
Revision History

Version and Date	Description of Changes
54027-00, Rev. B, April 2014	Added the MegaRAID SAS 9380-4i4e RAID controller and the MegaRAID SAS 9380-8e RAID controller.
54027-00, Rev. A, October 2013	Initial release of the document.

LSI, the LSI & Design logo, Storage.Networking.Accelerated., CacheCade, CacheVault, Fusion-MPT, MegaRAID, and SafeStore are trademarks or registered trademarks of LSI Corporation in the United States and/or other countries. All other brand and product names may be trademarks of their respective companies.

LSI Corporation reserves the right to make changes to the product(s) or information disclosed herein at any time without notice. LSI Corporation does not assume any responsibility or liability arising out of the application or use of any product or service described herein, except as expressly agreed to in writing by LSI Corporation; nor does the purchase, lease, or use of a product or service from LSI Corporation convey a license under any patent rights, copyrights, trademark rights, or any other of the intellectual property rights of LSI Corporation or of third parties. LSI products are not intended for use in life-support appliances, devices, or systems. Use of any LSI product in such applications without written consent of the appropriate LSI officer is prohibited.

Corporate Headquarters
San Jose, CA
800-372-2447

Website
www.lsi.com

Document Number: 54027-00, Rev. B
Copyright © 2014 LSI Corporation
All Rights Reserved

Table of Contents

Chapter 1: Overview	5
1.1 Overview	5
1.1.1 SAS/SATA Standards and Communication Protocols	5
1.2 General Description	6
1.3 12Gb/s MegaRAID SATA+SAS RAID Controllers – Detailed Descriptions	6
1.3.1 MegaRAID SAS 9341-4i RAID Controller and MegaRAID SAS 9341-8i RAID Controller	6
1.3.2 MegaRAID SAS 9361-4i RAID Controller and MegaRAID SAS 9361-8i RAID Controller	6
1.3.3 MegaRAID SAS 9380-4i4e RAID Controller	6
1.3.4 MegaRAID SAS 9380-8e RAID Controller	7
1.4 Configuration Scenarios	7
1.5 Benefits of the SAS Interface	8
1.5.1 PCI Express Architecture	8
1.5.2 Operating System Support	9
1.6 Summary of 12Gb/s MegaRAID SATA+SAS RAID Controller Characteristics	9
1.6.1 SAS Features	10
1.6.2 SAS Array Limitations	10
1.6.3 SATA III Features	11
1.6.4 PCI Express Performance	11
1.6.5 Usability Features	12
1.6.6 Flexibility Features	12
1.6.7 Drive Roaming	12
1.6.8 Drive Migration	13
1.7 Hardware Specifications	14
1.8 Technical Support	15
Chapter 2: MegaRAID SAS Hardware Installation	16
2.1 Requirements	16
2.2 Quick Installation	16
2.3 Detailed Installation	17
2.4 After Installing the RAID Controller	19
2.5 SAS Device Cables and Connectors	19
2.5.1 Connecting a RAID Controller with Internal Port Connectors by Cable to Internal Drives	21
Chapter 3: MegaRAID SAS RAID Controller Characteristics	23
3.1 12GB/s MegaRAID SAS RAID Controller Family	23
3.1.1 MegaRAID SAS 9341 RAID Controllers	23
3.1.1.1 MegaRAID SAS 9341-8i RAID Controller – Board Layout and Jumper and Connector Information	23
3.1.2 MegaRAID SAS 9361 RAID Controllers	24
3.1.2.1 MegaRAID SAS 9361-8i RAID Controller – Board Layout and Jumper and Connector Information	24
3.1.3 MegaRAID SAS 9380-4i4e RAID Controllers	28
3.1.3.1 MegaRAID SAS 9380-4i4e RAID Controller – Board Layout and Jumper and Connector Information	28
3.1.4 MegaRAID SAS 9380-8e RAID Controllers	31
3.1.4.1 MegaRAID SAS 9380-8e RAID Controller – Board Layout and Jumper and Connector Information	31
3.2 12GB/s MegaRAID SAS RAID Controller Characteristics	33
3.3 Technical Specifications	34
3.3.1 RAID Controller Specifications	34
3.3.2 Array Performance Features	35
3.3.3 Fault Tolerance	36

3.3.4 Electrical Characteristics	36
3.3.4.1 Power Supply Requirements for the MegaRAID SAS 9341 RAID Controller.....	36
3.3.4.2 Operating and Nonoperating Conditions for MegaRAID SAS 9341 RAID Controllers	36
3.3.4.3 Power Supply Requirements for the MegaRAID SAS 9361 RAID Controllers.....	37
3.3.4.4 Operating and Nonoperating Conditions for MegaRAID SAS 9361 RAID Controllers	37
3.3.4.5 Power Supply Requirements for the MegaRAID SAS 9380-4i4e RAID Controllers.....	37
3.3.4.6 Operating and Nonoperating Conditions for MegaRAID SAS 9380-4i4e RAID Controllers.....	38
3.3.4.7 Power Supply Requirements for the MegaRAID SAS 9380-8e RAID Controllers.....	38
3.3.4.8 Operating and Nonoperating Conditions for MegaRAID SAS 9380-8e RAID Controllers	39
3.3.5 Safety Characteristics	39
Glossary.....	40

Chapter 1: Overview

This document is the primary reference and user's guide for the LSI® MegaRAID® SATA+SAS RAID controllers based on the 12Gb/s SAS/SATA RAID-on-a-chip (ROC) devices. This document contains complete installation instructions and specifications for these RAID controllers.

1.1 Overview

The 12Gb/s MegaRAID SATA+SAS RAID controllers are high-performance intelligent PCIe®-to-SATA+SAS controllers with RAID control capability. The 12Gb/s MegaRAID SATA+SAS RAID controllers provide reliability, high-performance, and fault-tolerant drive subsystem management. They are an ideal RAID solution for the internal storage of workgroup, departmental, and enterprise systems. The 12Gb/s MegaRAID SATA+SAS RAID controllers offer a cost-effective way to implement RAID in a server.

SAS technology brings a wealth of options and flexibility with the use of SAS devices and SATA devices within the same storage infrastructure. However, SAS devices and SATA devices bring individual characteristics that make each one a more suitable choice depending on your storage needs. MegaRAID technology gives you the flexibility to combine these two similar technologies on the same controller, within the same enclosure, and in the same virtual drive.

NOTE Carefully assess any decision to mix SAS drives and SATA drives within the same *virtual drive*. Although you can mix drives, the practice is strongly discouraged.

LSI offers a family of MegaRAID SATA+SAS RAID controllers that address the needs for both internal and external solutions. The 12Gb/s MegaRAID SATA+SAS RAID controllers are based on the LSI first-to-market SAS technology and proven MegaRAID technology. As third-generation PCIe RAID controllers, these controllers address the growing demand for increased data throughput and scalability requirements across midrange and enterprise-class server platforms. These controllers provide these features:

- 12Gb/s Serial Attached SCSI (SAS) performance
- 6Gb/s SATA III performance
- Eight-lane, 8 GT/s PCIe host interface

1.1.1 SAS/SATA Standards and Communication Protocols

MegaRAID SATA+SAS controllers support the ANSI® *Serial Attached SCSI standard, version 3.0*. In addition, the controller supports the SATA III protocol defined by the *Serial ATA specification, version 3.0*. Supporting both the SAS interface and the SATA interface, the SAS controller is a versatile controller that provides the backbone of both server and high-end workstation environments.

Each port on your MegaRAID SAS RAID controller supports SAS devices, SATA devices, or both, by using the following protocols:

- SAS Serial SCSI Protocol (SSP), which enables communication with other SAS devices
- SATA, which enables communication with other SATA devices
- Serial Management Protocol (SMP), which communicates topology management information directly with an attached SAS expander device
- Serial Tunneling Protocol (STP), which enables communication with SATA devices through an attached expander

1.2 General Description

The 12Gb/s MegaRAID SATA+SAS RAID controllers bring 12Gb/s Serial Attached SCSI and 6Gb/s SATA III performance to host adapter, workstation, and server designs. The 12Gb/s MegaRAID SAS 9341 RAID controllers are based on the LSISAS3008 PCIe-to-SAS/SATA controller. The following 12Gb/s MegaRAID SAS controllers are based on the LSISAS3108 PCIe RoC device:

- MegaRAID SAS 9361-4i and SAS 9361-8i RAID controllers
- MegaRAID SAS 9380-4i4e RAID controller
- MegaRAID SAS 9380-8e RAID controller

The controllers support internal storage devices and/or external storage devices, which allow you to use a system that supports enterprise-class SAS drives and desktop-class SATA III drives. Each 12Gb/s MegaRAID SATA+SAS RAID controller can connect to drives and can use expanders to connect to additional drives. Simplified cabling between devices is an additional benefit.

