# intel®

# Intel® Storage Adapters RS3P4GF016J and RS3P4QF160J

## *Hardware User Guide*

A document providing an overview of product features, specification data, and hardware installation instructions.

**Rev. 1.3**

**March 2022**

**Delivering Breakthrough Data Center System Innovation – Experience What's Inside!**

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## *Document Revision History*

| Date | Revision | Changes |
|---|---|---|
| April 2021 | 1.0 | Initial release. |
| June 2021 | 1.1 | • Added the RS3P4GF016J adapter to the guide.<br>• Removed support for the RES3FV288 expander.<br>• Added support for the CYPCBLSLSLX8L cable.<br>• Added support for the CYPCBLSLHD kit cables.<br>• Minor changes throughout the document for clarity. |
| September 2021 | 1.2 | • Corrected swapped column names on table 1.<br>• Added identification for pin1 on table 2.<br>• Added missing heartbeat LED on figure 3.<br>• Corrected cable names on figures 10 and 11. |
| March 2022 | 1.3 | • Added support for the Intel Server Systems R2000WF and R1000WF Families.<br>• Corrected cable names on figures 11 and 12.<br>• Removed safety page.<br>• Updated the safety and regulatory section.<br>• Updated link on product support collaterals section.<br>• Added more details on the connector type added in table 1 and figures.<br>• Corrected the backplane drawing on figure 12.<br>• Grammar and format edits throughout the document. |

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# *Warnings*

**Heed safety instructions:** Before working with your server product, whether you are using this guide or any other resource as a reference, pay close attention to the safety instructions. You must adhere to the assembly instructions in this guide to ensure and maintain compliance with existing product certifications and approvals. Use only the described, regulated components specified in this guide. Use of other products/components will void the UL listing and other regulatory approvals of the product and will most likely result in noncompliance with product regulations in the region(s) in which the product is sold.

**System power on/off:** The power button DOES NOT turn off the system AC power. To remove all power from the system, you must unplug the AC power cord from the electrical outlet. Make sure that the AC power cord is unplugged before you open the chassis, add, or remove any components.

**Hazardous conditions, devices, and cables**: Hazardous electrical conditions may be present on power, telephone, and communication cables. Turn off the server and disconnect the power cord, telecommunications systems, networks, and modems attached to the server before opening it. Otherwise, personal injury or equipment damage can result.

**Installing or removing jumpers:** A jumper is a small plastic-encased conductor that slips over two jumper pins. Some jumpers have a small tab on top that you can grip with your fingertips or with a pair of fine needle nosed pliers. If your jumpers do not have such a tab, take care when using needle-nosed pliers to remove or install a jumper; grip the narrow sides of the jumper with the pliers, never the wide sides. Gripping the wide sides can damage the contacts inside the jumper, causing intermittent problems with the function controlled by that jumper. Take care to grip with, but not squeeze, the pliers or other tool you use to remove a jumper, or you may bend or break the pins on the board.

**Electrostatic discharge (ESD) and ESD protection:** ESD can damage disk drives, boards, and other parts. We recommend that you perform all procedures in this chapter only at an ESD workstation. If one is not available, provide some ESD protection by wearing an anti-static wrist strap attached to chassis ground, any unpainted metal surface on your server when handling parts.

**ESD and handling boards:** Always handle boards carefully. They can be extremely sensitive to ESD. Hold boards only by their edges. After removing a board from its protective wrapper or from the server, place the board component side up on a grounded, static-free surface. Use a conductive foam pad if available but not the board wrapper. Do not slide board over any surface.

# Table of Contents

# List of Figures

# List of Tables

# 1.    Introduction

## 1.1    About This Document

This document provides an overview of product features, specification data, and hardware installation instructions for the Intel® Storage Adapters RS3P4QF160J and RS3P4GF016J.

### 1.1.1        Document Organization

This document includes the following chapters and appendix:

- Introduction. Preface and product support collaterals (reference documents and online articles).
- Product Overview. A product overview of the features set and support specifications.
- Tri-Mode Intel® Storage Adapters General Features. Descriptions for the features that are common for the products covered by this guide.
- Tri-Mode Intel® Storage Adapters Detailed Characteristics. Details on the characteristics for each of the products covered by this guide.
- Hardware Installation. Support for the installation of the product on the Intel systems (where they are supported).
- Safety and Regulatory (Class A). Covers intended application, also the product's compliance on safety, EMC, and environmental aspects.
- Appendix A. Glossary. A list of acronyms and specialized terms used throughout this document.

## 1.2    Product Support Collaterals

For general Intel® RAID and storage adapters product documentation, hardware and software user guides, go to the Intel webpage: https://www.intel.com/content/www/us/en/support/articles/000055582/server-products/sasraid.html.

For Intel RAID and storage adapters product warranty information, firmware, device drivers, configuring and troubleshooting guides, go to the Intel webpage:
https://www.intel.com/content/www/us/en/support/topics/raid-bios-firmware.html.

# 2. Product Overview

The Intel Storage Adapters RS3P4QF160J and RS3P4GF016J are part of the second generation of tri-mode Intel storage adapters. This new generation of host bus adapters (HBAs) provides the capability of installing Serial Attached SCSI (SAS) drives and/or Serial Advanced Technology Attachment (SATA) drives, and/or Non-Volatile Memory Express* (NVMe*) drives (Intel Storage Adapter RS3P4QF160J only), with an x8 Peripheral Component Interconnect Express* (PCIe*) 4.0 host interface.

The Intel Storage Adapters RS3P4QF160J and RS3P4GF016J provide a reliable and high-performance drive subsystem management.

Secure boot is another new feature, which allows only authenticated firmware to execute on the adapter, which increases security.

**Note:** The tri-mode Intel storage adapters are designed to work on systems configured for optimized UEFI boot mode. No built-in configuration utility is available for these adapters when the system is configured for legacy boot mode. If used on systems configured for legacy boot mode, no boot support is available.

The Intel® Storage Adapter RS3P4QF160J includes a SAS interface and an NVMe interface. Both share the SFF-8654 8i connector by multiplexing the data and sideband signals. Compared with the previous generation of Intel storage adapters, the new tri-mode family offers increased performance by reducing latency, reducing power consumption, increasing IOPS, increasing queue depth, and increasing cache memory.

Additionally, the new PCIe 4.0 interface doubles the host bandwidth. It offers a variety of NVMe drive configurations, including direct attach, through switch, x4 and x2 connections, and support for common clock and SRIS NVMe type drives.

The Intel® Storage Adapter RS3P4GF016J includes only an external SAS interface with four external SFF-8644 female connectors to connect to external enclosures. The host interface is x8 PCIe 4.0.

Although the Intel Storage Adapters RS3P4QF160J and RS3P4GF016J can be installed on many different server systems, these were designed for the Intel® Server System M50CYP and the Intel® Server Systems R2000WF and R1000WF Families. This guide refers to these specific server systems.

**Notes:**
- At launch, only x4 common clock direct-attach NVMe drives are supported on the Intel Server System M50CYP.
- On the Intel Server Systems R2000WF and R1000WF Families, only the SAS and SATA drives are supported.

# 3.  Tri-Mode Intel® Storage Adapters General Features

## 3.1  Overview

The Intel Storage Adapter RS3P4QF160J includes a Serial Attached SCSI (SAS) interface and a Non-Volatile Memory Express (NVMe) interface. By using the proper cables, it is possible to connect NVMe only drives, SAS / SATA drives, or a mix of them. The Intel Storage Adapter RS3P4GF016J includes only an external SAS interface.

## 3.2  SAS Interface

SAS is a serial, point-to-point, enterprise-level device interface that uses the proven SCSI protocol set. SAS is a convergence of the advantages of SATA, SCSI, and fiber channel, also the mainstay of the enterprise and high-end workstation storage markets.

The SAS interface uses the 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, also lower pin count and power requirements when compared to the original parallel SCSI.

SAS adapters use a common electrical and physical connection interface that is compatible with SATA technology. The SAS protocols and the SATA III protocols use a common thin, 7-wire connector. 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 primary-secondary architecture while maintaining compatibility with existing ATA firmware.

The support for SAS drives is automatic, the controller detects the drive type, there is no need to switch profiles or IDs.

### 3.2.1  SAS Features

The following are the SAS interface characteristics.

- Supports the following:
    - 12 Gb/s, 6 Gb/s, and 3 Gb/s SAS data transfers per PHY.
    - Serial Management Protocol (SMP) communicating topology management information.
    - Serial SCSI Protocol (SSP) enabling communication with other SAS devices.
    - SATA Tunneling Protocol (STP) enabling communication with SATA devices through an attached expander.
- Provides a serial, point-to-point, enterprise-level storage interface.
- Simplifies cabling between devices.
- Provides a scalable interface that supports up to 240 devices using expanders.
- Supports x2 through x8 wide ports that consist of two (2), four (4), or eight (8) PHYs within a single port.
- Supports narrow ports consisting of a single PHY.
- Transfers data by using SCSI information units.

### 3.2.2    SATA III Features

The SAS interface is compatible with SATA and it has the following characteristics.

- Supports the following:
    - SATA III data transfers up to 6 Gb/s.
    - STP data transfers up to 6 Gb/s.
- Provides a serial, point-to-point storage interface.
- Simplifies cabling between devices.
- Eliminates the primary-secondary construction used in parallel ATA.
- Permits addressing of multiple SATA targets through an expander.

## 3.3    NVM Express* (NVMe*) Interface (Intel® Storage Adapter RS3P4QF160J Only)

NVMe is a storage protocol created to accelerate the transfer of data with solid-state drives (SSDs) by using multiple PCIe connections. Benefits are increased bandwidth (up to 8 Gb/s per lane), lower latency, increased efficiency, lower CPU use with multiple long command queues, and lower power.

The support for NVMe drives is automatic, the controller detects the drive type, there is no need to switch profiles or IDs.

### 3.3.1    NVMe* Interface Features

The NVMe drive interface has the following characteristics.

- Supports the following:
    - Data transfers of 16 Gb/s per lane (64 Gb/s when 4 PCIe lanes are being used).
    - *PCI Bus Power Management Interface Specification,* revision 1.2.
    - Active State Power Management, states, by placing links in a power-saving mode during times of no link activity.
- Supports PCIe hot plug.
- Supports error handling.
- Provides high bandwidth per pin with low overhead and low latency.
- Supports lane reversal and polarity inversion.
- Two (2) or four (4) PCIe lanes per drive.
- Common clock and SRIS drive support.

