Intel® Server Chassis SC5600

Technical Product Specification

Revision History

Date	Revision Number	Modifications
May, 2008	0.5	Initial version
March, 2009	1.0	Updated Chassis Feature and System Cooling sections; Updated Chassis Power Subsystem section; Updated MTBF and MTTR table; updated Glossary table
April 2010	1.1	Removed CCC related notice

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1. Introduction

This specification details the feature set of the Intel® Server Chassis SC5600 family, a server chassis series designed for Intel® Server Board products. The Intel® Server Chassis SC5600 series of products are low cost, quick to integrate, and allow utilization of multiple platforms and configurations. The Intel® Server Chassis SC5600 series comes in three configurations:

- Intel® Server Chassis SC5600 670-W fixed power supply - SC56000BASE
- Intel® Server Chassis SC5600 750-W (1+1) redundant power supply - SC5600BRP
- Intel® Server Chassis SC5600 750-W (1+1) redundant power supply with redundant system fans - SC5600LX

The configurations are distinguishable from one another based primarily on power supply and cooling features.

1.1 Intel® Server Chassis SC5600 Design Features

The Intel® Server Chassis SC5600 series make extensive use of tool-less hardware features and, depending on configuration and upgrade features, provides redundant cooling and redundant power supply capability. The following table lists the features for the Intel® Server Chassis SC5600BASE, Intel® Server Chassis SC5600BRP, and Intel® Server Chassis SC5600LX configurations.

Table 1. Intel® Server Chassis SC5600BASE, SC5600BRP, and SC5600LX Features

	Intel® Server Chassis SC5600BASE	Intel® Server Chassis SC5600BRP	Intel® Server Chassis SC5600LX
Power Delivery	Includes one (1) fixed 670-W power factor corrected (PFC) Intel validated power supply unit (PSU) with an integrated cooling fan.	Includes Intel validated PMBus-compliant (1+1) hot-swap redundant power supply with two (2) PFC 750-W power modules. Each power module includes integrated cooling fans. Each redundant power module includes one (1) AC line input.	Includes Intel validated PMBus-compliant (1+1) hot-swap redundant power supply with two (2) PFC 750-W power modules. Each power module includes integrated cooling fans. Each redundant power module includes one (1) AC line input.
System Cooling	Three fixed, non-redundant chassis fans: Two (2) 120 mm and one (1) 92 mm.	Three fixed, non-redundant chassis fans: Two (2) 120mm and one (1) 92mm.	Four tool-less, hot-swap and redundant chassis fans with handle-mounted diagnostic failure LEDs: two (2) 120 mm and two (2) 92 mm.
Peripheral Bays	Three tool-less, multi-mount 5.25-inch peripheral bays.	Three tool-less, multi-mount 5.25-inch peripheral bays.	Three tool-less, multi-mount 5.25-inch peripheral bays.
(6+4) Drive Bays Layout	Includes one (1) tool-less fixed drive bay for up to six (6) fixed drives. The Intel® Server Chassis SC5600BASE configuration supports up to six (6) drives.	Includes one (1) tool-less fixed drive bay for up to six (6) fixed drives. The Intel® Server Chassis SC5600BRP configuration	Includes one (1) tool-less fixed drive bay for up to six (6) fixed drives. The Intel® Server Chassis SC5600LX configuration

	Intel® Server Chassis SC5600BASE	Intel® Server Chassis SC5600BRP	Intel® Server Chassis SC5600LX
		supports up to ten (10) drives.	supports up to ten (10) drives
PCI Slots	Seven (7) full-length PCI slots.	Seven (7) full-length PCI slots.	Seven (7) full-length PCI slots.
Form Factor	5U Tower, convertible to rack mount.	5U Tower, convertible to rack mount.	5U Tower, convertible to rack mount.
Front Panel	LEDs for NIC1, NIC2, System ID, HDD activity, and system status.\nPower switch, ID switch, Reset switch, and NMI switch.\nOptical side cover intrusion switch and connection for bezel intrusion switch.\nIntegrated temperature sensor for fan speed management.	LEDs for NIC1, NIC2, System ID, HDD activity and system status.\nPower switch, ID switch, Reset switch, and NMI switch.\nOptical side cover intrusion switch and connection for bezel intrusion switch\nIntegrated temperature sensor for fan speed management.	LEDs for NIC1, NIC2, System ID, HDD activity, and system status.\nPower switch, ID switch, Reset switch, and NMI swtich.\nOptical side cover intrusion switch and connection for bezel intrusion switch.\nIntegrated temperature sensor for fan speed management.
External	Two (2) front USB and one (1) optional front- or rear-mounted serial port.	Two (2) front USB and one (1) optional front- or rear-mounted serial port.	Two (2) front USB and one (1) optional front- or rear-mounted serial port.
Color	Black	Black	Black
Construction	1.0 mm, zinc plated sheet metal. Meets Intel Cosmetic Spec # C25432.	1.0 mm, zinc plated sheet metal. Meets Intel Cosmetic Spec # C25432.	1.0 mm, zinc plated sheet metal. Meets Intel Cosmetic Spec # C25432.
Chassis ABS	Fire retardant, non-brominated PC-ABS.	Fire retardant, non-brominated PC-ABS.	Fire retardant, non-brominated PC-ABS.
Dimensions (Rack)	8.6-inch x 16.6-inch x 27.4-inch	8.6-inch x 16.6-inch x 27.4-inch	8.6-inch x 16.6-inch x 27.4-inch
Dimensions (Pedestal)	17.0-inch x 8.6-inch x 28.4-inch	17.0-inch x 8.6-inch x 28.4-inch	17.0-inch x 8.6-inch x 28.4-inch
Weight	34.6 kilograms	36.2 kilograms	36.2 kilograms
Optional Accessories[1]	• Rack Conversion Kit\n• Rack Cable Management Arm\n• Intel® Remote Management Module 3\n• Four (4) Drive Fixed Bay\n• Six (6) Drive Hot-swap SAS/SATA Backplane\n• Six (6) Drive Hot-swap SAS/SATA Expander Backplane\n• 10-pack Branding / Customization Panels\n• Unpainted Rack Top Cover	• Rack Conversion Kit\n• Rack Cable Management Arm\n• Intel® Remote Management Module 3\n• Redundant Power Supply\n• Four (4) Drive Fixed Bay\n• Six (6) Drive Hot-swap SAS/SATA Backplane\n• Six (6) Drive Hot-swap SAS/SATA Expander Backplane\n• Four (4) Drive Hot-swap SAS/SATA Backplane\n• Four (4) Drive Hot-swap SAS/SATA Expander	• Rack Conversion Kit\n• Rack Cable Management Arm\n• Intel® Remote Management Module 3\n• Redundant Power Supply\n• Four (4) Drive Fixed Bay\n• Six (6) Drive Hot-swap SAS/SATA Backplane\n• Six (6) Drive Hot-swap SAS/SATA Expander Backplane\n• Four (4) Drive Hot-swap SAS/SATA Backplane\n• Four (4) Drive Hot-swap SAS/SATA Expander

	Intel® Server Chassis SC5600BASE	Intel® Server Chassis SC5600BRP	Intel® Server Chassis SC5600LX
		Backplane • 10-pack Branding / Customization Panels • Unpainted Rack Top Cover	Backplane • 10-pack Branding / Customization Panels • Unpainted Rack Top Cover

1. For the product and order codes of each accessory, see Intel® Server Chassis SC5600 Configuration Guide, or refer to Intel® Server Configurator Tool at http://serverconfigurator.intel.com/default.aspx