These devices are compliant with the Fusion-MPT™ architecture and provides a PCIe x8 interface. Each port on the MegaRAID SAS controllers supports SAS devices, SATA devices, or both, using SSP, SMP, STP, and SATA. The SSP protocol enables the MegaRAID SAS controllers to communicate with other SAS devices. The SATA protocol enables the MegaRAID SAS controllers to communicate with SATA devices.

NOTE All of these RAID controllers provide an x8 PCIe 3.0 interface.

1.3 12Gb/s MegaRAID SATA+SAS RAID Controllers – Detailed Descriptions

The 12Gb/s MegaRAID SATA+SAS RAID controllers are described in detail in the following subsections.

1.3.1 MegaRAID SAS 9341-4i RAID Controller and MegaRAID SAS 9341-8i RAID Controller

- The 12Gb/s MegaRAID SAS 9341-4i PCIe 3.0 Low-Profile Serial-Attached SCSI/SATA Disk Array Controller controls four internal SAS/SATA ports through one SFF-8643 mini-SAS HD-4i internal connector.
- The 12Gb/s MegaRAID SAS 9341-8i PCIe 3.0 Low-Profile Serial-Attached SCSI/SATA Disk Array Controller controls eight internal SAS/SATA ports through two SFF-8643 mini-SAS HD-4i internal connectors.

1.3.2 MegaRAID SAS 9361-4i RAID Controller and MegaRAID SAS 9361-8i RAID Controller

- The 12Gb/s MegaRAID SAS 9361-4i PCIe 3.0 Serial-Attached SCSI/SATA Disk Array Controller controls four internal SAS/SATA ports through one SFF-8643 mini-SAS HD-4i internal connector.
- The 12Gb/s MegaRAID SAS 9361-8i PCIe 3.0 Serial-Attached SCSI/SATA Disk Array Controller controls eight internal SAS/SATA ports through two SFF-8643 mini-SAS HD-4i internal connectors.

1.3.3 MegaRAID SAS 9380-4i4e RAID Controller

The 12Gb/s MegaRAID SAS 9380-4i4e PCIe 3.0 Serial-Attached SCSI/SATA Disk Array Controller controls four internal SAS/SATA ports through one SFF-8643 mini-SAS HD-4i internal connectors and four external SAS/SATA ports through one SFF-8644 mini-SAS HD-4e internal connector.

1.3.4 MegaRAID SAS 9380-8e RAID Controller

The 12Gb/s MegaRAID SAS 9380-8e PCIe 3.0 Serial-Attached SCSI/SATA Disk Array Controller controls eight external SAS/SATA ports through two SFF-8644 mini-SAS HD-4e external connectors.

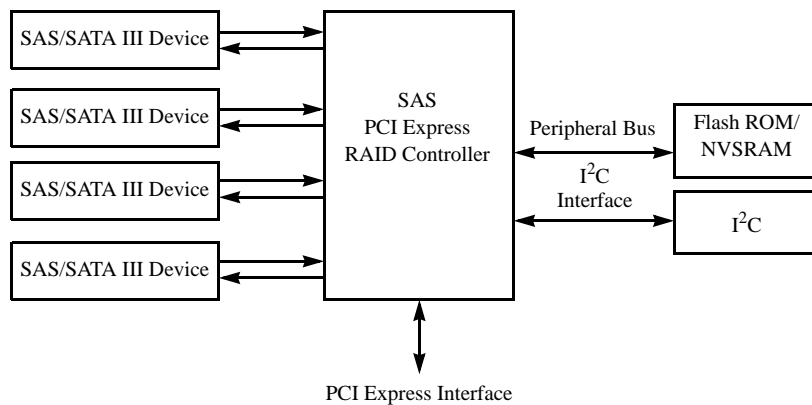
1.4 Configuration Scenarios

You can use the MegaRAID SAS RAID controllers in three main scenarios:

- **Low-end, internal SATA configuration:** In this configuration, use the RAID controller as a high-end SATA II or SATA III compatible controller that connects up to eight drives either directly or through a port expander. This configuration is mostly for low-end or entry servers. An out-of-band I²C bus provides enclosure management. Side bands of both types of internal SAS connectors support the SFF-8485 (SGPIO) interface.
- **Midrange internal SAS configuration:** This configuration is like an internal SATA configuration, but with high-end SAS drives. This configuration is more suitable for low-range to midrange servers.
- **High-end external SAS/SATA configuration:** This configuration is for external connectivity using SATA II drives, SATA III drives, SAS drives, or combinations of SATA and SAS drives. External enclosure management is supported through in-band, SCSI-enclosed storage. The configuration must support STP and SMP.

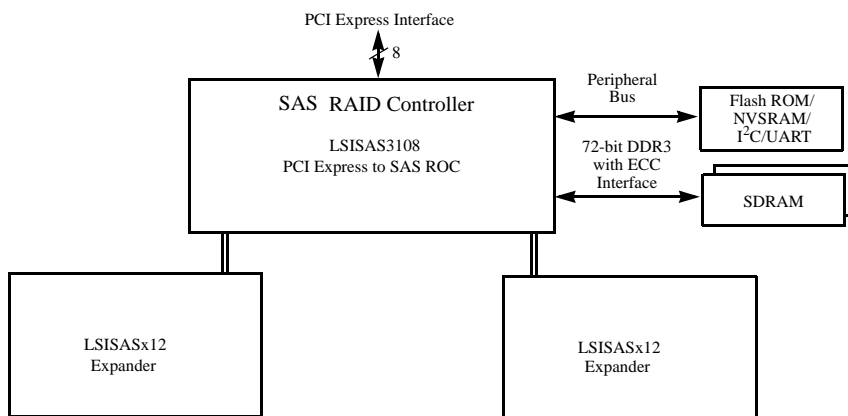
The following figure shows a direct-connect configuration. The Inter-IC (I²C) interface communicates with peripherals. The external memory bus provides an 8-bit/16-bit interface for connecting peripheral devices, such as nonvolatile static random access memory (NVS RAM) and Flash ROM.

Figure 1 Example of an LSI SAS Direct-Connect Application



The following figure shows an example of a SAS RAID controller configured with an LSISASx12 expander that is connected to SAS drives, SATA III drives, or both.

Figure 2 Example of an LSI SAS RAID Controller Configured with an LSISASx12 Expander



1.5 Benefits of the SAS Interface

SAS is a serial, point-to-point, enterprise-level device interface that leverages the proven SCSI protocol set. SAS is a convergence of the advantages of SATA, SCSI, and Fibre Channel, and it is the future mainstay of the enterprise and high-end workstation storage markets. SAS offers a higher bandwidth per pin than parallel SCSI, and it improves signal and data integrity.

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 serial transmission of SCSI commands eliminates clock-skew challenges. 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 a common electrical and physical connection interface that is compatible with Serial ATA technology. The SAS protocols and the SATA III protocols use a thin, 7-wire connector instead of the 68-wire SCSI cable or 26-wire ATA cable. The SAS/SATA III connector and cable are easier to manipulate, allow connections to smaller devices, and do not inhibit airflow. The point-to-point SATA III architecture eliminates inherent difficulties created by the legacy ATA master-slave architecture, while maintaining compatibility with existing ATA firmware.

1.5.1 PCI Express Architecture

PCI Express® (PCIe) is a local bus system designed to increase data transfers without slowing down the central processing unit (CPU). You can install MegaRAID PCIe RAID controllers in PCIe computer systems with a standard bracket type. With these controllers in your system, you can connect SAS devices and SATA devices over the bus.

NOTE Some PCIe slots support only PCIe graphics cards. RAID controllers installed in these PCIe slots do not function.

