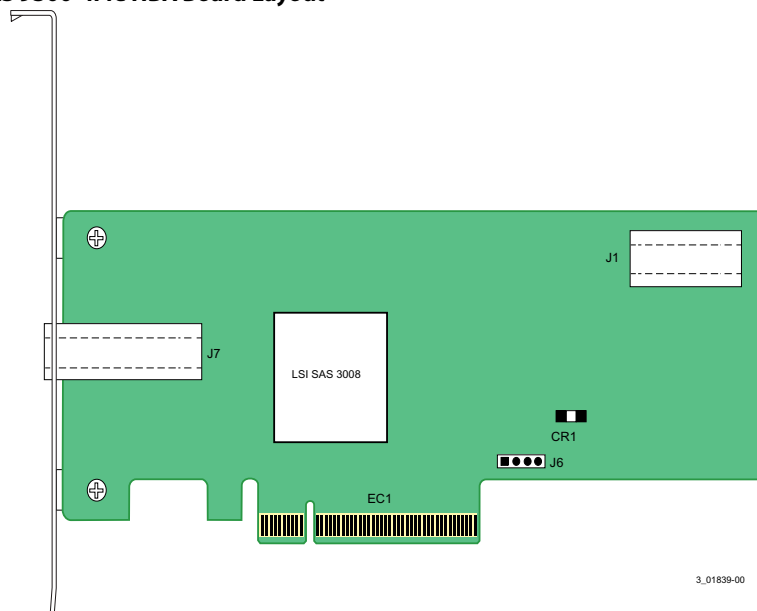
Table 6 LSI SAS HBA UART Pinout

Pin	Function
1	UART0_TX
2	Gnd
3	UART0_RX
4	1.8 V

3.3.4 Physical Characteristics

The LSI 12Gb/s SAS HBA is a 6.0-in. × 2.7-in., low-profile board. The component height on the top and bottom of the LSI 12Gb/s SAS HBA is in accordance with the PCIe specification. The following figure shows the HBA board layout.

Figure 4 LSI SAS 9300-4i4e HBA Board Layout



- **EC1** – PCIe x8 board edge connector
- **CR1** – Heartbeat LED
- **J1** – SFF-8643 mini-SAS HD, internal, right-angle connector
- **J7** – SFF-8644 mini-SAS HD, external, right-angle connector
- **J6** – UART connection

3.4 LSI SAS 9300-4i HBA Characteristics

3.4.1 Memory

The LSI 12Gb/s SAS HBA provides one 4-M × 16-bit Flash ROM to store the firmware and the BIOS.

3.4.2 LED

The LSI 12Gb/s SAS HBA Heartbeat LED, CR1, blinks green to indicate the HBA is capable of general activity.

3.4.3 Connectors

PCIe Connector (EC1). The LSI 12Gb/s SAS HBA supports a x8 interface. The PCIe host interface connection is through the edge connector, EC1, which provides connections on both the top (EC1 B) and bottom (EC1 A) of the board. The signal definitions and pin numbers conform to the PCIe specification.

SATA+SAS Connector (J1). The LSI 12Gb/s SAS HBA supports a SATA and SAS connector through an SFF-8643 mini-SAS HD, internal connector.

UART Connector (J6). The UART connector debug port requires a special cable and Avago support to gather detailed IOC status.

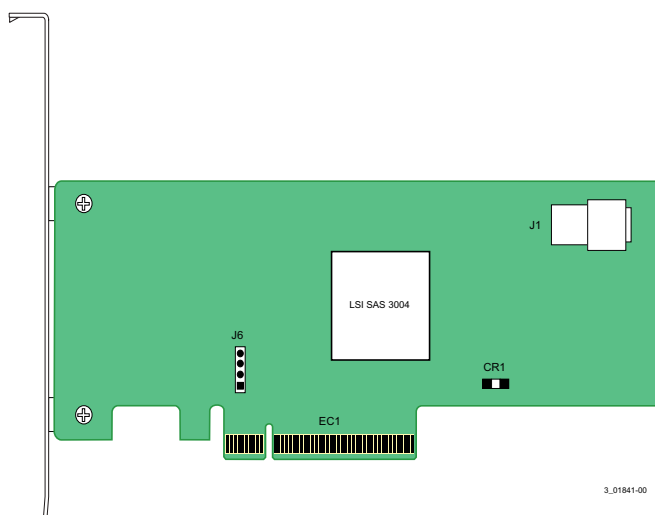
Table 7 LSI SAS HBA UART Pinout

Pin	Function
1	UART0_TX
2	Gnd
3	UART0_RX
4	1.8 V

3.4.4 Physical Characteristics

The LSI 12Gb/s SAS HBA is a 6.0-in. × 2.7-in., low-profile board. The component height on the top and bottom of the LSI 12Gb/s SAS HBA is in accordance with the PCIe specification. The following figure shows the HBA board layout.