1.2   Intel® Server Chassis SC5600BASE Summary

The Intel® Server Chassis SC5600BASE is designed to address the entry-level market. It includes a fixed single 670-W Power Factor Correction (PFC) non-redundant power supply, which supports up to six hard drives. Two tachometer output fans (4-pin) are mounted in front of the server board and one tachometer output fan (4-pin) is mounted at the back edge of the chassis. Optional four- and six-drive SATA/SAS hot-swap drive bay kits provide upgrades to allow support for six hot-swap SATA drives. Three 5.25-inch half-height peripheral bays are available for the installation of a floppy drive, CD-ROM drive, and/or other accessories. Standard chassis configuration is pedestal. A rack mount conversion kit is available.
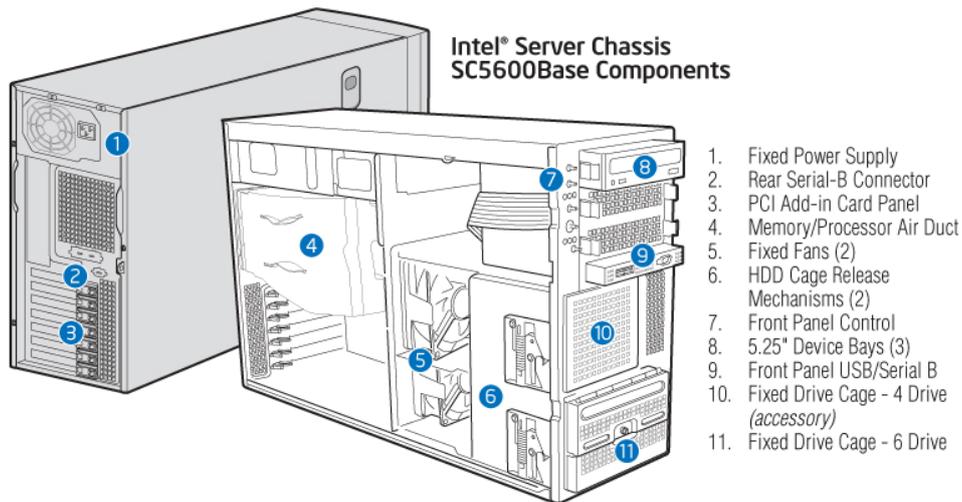
Figure 1. Intel® Server Chassis SC5600BASE Components

1.3   Intel® Server Chassis SC5600BRP Summary

The Intel® Server Chassis SC5600BRP supports the redundant power capability of the SC5600LX configuration and the fixed fan features of the Intel® Server Chassis SC5600BASE configuration. The SC5600BRP configuration includes PMBus-compliant 750-W PFC 1+1 hot-swap redundant power supply with all (two) power modules installed. Two tachometer output

fans (4-pin) are mounted in front of the server board and one tachometer output fan (4-pin) is mounted at the back edge of the chassis. Optional four- and six-drive SATA/SAS hot-swap drive bay kits provide upgrades to allow support for up to 10 hot-swap SATA/SAS drives. Three 5.25-inch half-height peripheral bays are available for installations of a floppy drive, CD-ROM drive, and/or other accessories. Standard chassis configuration is pedestal. A rack mount conversion kit is available.

1.4   Intel® Server Chassis SC5600LX Summary

The Intel® Server Chassis SC5600LX supports redundant power and includes redundant fan features. The SC5600LX configuration includes PMBus-compliant 750-W PFC 1+1 hot-swap redundant power supply with all (two) power modules installed. Four LED hot-swap tachometer output fans (6-pin) are mounted in front of the server board providing redundant cooling. Optional four- and six-drive SAS/SATA hot-swap drive bay kits provide upgrades to allow support for up to ten hot-swap SAS/SATA drives. Three 5.25-inch half-height peripheral bays are available for the installation of a floppy drive, CD-ROM drive, and/or other accessories. The standard chassis configuration is pedestal. A rack-mount conversion kit is available.
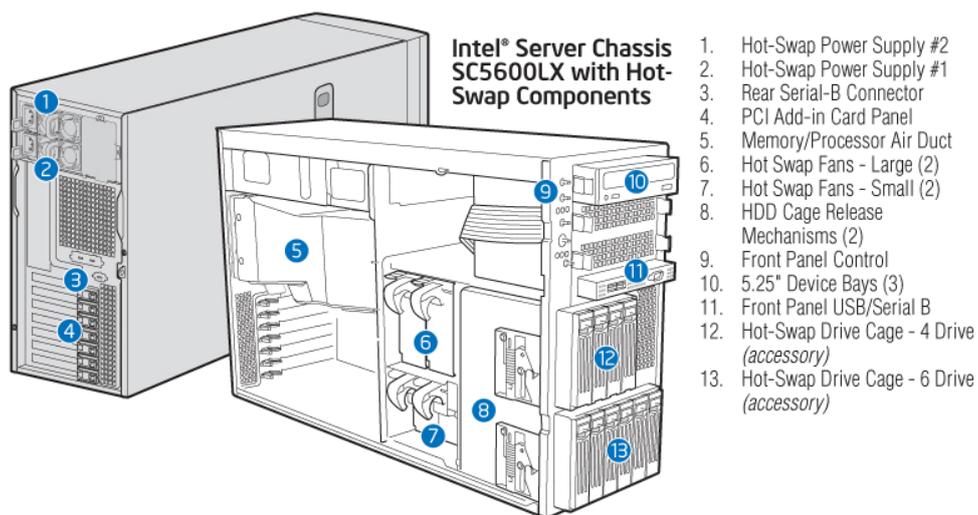
Figure 2. Intel® Server Chassis SC5600LX Components

1.5   Product Matrix

The following product matrix table lists the supported upgrades and optional accessories for the Intel® Server Chassis SC5600 series.

Table 2. Product Matrix

Product Code	Compatible Intel® Server Board	Standard Fixed Hard Drive Bays	Optional Hot-swap SAS/SATA Drives	Power Supply and Required Power Cord Configuration	Hot-swap Redundant Fans	Pedesta Rack
SC5600BASE Fixed 670-W Power Supply	Intel® Server Board S5520HC Intel® Server Board S5500HCV Intel® Server Board S5520HCT Intel® Workstation Board S5520SC	6-drive bay	6-SAS/SATA 6-SAS/SATA Expander	Fixed 670-W PFC. Requires one power cord	No	Pedesta Standar Rack Convers accesso availabl
SC5600BRP Hot-swap Redundant 750-W Power Supply	Intel® Server Board S5520HC Intel® Server Board S5500HCV Intel® Server Board S5520HCT	6-drive bay; 4-drive bay optional accessory is available.	6-SAS/SATA 6-SAS/SATA Expander 4-SAS/SATA 4-SAS/SATA Expander	All (two) 750-W PFC modules are installed. Requires one power cord per module.	No	Pedesta Standar Rack Convers accesso availabl
SC5600LX Hot-swap Redundant 750-W Power Supply and Hot-swap Redundant Fans	Intel® Server Board S5520HC Intel® Server Board S5500HCV Intel® Server Board S5520HCT	6-drive bay; 4-drive bay optional accessory is available	6-SAS/SATA 6-SAS/SATA Expander 4-SAS/SATA 4-SAS/SATA Expander	All (two) 750-W PFC modules are installed. Requires one power cord per module.	Yes	Pedesta Standar Rack Convers accesso availabl

2.   Chassis Features

2.1   Chassis Dimensions and Weight

Shipping weights include packaging.

Complete systems configured with server board, accessories, and hard disk drives will have varying weights.

Table 3. Chassis Dimensions and Weights

Configuration		Pedestal	Rack
Height		17 inches (43.2 cm)	8.6 inches (21.8 cm)
Width		8.6 inches (21.8 cm)	16.6 inches (42.2 cm)
Depth		28.4 inches (70.9 cm)	27.4 inches (69.6 cm)
Clearance front		10 inches (25.4 cm)	N/A
Clearance rear		5 inches (12.7 cm)	N/A
Clearance side		3 inches (7.6 cm)	N/A
Weight	LX	36.2 kg	36.2 kg
	Base	34.6 kg	34.6 kg

2.2   System Colors

The Intel® Server Chassis SC5600 is available in one color configuration, black.

Table 4. System Color Code

Manufacturer	Color Code
GE	Black GE701

2.3   Pedestal Configuration

The standard pedestal front bezel is a molded plastic door covering all drive bays. A key lock is provided to prevent unauthorized access to the peripheral bays. A molded plastic sub-bezel is located on the face of the chassis under the front bezel. The sub-bezel houses the front panel buttons and light pipes for the front panel indicators. Each peripheral bay is covered with a removable electromagnetic interference (EMI) shield.

Opening the exterior plastic door on the pedestal chassis accesses the hot-swap hard drives. An EMI shield is incorporated into the drive carrier design, eliminating the need for a separate shield or door. This adds flexibility to the bezel design by making EMI performance independent of the cosmetic plastic parts.