PCIe goes beyond the PCI specification in that it is intended as a unifying I/O architecture for various systems: desktops, workstations, mobile devices, servers, communications, and embedded devices.

1.5.2 Operating System Support

The 12Gb/s MegaRAID SATA+SAS RAID controllers support the following operating systems:

- Microsoft® Windows® XP SP2 (64-bit only), Windows 2003 R2 SP2, Windows Vista® SP2, Windows 7 Client SP1, Windows 8, Windows 2008 SP2, Windows 2008 R2 SP1, and Window Server® 2012
- Red Hat® Linux®
- SuSE® SLES
- Ubuntu® Linux
- VMware®
- Solaris®
- FreeBSD®
- XenServer®
- Oracle® Enterprise Linux (OEL)

Refer to the *MegaRAID SAS Device Driver Installation User Guide* for more information about the drivers. To download the latest operating system drivers, go to <http://www.lsi.com/cm/DownloadSearch.do>.

The 12Gb/s MegaRAID SATA+SAS RAID controllers use Fusion-MPT architecture for all major operating systems, which results in thinner drivers and better performance.

1.6 Summary of 12Gb/s MegaRAID SATA+SAS RAID Controller Characteristics

This section summarizes the features and benefits offered by the 12Gb/s MegaRAID SATA+SAS RAID controllers. It contains information on SAS features, SATA features, PCI performance, integration, usability, and flexibility.

The 12Gb/s MegaRAID SATA+SAS RAID controllers have the following features:

- PCIe x8 lane width (with support for x16 connections)
- PCIe performance up to 8Gb/s per lane
- Support for 1-GB and 2-GB DDR3 at 1866 MHz with ONFI cache offload support
- One internal connector for the MegaRAID SAS 9341-4i RAID controller, the MegaRAID SAS 9361-4i RAID controller, and MegaRAID SAS 9380-4i4e RAID controller
- Two internal connectors for the MegaRAID SAS 9341-8i RAID controller and the MegaRAID SAS 9361-8i RAID controller
- One external connector for the MegaRAID SAS 9380-4i4e RAID controller
- Two external connectors for the MegaRAID SAS 9380-8e RAID controller
- Support for RAID levels 0, 1, 5, 6, 10, 50, and 60
- Advanced array configuration and management utilities
- Support for global hot spares and dedicated hot spares
- Support for user-defined strip sizes: 64 KB, 128 KB, 256 KB, 512 KB, or 1024 KB

NOTE MegaRAID does not support strip sizes smaller than 64 KB. However, you can import virtual drives from legacy MegaRAID generations) that use strip sizes smaller than 64 KB.

NOTE The MegaRAID SAS 9341-4i RAID controller and the MegaRAID SAS 9341-8i RAID controller support a stripe size of 64 KB only. The stripe size for these two controllers cannot be changed.

- Advanced array configuration and management utilities offer these capabilities:
 - Online capacity expansion to add space to an existing drive or a new drive
 - Online RAID level migration
 - Drive migration
 - Drive roaming
 - No reboot necessary after expansion
 - Load balancing
 - Media scan
- User-specified rebuild rate (specifying the percentage of system resources to use from 0 percent to 100 percent)
- NVSRAM of 32 KB for storing RAID system configuration information; the MegaRAID SAS firmware is stored in flash ROM for easy upgrade.

1.6.1 SAS Features

The 12Gb/s MegaRAID SATA+SAS RAID controllers support the following SAS features:

- They provide four fully independent PHYs or eight fully independent PHYs, depending on the controller.
- They support 12Gb/s, 6Gb/s, and 3Gb/s SAS data transfers per PHY.
- They support SMP to communicate topology-management information.
- They support SSP to enable communication with other SAS devices.
- They support STP to enable communication with SATA devices through an attached expander.
- They provide a serial, point-to-point, enterprise-level storage interface.
- They simplify cabling between devices.
- They provide a scalable interface that supports up to 255 devices through the use of expanders.

NOTE The number of devices varies depending on the MegaRAID product. Check the LSI website, <http://www.lsi.com>, for specific details about your product.

- They support wide ports that consist of two, three, or four PHYs within a single quad port.
- They support narrow ports consisting of a single PHY.
- They transfer data by using SCSI information units.

1.6.2 SAS Array Limitations

This section describes the array limitations of the 12Gb/s MegaRAID SATA+SAS RAID controllers. These limitations include the number of drives supported per controller, the maximum number of drives per controller, and the maximum number of virtual drives allowed per controller.

The following table lists the array limitations for the 12Gb/s MegaRAID SATA+SAS RAID controllers.

Table 1 12Gb/s MegaRAID SATA+SAS RAID Controllers Array Limitations

Specification	MegaRAID SAS 9341-4i Controller MegaRAID SAS 9341-8i Controller	MegaRAID SAS 9361-4i Controller MegaRAID SAS 9361-8i Controller	MegaRAID SAS 9380-4i4e Controller	MegaRAID SAS 9380-8e Controller
Maximum virtual drives per controller	32	64	64	64
Maximum drive groups per controller	32	128	128	128
Maximum virtual drives per drive group	16	16	16	16
Maximum drives per drive group	32	32	32	32

Table 1 12Gb/s MegaRAID SATA+SAS RAID Controllers Array Limitations

Specification	MegaRAID SAS 9341-4i Controller MegaRAID SAS 9341-8i Controller	MegaRAID SAS 9361-4i Controller MegaRAID SAS 9361-8i Controller	MegaRAID SAS 9380-4i4e Controller	MegaRAID SAS 9380-8e Controller
Maximum drives per controller	64 (32 configurable drives)	240	240	240
Maximum hot spares per controller	32	240	240	240
Maximum spans per virtual drive	8	8	8	8
Maximum enclosures	2	16 per port	16 per port	16 per port

These RAID controllers support 64-bit logical block addressing (LBA), which makes it possible to connect a large number of drives to the RAID controller, directly and through expanders. However, the actual number of drives that you can attach depends on the limits listed in this table rather than by actual RAID volume capacity.

1.6.3 SATA III Features

The following list describes the SATA III features of the RAID controllers:

- They support SATA III data transfers of 6Gb/s.
- They support STP data transfers of 6Gb/s and 3Gb/s.
- They provide a serial, point-to-point storage interface.
- They simplify cabling between devices.
- They eliminate the master-slave construction used in parallel ATA.
- They permit addressing of multiple SATA targets through an expander.
- They permit multiple initiators to address a single target (in a fail-over configuration) through an expander.
- They comply with the *Serial ATA specification, version 3.0*.

1.6.4 PCI Express Performance

The following list describes the PCIe performance features of the RAID controllers:

- They provide a PCIe interface that does the following:
 - Supports a dedicated PCIe bus.
 - Supports x8 lane configuration.
 - Supports transfer rates of up to 8Gb/s per lane.
 - Complies with the *PCI Express specification, Revision 3.0*.
- They provide unequalled performance through the Fusion-MPT architecture.
- They provide high throughput and low CPU utilization to off load the host processor.

1.6.5 Usability Features

The following list describes the usability features of the RAID controllers:

- They simplify cabling with point-to-point, serial architecture.
- They support smaller, thinner cables that do not restrict airflow.
- They provide drive spin-up sequencing control.
- They provide one LED signal for each PHY to indicate link activity (this LED is a fault LED only for controllers with internal port connectors).
- They provide an I²C interface for enclosure management.
- They support the internal SAS Sideband signal SFF-8485 (SGPIO) interface.

NOTE LED signals indicate an error condition or drive activity. The MegaRAID controllers support different blink patterns for these LEDs, depending on the user configuration and storage enclosure. For information about the LED blink patterns, contact your storage enclosure manufacturer.

1.6.6 Flexibility Features

These features increase the flexibility of the RAID controllers:

- They support a Flash ROM interface and a NVSRAM interface.
- They offer a flexible programming interface to tune I/O performance.
- They permit mixed connections to SAS targets or SATA III targets.
- They leverage compatible connectors for SAS connections and SATA III connections.
- They permit grouping of up to four PHYs in a single quad port to form a wide port.
- They permit programming of the World Wide Name.

1.6.7 Drive Roaming

Drive roaming occurs when the drives are changed to different ports on the same controller. When the drives are placed on different channels, the controller detects the RAID configuration from the configuration data on the drives.