## 3.4    Safety Characteristics

All the tri-mode Intel storage adapters meet or exceed the requirements of UL flammability rating 94 V0. Each bare board is also marked with the supplier name or trademark, type, and UL flammability rating.

## 3.5  Tri-Mode Intel® Storage Adapters Feature Set

The following table describes the feature set of the tri-mode Intel storage adapters.

### Table 1. Tri-Mode Intel® Storage Adapter Feature Set

| Feature | Intel® Storage Adapter RS3P4QF160J | Intel® Storage Adapter RS3P4GF016J |
|---|---|---|
| I/O processor | Broadcom* SAS3816 IOC | Broadcom SAS3816 IOC |
| Form factor | MD2 (PCIe card) | MD2 (PCIe card) |
| Drive interface connectors | 2 internal SFF-8654 female (SlimSAS*) | 4 external (SFF-8644 female) |
| PCIe* interface | x8 PCIe 4.0. PCIe performance up to 16 GT/s per lane | x8 PCIe 4.0. PCIe performance up to 16 GT/s per lane |
| Data transfer rates | 12, 6, and 3 Gbps per port SAS, 6 and 3 Gbps per port SATA and 16 Gbps per lane NVMe | 12, 6, and 3 Gbps per port SAS, 6 and 3 Gbps per port SATA |
| Maximum operating temperature (chassis internal) | 55 °C | 55 °C |
| Operating system | Windows*, Linux* (SUSE*, Red Hat*) | Windows, Linux (SUSE, Red Hat) |
| Drive types | SAS, SATA, NVMe | SAS, SATA |
| Maximum direct-attached NVMe* drives supported | 4 | 0 |
| Maximum NVMe* drives supported through switches | 24 | 0 |
| Maximum SAS / SATA devices supported (through expanders)[1] | 1024[1] | 1024[1] |
| MTBF (hours) | >5,000,000 | >4,500,000 |
| Minimum required airflow | 200 LFM | 200 LFM |
| Standard warranty | 3 years, AWR option | 3 years, AWR option |

**Note:** [1] Devices include drives and expanders. Drives on dual-ported backplanes count twice.

## 3.6  UART Interface

The tri-mode Intel storage adapters include a UART interface for special debugging purposes. The UART connector debug port requires a special cable and Intel support to gather detailed ROC / IOC status. The UART connector uses the layout shown in the following table.

### Table 2. UART Connector Pinout

| Pin | Function |
|---|---|
| 1[1] | UART_TX |
| 2 | Gnd |
| 3 | UART_RX |
| 4 | 1.8 V |

**Note:** [1] Pin 1 has a square solder mask, while the other pins have a round solder mask.

The default communication parameters are 921,600 b/s, 8-bit characters, no parity bit, one stop bit, and no XON / XOFF flow control.

## 3.7  Secure Boot

The tri-mode Intel storage adapters include a hardware secure boot feature; this provides advanced security, allowing only authenticated firmware to be executed. Intel provides the signed firmware images using the hardware secure boot transparent to customers, while providing confidence in the security of the solution.

# 4.    Tri-Mode Intel® Storage Adapters Detailed Characteristics

## 4.1    Intel® Storage Adapter RS3P4QF160J

The following sections include detailed information about the Intel Storage Adapter RS3P4QF160J, like dimensions, requirements, and power consumption.

### 4.1.1    Intel® Storage Adapter RS3P4QF160J Description

The Intel Storage Adapter RS3P4QF160J with 16 internal ports is based on the Avago* SAS3816 IOC. It has an x8 PCI Express (PCIe) 4.0 interface and it supports up to: 1024 physical SAS / SATA devices; 4 direct attach NVMe drives; 32 NVMe devices through switches. The next figures describe the connectors for this adapter.

**Note:** Physical SAS / SATA devices include expanders and if dual-ported backplanes are being used, each drive counts twice.
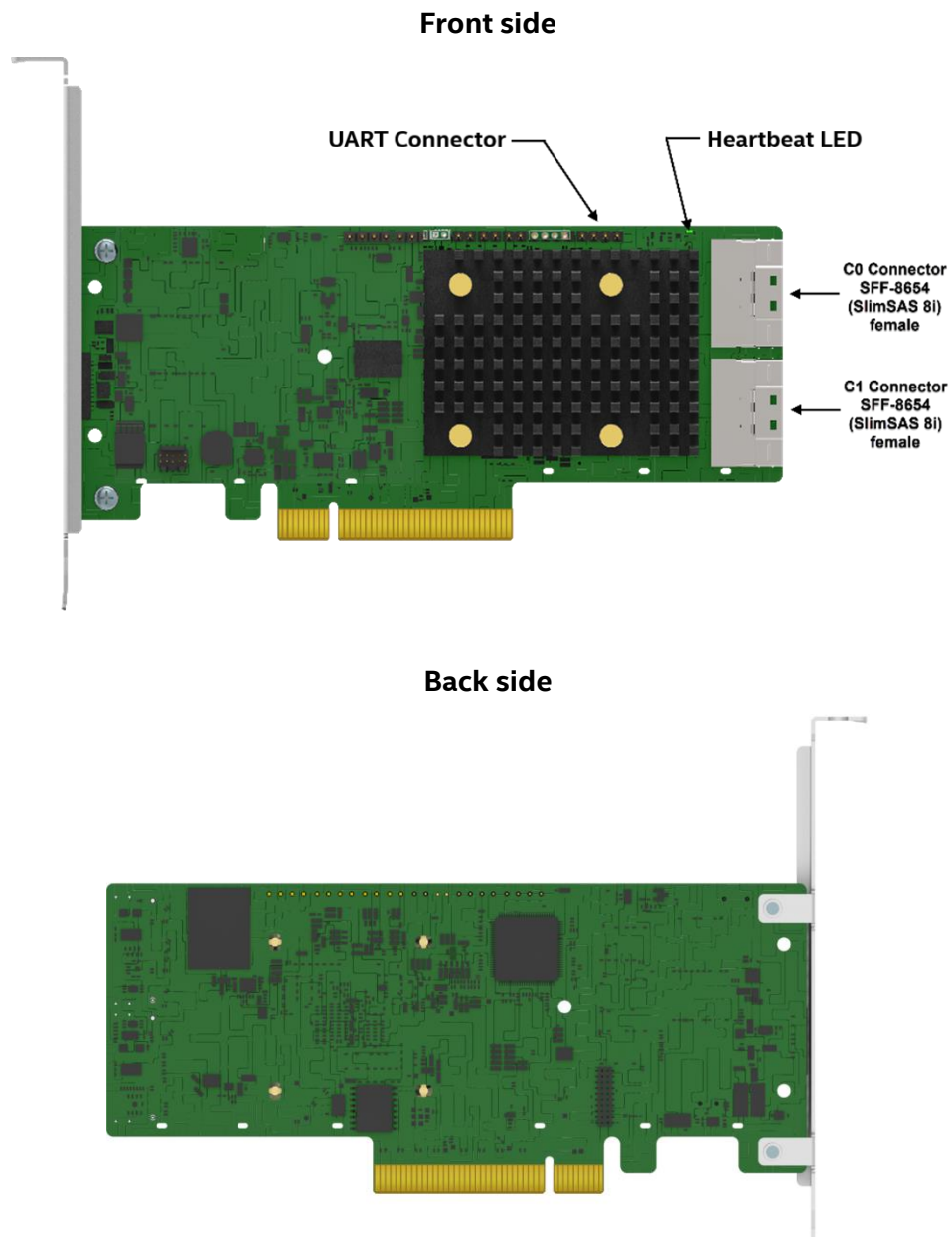
**Front side**



**Back side**



**Figure 1. Intel® Storage Adapter RS3P4QF160J Layout**

### 4.1.2 Intel® Storage Adapter RS3P4QF160J Dimensions

The next figure shows the dimensions for the Intel Storage Adapter RS3P4QF160J in millimeters, without the PCI bracket.



**Figure 2. Intel® Storage Adapter RS3P4QF160J Dimensions**

### 4.1.3    Intel® Storage Adapter RS3P4QF160J Electrical, Thermal, and Atmospheric Requirements

List of operating conditions for the Intel Storage Adapter RS3P4QF160J:

- Power supply voltage at the 12 V rail (from PCI edge connector): 12 V ± 8%.
- Power supply voltage at the 3.3 V rail (from PCI edge connector): 3.3 V ± 9%.
- Relative humidity range is 20–80% non-condensing.
- Temperature range: 0–+55 °C (with or without the RMFBU Adapter attached).

List of non-operating conditions (while in storage or in transit) for the Intel Storage Adapter RS3P4QF160J:

- Relative humidity range is 5–95% non-condensing.
- Temperature range: -45–+105 °C without backup battery unit.
- Temperature range: 0–70 °C with backup battery unit.

### 4.1.4    Intel® Storage Adapter RS3P4QF160J Power Consumption

The following table describes the power consumption of the Intel Storage Adapter RS3P4QF160J under the following states:

- **State 1:** While sitting idle at the EFI shell.
- **State 2:** During a drive stress test.

#### Table 3. Intel® Storage Adapter RS3P4QF160J Power Consumption

| Power Mode | State 1 | State 2 |
|---|---|---|
|  | Typical | Typical |
| 3.3 V supply | 0.01 W | 0.22 W |
| + 12 V supply | 7.09 W | 11.67 W |
| Total power | 7.1 W | 11.89 W |

## 4.2 Intel® Storage Adapter RS3P4GF016J

The following sections include detailed information about the Intel Storage Adapter RS3P4GF016J, like dimensions, requirements, and power consumption.

### 4.2.1 Intel® Storage Adapter RS3P4GF016J Description

The Intel Storage Adapter RS3P4GF016J with 16 internal ports is based on the Avago SAS3816 IOC. It has an x8 PCIe 4.0 interface and it supports up to 1024 physical SAS / SATA devices. The next figures describe the connectors for this adapter.

**Note:** Physical SAS / SATA devices include expanders and if dual-ported backplanes are being used, each drive counts twice.