Figure 5 LSI SAS 9300-4i HBA Board Layout



- **EC1** – PCIe x8 board edge connector
- **CR1** – Heartbeat LED
- **J1** – SFF-8643 mini-SAS HD, internal, right-angle connector
- **J6** – UART connection

3.5 LSI SAS 9310-8i HBA Characteristics

3.5.1 Memory

The LSI 12Gb/s SAS HBA provides one 4-M × 16-bit Flash ROM to store the firmware and the BIOS. The LSI 12Gb/s SAS HBA can provide up to 32 K × 8-bit NVSRAM for storing nonvolatile RAID information when a system failure occurs or to reflash the board to run integrated RAID (IR) firmware.

3.5.2 LED

The LSI 12Gb/s SAS HBA Heartbeat LED, CR1, blinks green to indicate the HBA is capable of general activity.

3.5.3 Connectors

PCIe Connector (EC1). The LSI 12Gb/s SAS HBA supports a x8 interface. The PCIe host interface connection is through the edge connector, EC1, which provides connections on both the top (EC1 B) and bottom (EC1 A) of the board. The signal definitions and pin numbers conform to the PCIe specification.

SATA+SAS Connector (J4). The LSI 12Gb/s SAS HBA supports SATA and SAS connectors through connectors that are SFF-8643 mini-SAS HD, internal connectors.

UART Connector (J3). The UART connector debug port requires a special cable and Avago support to gather detailed IOC status.

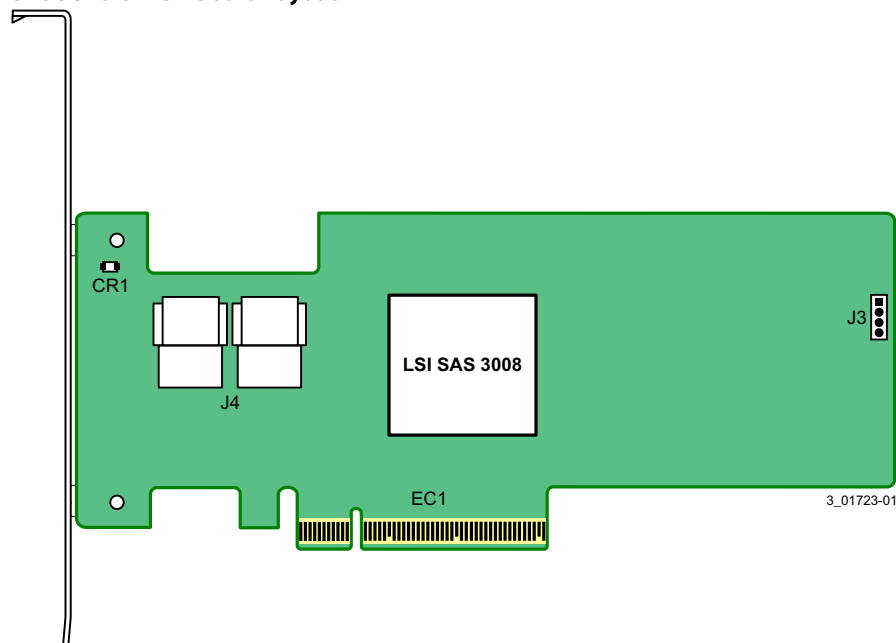
Table 8 LSI SAS HBA UART Pinout

Pin	Function
1	UART0_TX
2	Gnd
3	UART0_RX
4	1.8 V

3.5.4 Physical Characteristics

The LSI 12Gb/s SAS HBA is a 6.6-in. × 2.7-in., low-profile board. The component height on the top and bottom of the LSI 12Gb/s SAS HBA is in accordance with the PCIe specification. The following figure shows the HBA board layout.