Configuration data is saved in both the NVSRAM on the RAID controller and on the drives attached to the controller. This action maintains the integrity of the data on each drive, even if the drives have changed their physical device ID.

NOTE If you move a drive that is being rebuilt, the rebuild operation restarts; it does not resume from the stopping point.

Follow these steps to use the drive roaming feature:

1. Turn off the power to the server and all drives, enclosures, and system components. Disconnect the power cords from the system.
2. Open the host system by following the instructions in the host system technical documentation.
3. Move the drives to different positions on the backplane to change the targets.
4. Determine the SAS target requirements.
5. Perform a safety check.
 - a. Make sure that the drives are inserted correctly.
 - b. Close the cabinet of the host system.
6. Reconnect the power cords to the system.

7. Turn on the power to the system.
The controller then detects the RAID configuration from the configuration data on the drives.

1.6.8 Drive Migration

Drive migration is the transfer of a set of drives in an existing configuration from one controller to another. The drives must remain on the same channel and must be reinstalled in the same order as in the original configuration. The controller to which you migrate the drives cannot have an existing configuration.

NOTE Partial configurations, which include individual virtual drives, can be migrated.

NOTE Drive roaming and drive migration cannot be supported at the same time.

Follow these steps to migrate drives:

1. Make sure that you clear the configuration on the system to which you migrate the drives to prevent a configuration data mismatch between the drives and the NVSRAM.

NOTE When you migrate drives, move only the drives that make up the virtual drive (not all of the drives in a drive group), so that you do not see an NVSRAM mismatch error (providing a configuration is on the destination controller). The NVSRAM mismatch error appears only if you move all of the drives to the other controller.

2. Turn off power to the server and all drives, enclosures, and system components. Disconnect the power cords from the systems.
3. Open the host system by following the instructions in the host system technical documentation.
4. Either remove the SAS cable connectors from the internal drives, or remove the shielded cables from the external drives that you want to migrate.
 - a. Make sure that pin 1 on the cable matches pin 1 on the connector.
 - b. Make sure that the SAS cables conform to all SAS specifications.
5. Remove the drives from the first system, and insert them into the drive bays on the second system.
6. Connect the SAS cables to the drives in the second system.
7. Determine the SAS target requirements.
8. Perform a safety check.
 - a. Make sure that all of the cables are attached correctly.
 - b. Make sure that the RAID controller is installed correctly.
 - c. Close the cabinet of the host system.
9. Reconnect the power cords to the system.
10. Turn on the power to the system.

The controller detects the RAID configuration from the configuration data on the drives.

1.7 Hardware Specifications

You can install the 12Gb/s MegaRAID SATA+SAS RAID controllers in a computer with a motherboard that has a PCIe slot. The following table describes the hardware configuration features for the 12Gb/s MegaRAID SATA+SAS RAID controllers.

Table 2 12Gb/s MegaRAID SATA+SAS RAID Controller Features

Specification	MegaRAID SAS 9341-4i RAID Controller, MegaRAID SAS 9341-8i RAID Controller, MegaRAID SAS 9361-4i RAID Controller, MegaRAID SAS 9361-8i RAID Controller MegaRAID SAS 9380-4i4e RAID Controller, MegaRAID SAS 9380-8e RAID Controller
RAID levels	MegaRAID SAS 9341 RAID controllers: 0, 1, 5, 10, 50 MegaRAID SAS 9361 RAID controllers: 0, 1, 5, 6, 10, 50, 60 MegaRAID SAS 9380-4i4e RAID controllers: 0, 1, 5, 6, 10, 50, 60 MegaRAID SAS 9380-8e RAID controllers: 0, 1, 5, 6, 10, 50, 60
Devices supported per port	MegaRAID SAS 9341 RAID controllers: Up to 64 SAS devices or SATA III devices (such as drives and expanders) MegaRAID SAS 9361 RAID controllers: Up to 255 SAS devices or SATA III devices (such as drives and expanders) MegaRAID SAS 9380-4i4e RAID controllers: Up to 255 SAS devices or SATA III devices (such as drives and expanders) MegaRAID SAS 9380-8e RAID controllers: Up to 255 SAS devices or SATA III devices (such as drives and expanders)
Number of ports	MegaRAID SAS 9341-4i RAID controller: Four ports through one SFF-8643 mini-SAS HD-4i connector MegaRAID SAS 9341-8i RAID controller: Eight ports through two SFF-8643 mini-SAS HD-4i connectors MegaRAID SAS 9361-4i RAID controller: Four ports through one SFF-8643 mini-SAS HD-4i connector MegaRAID SAS 9361-8i RAID controller: Eight ports through two SFF-8643 mini-SAS HD-4i connectors MegaRAID SAS 9380-4i4e RAID controller: Four ports through one SFF-8643 mini-SAS HD-4i connector and four ports through one SFF-8644 mini-SAS HD-4e connector MegaRAID SAS 9380-8e RAID controller: Eight ports through two SFF-8644 mini-SAS HD-4e connectors
Data transfer rate	Up to 12Gb/s per PHY
Bus	PCIe 3.0 (for LSI SAS3108-based controllers)
Cache function	Write-back, write-through, non-read-ahead, read-ahead, cache I/O, direct I/O
Multiple virtual drives per controller	MegaRAID SAS 9341 RAID controllers: Up to 32 MegaRAID SAS 9361 RAID controllers: Up to 64 MegaRAID SAS 9380-4i4e RAID controllers: Up to 64 MegaRAID SAS 9380-8e RAID controllers: Up to 64
Online capacity expansion	Yes
Dedicated and global hot spares	Yes
Hot-swap devices supported	Yes
Non-drive devices supported	Yes
Mixed-capacity drives supported	Yes
Number of internal connectors	MegaRAID SAS 9341-4i RAID controller: One SFF-8643 mini-SAS HD-4i connector MegaRAID SAS 9341-8i RAID controller: Two SFF-8643 mini-SAS HD-4i connectors MegaRAID SAS 9361-4i RAID controller: One SFF-8643 mini-SAS HD-4i connector MegaRAID SAS 9361-8i RAID controller: Two SFF-8643 mini-SAS HD-4i connectors MegaRAID SAS 9380-4i4e RAID controller: One SFF-8643 mini-SAS HD-4i connector

Table 2 12Gb/s MegaRAID SATA+SAS RAID Controller Features (Continued)

Specification	MegaRAID SAS 9341-4i RAID Controller, MegaRAID SAS 9341-8i RAID Controller, MegaRAID SAS 9361-4i RAID Controller, MegaRAID SAS 9361-8i RAID Controller, MegaRAID SAS 9380-4i4e RAID Controller, MegaRAID SAS 9380-8e RAID Controller
Number of external connectors	MegaRAID SAS 9380-4i4e RAID controller: One SFF-8644 mini-SAS HD-4e connector MegaRAID SAS 9380-8e RAID controller: Two SFF-8644 mini-SAS HD-4e connectors
Hardware exclusive OR (XOR) assistance	Yes
Direct I/O	Yes
Architecture	Fusion-MPT

1.8 Technical Support

For assistance installing, configuring, or running your 12Gb/s MegaRAID SATA+SAS RAID controller, contact LSI Technical Support.

Click the following link to access the LSI Technical Support page for storage and board support:

http://www.lsi.com/support/storage/tech_support/index.html

From this page, you can email or call LSI Technical Support or submit a new service request and view its status.

NOTE Record your controller serial number in a safe location in case you need to contact LSI.

Email:

<http://www.lsi.com/support/email/Pages/default.aspx>

Support Request:

<http://www.lsi.com/support/Pages/submitsupportrequest.aspx>

Telephone Support:

<http://www.lsi.com/support/Pages/call-us.aspx>

1-800-633-4545 (North America)

00-800-5745-6442 (International)

NOTE The international toll-free number does not require country-specific access codes.

Documents and Downloads:

http://www.lsi.com/support/Pages/downloads.aspx?k=*

Chapter 2: MegaRAID SAS Hardware Installation

2.1 Requirements

The following items are required to install a 12Gb/s MegaRAID SATA+SAS RAID controller:

- A MegaRAID SAS 93xx RAID controller
- A host system with an available x8 PCIe 3.0 slot

NOTE These controllers also work in PCI Express first generation slots. The PCI Express software is backward compatible with previous revisions of the PCI bus and the PCI-X® bus.