Figure 3. Intel® Storage Adapter RS3P4GF016J Layout

## 4.2.2    Intel® Storage Adapter RS3P4GF016J Dimensions

The next figure shows the dimensions for the Intel Storage Adapter RS3P4GF016J in millimeters, without the PCI bracket.
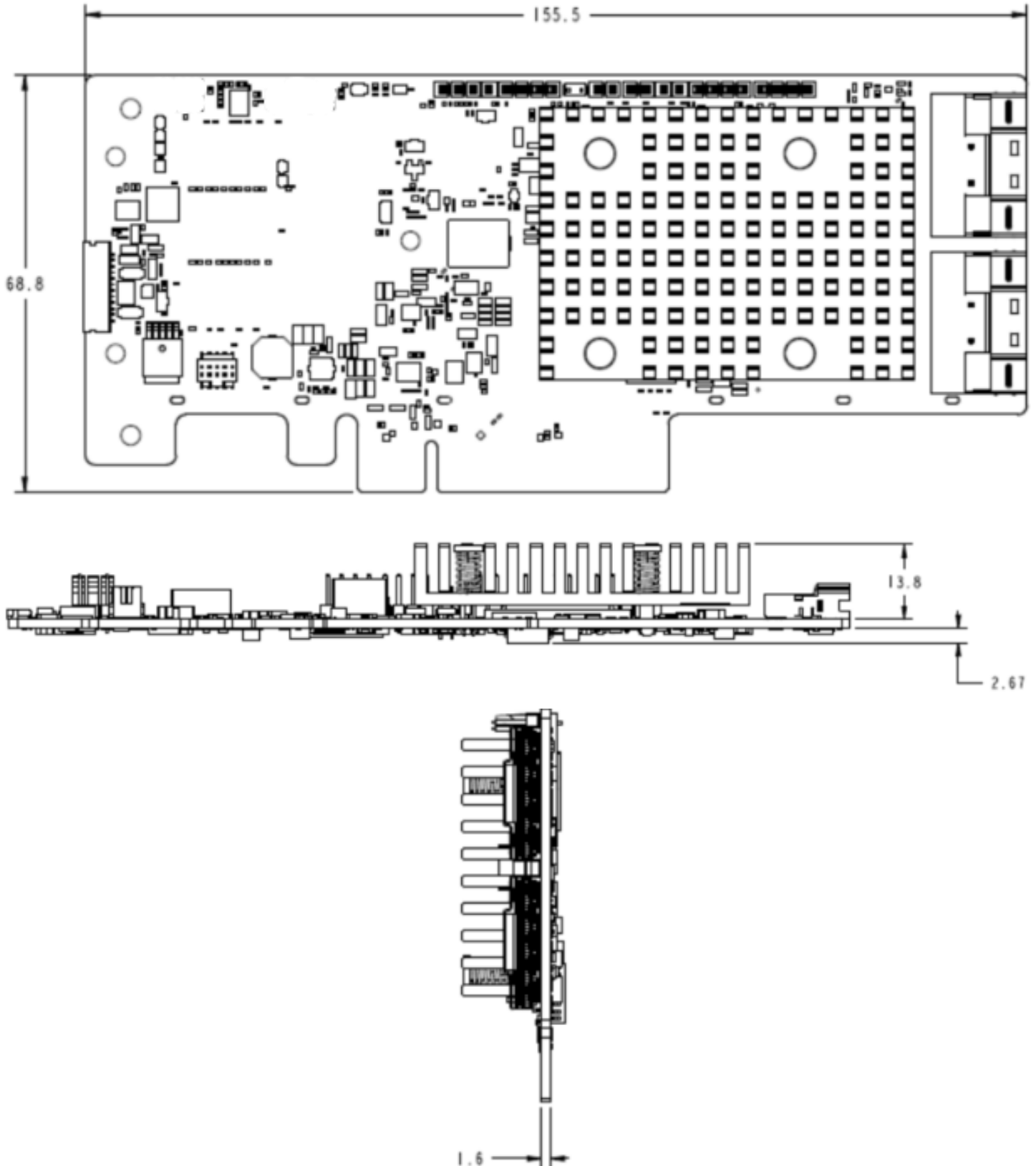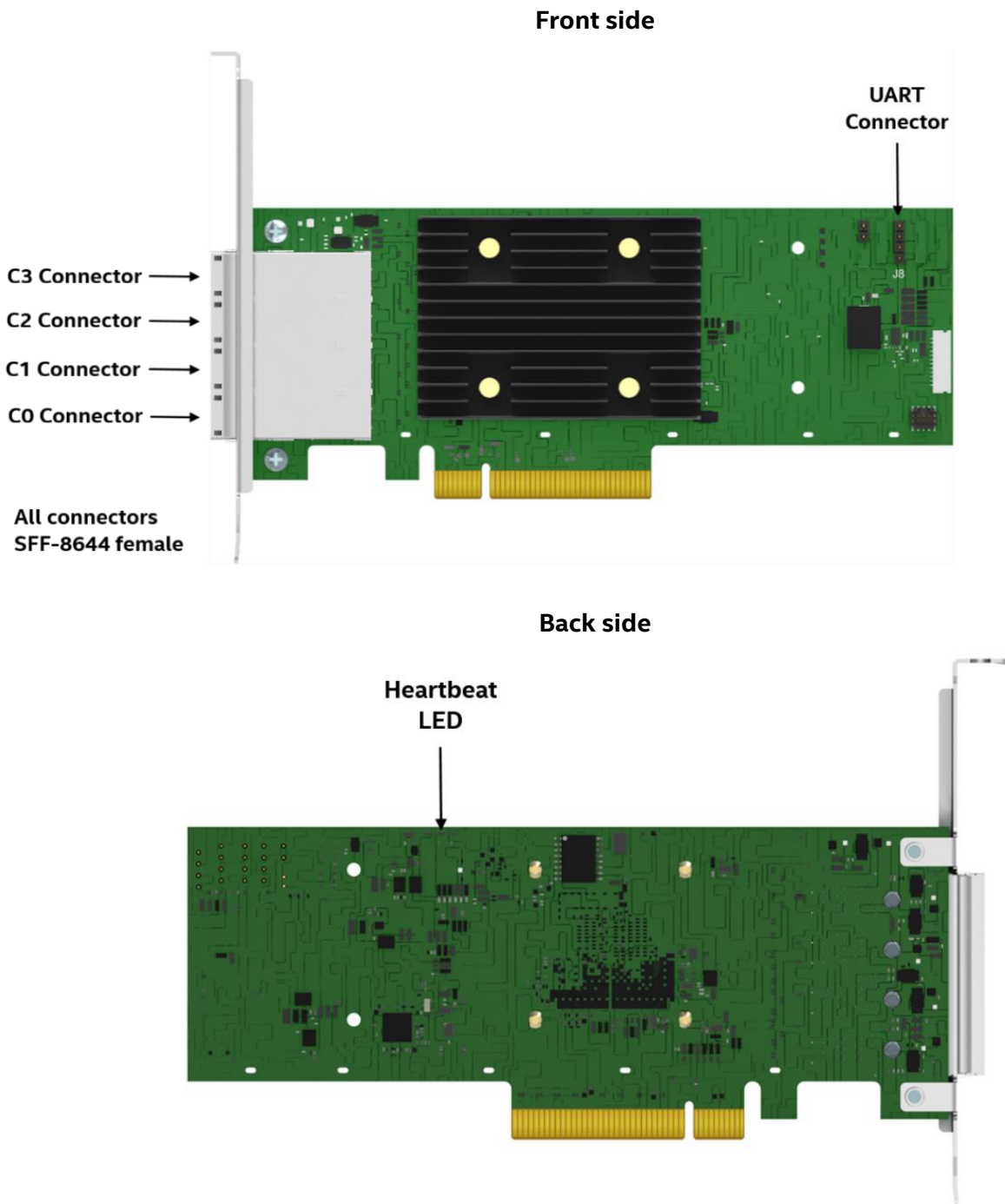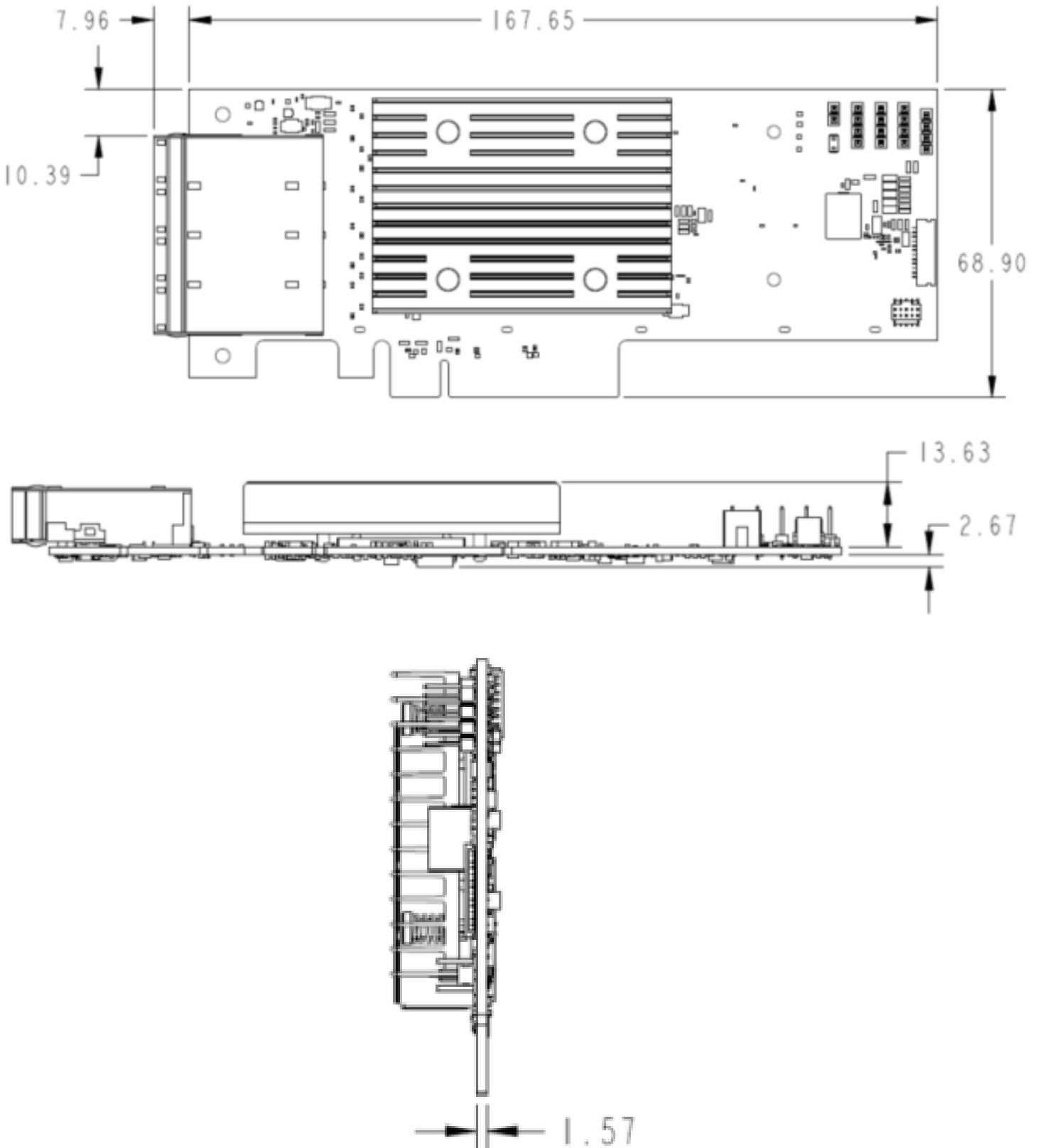


**Figure 4. Intel® Storage Adapter RS3P4GF016J Dimensions**

### 4.2.3 Intel® Storage Adapter RS3P4GF016J Electrical, Thermal, and Atmospheric Requirements

List of operating conditions for the Intel Storage Adapter RS3P4GF016J:

- Power supply voltage at the 12 V rail (from PCI edge connector): 12 V ± 8%.
- Power supply voltage at the 3.3 V rail (from PCI edge connector): 3.3 V ± 9%.
- Relative humidity range is 20–80% non-condensing.
- Temperature range: 0–+55 °C.