Customized bezels for OEM customers can be designed from the standard bezel design. OEM snap-in branding panels are also available.
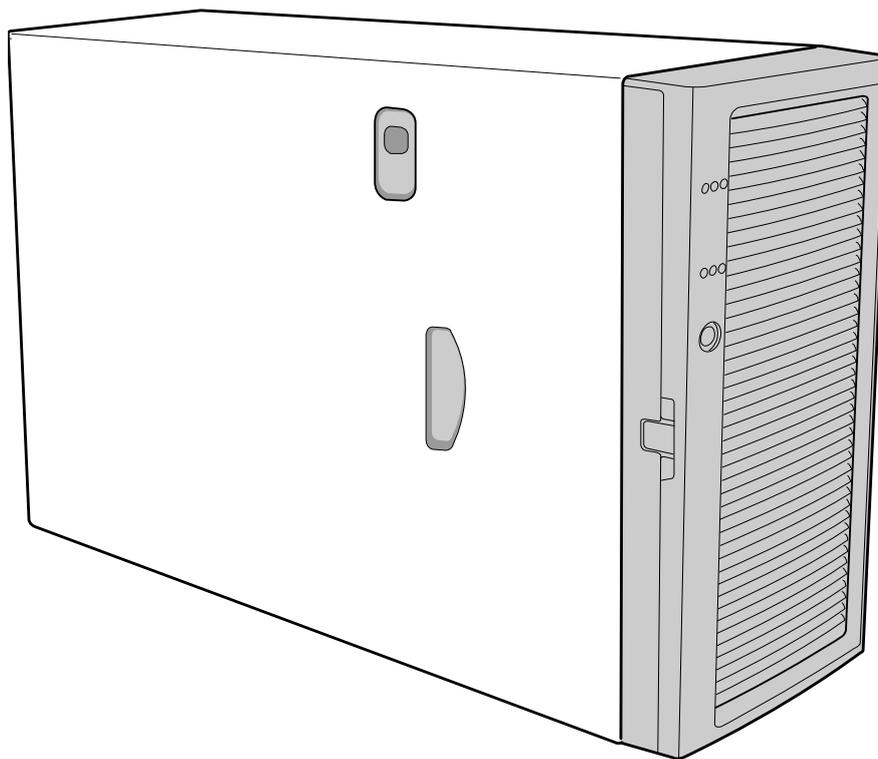
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Figure 3. Bezel Assembly

2.4   Rack Mount Configuration

In the rack mount configuration, the front door is removed and the sub-bezel becomes the front panel for the rack mount system. The drive bays and bezel icons are rotated 90° to have the correct orientation. The rack mount kit includes the chassis slides, rack handles, front door hinge cover plate, and icon label.
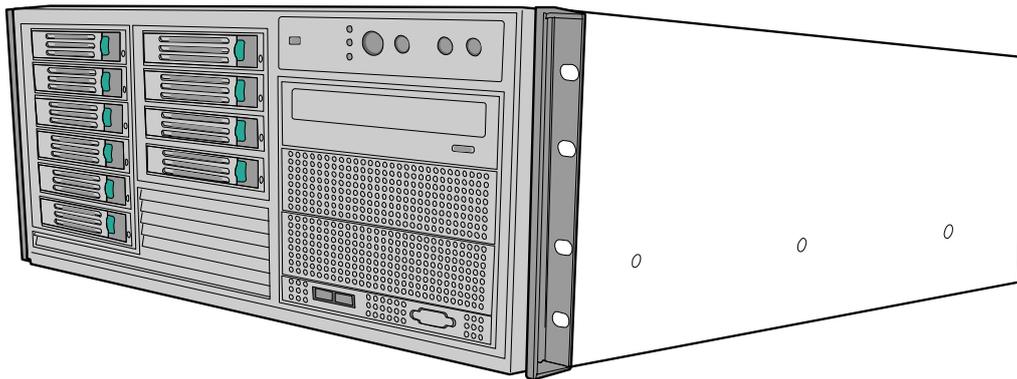
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Figure 4. Rack Configuration

2.5   Security

A variety of chassis security options are provided at the system level:

- A two-position key lock/switch unlocks the front bezel and side cover in the pedestal configuration only. The rack mount configuration does not have a key lock.
- A removable padlock loop on the rear of the system access cover can be used to prevent access to the microprocessors, memory, and add-in cards in rack mount systems. The 0.270-inch diameter loop can accommodate a variety of lock sizes.
- A Kensington* cable lock mounting hole is provided on the rear chassis I/O panel.
- An intrusion switch for the side panel and front bezel door are standard. In the rack mount configuration, only the system cover has an active intrusion switch.

Note: See the appropriate *Server Board Technical Product Specification* on the support.intel.com web site for a description of the BIOS and Intel® Server Management security features. Intrusion switches are provided allowing server management software, such as Intel® System Management Software, to detect unauthorized access to the system cover and pedestal bezel door.

2.6   I/O Panel

All input/output (I/O) connectors are accessible on the rear of the chassis. The SSI E-bay 3.5-compliant chassis provides an Advanced Technology Extended (ATX) specification, revision 2.03-compatible cutout for I/O shield installation. Boxed server boards provide the required I/O shield for installation in the cutout. The following figure shows the I/O cutout dimensions.

The rear I/O panel conforms to the ATX Specification, Revision 2.1, and supports seven full-length expansion PCI adaptor cards.
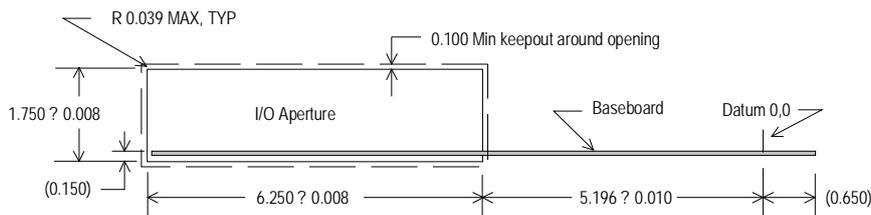
Figure 5. ATX 2.03 I/O Aperture

2.7   Standard and Optional Hot-swap Drive Bays

One fixed bay, supporting six cabled drives, ships with the standard chassis. A 4-drive bay accessory for cabled (fixed) drives is also available. Optional 4-drive and 6-drive hot-swap bays assembly are also available, which you can install to replace either the 4-drive or 6-drive fixed bays. No tools are required to replace the fixed drive bays.
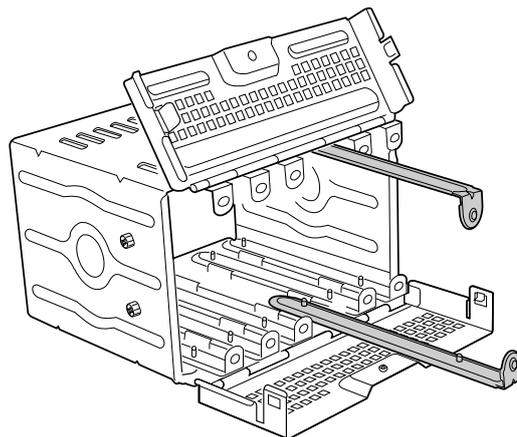
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Figure 6. 6-Drive Fixed Drive Cage
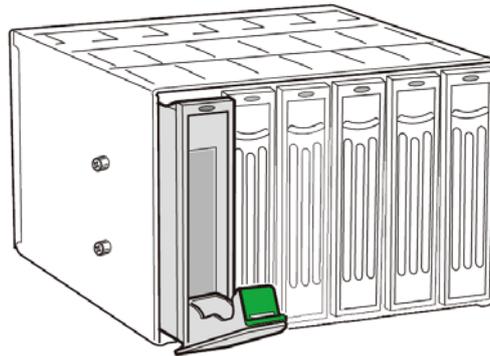
Figure 7. 6-Drive Hot-swap Drive Cage

2.7.1   Hot-swap Drive Trays

Each hard drive must be mounted to a hot-swap drive tray, making insertion and extraction of the drive from the chassis very simple. Each drive tray has its own dual-purpose latching mechanism used to both insert and extract drives from the chassis and lock the tray in place. Each drive tray supports a light pipe providing a drive status indicator, located on the backplane, to be viewable from the front of the chassis.
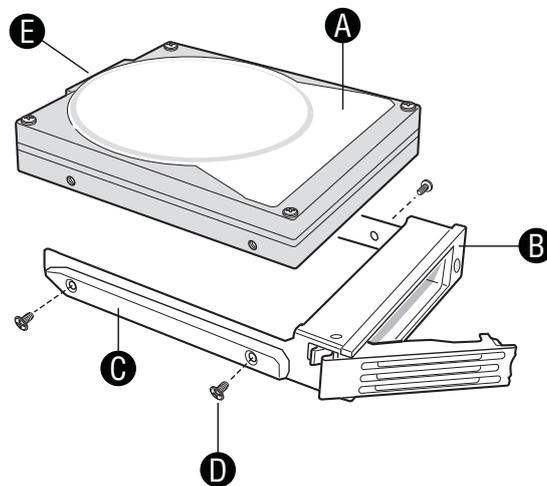
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A. Hard Drive
B. Drive Carrier
C. Side Rail
D. Mounting Screw
E. Hard Drive Connector