- The *MegaRAID Universal Software Suite* CD, which contains the drivers and documentation
- The necessary internal cables, external cables, or both
- SAS drives or SATA drives

NOTE Make sure to use an uninterruptible power supply.

2.2 Quick Installation

The following steps quickly install your 12Gb/s MegaRAID SATA+SAS RAID controller. These steps are for experienced computer users or installers. [Section 2.3, Detailed Installation](#), contains the steps for all other users to follow.

1. Turn off the power to the system and all drives, enclosures, and system components, and disconnect the PC power cord.
2. Open the cabinet of the host system by following the instructions in the host system technical documentation.
3. Check the jumper settings to make sure that they are in the desired position. The jumpers are set at the factory, and you usually do not need to change them.

NOTE See [Chapter 3, MegaRAID SAS RAID Controller Characteristics](#), for detailed information about the jumpers and the connectors.

4. Install the 12Gb/s MegaRAID SATA+SAS RAID controller in the server, and connect SAS devices or SATA devices to it. Make sure that the cables you use conform to all specifications.
5. Perform a safety check.
 - a. Make sure that all cables are attached correctly.
 - b. Make sure that the RAID controller is installed correctly.
 - c. Close the cabinet of the host system.
6. Reconnect the power cords to the system.
7. Turn on the power to the system.

Make sure that the power is turned on to any external drives before the power is turned on to the host computer. If the computer is powered up before these devices, the devices might not be recognized.

2.3 Detailed Installation

This section provides detailed instructions on how to install your 12Gb/s MegaRAID SATA+SAS RAID controller.

The figure in this section shows the installation of the MegaRAID SAS 9361-8i RAID controller in a PCIe slot. You can install the other MegaRAID SAS RAID controllers in the same way.

1. Unpack your 12Gb/s MegaRAID SATA+SAS RAID controller.

Unpack and remove your RAID controller. Inspect it for damage. If it appears damaged, or if any of the following items are missing, contact your LSI Customer and Technical Support representative. The RAID controller is shipped with the following items:

- A CD that contains an electronic version of this user's guide, and other related documentation
- A license agreement
- Warranty information

2. Turn off the power to the system.

Turn off the power to the computer, and disconnect the AC power cord. Remove the computer cover. Refer to the system documentation for instructions. Before you install the controller, make sure that the computer is disconnected from the power and from any networks.

3. Review the RAID controller jumpers and connectors.

The jumpers are set at the factory, and you usually do not need to change them. See [Chapter 3, MegaRAID SAS RAID Controller Characteristics](#), for diagrams of the 12Gb/s MegaRAID SATA+SAS RAID controllers that show their jumpers and connectors.

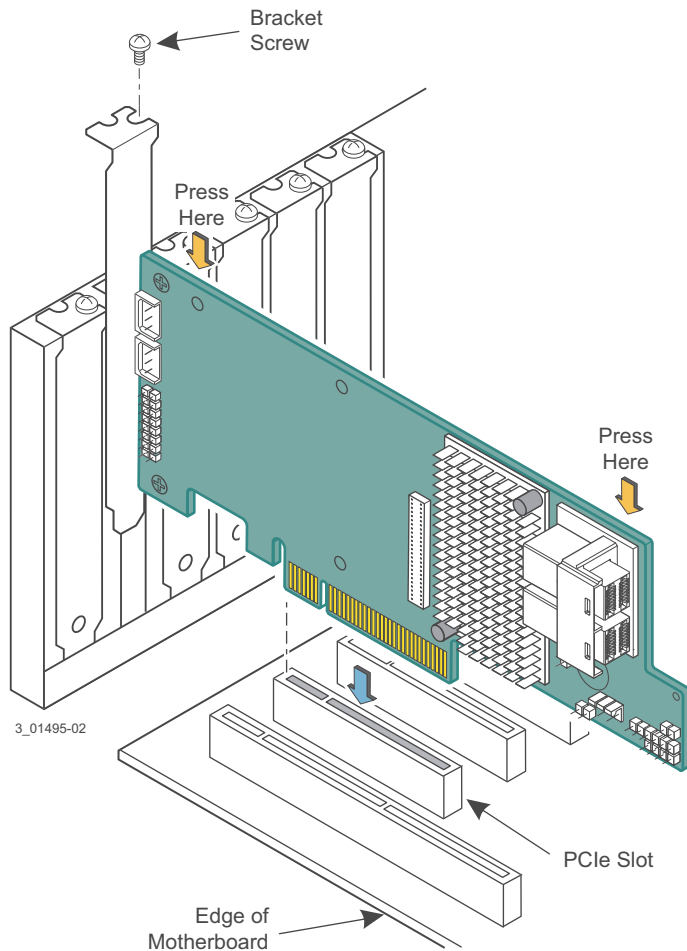
4. Install the RAID controller.

Select a PCIe slot, and align the controller's PCIe bus connector to the slot, as shown in the following figure. Press down gently, but firmly, to make sure that the card is seated correctly in the slot. Secure the bracket to the computer chassis with the bracket screw.

ATTENTION If your RAID controller has a CacheVault® Flash Module (CVFM), do not press down on the module when you insert the controller.

NOTE This RAID controller is a PCIe x8 card, and it can operate in x8 or x16 slots. Some PCIe slots, however, support only PCIe graphics cards; if a RAID controller is installed in one of these slots, the RAID controller will not function. Refer to the guide for your motherboard for information about the PCIe slot.

Figure 3 Example of the MegaRAID SAS 9361-8i Controller Installation in a PCIe Slot



5. Configure and install the SAS devices, the SATA devices, or both in the host computer case. Refer to the documentation for the devices for any pre-installation configuration requirements.
6. Connect the RAID controller to the devices.
Use SAS cables to connect SAS devices, SATA devices, or both to the 12Gb/s MegaRAID SATA+SAS RAID controller. See [Section 2.5, SAS Device Cables and Connectors](#), for SAS cable and connector information. See [Section 2.5.1, Connecting a RAID Controller with Internal Port Connectors by Cable to Internal Drives](#), for information about connecting the controller to the drives.
The maximum cable length is 1 meter (39.37 in.). You can connect one device per SAS PHY unless you use an expander.
System throughput problems can occur if the SAS cables are not the correct type. To minimize the potential for problems, use the following guidelines:
 - Use cables no longer than 1 meter (39.37 in.). (Use shorter cables, if possible.)
 - Use cables that meet the SAS specification.
 - Route the SAS cables carefully.

7. Turn on the power to the system.

Reinstall the computer cover, and reconnect the AC power cords. Turn on power to the host computer. Make sure that the power is turned on to the SAS devices, SATA devices, or both before or at the same time that the power is turned on to the host computer. If the computer is powered on before these devices, the devices might not be recognized.

During boot, a BIOS message appears. The firmware takes several seconds to initialize. The configuration utility prompt times out after several seconds. The second portion of the BIOS message shows the 12Gb/s MegaRAID SATA+SAS RAID controller number, firmware version, and cache SDRAM size. The numbering of the controllers follows the PCI slot scanning order used by the host motherboard.

8. Run the WebBIOS™ Configuration Utility.

Run the WebBIOS Configuration Utility to configure the drive groups and the virtual drives. When the message `Press CTRL+H for WebBIOS` appears on the screen, immediately press `Ctrl+H` to run the utility.

9. Install the operating system driver.

MegaRAID SAS RAID controllers can operate under various operating systems. To operate under these operating systems, you must install the software drivers. The *MegaRAID Universal Software Suite* CD includes software drivers for the supported operating systems, along with documentation. You can view the supported operating systems and download the latest drivers for RAID controllers from the LSI website.

For information about installing the driver, refer to the *MegaRAID SAS Device Driver Installation User Guide* on the *MegaRAID Universal Software Suite* CD. Be sure to use the latest service packs provided by the operating system manufacturer and to review the `readme` file that accompanies the driver.

2.4 After Installing the RAID Controller

After you install the 12Gb/s MegaRAID SATA+SAS RAID controller, you must configure the controller and install the operating system driver. The *MegaRAID SAS Software User Guide* instructs you on the configuration options and how to set them on your 12Gb/s MegaRAID SATA+SAS RAID controller. The *MegaRAID SAS Device Driver Installation User Guide* provides detailed installation instructions for operating system drivers.