List of non-operating conditions (while in storage or in transit) for the Intel Storage Adapter RS3P4GF016J:

- Relative humidity range is 5–95% non-condensing.
- Temperature range: -45–+105 °C.
- Temperature range: 0–+70 °C with backup battery unit.

### 4.2.4 Intel® Storage Adapter RS3P4GF016J Power Consumption

The following table describes the power consumption of the Intel Storage Adapter RS3P4GF016J under the following states:

**State 1:** While sitting idle at the EFI shell.
**State 2:** During a drive stress test.

#### Table 4. Intel® Storage Adapter RS3P4GF016J Power Consumption

| Power Mode | State 1 | State 2 |
|---|---|---|
|  | Typical | Typical |
| 3.3V supply | 0.04 W | 0.04 W |
| + 12 V supply | 8.7 W | 11.85 W |
| Total power | 8.74 W | 11.89 W |

## 4.3 Connectivity and Drive Support

The Intel Storage Adapter RS3P4QF160J has two standard female SFF-8643 (MiniSAS* high-density) connectors to connect the internal drives. Each connector supports up to two direct-attach NVMe drives or up to eight direct-attach SAS / SATA drives. Using PCIe switches can increase the number of supported NVMe drives; and using SAS expanders can increase the number of supported SAS / SATA drives.

As mentioned on Chapter 2, the Intel storage adapters are designed for the Intel Server System M50CYP, which has the appropriate backplane capable of supporting SAS, SATA and NVMe drives. There are separate cables for NVMe drives and SAS / SATA drives, appropriate cables must be used to connect the drives. The cable part numbers are indicated on Section 4.5 and Section 4.6.

The Intel Storage Adapter RS3P4GF016J has four standard female SFF-8644 (external MiniSAS high-density) connectors to connect to external SAS / SATA enclosures (JBOD or RBOD devices).

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**Note:** At launch, only x4 direct-attach NVMe drives are supported on the 2U Intel Server System M50CYP.

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## 4.4    Connector Pinout

The Intel Storage Adapter RS3P4QF160J has two standard female SFF-8654 (SlimSAS* 8i) connectors to connect to a data cable. The connector pinout follows the SFF-9402 specification. SFF-9402 defines how to share sideband signals between SAS and PCIe (with NVMe).

When SAS / SATA drives are connected either as a direct attach connection or through an expander, existing 12 Gb/s SAS cables and mid-plane connector designs are supported by the storage adapter. The next figure shows the pinout for the female SFF-8654 connectors on the adapter cards.
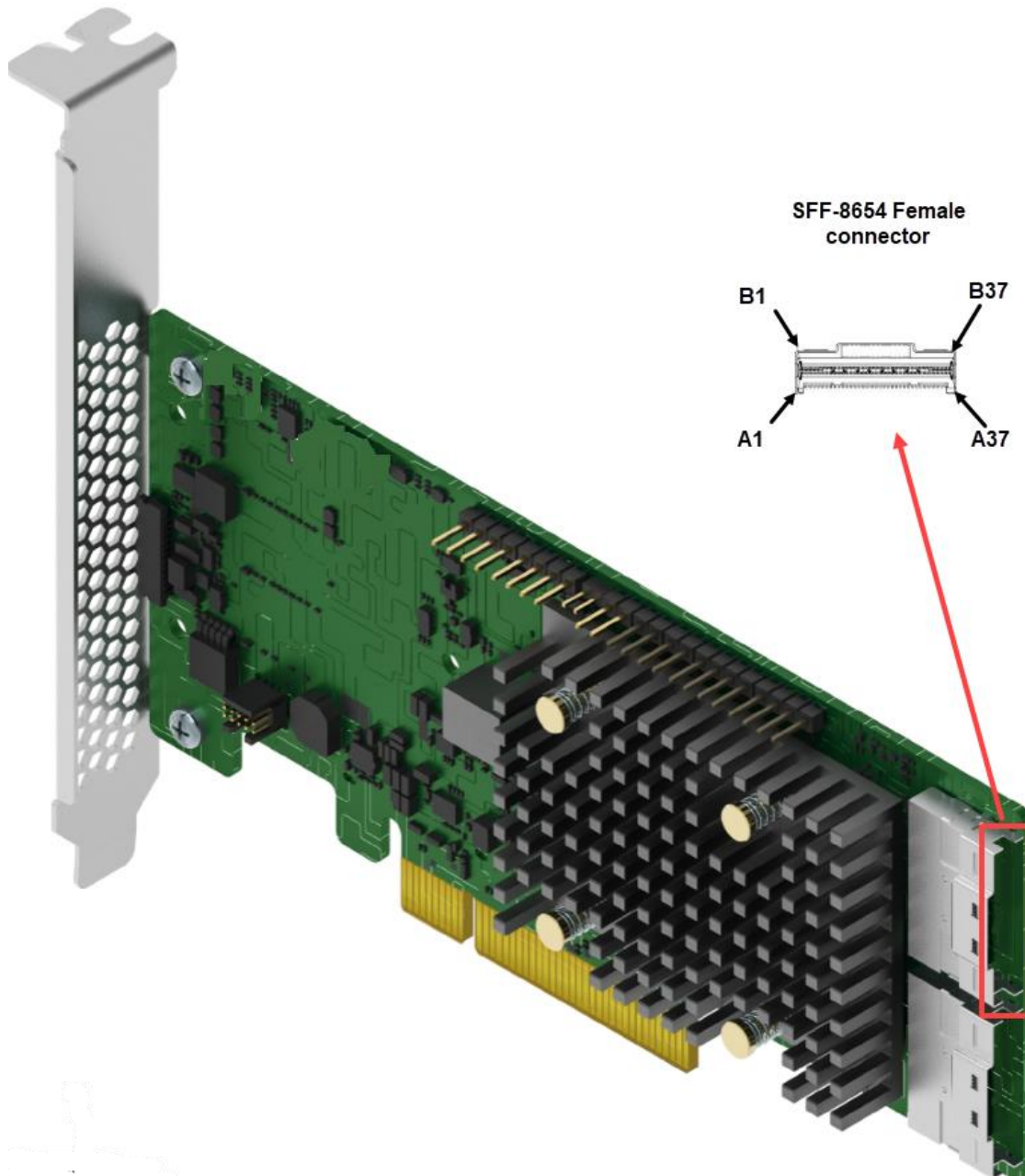


**Figure 5. Intel® Storage Adapter RS3P4QF160J SFF–8654 Connector**

**Table 5. SFF-8654 Connector Pinout**

| Pin # | Signal Name | Pin # | Signal Name |
|---|---|---|---|
| A1 | GND | B1 | GND |
| A2 | PERp0, RX0+ | B2 | PETp0, TX0+ |
| A3 | PERn0, RX0- | B3 | PETn0, TX0- |
| A4 | GND | B4 | GND |
| A5 | PERp1, RX1+ | B5 | PETp1, TX1+ |
| A6 | PERn1, RX1- | B6 | PETn1, TX1- |
| A7 | GND | B7 | GND |
| A8 | BP_TYPEA | B8 | 2W-CLKA, SClockA |
| A9 | 2W_RESETA, SDataOutA | B9 | 2W-DATAA, SloadA |
| A10 | GND | B10 | GND |
| A11 | REFCLKA+ | B11 | PERSTA#, SDatainA |
| A12 | REFCLKA- | B12 | CPRSNTA#, CNTRLR_TYPEA |
| A13 | GND | B13 | GND |
| A14 | PERp2, RX2+ | B14 | PETp2, TX2+ |
| A15 | PERn2, RX2- | B15 | PETn2, TX2- |
| A16 | GND | B16 | GND |
| A17 | PERp3, RX3+ | B17 | PETp3, TX3+ |
| A18 | PERn3, RX3- | B18 | PETn3, TX3- |
| A19 | GND | B19 | GND |
| A20 | PERp0, RX4+ | B20 | PETp0, TX4+ |
| A21 | PERn0, RX4 | B21 | PETn0, TX4- |
| A22 | GND | B22 | GND |
| A23 | PERp1, RX5+ | B23 | PETp1, TX5+ |
| A24 | PERn1, RX5- | B24 | PETn1, TX5- |
| A25 | GND | B25 | GND |
| A26 | BP_TYPEB | B26 | 2W-CLKB, SClockB |
| A27 | 2W_RESETB, SDataOutB | B27 | 2W-DATAB, SLoadB |
| A28 | GND | B28 | GND |
| A29 | REFCLKB+ | B29 | PERSTB#, SDataInB |
| A30 | REFCLKB- | B30 | CPRSNTB#, CNTRLR_TYPEB |
| A31 | GND | B31 | GND |
| A32 | PERp2, RX6+ | B32 | PETp2, TX6+ |
| A33 | PERn2, RX6 | B33 | PETn2, TX6- |
| A34 | GND | B34 | GND |
| A35 | PERp3, RX7+ | B35B | PETp3, TX7+ |
| A36 | PERn3, RX7- | 36B | PETp3, TX7+ |
| A37 | GND | B37 | GND |

## 4.5   SAS / SATA Drive Support

The Intel Storage Adapters RS3P4QF160J and RS3P4GF016J support the ANSI Serial Attached SCSI standard, version 3.0. In addition, the adapters support the SATA III protocol defined by the SATA specifications, version 3.0. Supporting both the SAS interface and the SATA interface, the SAS adapter is a versatile adapter that provides the backbone of both server and high-end workstation environments.