Figure 8. Hot-swap Drive Tray

2.7.2   Drive Blanks

You must use drive blanks when a hard drive bay does not have a hard drive installed. Drive blanks simulate the spatial volume of a hard disk that is required to maintain proper air pressure limits necessary to cool the system.
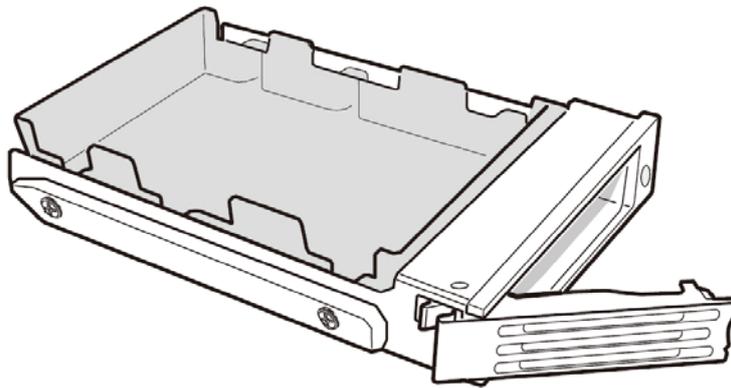
Figure 9. Drive Tray with Drive Blank

2.8   5.25-inch Half-height Peripheral Bays

Three 5.25-inch half-height drive bays are available for installation of a floppy drive, CD-ROM drive, or tape drive. The chassis ships with a 3.5-inch fixed drive adapter bracket, installed in the top 5.25-inch drive bay, and two empty 5.25-inch drive bays. Tool-less mounting rails are included for all three-drive bays and attach without screws.
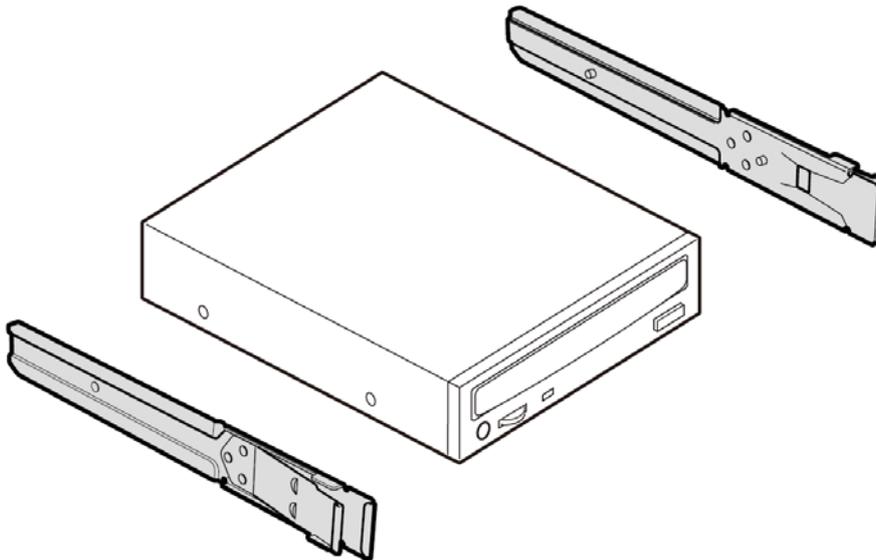
Figure 10. Tool-less Rails Mounting 5.25-inch CD-ROM Drive

3. Front Panel

The Intel® Server Chassis SC5600 provides a 24-pin cable option with the chassis kit. A 24-pin Entry-level Electronic Bay SSI (rev 3.61) front panel header for Intel® server boards is located on the back of the front panel. This allows a 24-pin ribbon cable to connect to SSI rev 3.61-compliant server boards. The front panel features control buttons and LED indicators. The LEDs are visible with the pedestal exterior access door closed. The blue ID LED and ID toggle switch featured in the rack mount Intel® Server Chassis SC5600 indicate which chassis among several in a rack configuration is being serviced.

3.1 Front Panel Board Layout
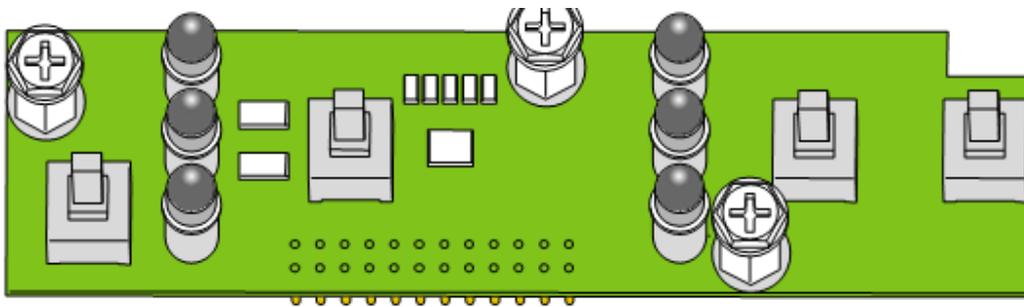
Figure 11. Front Panel Primary Side
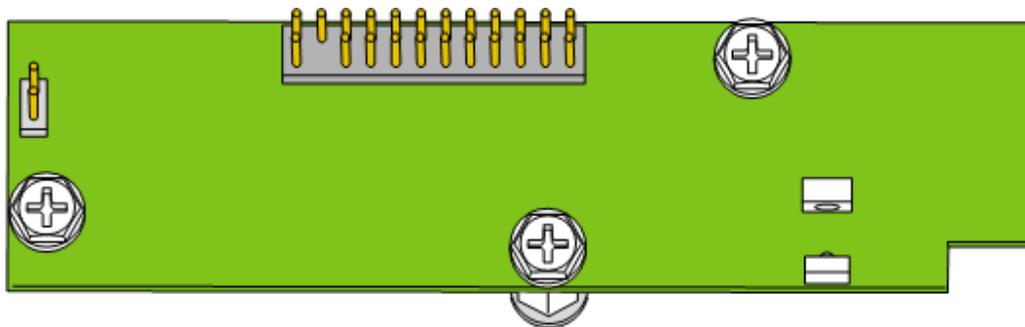
Figure 12. Front Panel Secondary Side

3.2   Front Panel Connectors

The following table lists the front panel connectors.

Table 5. Front Panel Connector Designations

Designator	Header Size	Description
J4L2	12x2	Front panel SSI connector
J4L1	2x1	Intrusion or front panel key switch

3.2.1   24-pin EEB SSI Compliance Connector Pin-out

A 24-pin Entry-level Electronics Bay (EEB) SSI (rev 3.61) front panel header is located on the back of the front panel. This allows for a 24-pin ribbon cable connection for use with SSI rev 3.61-compliant server boards.

Table 6. 24-pin EEB SSI Compliance Connector Pin-out
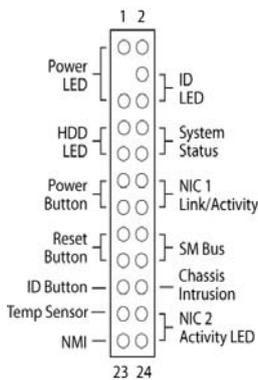
Pin	Signal Name	Description	Pin	Signal Name	Description
1	P3V3_STBY (Power_LED_Anode)	Power LED +	2	P3V3_STBY	Front Panel Power
3	Key	No Connection	4	P5V_STBY (ID LED Anode)	ID LED +
5	FP_PWR_LED_N	Power LED -	6	FP_ID_LED_BUF_N	ID LED -
7	P3V3 (HDD_ACTIVITY_Anode)	HDD Activity LED +	8	FP_LED_STATUS_GREEN_N	Status LED Green -
9	LED_HDD_ACTIVITY_N	HDD Activity LED -	10	FP_LED_STATUS_AMBER_N	Status LED Amber -
11	FP_PWR_BTN_N	Power Button	12	NIC1_ACT_LED_N	NIC 1 Activity LED -
13	GND (Power Button GND)	Power Button Ground	14	NIC1_LINK_LED_N	NIC 1 Link LED -
15	BMC_RST_BTN_N	Reset Button	16	SMB_SENSOR_3V3STB_DATA	SMB Sensor DATA
17	BND (Reset GND)	Reset Button Ground	18	SMB_SENSOR_3V3STB_CLK	SMB Sensor Clock
19	FP_ID_BTN_N	ID Button	20	FP_CHASSIS_INTRU	Chassis Intrusion
21	FM_SIO_TEMP_SENSOR	Front Panel Temperature Sensor	22	NIC2_ACT_LED_N	NIC 2 Activity LED -
23	FP_NMI_BTN_N	NMI Button	24	NIC2_LINK_LED_N	NIC 2 Link LED -

3.3   Front Panel Controls and Indicators

The following figure displays the front panel control buttons and LED indicators. The tool-activated non-maskable Interrupt (NMI) switch is located below the Status Fault LED.