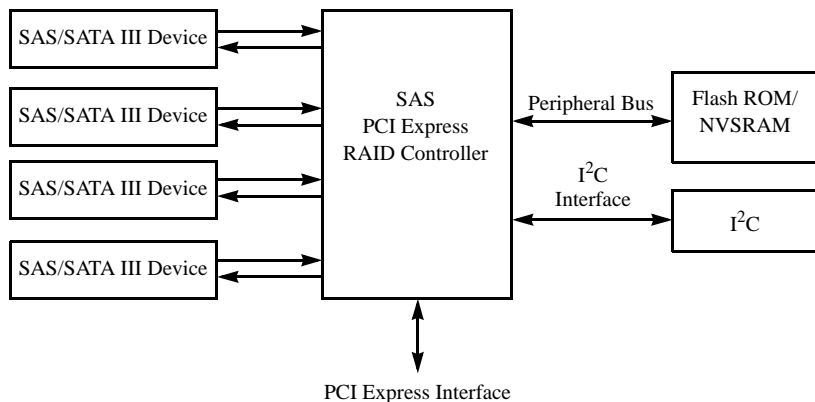
2.5 SAS Device Cables and Connectors

This section describes the cables and the connectors used on the MegaRAID SAS controllers and provides step-by-step instructions for connecting SAS drives, SATA drives, or both to the MegaRAID SAS RAID controller. The SAS protocol and the SATA protocol use a thin, 7-wire connector instead of the 68-wire SCSI cable or the 40-wire ATA cable.

NOTE Use only straight SAS cables, not crossover SAS cables.

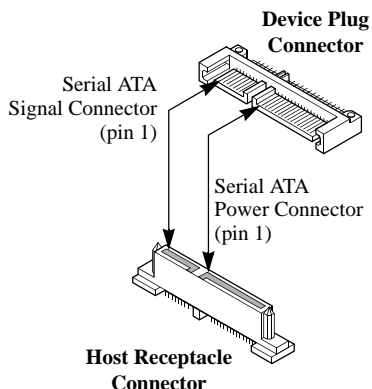
The following figure shows the SAS cable that connects the internal connectors on a SAS RAID controller to SAS drives, SATA drives, or both.

Figure 4 Internal SAS Cable for Connection to SAS Drives, SATA II Drives, or SATA III Drives



The following figure shows the SATA III device plug connector that connects a SAS RAID controller with internal connectors to the host receptacle connector on a backplane. A SATA III connector consists of a signal connector and a power connector.

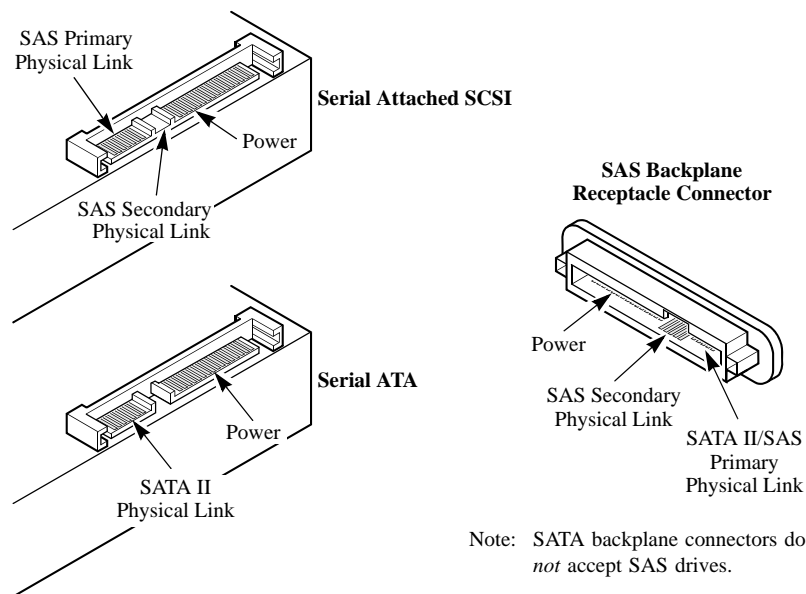
Figure 5 SATA III Connectors



The following figure shows SAS connectors and SATA connectors on SAS drives and SATA drives, respectively. Cables connect internal connectors on the RAID controllers to connectors on SAS drives, SATA drives, or both. Both SAS drives and SATA drives can connect to SAS backplane receptacle connectors. The difference between the SAS connector and the SATA connector is the bridge between the SAS primary physical link and the power connector on the SAS controller, which the SATA connector does not have.

NOTE SAS backplane connectors accept SAS drives or SATA drives, but SATA backplane connectors *cannot* accept SAS drives.

Figure 6 SAS Plugs, SATA Plugs, and SAS Backplane Receptacle Connector



The following subsections provide step-by-step instructions for connecting the MegaRAID SAS RAID controllers to SAS drives and SATA drives, either directly or through an expander.

2.5.1 Connecting a RAID Controller with Internal Port Connectors by Cable to Internal Drives

This section provides step-by-step instructions for connecting the SAS cable from the internal SAS port connectors on the RAID controller to internal SAS drives and SATA drives.

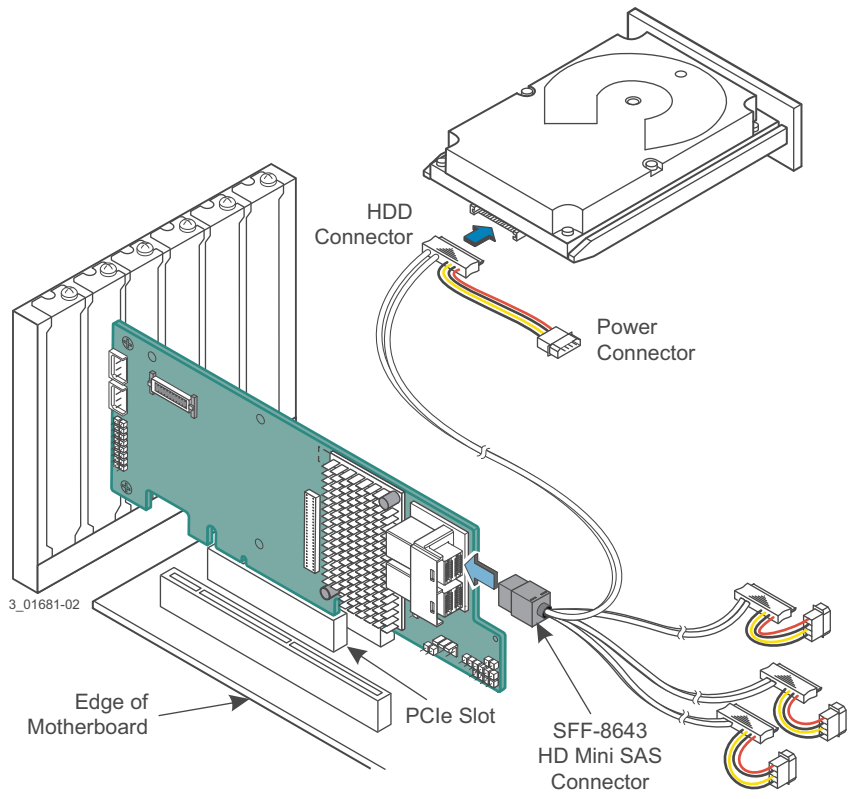
Follow these steps to connect your RAID controller with internal SAS port connectors directly to SAS drives or SATA drives.

NOTE The MegaRAID SAS 9361-8i RAID controller is shown as an example. You can connect the other MegaRAID SAS 93xx controllers in the same way.

1. Insert the SFF-8643 internal mini-SAS HD-4i connector on the cable into a SFF-8643 internal mini-SAS HD-4i connector on the MegaRAID SAS 9361-8i RAID controller, as shown in the following figure.
2. Plug the HDD connector on the other end of the cable into the connector on the SAS drive or SATA drive.
3. If you have another drive, connect it to another plug on the internal cable.

You can connect other devices if the cable has more connectors.