Figure 6 LSI SAS 9310-8i HBA Board Layout



- **EC1** – PCIe x8 board edge connector
- **CR1** – Heartbeat LED
- **J4** – SFF-8643 mini-SAS HD, internal, right-angle connectors
- **J3** – UART connection

3.6 LSI SAS 9311-8i HBA Characteristics

3.6.1 Memory

The LSI 12Gb/s SAS HBA provides one 4-M × 16-bit Flash ROM to store the firmware and the BIOS. The LSI 12Gb/s SAS HBA can provide up to 32 K × 8-bit NVSRAM for storing nonvolatile RAID information when a system failure occurs or to reflash the board to run IR firmware.

3.6.2 LED

The LSI 12Gb/s SAS HBA Heartbeat LED, CR1, blinks green to indicate the HBA is capable of general activity.

3.6.3 Connectors

PCIe Connector (EC1). The LSI 12Gb/s SAS HBA supports a x8 interface. The PCIe host interface connection is through the edge connector, EC1, which provides connections on both the top (EC1 B) and bottom (EC1 A) of the board. The signal definitions and pin numbers conform to the PCIe specification.

SATA+SAS Connector (J1). The LSI 12Gb/s SAS HBA supports SATA and SAS connectors through connectors that are SFF-8643 mini-SAS HD, internal connectors.

UART Connector (J6). The UART connector debug port requires a special cable and Avago support to gather detailed IOC status.

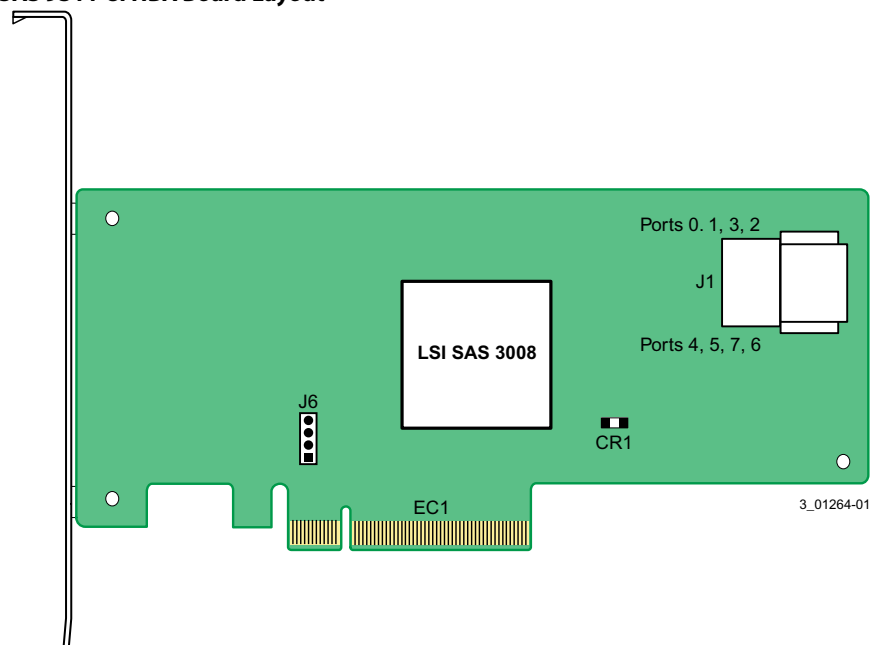
Table 9 LSI SAS HBA UART Pinout

Pin	Function
1	UART0_TX
2	Gnd
3	UART0_RX
4	1.8 V

3.6.4 Physical Characteristics

The LSI 12Gb/s SAS HBA is a 6.0-in. × 2.7-in., low-profile board. The component height on the top and bottom of the LSI 12Gb/s SAS HBA is in accordance with the PCIe specification. The following figure shows the HBA board layout.

Figure 7 LSI SAS 9311-8i HBA Board Layout



- **EC1** – PCIe x8 board edge connector
- **CR1** – Heartbeat LED
- **J1** – SFF-8643 mini-SAS HD, internal, right-angle connectors
- **J6** – UART connection

3.7 LSI SAS 9311-4i4e HBA Characteristics

3.7.1 Memory

The LSI 12Gb/s SAS HBA provides one 4-M × 16-bit Flash ROM to store the firmware and the BIOS. The LSI 12Gb/s SAS HBA can provide up to 32 K × 8-bit NVSRAM for storing nonvolatile RAID information when a system failure occurs or to reflash the board to run IR firmware.