Each port on the storage adapters support SAS devices, SATA devices, or both, through these 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.
- SATA Tunneling Protocol (STP), which enables communication with SATA devices through an attached expander.

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 the requirements of the given operating environment and storage needs. The tri-mode Intel storage adapters provide the flexibility to combine these two storage technologies on the same adapter and within the same enclosure.

The recommended cables for SAS / SATA support are in the **iPC CYPCBLSLHDKIT**, this kit includes 1 660-mm long SlimSAS to 2x MiniSAS HD, and one 860-mm long SlimSAS to 2x MiniSAS HD. The next figures show the connection diagram for SAS / SATA drives between the Intel Storage Adapter RS3P4QF160J and the backplanes for a 2U Intel Server System M50CYP and a 2U Intel® Server System R2000WF.
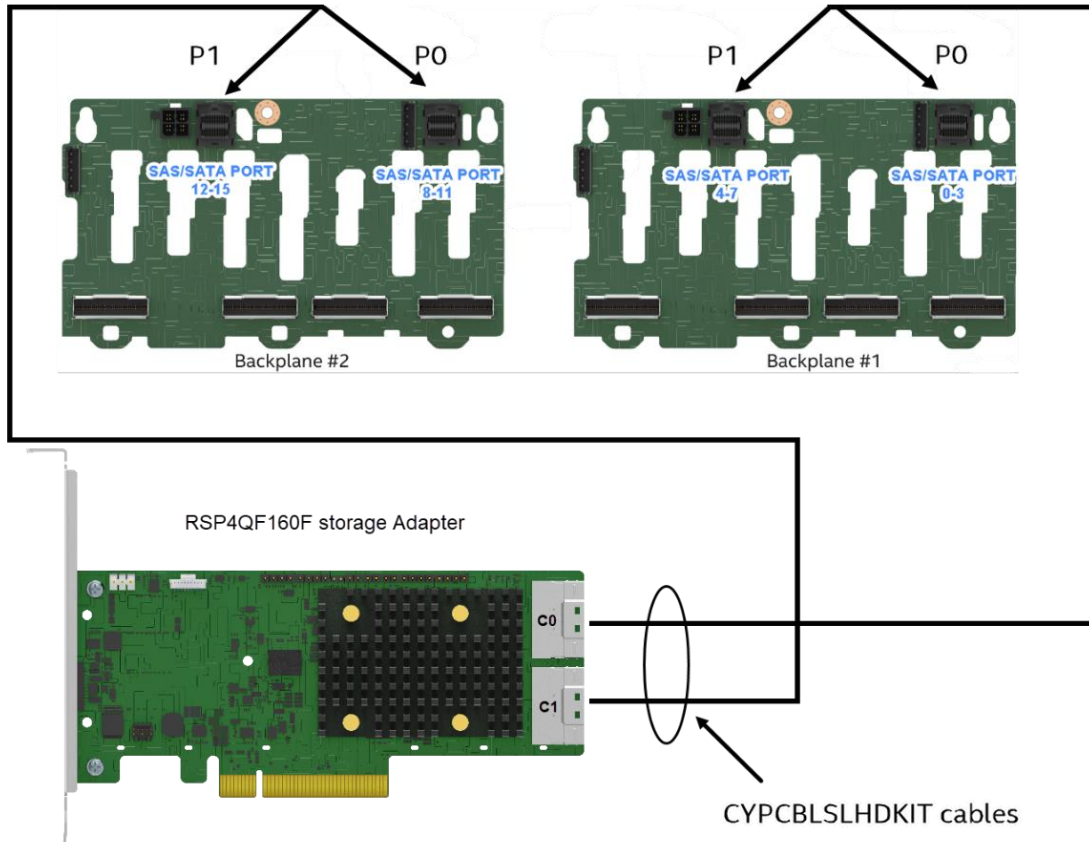


**Figure 6. Intel® Storage Adapter RS3P4QF160J Card Connection to the 2U Intel® Server System M50CYP Backplane for SAS / SATA Drives**
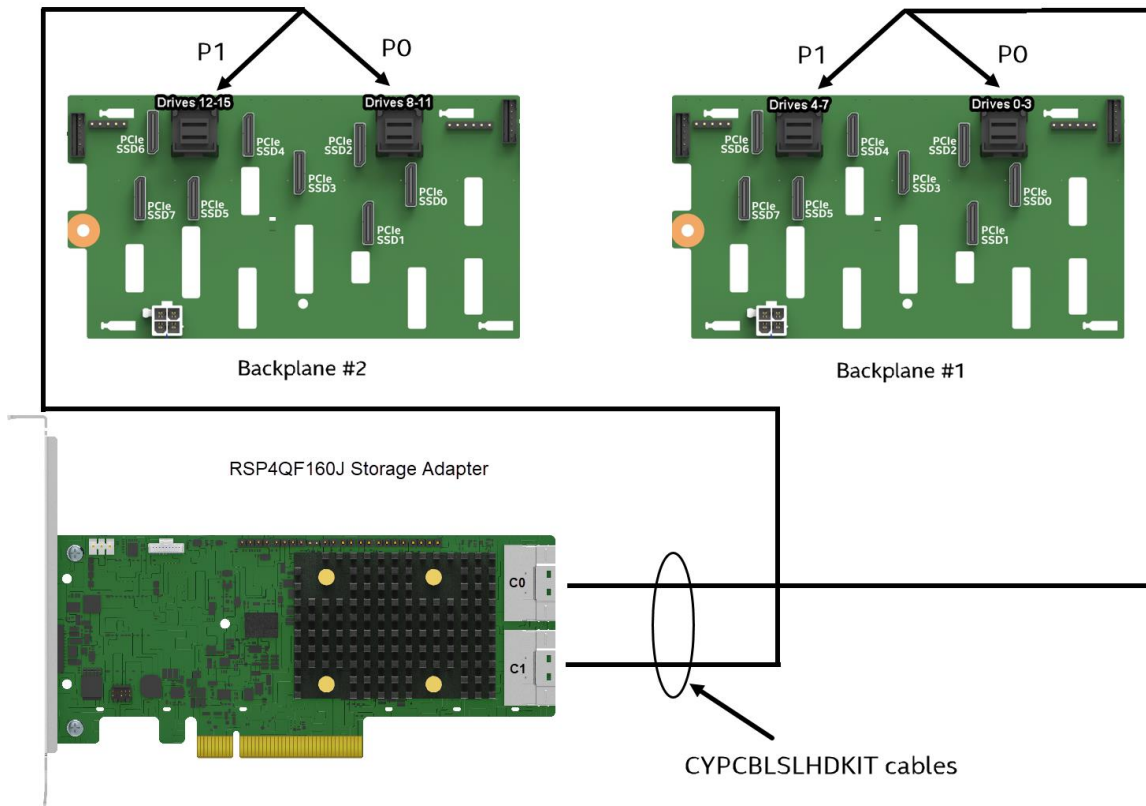
**Figure 7. Intel® Storage Adapter RS3P4QF160J Card Connection to the 2U Intel® Server System R2000WF Backplane for SAS / SATA Drives**

### 4.5.1 Intel® 12 Gb/s SAS 3.0 Expander Support

For system configurations that require more physical SAS / SATA drives than the adapter's number of internal ports, the Intel Storage Adapter RS3P4QF160J can support the following Intel storage expander.

**Table 6. Supported Intel® SAS Expander Options**

| Intel Product Code | Product Description |
|---|---|
| **iPC – RES3TV360**<br><br><br><br>**SAS Intel® Storage Expander RES3TV360** | **SAS 3.0 12 Gb/s expander**<br>• Featuring 6 Gbp/s data aggregation for 12 Gbp/s data transfer with 6 Gb/s devices.<br>• Internal mount mid-plane form factor.<br>• 36 internal ports supporting point-to-point 12, 6, and 3 Gb/s data transfer rates.<br>• RA 4-pin power connector.<br>• HD MiniSAS 8643 connectors.<br><br>**Kit includes:** (1) SAS expander card; (1) 130mm power cable; (1 set) expander-to-backplane cables: (4) HD-HD 165 mm, (1) HD-HD 300 mm, (1) HD-HD 250 mm, (3) rubber pads, and mounting screws. |

### 4.5.2 SAS-Compatible Intel® Storage Expander Configuration for the Intel® Storage Adapter RS3P4QF160J

The SAS ports of the Intel Storage Adapters RS3P4QF160J and RS3P4GF016J are divided into two separate SAS domains: Domain 1 and Domain 2. One or two SAS connectors within a common domain can be cabled to a single SAS-compatible Intel storage expander card when cabling the storage adapter to a SAS expander.