When the hot-swap drive bay is installed, a bi-color hard drive LED is located on each drive carrier (six total) to indicate specific drive failure or activity. For pedestal systems, these LEDs are visible when the front bezel door is open.

A.   System ID Button
B.   Reset Button
C.   LAN # 1 Activity LED
D.   System ID LED
E.   LAN # 2 Activity LED
F.   Power Button
G.   Hard Drive Activity LED
H.   Power / Sleep LED
I.   Status LED
J.   NMI Button
K.   Chassis Intrusion Detection
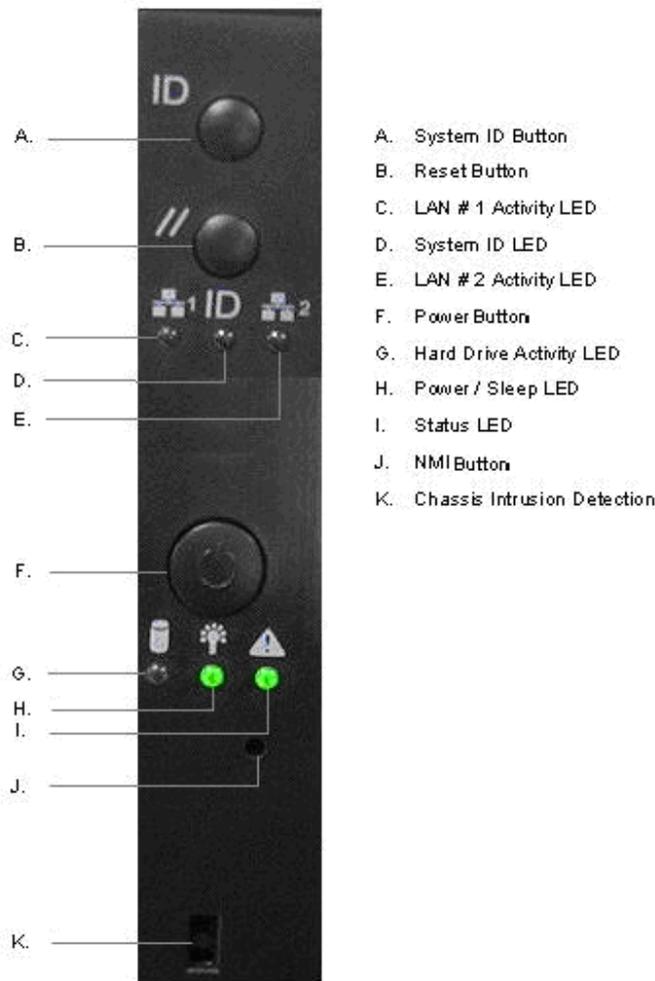
Figure 13. Front Panel Controls and Indicators

The following table shows the function of the front panel buttons and indicator LEDs.

Table 7. Front Panel LED Functions

LED	Color	Condition[1]	What It Means
Power/Sleep	Green	On	Power on
		Blink	Sleep S1/S3
		Off	Off (also Sleep S4/S5)
System Status	Off	N/A	AC power off. System is powered down or S5 states, if no degraded, non-critical, critical, or non-recoverable conditions exist.
	Green	Solid on	System booted / Normal operation
		Blink	System degraded (See Section 3.3.2.3)
	Amber	Blink	Non-critical condition (See Section 3.3.2.3)
		Solid on	Critical condition (See Section 3.3.2.1)
HDD	Green	Blink	Drive activity
		Off	No drive activity
NIC 1 / NIC 2 Activity	Green	On	NIC link
		Blink	NIC activity
		Off	No connection
Identification	Blue	On	Unit selected for identification
		Off	No identification

Note: LED functionality is dependent on server board support. Not all server boards support all features. For additional details about control panel functions supported for a specific board, refer to the individual server board's technical product specification.

3.3.1   Power / Sleep LED

The green power LED is active when system DC power is on. The power LED is controlled by the BIOS. The power LED reflects a combination of the state of system (DC) power and the system ACPI state. Table 8 shows the states that can be assumed.

Table 8. Power LED Operation.

State	Power Mode	LED	Description
Power off	Non-ACPI	Off	System power is off, and the BIOS has not initialized the chipset.
Power on	Non-ACPI	On	System power is on, but the BIOS has not yet initialized the chipset.
S5	ACPI	Off	Mechanical is off, and the operating system has not saved any context to the hard disk.
S4	ACPI	Off	Mechanical is off. The operating system has saved context to the hard disk.
S3-S1	ACPI	Slow blink	DC power is still on. The operating system has saved context and entered into a level of low-power state.
S0	ACPI	Steady on	System and the operating system are up and running.

3.3.2   System Status LED

The system status LED is a bi-color LED. Green (status) shows a normal operation state or a degraded operation. Amber (fault) shows the platform hardware state and overrides the green status.

When the server is powered down (transitions to the DC-off state or S5), the BMC is still on standby power and retains the sensor and front panel status LED state established prior to the power-down event. If the system status is normal when the system is powered down (the LED is in a solid green state), the system status LED will be off.

3.3.2.1   Critical Conditions

A critical condition is defined as any critical or non-recoverable threshold crossing associated with the following events:

- CPU Missing
- Thermal Trip asserted
- Non-recoverable temperature threshold asserted
- Non-recoverable voltage threshold asserted
- Power fault / Power Control Failure
- Fan redundancy lost, insufficient system cooling. This does not apply to non-redundant systems.
- Power supply redundancy lost insufficient system power. This does not apply to non-redundant systems.

3.3.2.2   Non-Critical Conditions

A non-critical condition is a threshold crossing associated with the following events:

- Critical temperature threshold asserted
- CATERR asserted
- Critical voltage threshold asserted
- VRD hot asserted
- SMI Timeout asserted

3.3.2.3   Degraded Conditions

A degraded condition could be associated with the following events:

- Non-critical temperature threshold asserted
- Non-critical voltage threshold asserted
- Non-critical fan threshold asserted
- Fan redundancy lost, sufficient system cooling maintained. This does not apply to non-redundant systems.
- Power supply predictive failure.
- Power supply redundancy lost. This does not apply to non-redundant systems.
- Correctable errors over a threshold of 10 and migrating to a mirrored DIMM (memory mirroring). This indicates the user no longer has spare DIMMs indicating a redundancy lost condition. The corresponding DIMM LED should light up.

3.3.3   Drive Activity LED

The drive activity LED on the front panel indicates drive activity from the onboard hard disk controllers.

3.3.4   System Identification LED

The blue system identification LED is used to identify a system for servicing. This is especially useful when the system is installed in a high-density rack or cabinet populated with several similar systems. The system ID LED will light when the System ID button on the control panel is pressed or activated remotely through server management software.

4. System Cooling

Two cooling solutions are used in the Intel® Server Chassis SC5600 series. The base solution consists of three fixed fans (one 92-mm and two 120-mm) to provide sufficient system cooling. The second redundant solution is designed for maximum up time by providing four replaceable hot-swap fans (two 92-mm and two 120-mm). The fans can maintain proper system cooling, even with a single failed fan. Air ducts are used in both configurations and an active memory heat sink solution for the server board memory may be required for several of the system configurations.

4.1 Processor Heat Sink Cooling

4.1.1 Activate Heat Sink Cooling

Unless otherwise indicated in the server board manuals, you should use processors with **active** heat sinks in the Intel® Server Chassis SC5600BASE and SC5600BRPs. The ducting shown (Figure 14) is designed to work with the active heat sink. Intel® Server Chassis SC5600BASE and SC5600BRP do not include processor heat sinks.

A. Chassis align holes for air duct	**To Install the air duct:**
B. Air duct align holes	1. Align the air duct and chassis rails.
C. Air duct and chassis alignment rails	2. Install the air duct. Ensure that alignment holes match up, and then engage the latch.