3.7.2 LED

The LSI 12Gb/s SAS HBA Heartbeat LED, CR1, blinks green to indicate the HBA is capable of general activity.

3.7.3 Connectors

PCIe Connector (EC1). The LSI 12Gb/s SAS HBA supports a x8 interface. The PCIe host interface connection is through the edge connector, EC1, which provides connections on both the top (EC1 B) and bottom (EC1 A) of the board. The signal definitions and pin numbers conform to the PCIe specification.

SATA+SAS Connectors (J1 and J7). The LSI 12Gb/s SAS HBA supports SATA and SAS connectors through connector J1, which is an SFF-8643 mini-SAS HD internal connector, and connector J7, which is an SFF-8644 mini-SAS HD external connector.

UART Connector (J6). The UART connector debug port requires a special cable and Avago support to gather detailed IOC status.

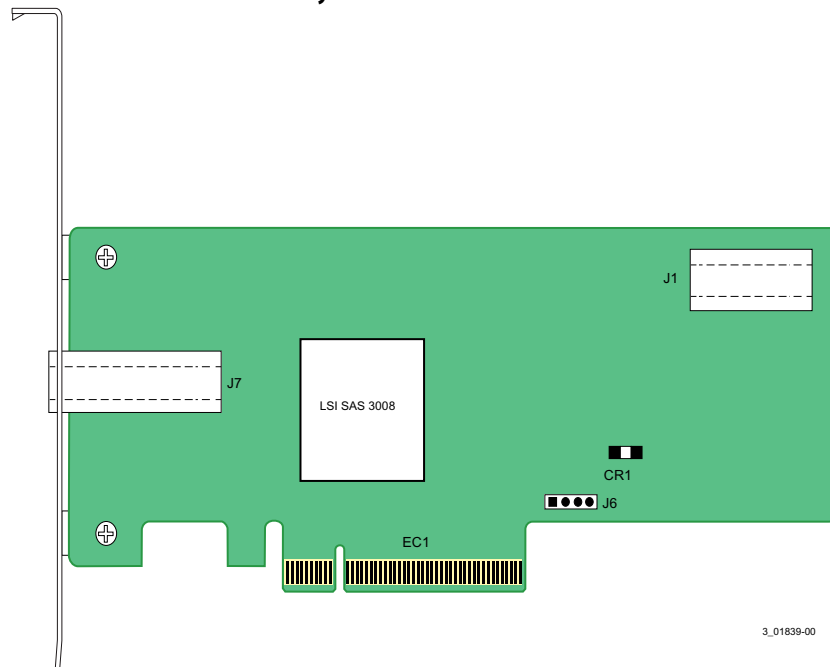
Table 10 LSI SAS HBA UART Pinout

Pin	Function
1	UART0_TX
2	Gnd
3	UART0_RX
4	1.8 V

3.7.4 Physical Characteristics

The LSI 12Gb/s SAS HBA is a 6.0-in. × 2.7-in., low-profile board. The component height on the top and bottom of the LSI 12Gb/s SAS HBA is in accordance with the PCIe specification. The following figure shows the HBA board layout.

Figure 8 LSI SAS 9311-4i4e HBA Board Layout



- **EC1** – PCIe x8 board edge connector
- **CR1** – Heartbeat LED
- **J1** – SFF-8643 mini-SAS HD, internal, right-angle connector
- **J7** – SFF-8644 mini-SAS HD, external, right-angle connector
- **J6** – UART connection

3.8 LSI SAS 9311-4i HBA Characteristics

3.8.1 Memory

The LSI 12Gb/s SAS HBA provides one 4-M × 16-bit Flash ROM to store the firmware and the BIOS. The LSI 12Gb/s SAS HBA can provide up to 32 K × 8-bit NVSRAM for storing nonvolatile RAID information when a system failure occurs or to reflash the board to run IR firmware.

3.8.2 LED

The LSI 12Gb/s SAS HBA Heartbeat LED, CR1, blinks green to indicate the HBA is capable of general activity.