**Note:** Mixing SAS ports from different domains to a single SAS expander card is not supported.
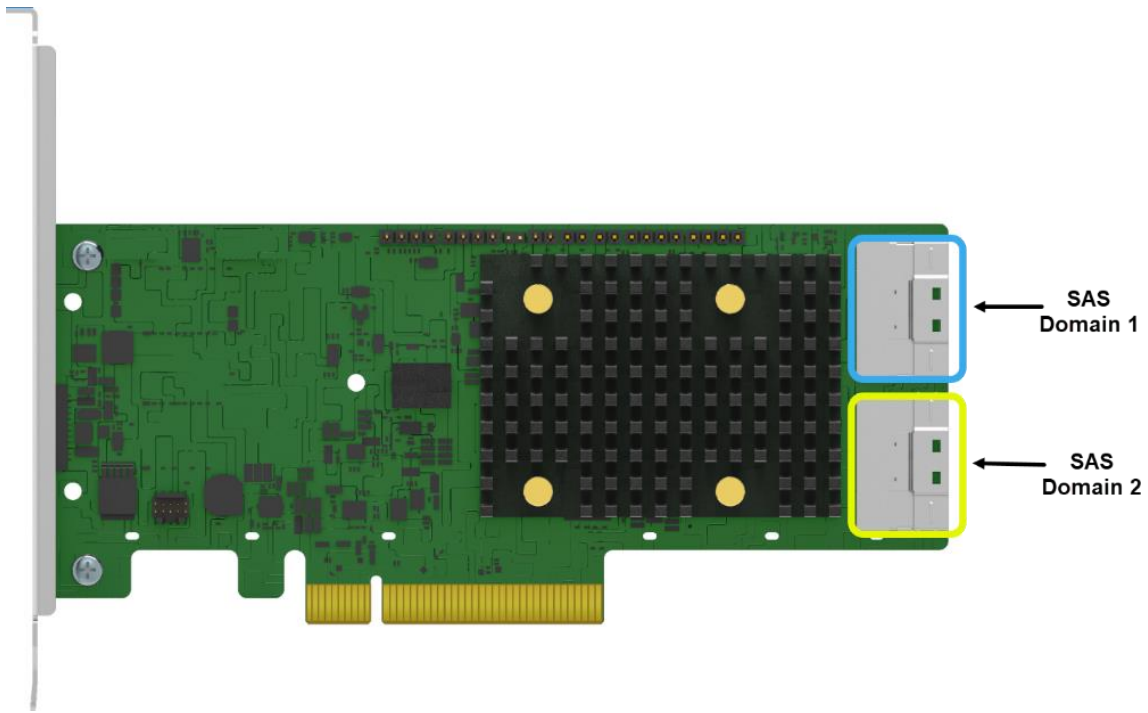
**Figure 8. Intel® Storage Adapter RS3P4QF160J SAS Port Domain Identification**
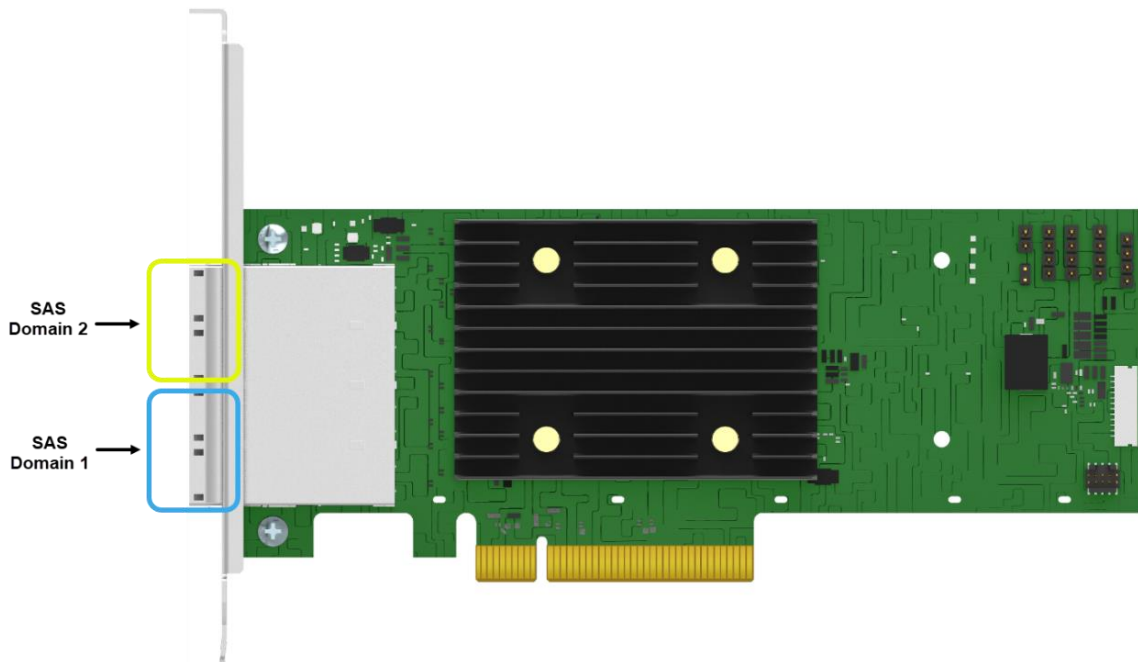


**Figure 9. Intel® Storage Adapter RS3P4GF016J SAS Port Domain Identification**

Supported SAS-compatible Intel storage expanders include several multiport MiniSAS HD (8643) connectors. Some are used as output connectors to a backplane while others are used as input connectors from the storage adapter. The following diagrams identify the connector types for each supported SAS expander card.
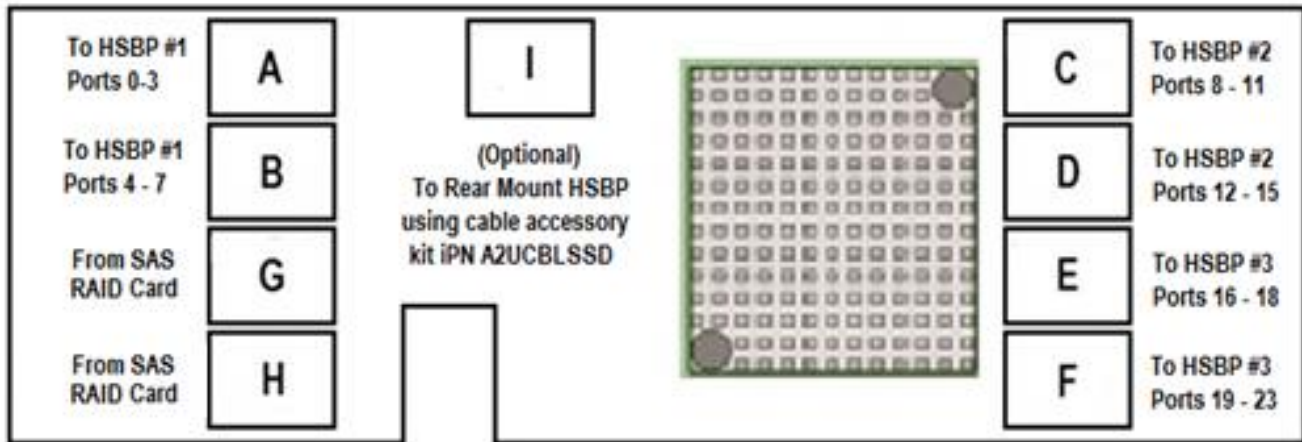
**Figure 10. SAS Ports for the Intel® Storage Expander RES3TV360**

**Notes for the input cable configuration:**
- The SAS expander card identified above can support one (1) or two (2) input SAS port cables.
- When routing two (2) input SAS port cables from the storage adapter, use cables from the same SAS domain, as previously illustrated.

## 4.6 NVMe* Drive Support

The Intel Storage Adapter RMS4PQF160J can support a variety of NVMe drive configurations. At launch, only four direct-attach common clock NVMe drives are supported.

The support for NVMe drives is limited to the U.2 (SFF-8639) form factor, connected through a supported backplane using an SFF-8654 8i to SFF-8654 8i. The recommended cables for this kind of connection are **iPC CYPCBLSLSLX8M** (860-mm long) and **iPC CYPCBLSLSLX8L** (1.0-m long).

**Note:** Both cables must be connected, even if only one or two NVMe drives are being installed.

The next figures show how to connect the cables in the **iPC CYPCBLSLSLX8** kit to the 2U system's 8 x 2.5" backplane and to the system's 12 x 2.5" backplane of a 1U Intel Server System M50CYP.

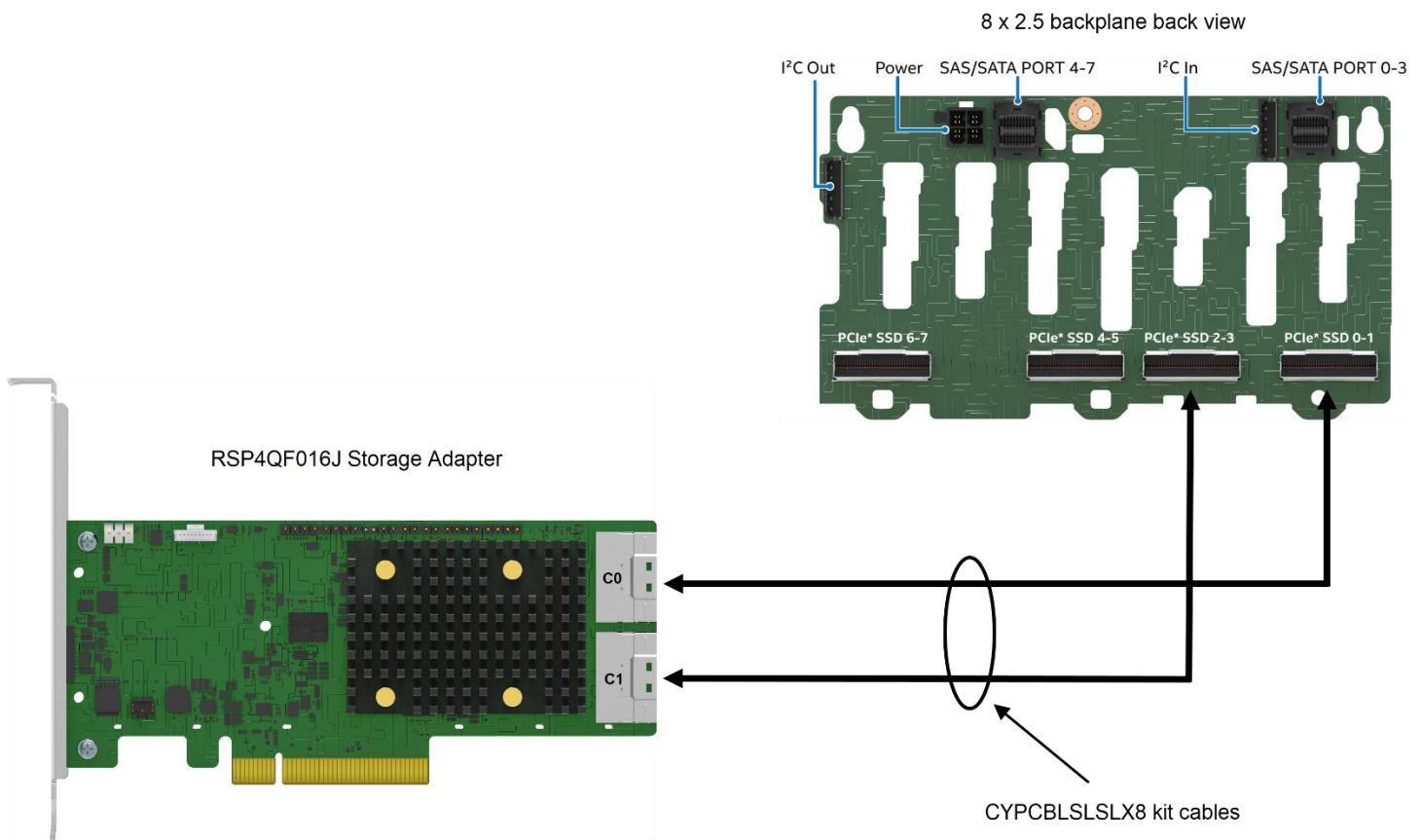**Note:** The Intel Server Systems R2000WF and R1000WF Families have no NVMe drive support.