Figure 7 Connecting the MegaRAID SAS 9361-8i RAID Controller to a Drive



Chapter 3: MegaRAID SAS RAID Controller Characteristics

3.1 12GB/s MegaRAID SAS RAID Controller Family

The 12Gb/s MegaRAID SATA+SAS RAID controllers are dual-PHY, SAS PCI Express (PCIe) RAID controllers and are used in a system with a PCIe slot. PCIe goes beyond the PCI specification in that it is intended as a unifying I/O architecture for various systems: desktops, workstations, mobile devices, servers, communications, and embedded devices.

The following subsection provides figures and connector information for the 12GB/s MegaRAID SAS RAID controllers.

3.1.1 MegaRAID SAS 9341 RAID Controllers

The MegaRAID SAS 9341-4i low-profile SATA+SAS RAID controller controls four internal SAS/SATA ports through one SFF-8643 internal mini-SAS HD-4i connector.

The MegaRAID SAS 9341-8i low-profile SATA+SAS RAID controller controls eight internal SAS/SATA ports through two SFF-8643 internal mini-SAS HD-4i connectors.

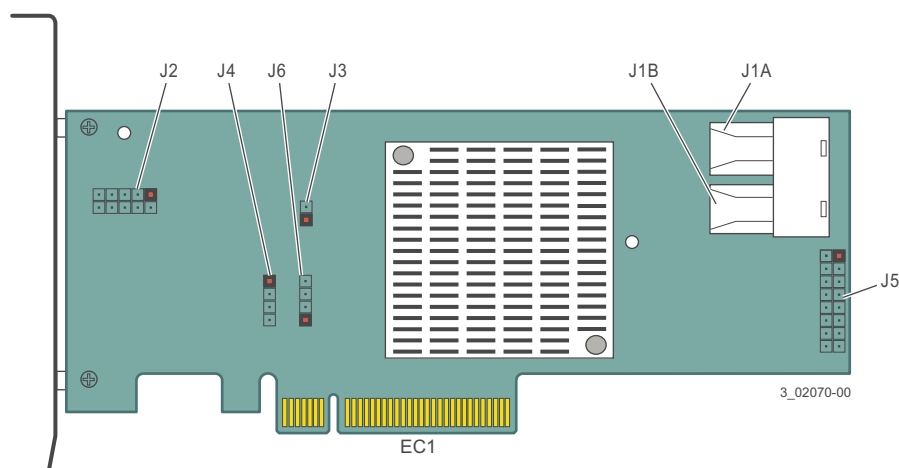
3.1.1.1 MegaRAID SAS 9341-8i RAID Controller – Board Layout and Jumper and Connector Information

This subsection provides the board layout, and the connector and jumper information for the MegaRAID SAS 9341 RAID controllers. The following figure shows the jumpers and the connectors on the MegaRAID SAS 9341-8 controller.

NOTE The MegaRAID SAS 9341-4i RAID controller is the same as the MegaRAID SAS 9341-8i RAID controller, except that the MegaRAID SAS 9341-8i RAID controller contains an additional internal port connector, J1B.

NOTE Pin 1 on the headers and connectors is highlighted in red in this figure.

Figure 8 Card Layout for the MegaRAID SAS 9341-8i RAID Controller



NOTE Pin 1 on the headers and connectors is highlighted in red in this figure.

The following table describes the jumpers and the connectors on the MegaRAID SAS 9341-8i RAID controller.

Table 3 Jumpers and Connectors

Jumper/Connector	Type	Description
EC1	Standard edge card connector	The interface between the RAID controller and the host system. Along with the PCIe interface, this connector provides power to the board and an I ² C interface connected to the I ² C bus for the Intelligent Platform Management Interface (IPMI).
J1A	x4 SAS Port 0 through Port 3 internal connector	Two SFF-8643 mini-SAS HD-4i internal connectors Connects the controller by cable to SAS drives or SATA drives.
J1B	x4 SAS Port 4 through Port 7 internal connector	Two SFF-8643 mini-SAS HD-4i internal connectors Connects the controller by cable to SAS drives or SATA drives.
J2	CPLD header	10-pin header Reserved for LSI use.
J3	Modular RAID Key header	2-pin connector Reserved for LSI use.
J4	On-board Serial Universal Asynchronous Receiver/Transmitter (UART) connector	4-pin connector Reserved for LSI use.
J5	RISCwatch header	16-pin header Reserved for LSI use.
J6	LSI Test header	2-pin connector Reserved for LSI use.

3.1.2 MegaRAID SAS 9361 RAID Controllers

The MegaRAID SAS 9361-4i low-profile SATA+SAS RAID controller controls four internal SAS/SATA ports through one SFF-8643 internal mini-SAS HD-4i connector.

The MegaRAID SAS 9361-8i low-profile SATA+SAS RAID controller controls eight internal SAS/SATA ports through two SFF-8643 internal mini-SAS HD-4i connectors.

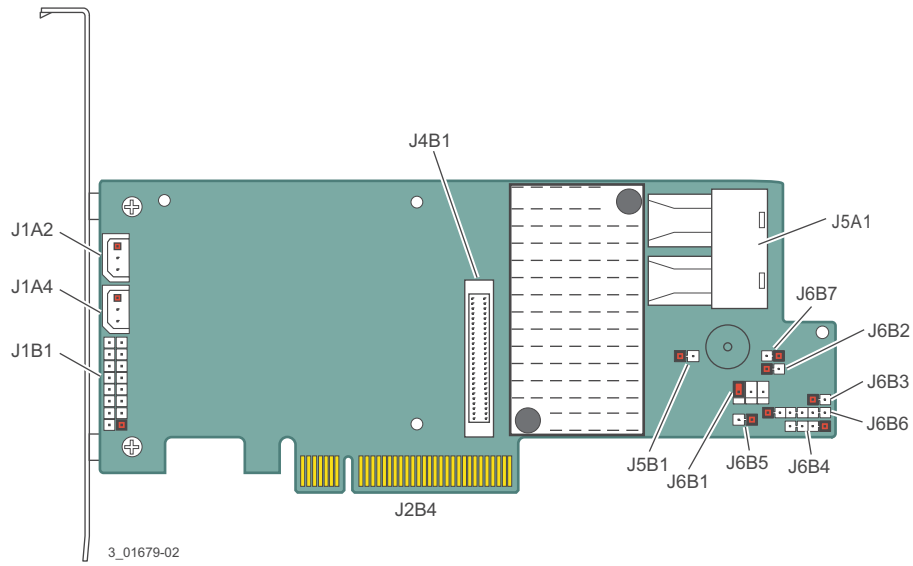
3.1.2.1 MegaRAID SAS 9361-8i RAID Controller – Board Layout and Jumper and Connector Information

This subsection provides the board layout, and the connector and jumper information for the MegaRAID SAS 9361 RAID controllers. The following figure shows the jumpers and the connectors on the MegaRAID SAS 9361-8 controller.

NOTE The MegaRAID SAS 9361-4i RAID controller is the same as the MegaRAID SAS 9361-8i RAID controller except that the J5A1 connector on the MegaRAID SAS 9361-4i RAID controller is a single internal port connector. The J5A1 connector on the MegaRAID SAS 9361-8i RAID controller is a dual internal port connector.

NOTE Pin 1 on the headers and connectors is highlighted in red in this figure.

Figure 9 Card Layout for the MegaRAID SAS 9361-8i RAID Controller



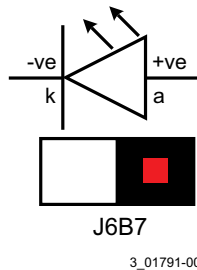
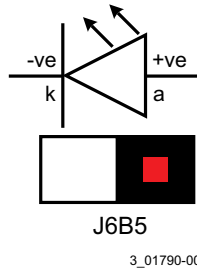
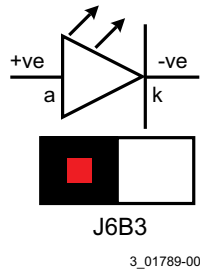
The following table describes the jumpers and the connectors on the MegaRAID SAS 9361-8i RAID controller.