3.8.3 Connectors

PCIe Connector (EC1). The LSI 12Gb/s SAS HBA supports a x8 interface. The PCIe host interface connection is through the edge connector, EC1, which provides connections on both the top (EC1 B) and bottom (EC1 A) of the board. The signal definitions and pin numbers conform to the PCIe specification.

SATA+SAS Connector (J1). The LSI 12Gb/s SAS HBA supports a SATA and SAS connector through an SFF-8643 mini-SAS HD, internal connector.

UART Connector (J6). The UART connector debug port requires a special cable and Avago support to gather detailed IOC status.

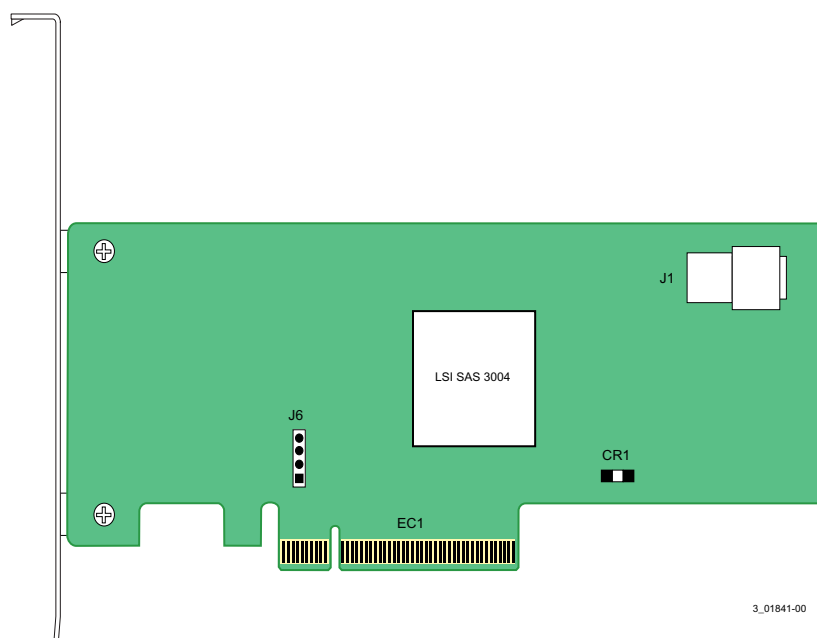
Table 11 LSI SAS HBA UART Pinout

Pin	Function
1	UART0_TX
2	Gnd
3	UART0_RX
4	1.8 V

3.8.4 Physical Characteristics

The LSI 12Gb/s SAS HBA is a 6.0-in. × 2.7-in., low-profile board. The component height on the top and bottom of the LSI 12Gb/s SAS HBA is in accordance with the PCIe specification. The following figure shows the HBA board layout.

Figure 9 LSI SAS 9311-4i HBA Board Layout



- **EC1** – PCIe x8 board edge connector
- **CR1** – Heartbeat LED
- **J1** – SFF-8643 mini-SAS HD, internal, right-angle connector
- **J6** – UART connection

3.9 LSI SAS 9300-16e HBA Characteristics

3.9.1 Memory

The LSI 12Gb/s SAS HBA provides two 4-M × 16-bit Flash ROMs to store the firmware and the BIOS.

3.9.2 LED

The LSI 12Gb/s SAS HBA Heartbeat LEDs, CR3 and CR4, blink green to indicate the HBA is capable of general activity.

3.9.3 Connectors

PCIe Connector (EC1). The LSI 12Gb/s SAS HBA supports a x8 interface. The PCIe host interface connection is through the edge connector, EC1, which provides connections on both the top (EC1 B) and bottom (EC1 A) of the board. The signal definitions and pin numbers conform to the PCIe specification.

SATA+SAS Connectors (J6, J7). The LSI 12Gb/s SAS HBA supports SATA and SAS connectors through connectors that are SFF-8644 mini-SAS HD, external connectors.

Auxiliary Power Connector (J5). The LSI 12Gb/s SAS HBA provides a 6-pin PCIe power connector.

UART Connectors (J3, J4). The UART connector debug port requires a special cable and Avago support to gather detailed IOC status. Both UART connectors use the following layout.