**Figure 11. Intel® Storage Adapter RS3P4GF016J Card Connection to the 2U Intel® Server System M50CYP Backplane for Direct-Attach NVMe* Drives**
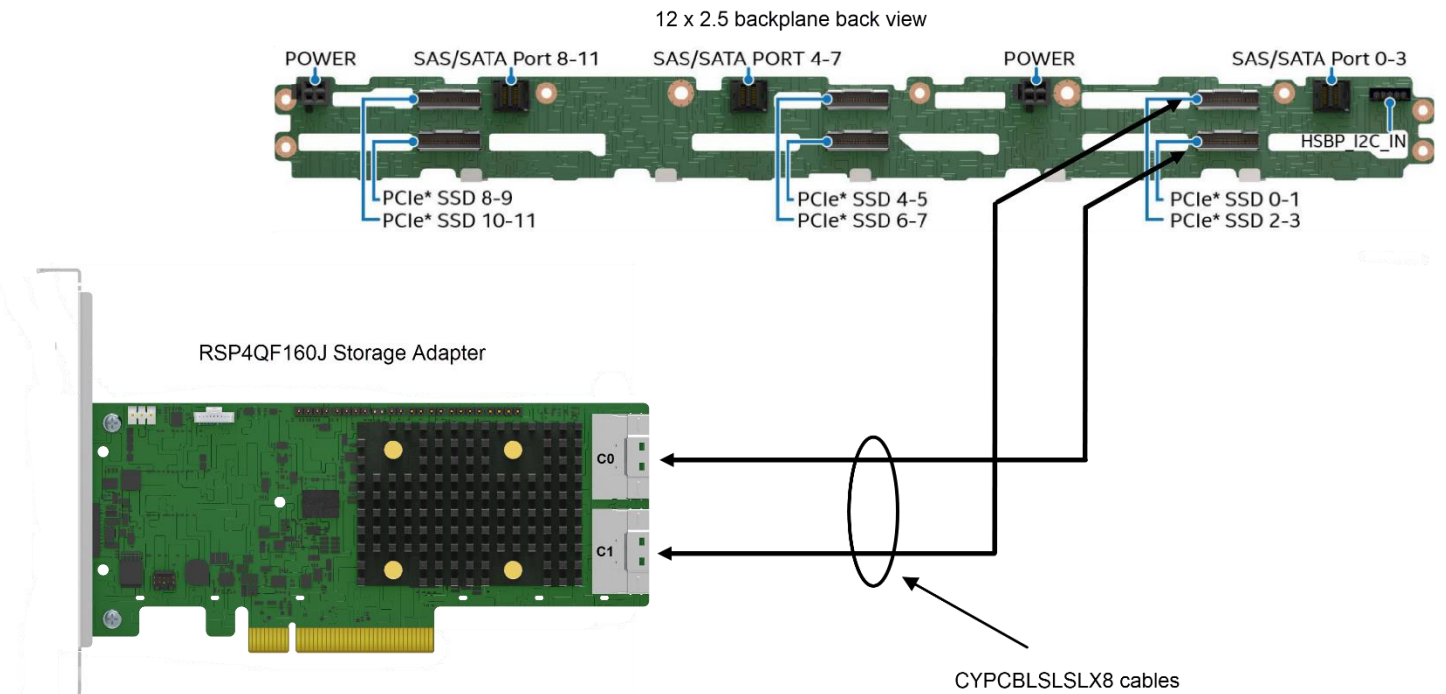
27

**Figure 12. Intel® Storage Adapter RS3P4QF160J Card Connection to the 1U Intel® Server System M50CYP Backplane for Direct-Attach NVMe* Drives**

# 5.    Hardware Installation

## Warnings

**Heed safety instructions:** Before working with your server product, whether you are using this guide or any other resource as a reference, pay close attention to the safety instructions. You must adhere to the assembly instructions in this guide to ensure and maintain compliance with existing product certifications and approvals. Use only the described, regulated components specified in this guide. Use of other products/components will void the UL listing and other regulatory approvals of the product and will most likely result in noncompliance with product regulations in the region(s) in which the product is sold.

**System power on/off:** The power button **DOES NOT** turn off the system AC power. To remove power from the system, you must unplug all AC power cords from the server system before you open the chassis, add, or remove any components.

**Hazardous conditions, devices, and cables:** Hazardous electrical conditions may be present on power, telephone, and communication cables. Turn off the server and disconnect the power cord, telecommunications systems, networks, and modems attached to the server before opening it. Otherwise, personal injury or equipment damage can result.

**Installing or removing jumpers:** A jumper is a small plastic encased conductor that slips over two jumper pins. Some jumpers have a small tab on top that you can grip with your fingertips or with a pair of fine needle nosed pliers. If your jumpers do not have such a tab, take care when using needle nosed pliers to remove or install a jumper; grip the narrow sides of the jumper with the pliers, never the wide sides. Gripping the wide sides can damage the contacts inside the jumper, causing intermittent problems with the function controlled by that jumper. Take care to grip with, but not squeeze, the pliers or other tool you use to remove a jumper, or you may bend or break the pins on the board.

**Electrostatic Discharge (ESD):** Electrostatic discharge can damage your computer or the components within it. ESD can occur without the user feeling a shock while working inside the system chassis or while improperly handling electronic devices like processors, memory or other storage devices, and add-in cards.



Intel recommends the following steps be taken when performing any procedures described within this document or while performing service to any computer system.

- Where available, all system integration and/or service should be performed at a properly equipped ESD workstation.
- Wear ESD protective gear like a grounded antistatic wrist strap, sole grounders, and/or conductive shoes.
- Wear an anti-static smock or gown to cover any clothing that may generate an electrostatic charge.
- Remove all jewelry.
- Disconnect all cables and cords attached to the server before performing any integration or service.
- Touch any unpainted metal surface of the chassis before performing any integration or service.
- Hold all circuit boards and other electronic components by their edges only.

After removing electronic devices from the system or from their protective packaging, place them component side up on to a grounded anti-static surface or conductive foam pad. **DO NOT** place electronic devices on to the outside of any protective packaging.

## 5.1    Intel® Storage Adapters Installation

### 5.1.1      Requirements

The following items are required to install an Intel storage adapter:

- Intel storage adapter.
- Intel server board based server system with support for an integrated Intel storage adapter.
- Internal SAS / SATA data cables.
- SAS drives or SATA drives.

### 5.1.2      Packing List

1. Intel storage adapter.
2. Low profile mounting bracket.
3. Attention document.

**Note:** Intel storage products do not include SAS / SATA / NVMe data cables. Appropriate data cables may be included with the server system or must be purchased separately.

### 5.1.3      Installation Instructions

Although the Intel storage adapters can be installed on many different systems, the instructions presented here show how to install on a 2U Intel Server System M50CYP.

1. Unpack the Intel storage adapter. Inspect it for damage. If it appears damaged, contact the corresponding Intel Customer and Technical Support representative.
2. Turn off the power to the computer and disconnect the AC power cord.
3. Remove the computer cover. Refer to the system documentation for instructions.
4. Remove the riser card assembly (the adapter can be installed on any riser card assembly).
   A. Loosen the screws.
   B. Pull up the riser bracket.



**Figure 13. Intel® Storage Adapter Card Installation (Riser Card Assembly Removal)**

5. Install the storage adapter.
   A. Remove the screw.
   B. Remove the filler panel
   C. Insert the adapter in the desired slot. Press down gently, but firmly to make sure that the card is seated correctly in the slot. Secure the bracket with the bracket screw.
   D. Secure the storage card with the screw.
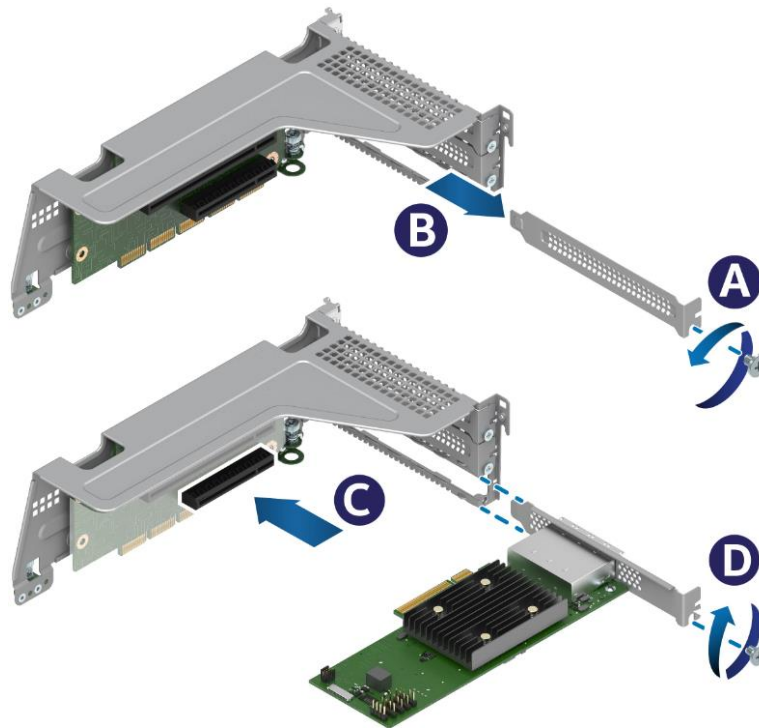
**Figure 14. Intel® Storage Adapter Installation (Insert Adapter in Slot)**