Table 4 Jumpers and Connectors

Jumper/ Connector	Type	Description
J1A2	IPMI-style I ² C connector for Ports 4 to 7	3-pin connector Supports SCSI Enclosure Services (SES) over I ² C through an internal I ² C backplane cable.
J1A4	IPMI-style I ² C connector for Ports 0 to 3	3-pin connector Supports SES over I ² C through an internal I ² C backplane cable.
J1B1	Individual PHY and drive fault indication header Ports 0 to 3 Ports 4 to 7	2x8-pin header Connects to an LED that indicates whether a drive is in a fault condition. One LED exists per port. When lit, each LED indicates the corresponding drive has failed or is in the <i>Unconfigured-Bad</i> state. The LEDs function in a direct-attach configuration (no SAS expanders exist). Direct attach is defined as a maximum of one drive connected directly to each port. NOTE The J5A1 connector on the MegaRAID SAS 9361-4i RAID controller is a single internal port connector.
J2B4	Standard edge card connector	The interface between the RAID controller and the host system. Along with the PCIe interface, this connector provides power to the board and an I ² C interface connected to the I ² C bus for the Intelligent Platform Management Interface (IPMI).
J4B1	CacheVault Flash Module (ONFI) interface	70-pin connector Connects the RAID controller to a flash module.
J5A1	Dual x4 SAS Port 0 through Port 7 internal connector	Two SFF-8643 mini-SAS HD-4i internal connectors Connects the controller by cable to SAS drives or SATA drives.
J5B1	LSI Test header	2-pin connector Reserved for LSI use.

Table 4 Jumpers and Connectors (Continued)

Jumper/ Connector	Type	Description
J6B1	Advanced software options hardware key header	3-pin header Enables support for selected advanced features, such as Recovery, CacheCade®, FastPath, and SafeStore™ disk encryption. Refer to the <i>MegaRAID Advanced Services Hardware Key Quick Installation Guide</i> for more information.
J6B2	Default Serial boot ROM (SBR) header	2-pin connector Reserved for LSI use.
J6B3	Global hard disk drive (HDD) activity LED header	2-pin connector Connects to an LED that indicates activity on the drives connected to the controller.
J6B4	On-board Serial Universal Asynchronous Receiver/Transmitter (UART) connector	4-pin connector Reserved for LSI use.
J6B5	Global drive fault LED header	2-pin connector Connects to an LED that indicates whether a drive is in a fault condition
J6B6	Complex programmable logic device (CPLD) header	6-pin connector Reserved for LSI use.
J6B7	Cache write pending header	2-pin connector. Connector for an LED mounted on the system enclosure. The LED indicates that the data in the cache has yet to be written to the storage devices.



3.1.3 MegaRAID SAS 9380-4i4e RAID Controllers

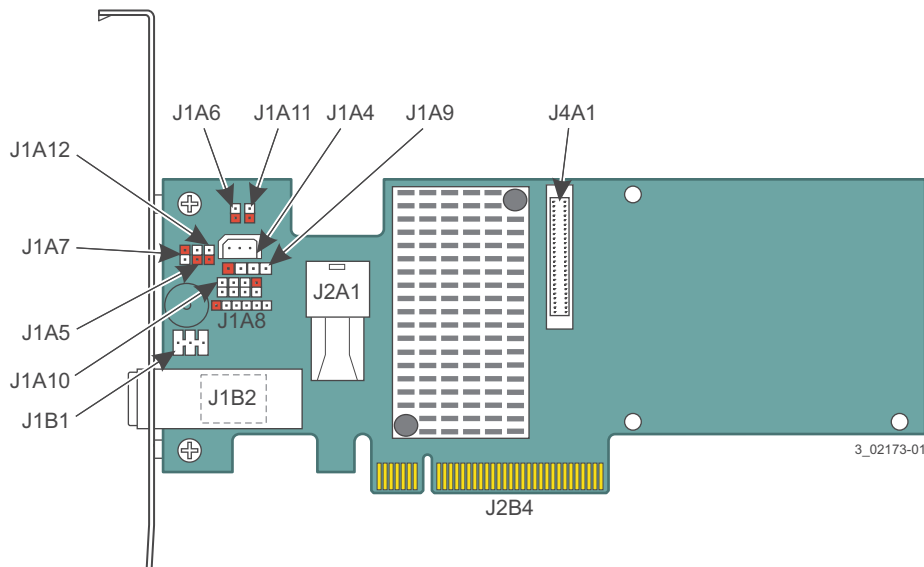
The MegaRAID SAS 9380-4i4e low-profile SATA+SAS RAID controller controls four internal SAS/SATA ports through one SFF-8643 internal mini-SAS HD-4i connector and four external SAS/SATA ports through one SFF-8644 mini-SAS HD-4e connector.

3.1.3.1 MegaRAID SAS 9380-4i4e RAID Controller – Board Layout and Jumper and Connector Information

This subsection provides the board layout, and the connector and jumper information for the MegaRAID SAS 9380-4i4e RAID controller. The following figure shows the jumpers and the connectors on the controller.

NOTE Pin 1 on the headers and connectors is highlighted in red in this figure.

Figure 10 Card Layout for the MegaRAID SAS 9380-4i4e RAID Controller



The following table describes the jumpers and the connectors on the MegaRAID SAS 9361-8i RAID controller.

Table 5 Jumpers and Connectors

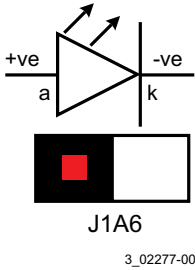
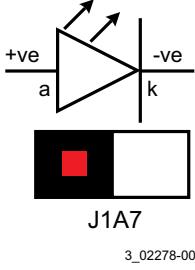
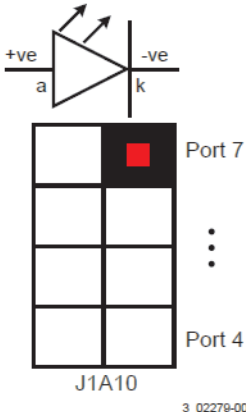
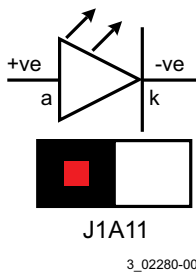
Jumper/ Connector	Type	Description
J1A4	IPMI-style I ² C connector for Ports 4 to 7	3-pin connector Supports SCSI Enclosure Services (SES) over I ² C through an internal I ² C backplane cable.
J1A5	Default Serial boot ROM (SBR) header	2-pin connector Reserved for LSI use.
J1A6	Global drive fault LED header  <p style="text-align: center;">J1A6 3_02277-00</p>	2-pin connector Connects to an LED that indicates activity on the drives connected to the controller.
J1A7	Cache write pending header  <p style="text-align: center;">J1A7 3_02278-00</p>	2-pin connector. Connector for an LED mounted on the system enclosure. The LED indicates that the data in the cache has yet to be written to the storage devices.
J1A9	On-board Serial Universal Asynchronous Receiver/Transmitter (UART) connector	4-pin connector Reserved for LSI use.

Table 5 Jumpers and Connectors (Continued)

Jumper/ Connector	Type	Description
J1A10	Individual PHY and drive fault indication header Ports 4 to 7 	2x4-pin header Connects to an LED that indicates whether a drive is in a fault condition. One LED exists per port. When lit, each LED indicates the corresponding drive has failed or is in the <i>Unconfigured-Bad</i> state. The LEDs function in a direct-attach configuration (no SAS expanders exist). Direct attach is defined as a maximum of one drive connected directly to each port.
J1A11	Global hard disk drive (HDD) activity LED header 	2-pin connector Connects to an LED that indicates activity on the drives connected to the controller.
J1A12	LSI Test header	2-pin connector Reserved for LSI use.
J1B1	Advanced software options hardware key header	3-pin header Enables support for selected advanced features, such as Recovery, CacheCade, FastPath, and SafeStore disk encryption. Refer to the <i>MegaRAID Advanced Services Hardware Key Quick Installation Guide</i> for more information.
J1B2	SAS Port 0 through Port 3 external connector	One SFF-8644 mini-SAS HD-4e external connector Connects the controller by cable to an enclosure containing SAS drives or SATA drives.
J2A1	SAS Port 4 through Port 7 internal connector	One SFF-8643 mini-SAS HD-4i internal connector Connects the controller by cable to SAS drives or SATA drives.
J4A1	CacheVault Flash Module (ONFI) interface	80-pin connector Connects the RAID controller to a flash module.