Table 12 LSI SAS 9300-16e HBA UART Pinout, J3 UART

Pin	Function
1	FURY1_UART0_TX
2	Gnd
3	FURY1_UART0_RX
4	1.8 V

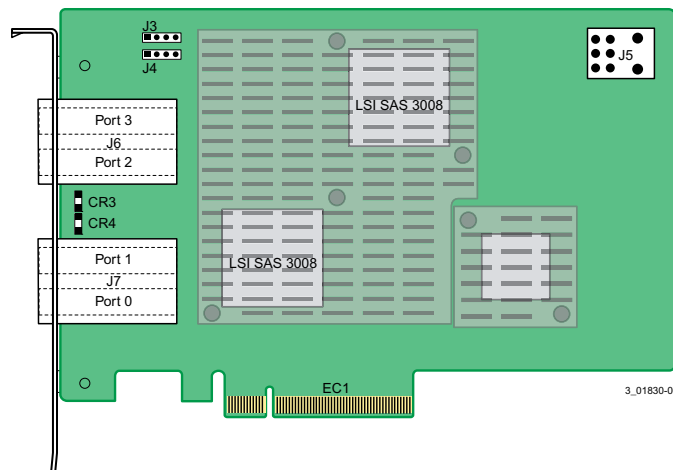
Table 13 LSI SAS 9300-16e HBA UART Pinout, J4 UART

Pin	Function
1	FURY0_UART0_TX
2	Gnd
3	FURY0_UART0_RX
4	1.8 V

3.9.4 Physical Characteristics

The LSI 12Gb/s SAS HBA is a 6.6-in. × 4.4-in board. The component height on the top and bottom of the LSI 12Gb/s SAS HBA is in accordance with the PCIe specification. The following figure shows the HBA board layout.

Figure 10 LSI SAS 9300-16e HBA Board Layout



- **EC1** – PCIe x8 board edge connector
- **CR3, CR4** – Heartbeat LEDs
- **J5** – Auxiliary power connector
- **J6, J7** – SFF-8644 mini-SAS HD, external, right-angle connectors
- **J3, J4** – UART connections

3.10 LSI SAS 9300-16i HBA Characteristics

3.10.1 Memory

The LSI 12Gb/s SAS HBA provides two 4-M × 16-bit Flash ROMs to store the firmware and the BIOS.

3.10.2 LED

The LSI 12Gb/s SAS HBA Heartbeat LEDs, LED1 and LED2, blink green to indicate the HBA is capable of general activity.

3.10.3 Connectors

PCIe Connector (J12). The LSI 12Gb/s SAS HBA supports a x8 interface. The PCIe host interface connection is through the edge connector, J12, which provides connections on both the top (J12 B) and bottom (J12 A) of the board. The signal definitions and pin numbers conform to the PCIe specification.

SATA+SAS Connector (J7). The LSI 12Gb/s SAS HBA supports SATA and SAS connectors through connectors that are SFF-8643 mini-SAS HD, internal connectors.

Auxiliary Power Connector (J10). The LSI 12Gb/s SAS HBA provides a 6-pin PCIe power connector.

UART Connectors (J1, J8). The UART connector debug port requires a special cable and Avago support to gather detailed IOC status. Both UART connectors use the following layout.

Table 14 LSI SAS 9300-16i HBA UART Pinout, J1 UART

Pin	Function
1	FURY1_UART0_TX
2	Gnd
3	FURY1_UART0_RX
4	1.8 V

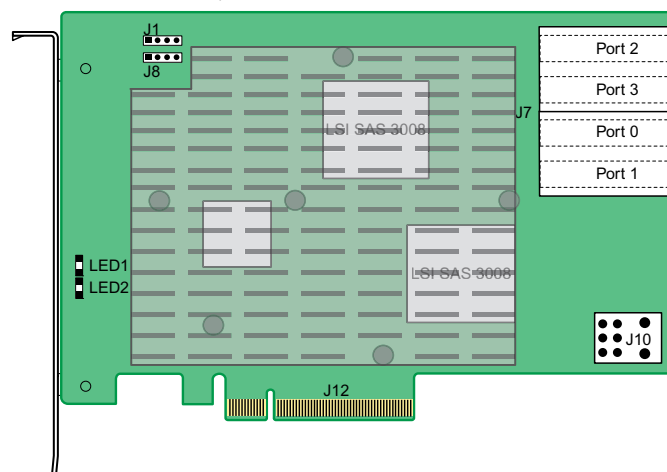
Table 15 LSI SAS 9300-16i HBA UART Pinout, J8 UART

Pin	Function
1	FURY0_UART0_TX
2	Gnd
3	FURY0_UART0_RX
4	1.8 V

3.10.4 Physical Characteristics

The LSI 12Gb/s SAS HBA is a 6.1-in. × 4.4-in board. The component height on the top and bottom of the LSI 12Gb/s SAS HBA is in accordance with the PCIe specification. The following figure shows the HBA board layout.