E. Insert back the riser card assembly, press down gently, but firmly.
F. Secure the riser card assembly using the screws.
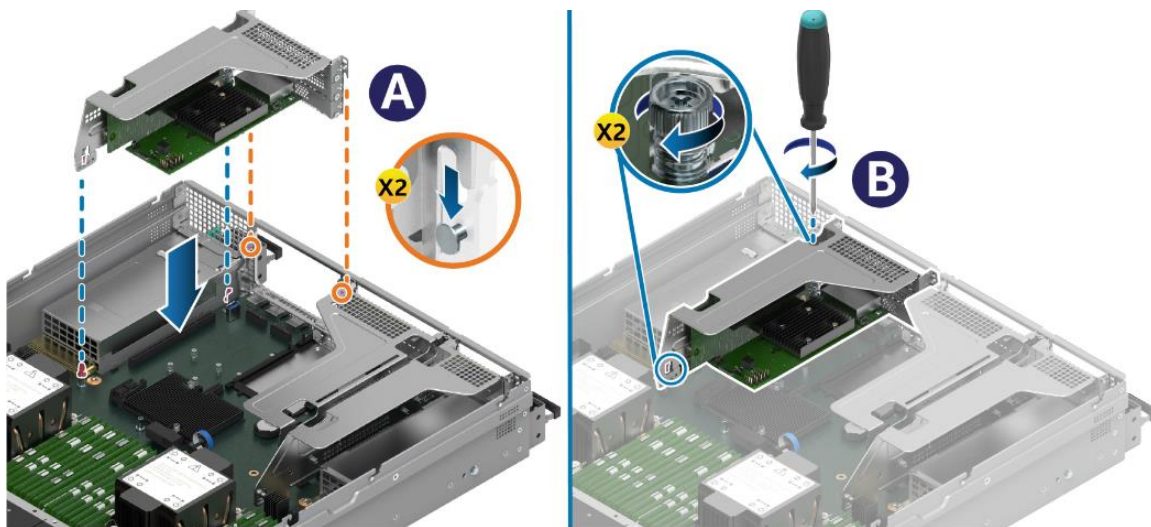


**Figure 15. Intel® Storage Adapter Installation (Riser Card Assembly Installation)**

6. Install SAS / SATA / NVMe drives in the host computer backplane. Refer to the documentation for the devices for any preinstallation configuration requirements.
7. Connect internal SAS / SATA / NVMe data cables to backplane.
8. Carefully route data cables back to the Intel storage adapter.
9. Connect the data cables to the storage adapter card.
10. Reinstall the computer cover, and reconnect the AC power cords to the system.

The hardware installation is now complete, and the Intel storage adapter is ready to be used.

# 6. Safety and Regulatory (Class A)

Intel storage adapter products typically have a variety of individual component level certifications. However, final regulatory compliance is based on the combination of the storage adapter card being within an Intel server system.

About the applications of these Intel storage adapter products, the user must consider the following points:

- **Intended application.** Intel RAID products are evaluated as information technology equipment (ITE) as part of Intel server chassis systems. These products are intended to be part of Intel server systems to be installed in offices, schools, computer rooms, and similar commercial-type locations.
- **Non-ITE application.** The suitability of this product for other product categories and environments (such as: medical, industrial, telecommunications, NEBS, residential, alarm systems, test equipment, and others) may require further evaluation.

## 6.1 Product Safety Compliance

### 6.1.1 USA / Canada Safety (UL-Listed)

- UL 60950-1, second edition, 2014-10-14 (Information Technology Equipment - Safety -Part 1: General Requirements).
- UL 62368-1, second edition.
- CSA C22.2 No. 62368-1-14, 2nd Edition.

### 6.1.2 CB Scheme Safety

- IEC 62368-1:2014 (second edition).
- EN 62368-1:2014+A11: 2017.

### 6.1.3 Taiwan (BSMI)

- CNS 13438.
- CNS15663.

### 6.1.4 Morocco (CMIM)

- EEN 62368-1:2020 +A11:2020.
- EN 55032:2015 +A11:2020 Class A.
- EN 55024:2010 +A1:2015.

## 6.2 Product EMC Compliance – Class A Compliance

### 6.2.1 USA / Canada (FCC)

- This device complies with Part 15 of the FCC Rules.
- FCC CFR Title 47, Part 15, Subpart B, Class A.
- ANSI C63.4:2014.
- ICES -003, Issue 7, Class A

### 6.2.2 KC Certification (Korea)

- Meets the KN32/KN35 testing requirements.

### 6.2.3 CE Certification (Europe)

- EN 55032:2015+A11:2020 Class A.
- BS EN 55032:2015+A11:2020 Class A.
- AS/NZS CISPR 32:2015 Class A.
- CISPR 32:2015+COR1:2016 Class A.
- EN IEC 61000-3-2:2019 Class A.
- BS EN IEC 61000-3-2:2019 Class A.
- EN 61000-3-3:2013+A1:2019.
- BS EN 61000-3-3:2013+A1:2019.
- EN 55024:2010+A1:2015.
- BS EN 55024:2010+A1:2015.

### 6.2.4 VCCI Emissions (Japan)

- VCCI- 32-1.
- VCCI-CISPR 32: 2016.
- CISPR 32:2015+COR1:2016 Class A.

### 6.2.5 Australia and New Zealand RCM

- AS/NZS CISPR 32:2015 Class A.
- CISPR 32:2015+COR1:2016 Class A.

### 6.2.6 EU Declaration

This product is in conformity with the relevant Union Harmonization Legislation:

- Low Voltage (Safety) Directive 2014/35/EU:
  o EN 62368-1:2020 +A11:2020
- EMC Directive 2014/30/EU:
  o EN 55032:2015 +A11:2020 Class A.
  o EN 55024:2010 +A1:2015.
- RoHS Directive 2011/65/EU with amendment Directive 2015/863/EU (RoHS2):
  o IEC 63000:2018.
  o EN 62321:2009.

This product complies with the relevant requirements in conformity in the following standards:

- EU WEEE Directive 2012/19/EU.
- EU REACH Regulation No. 1907/2006.
- EU Batteries Directive 2006/66/EC.

### 6.2.7 UK Declaration

This product is in conformity with the relevant Union Harmonization Legislation:

- Electrical Equipment (Safety) Regulations 2016 (S.I. 2016/1101):
  o EN 62368-1:2020 +A11:2020.
- Electromagnetic Compatibility Regulations 2016 (S.I. 2016/1091):
  o EN 55032:2015 +A11:2020 Class A.
  o EN 55024:2010 +A1:2015.

The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

- Regulations 2012:
  - IEC 63000:2018.
  - EN 62321:2009.

This product complies with the relevant requirements in conformity in the following standards:

- EU REACH Regulation No. 1907/2006.

## 6.3    Product Environmental Compliance

Intel has a system in place to restrict the use of banned substances in accordance with worldwide regulatory requirements. A material declaration datasheet is available for Intel products. For more reference on material restrictions and compliance, view Intel's Environmental Product Content Specification at http://supplier.intel.com/ehs/environmental.html.

- **European Directive** 2002/95/EC (Europe).
- **Restriction of Hazardous Substances** (RoHS).
  - Threshold limits and banned substances are the following.
    - Quantity limit of 0.1% by mass (1000 PPM) for:
      - Lead.
      - Mercury
      - Hexavalent Chromium.
      - Polybrominated Biphenyls Diphenyl Ethers (PBB/PBDE).
    - Quantity limit of 0.01% by mass (100 PPM) for:
      - Cadmium.
- **California Code of Regulations**, Title 22, Division 4.5, Chapter 33:
  - Best Management Practices for Perchlorate Materials.
- **China** – Restriction of Hazardous Substances (China RoHS).
- **WEEE Directive** (Europe).
- **Packaging Directive** (Europe).
- **REACH Directive** (Europe).

# Appendix A.  Glossary

| Term | Description |
|---|---|
| **Configuration** | Refers to the way a computer is set up, the combined hardware components (computer, monitor, keyboard, and peripheral devices) that make up a computer system, or the software settings that allow the hardware components to communicate with each other. |
| **Device driver** | A program that permits a microprocessor (through the operating system) to direct the operation of a peripheral device. |
| **HBA** | Host bus adapter. |
| **Host** | The computer system in which a Storage Controller is installed. It uses the Storage controller to transfer information to and from devices attached to the SCSI bus. |
| **iPC** | Intel product code. |
| **ITE** | Information technology equipment. |
| **PCI** | Acronym for Peripheral Component Interconnect. A high-performance, local bus specification that allows the connection of devices directly to computer memory. The PCI Local Bus allows transparent upgrades from 32-bit data path at 33 MHz to 64-bit data path at 33 MHz, and from 32-bit data path at 66 MHz to 64-bit data path at 66 MHz. |
| **PCI Express\*** | Acronym for Peripheral Component Interconnect Express. A high-performance, local bus specification that allows the connection of devices directly to computer memory. PCI Express is a two-way, serial connection that transfers data on two pairs of point-to-point data lines. PCI Express goes beyond the PCI specification in that it is intended as a unifying I/O architecture for various systems: desktops, workstations, mobile, server, communications, and embedded devices. |
| **Peripheral devices** | A piece of hardware (such as a video monitor, drive, printer, or CD-ROM) used with a computer and under the control of the computer. SCSI peripherals are controlled through an Intel® RAID controller (host adapter). |
| **PHY** | The interface required to transmit and receive data packets transferred across the serial bus.<br>Each PHY can form one side of the physical link in a connection with a PHY on a different SAS device. The physical link contains four wires that form two differential signal pairs. One differential pair transmits signals, while the other differential pair receives signals. Both differential pairs operate simultaneously and allow concurrent data transmission in both, the receive and the transmit directions. |
| **SAS** | Acronym for Serial Attached SCSI. A serial, point-to-point, enterprise-level device interface that uses the proven SCSI protocol set. The SAS interface provides improved performance, simplified cabling, smaller connections, lower pin count, and lower power requirements when compared to parallel SCSI. SAS controllers use a common electrical and physical connection interface that is compatible with Serial ATA.<br>The SAS controllers support the ANSI *Serial Attached SCSI Standard, Version 2.0*. In addition, the controller supports the Serial ATA III (SATA III) protocol defined by the *Serial ATA Specification, Version 3.0*. Supporting both the SAS interface and the SATA III interface, the SAS controller is a versatile controller that provides the backbone of both server and high-end workstation environments. Each port on the SAS controller supports SAS devices, SATA devices, or both. |
| **SAS device** | Any device that conforms to the SAS standard and is attached to the SAS bus by a SAS cable. This includes SAS Adapters controllers (host adapters) and SAS peripherals. |
| **SATA** | Acronym for Serial Advanced Technology Attachment. A physical storage interface standard, SATA is a serial link that provides point-to-point connections between devices. The thinner serial cables allow for better airflow within the system and permit smaller chassis designs. |
| **SMP** | Serial Management Protocol. Protocol for managing and monitoring SAS expanders |
| **SSP** | Acronym for Serial SCSI Protocol. SSP enables communication with other SAS devices. Each PHY on the SAS controller can function as an SSP initiator. |
| **STP** | SATA Tunneling Protocol. Protocol to allow SATA communication through SAS expanders |
| **SRIS** | Separate Reference Clock With Independent Spread. Refers to a PCIe device using an independent clock signal. |
| **UART** | Universal asynchronous receiver-transmitter. |