Figure 14. Air Duct for Intel® Server Chassis SC5600BASE and SC5600BRP

The Intel® Server Chassis SC5600BASE and SC5600BRP are compatible with the Intel® Thermal Solution STS100C (with fan installed) and STS100A. Air flows through the system from

front to back. Please refer to the Service Guide or Quick Start User's Guide of the compatible server boards for heat sink installation.

4.1.2 Passive Heat Sink Cooling

Unless otherwise indicated in the server board manuals, you should use processors with **passive** heat sinks should be used in the Intel® Server Chassis SC5600LX. The ducting shown (Figure 15) is designed to work with the passive heat sink. The Intel® Server Chassis SC5600LX does not include processor heat sinks.

The passive processor heat sink solution used for the Intel® Server Chassis SC5600LX is provided with the tower heat sink accessory FXXRGTHSINK. Air flows through the system from front to back. Please refer to the Service Guide or Quick Start User's Guide of the compatible server boards for heat sink installation.
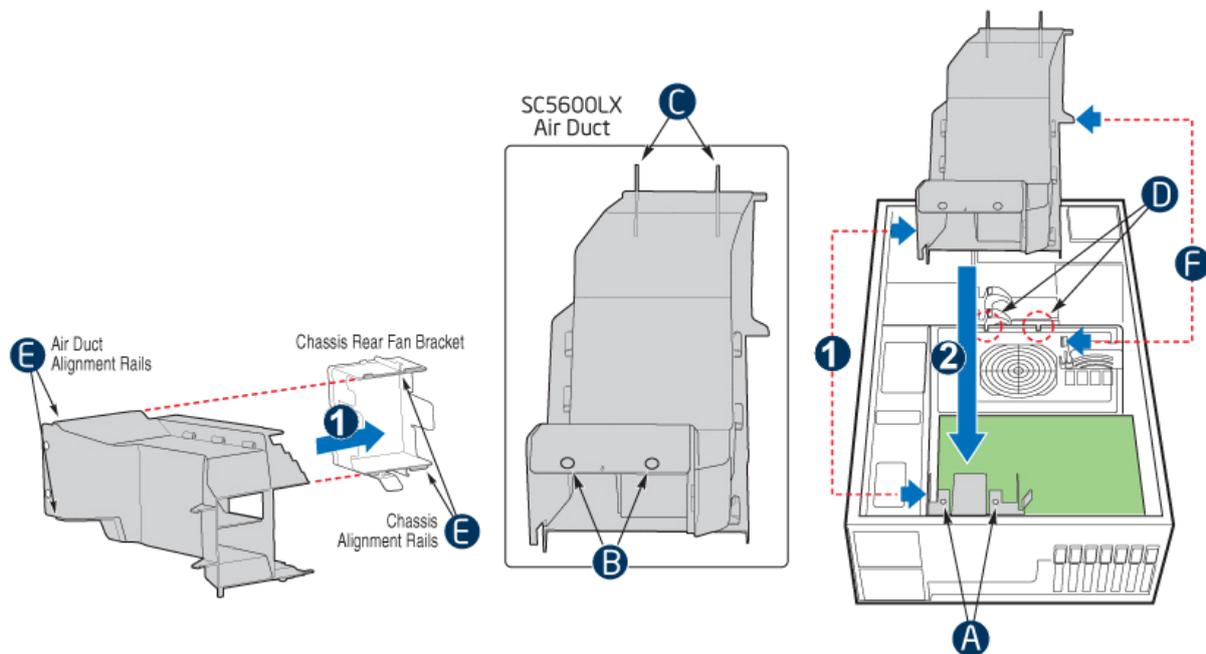
A. Chassis align holes for air duct
B. Air duct align holes
C. Air duct alignment tabs
D. Chassis alignment slots for air duct
E. Air duct and chassis alignment rails
F. Air duct alignment tab and matching chassis alignment slot

To Install the air duct:
1. Align the air duct and chassis rails.
2. Install the air duct.
   Ensure that alignment holes and tabs match up, then engage the latch.

Figure 15. Air Duct for Intel® Server Chassis SC5600LX

4.2 Base Cooling Solution

Base cooling solution is used in the Intel® Server Chassis SC5600BASE and SC5600BRP.

Two 120 x 38 mm fans and one 92 x 38 mm fan provide cooling for the processors, memory, hard drives, and add-in cards. Two fans (one 120 x 38 mm fan and one 92 x 38 mm fan) draw

air through the rear of each hard drive bay to provide drive, processors, and memory cooling. The rear fan (120 x 38 mm fan) draws air through the back edge of the chassis to provide cooling for memory and processors. All system fans provide a signal for RPM detection the server board can make available for server management functions.

In addition, the power supply fan provides cooling for the power supply.
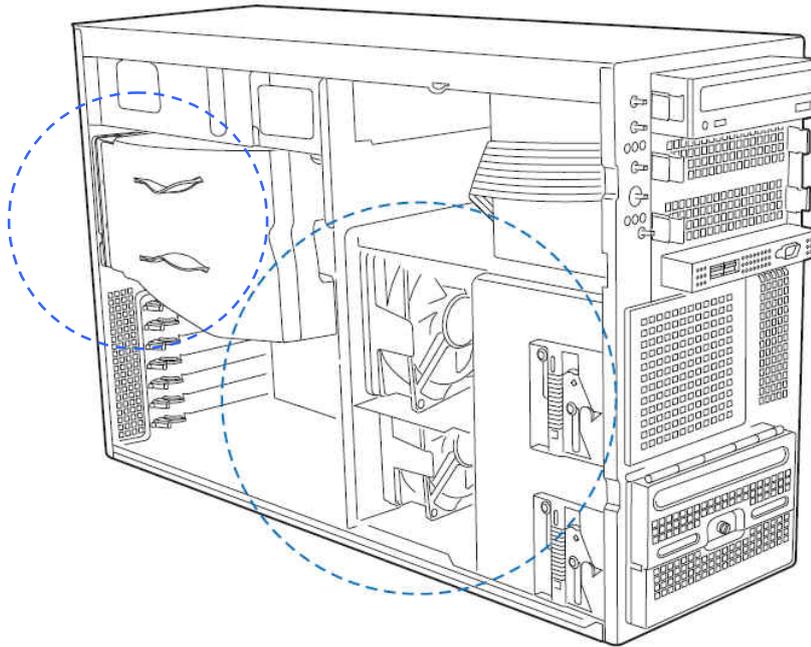
Figure 16. Fixed Fan Mounting

Note: The air duct covers the rear fan.

4.3   Redundant Cooling Solution

Redundant cooling solution is used in the Intel® Server Chassis SC5600LX.

Two hot-swap 120x38 mm fans and two hot-swap 92x38 mm fans provide cooling for the processors, hard drives, and add-in cards. The two 120x38 mm fans ensure proper cooling of the core area (processors and memory) and the hot-swap drive bay. The two 92x38 mm fans provide cooling for the PCI card area. When any single fan fails, the remaining fans increase in speed and maintain cooling until the failed unit is replaced. All system fans provide a signal for RPM detection that the server board can make available for server management functions.

In addition, the power supply fan provides cooling for the power supply.
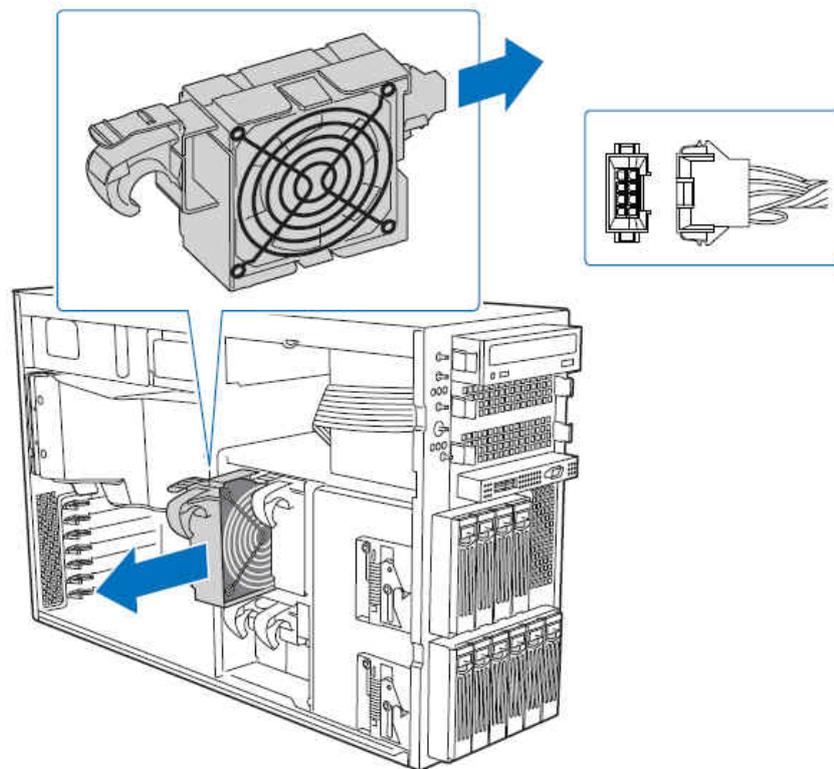
AF002679