Figure 11 LSI SAS 9300-16i HBA Board Layout



- **J12** – PCIe x8 board edge connector
- **LED1, LED2** – Heartbeat LEDs
- **J10** – Auxiliary power connector
- **J7** – SFF-8643 mini-SAS HD, internal, right-angle connector
- **J1, J8** – UART connections

3.11 LSI SAS 9302-16e HBA Characteristics

3.11.1 Memory

The LSI 12Gb/s SAS HBA provides two 4-M × 16-bit Flash ROMs to store the firmware and the BIOS.

3.11.2 LED

The LSI 12Gb/s SAS HBA Heartbeat LEDs, CR3 and CR4, blink green to indicate the HBA is capable of general activity.

3.11.3 Connectors

PCIe Connector (EC1). The LSI 12Gb/s SAS HBA supports a x16 interface. The PCIe host interface connection is through the edge connector, EC1, which provides connections on both the top (EC1 B) and bottom (EC1 A) of the board. The signal definitions and pin numbers conform to the PCIe specification.

SATA+SAS Connectors (J6, J7). The LSI 12Gb/s SAS HBA supports SATA and SAS connectors through connectors that are SFF-8644 mini-SAS HD, external connectors.

Auxiliary Power Connector (J5). The LSI 12Gb/s SAS HBA provides a 6-pin PCIe power connector.

UART Connectors (J3, J4). The UART connector debug port requires a special cable and Avago support to gather detailed IOC status. Both UART connectors use the following layout.

Table 16 LSI SAS 9302-16e HBA UART Pinout, J3 UART

Pin	Function
1	FURY1_UART0_TX
2	Gnd
3	FURY1_UART0_RX
4	1.8 V

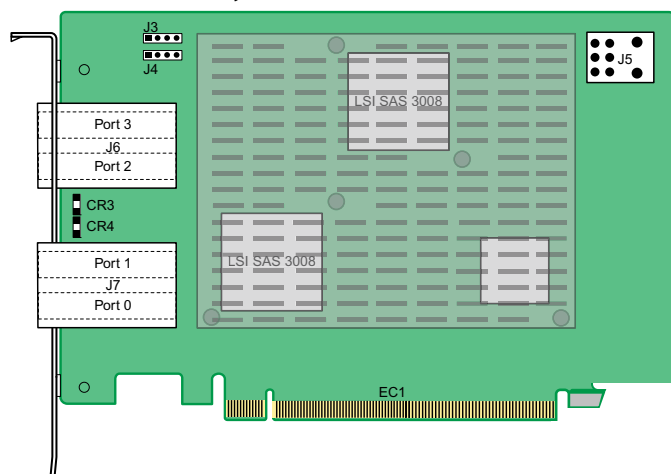
Table 17 LSI SAS 9302-16e HBA UART Pinout, J4 UART

Pin	Function
1	FURY0_UART0_TX
2	Gnd
3	FURY0_UART0_RX
4	1.8 V

3.11.4 Physical Characteristics

The LSI 12Gb/s SAS HBA is a 6.6-in. × 4.4-in. board. The component height on the top and bottom of the LSI 12Gb/s SAS HBA is in accordance with the PCIe specification. The following figure shows the HBA board layout.

Figure 12 LSI SAS 9302-16e HBA Board Layout



- **EC1** – PCIe x16 board edge connector
- **CR3, CR4** – Heartbeat LEDs
- **J5** – Auxiliary power connector
- **J6, J7** – SFF-8644 mini-SAS HD, external, right-angle connectors
- **J3, J4** – UART connections

3.12 Environmental Specifications

3.12.1 Power Requirements

The following table lists the maximum power requirements for the LSI 12Gb/s SAS HBAs.

Table 18 Maximum Power Requirements

HBA Model	PCIe 12.0 V (A)	Nominal Power (W)	Worst-Case Power (W)
LSI SAS 9300-8e ^a	1.07	14.5	22.5
LSI SAS 9300-8i	1.59	13.0	19.04
LSI SAS 9300-4i4e ^a	1.97	14.25	23.6
LSI SAS 9300-4i	1.46	10.2	17.5
LSI SAS 9311-8i	1.59	13.0	19.04
LSI SAS 9311-4i4e ^a	1.97	14.25	23.6
LSI SAS 9311-4i	1.46	10.2	17.5
LSI SAS 9310-8i	1.59	13.0	19.04
LSI SAS 9300-16e ^{a, c}	2.35 ^b	28.6	—
LSI SAS 9300-16i ^c	2.25	26.9	—
LSI SAS 9302-16e ^c	2.65 ^b	32.23	—

- a. Values reflect active cables.
- b. PCIe 3.3 V requirement is 0.13 A.
- c. Contact your Avago representative for worst-case power information.

3.12.2 Thermal and Atmospheric Limits

The atmospheric limits for the LSI 12Gb/s SAS HBA are as follows:

- Temperature range: 0 °C to 55 °C (32 °F to 131 °F) (dry bulb)
- Relative humidity range: 5% to 90% noncondensing
- Maximum dew point temperature: 32 °C (89.6 °F)
- Minimum airflow: 200 linear feet per minute at 55 °C inlet temperature
- LSI SAS 9302-16e HBA minimum airflow: 300 linear feet per minute at 55 °C inlet temperature

The following limits define the storage and transit environment for the LSI 12Gb/s SAS HBA:

- Temperature range: –45 °C to +105 °C (–49 °F to +221 °F) (dry bulb)
- Relative humidity range: 5% to 90% noncondensing

3.13 LSI 12Gb/s SAS HBA Certifications and Safety Characteristics

All LSI 12Gb/s SAS HBAs meet or exceed the requirements of UL flammability rating 94V-0. Each bare board is marked with the supplier's name or trademark, type, and UL flammability rating. Because these boards are installed in a PCIe bus slot, all voltages are less than the SELV 42.4-V limit.

The design and implementation of the LSI 12Gb/s SAS HBA minimizes electromagnetic emissions, susceptibility to radio frequency energy, and the effects of electrostatic discharge.

The LSI 12Gb/s SAS HBA meets the following integrated electromagnetic interference (EMI) compliance labels:

- CE mark
- RCM mark
- Canadian Compliance Statement
- FCC Class B, marked with the FCC Self-Certification logo
- UL Listed Mark for Canada/U.S.
- Japan VCCI
- Korean KCC
- Taiwan BSMI

The LSI 12Gb/s SAS HBA meets the following environmental directives:

- RoHS
- WEEE

Revision History

Version 1.6, February 2015

The following document changes were made:

- Removed Solaris 10 Update 11 and Solaris 11 Update 1 operating system support.
- Added [Section 1.4, Active Cable Management Support](#).
- Added the LSI SAS 9302-16e HBA.
- Template update.

Version 1.5, May 2014

The following document changes were made:

- Added the LSI SAS 9300-16i HBA.
- Changed LSI SAS 9300-16e HBA airflow requirements to 200 LFPM.
- Updated [Table 5, LSI SAS HBA UART Pinout](#).
- Updated [Table 13, LSI SAS 9300-16e HBA UART Pinout, J4 UART](#).
- Updated [Table 14, LSI SAS 9300-16i HBA UART Pinout, J1 UART](#).
- Updated [Table 15, LSI SAS 9300-16i HBA UART Pinout, J8 UART](#).

Version 1.4, December 2013

The following document changes were made:

- Added RAID support levels.

Version 1.3, May 2013

The following document changes were made:

- Updated [Table 18, Maximum Power Requirements](#).

Preliminary, Version 1.2, March 2013

The following document changes were made:

- Updated [Table 18, Maximum Power Requirements](#).
- Added [Section 1.5, LED Management](#).

Preliminary, Version 1.1, November 2012

The following document changes were made:

- Added the LSI SAS 9310-8i HBA, LSI SAS 9311-4i4e HBA, and LSI SAS 9311-4i HBA.
- Updated [Section 3.4, LSI SAS 9300-4i HBA Characteristics](#).
- Updated [Table 18, Maximum Power Requirements](#).

Preliminary, Version 1.0, June 2012

Initial document release.