Figure 17. Hot-swap Fans and Connectors

The following figure shows the airflow characteristics through the Intel® Server Chassis SC5600LX.
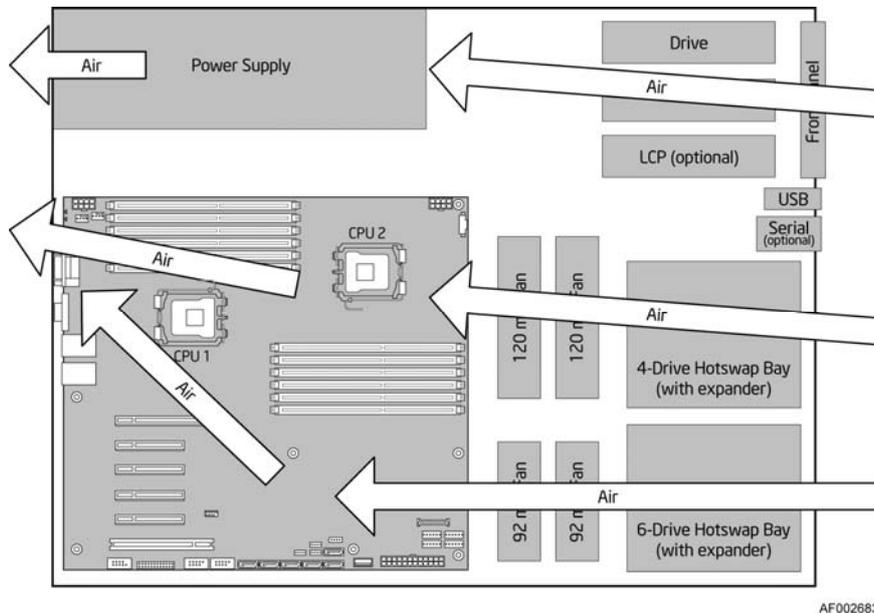
Figure 18. Redundant Chassis Airflow Characteristics

4.4   Fan Control

The fans in the Intel® Server Chassis SC5600 are designed for server boards that support fan control via a PWM control signal.

4.4.1   Basic Fan Control (All fans)

The front panel of the chassis has an active temperature sensor (for example, Texas Instruments* TMP141) connected to the front panel's bus. The server board firmware adjusts the fan speed based on the front panel inlet temperature and processor temperatures.

4.4.2   Additional Fan Control (120 mm fans)

Fan control will monitor the temperature of the processors and further reduce the speed of the 120-mm fans. This allows the system to provide minimal airflow for when processors are sitting idle then ramp fan speeds up when they are under a heavy load. This maintains proper system cooling of all components and peripherals, while minimizing the acoustic noise level.

Refer to the baseboard documentation for additional details on how fan control is implemented.

4.5   Fan Header Connector Descriptions

All system fan headers support pulse width modulated (PWM) fans for cooling the processors in the chassis. PWM fans have an improved RPM range (20% to 100% rated fan speed) when compared to voltage controlled fans.

Base and BRP chassis fans are a 4-wire/4-pin style designed to plug into 4-pin or 6-pin SSI Fan headers. When plugged into a 6-pin header, only the first four signals are used (Pwr, Gnd, Tach, PWM).

LX chassis fans are a 6-wire/6-pin style designed to plug into 6-pin headers. The extra signals provide for fan redundancy and failure indications (Pwr, Gnd, Tach, PWM, Presence, and Failure).

Server Boards installed in this chassis may feature two additional 4-pin CPU fan headers and one additional 4-pin system fan headers. These connections are not required for use with the Intel® Server Chassis SC5600.

To assist with fan connections in the system, the system fans are numbered one through five and color-coded. These correspond to fan header numbers on the server board. Fan 1 and fan 2 connectors are white in color and the fan 3, fan 4, and fan 5 connectors are blue in color. These colors should also match between server board and fans.

5.   Chassis Power Subsystem

The Intel® Server Chassis SC5600 power supplies are Server System Infrastructure (SSI) compliant. The SSI specifications are available at the following web site: http://www.ssiforum.org.

5.1   670-W Power Supply

The 670-W power supply has eight outputs: 3.3 V, 5 V, 12V1, 12V2, 12V3, 12V4, -12 V, and 5 Vsb (standby). The 670-W power supply contains a single 80 mm fan for cooling the power supply, which also provides part of the system cooling.

5.1.1   670-W Power Supply Mechanical Outline

The power supply size is 150 mm x 180 mm x 86 mm and has a wire harness for the DC outputs. The AC power cord plugs directly into the external face of the power supply.
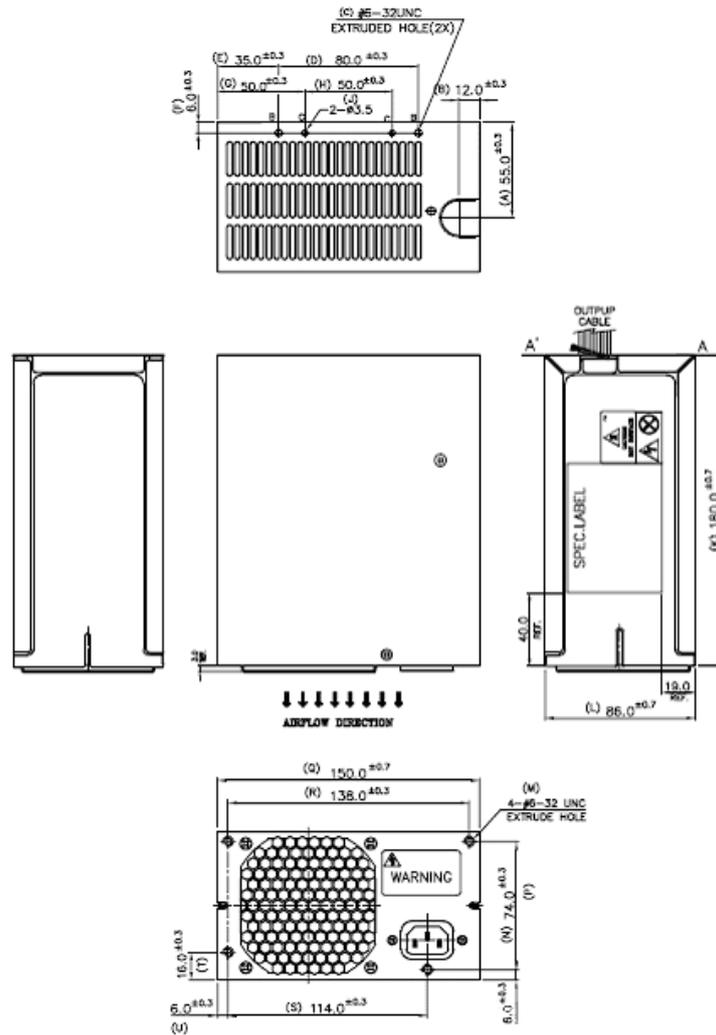
Note: All dimensions are in millimeters.
Figure 19. Mechanical Outline

5.1.2   670-W Power Supply Output Wire Harness

Listed or recognized component appliance wiring material (AVLV2), CN, rated minimum 105°C, 300 VDC shall be used for all output wiring.

Table 9. 670-W Power Supply Cable Lengths

From	Length (mm)	To Connector Number	Number of pins	Description
Power Supply cover exit hole	750	P1	24	Baseboard Power Connector
Power Supply cover exit hole	350	P2	8	CPU 2 Power Connector
Power Supply cover exit hole	600	P3	8	CPU 1 Power Connector
Power Supply cover exit hole	350	P4	5	Power Signal Connector
Power Supply cover exit hole	450	P5	4	Peripheral Power Connector for 5.25 inch
Extension	100	P6	4	Peripheral Power Connector for 5.25 inch
Extension	100	P7	4	Peripheral Power Connector for 5.25 inch
Power Supply cover exit hole	600	P8	4	Peripheral Power Connector for HDD
Extension	75	P9	4	Right-angle Peripheral Power Connector (Cover with sleeve) for HDD
Power Supply cover exit hole	750	P10	4	Peripheral Power Connector for HDD
Extension	75	P11	4	Peripheral Power Connector for HDD
Power Supply cover exit hole	750	P12	5	Right-angle SATA Power Connector for HDD
Extension	75	P13	5	SATA Power Connector for HDD

5.1.2.1   Server Board Power Connector (P1)

- Connector housing: 24-Pin Molex* Mini-Fit Jr. 39-01-2245 or equivalent
- Contact: Molex Mini-Fit, HCS, Female, Crimp 44476 or equivalent

Table 10. Baseboard Power Connector

Pin	Signal	18 AWG Color	Pin	Signal	18 AWG Color
1[1]	+3.3 VDC	Orange	13	+3.3 VDC	Orange
	3.3 V RS	Orange (24AWG)			
2	+3.3 VDC	Orange	14	-12 VDC	Blue
3[1]	COM	Black	15	COM	Black
	COM RS	Black (24AWG)			
4[1]	+5 VDC	Red	16	PSON#	Green (24AWG)
	5 V RS	Red (24AWG)			
5	COM	Black	17	COM	Black
6	+5 VDC	Red	18	COM	Black
7	COM	Black	19	COM	Black
8	PWR OK	Gray (24AWG)	20	Reserved	N.C.
9	5 VSB	Purple	21	+5 VDC	Red
10	+12V3	Yellow	22	+5 VDC	Red
11	+12V3	Yellow	23	+5 VDC	Red
	+12V3 RS	Yellow (24AWG)			
12	+3.3 VDC	Orange	24	COM	Black

Note:

[1] Remote Sense wire double-crimped.

5.1.2.2 CPU 2 Power Connector (P2)

- Connector housing: 8-Pin Molex 39-01-2080 or equivalent
- Contact: Molex 44476-1111 or equivalent

Table 11. CPU 2 Power Connector

Pin	Signal	18 AWG Color	Pin	Signal	18 AWG Color
1	COM	Black	5	+12V1	White
2	COM	Black	6	+12V1	White
3	COM	Black	7	+12V2	White
4	COM	Black	8	+12V2	White

5.1.2.3 CPU 1 Power Connector (P3)

- Connector housing: 8-Pin Molex 39-01-2080 or equivalent
- Contact: Molex 44476-1111 or equivalent

Table 12. CPU 1 Power Connector

Pin	Signal	18 AWG Color	Pin	Signal	18 AWG Color
1	COM	Black	5	+12V2	Brown
2	COM	Black	6	+12V2	Brown
3	COM	Black	7	+12V1	Brown
4	COM	Black	8	+12V1	Brown

5.1.2.4 Power Signal Connector (P4)

- Connector housing: 5-pin Molex 50-57-9405 or equivalent
- Contacts: Molex 16-02-0087 or equivalent

Table 13. Power Signal Connector

Pin	Signal	24 AWG Color
1	I^2C Clock	White
2	I^2C data	Yellow
3	Reserved	N.C.
4	COM	Black
5	3.3RS	Orange

5.1.2.5 Peripheral Power Connectors (P5, P6, P7, P8, P10, P11)

- Connector housing: Amp 1-480424-0 or equivalent
- Contact: Amp 61314-1 contact or equivalent

Table 14. Peripheral Power Connectors

Pin	Signal	18 AWG Color
1	+12V4	Green
2	COM	Black
3	COM	Black
4	+5 VDC	Red

5.1.2.6 Right-angle Peripheral Power Connectors (P9)

- Connector housing: JWT F6001HS2-4P or equivalent

Table 15. Right-Angle Peripheral Power Connectors

Pin	Signal	18 AWG Color
1	+12V4	Green
2	COM	Black
3	COM	Black
4	+5 VDC	Red

5.1.2.7 Right-angle SATA Power Connector (P12)

- Connector housing: JWT F6002HS0-5P-18 or equivalent

Table 16. Right-Angle SATA Power Connector

Pin	Signal	18 AWG Color
1	+3.3 V	Orange
2	COM	Black
3	+5 VDC	Red
4	COM	Black
5	+12V4	Green

5.1.2.8 SATA Power Connector (P13)

- Connector housing: JWT A3811H00-5P or equivalent
- Contacts: JWT A3811TOP-0D contact or equivalent

Table 17. SATA Power Connector

Pin	Signal	18 AWG Color
1	+3.3 V	Orange
2	COM	Black
3	+5 VDC	Red
4	COM	Black
5	+12V4	Green

5.1.3   670-W Power Supply Airflow and Temperature Rise

The power supply incorporates one 80-mm fan for self-cooling and system cooling. The fan provides 14 cubic feet per minute (CFM) airflow through the power supply when installed in the system. The cooling air enters the power module from the non-AC side.

5.1.3.1   Temperature Requirements

The power supply shall operate within all specified limits over the T_{op} temperature range. All airflow shall pass through the power supply and not over the exterior surfaces of the power supply.

Table 18: Thermal Requirements

Item	Description	MIN.	MAX.	Units
T_{op}	Operating temperature range	0	45	°C
T_{non-op}	Non-operating temperature range	-40	70	°C
Altitude	Maximum operating altitude	N/A	1500	m

The power supply meets Underwriters Laboratories (UL) enclosure requirements for temperature rise limits. All sides of the power supply, with exception to the air exhaust side, are classified as "Handle, knobs, grips, etc., held for short periods of time only."

5.1.4   670-W Power Supply AC Specifications

The power supply incorporates universal power input with active power factor correction, which reduces line harmonics in accordance with the EN61000-3-2 and JEIDA MITI standards.

5.1.4.1   AC Inlet Connector

The AC input connector is an IEC* 320 C14 power inlet. This inlet is rated for 15A / 250VAC.

5.1.4.2   AC Input Voltage Specification

The power supply operates within all specified limits over the following input voltage range (see the following table). The power supply shall power off if the AC input is less than 75±5 VAC ranges. The power supply operates properly starting at 80-85 VAC input voltages.

Table 19. AC Input Ratings

Parameter	MIN.	Rated	V_{MAX}	I_{MAX}	Start up VAC	Power Off VAC
Voltage (110)	90 V_{rms}	100-127 V_{rms}	140 V_{rms}	12 A[1, 3]	85 VAC +/-4 VAC	75 VAC +/-5 VAC
Voltage (220)	180 V_{rms}	200-240 V_{rms}	264 V_{rms}	7 A[2, 3]	N/A	N/A
Frequency	47 Hz	50/60 Hz	63 Hz	N/A	N/A	N/A

Notes:

[1] Maximum input current at low input voltage range shall be measured at 90 VAC at maximum load.

[2] Maximum input current at high input voltage range shall be measured at 180 VAC at maximum load.

[3] Do not use this requirement for determining agency input current markings.

5.1.4.3   Efficiency

The 670-W power supply has an efficiency of 68% at maximum load and over the specified AC input voltage range of 115 VAC to 220 VAC.

5.1.4.4   AC Line Dropout / Holdup

An AC line dropout occurs when the AC input drops to 0VAC at any phase of the AC line for any length of time. During an AC dropout of one cycle or less, the power supply meets dynamic voltage regulation requirements over the rated load. An AC line dropout of any duration shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than the hold up time (20msec), the power supply should recover and meet all turn-on requirements. The power supply meets the AC dropout requirement over rated AC voltages and frequencies. Any dropout of the AC line does not cause damage to the power supply.

5.1.4.5   AC Line Fuse

The power supply has one line fused in the single line fuse on the line (Hot) wire of the AC input. The input fuse is a slow blow type. AC inrush current does not cause the AC line fuse to blow under any conditions. Not all protection circuits shall cause the AC fuse to blow unless a component in the power supply has failed. This includes DC output load short conditions.

5.1.5   670-W Power Supply DC Output Specifications

5.1.5.1   Grounding

The output ground of the pins of the power supply provides the return path. The output connector ground pins is to the safety ground (power supply enclosure).

5.1.5.2   Output Voltage and Currents

The following tables define two power and current ratings for the 670-W power supply. The combined output power of all outputs shall not exceed the rated output power.

Table 20. Load Ratings

Voltage	MIN. Continuous	MAX. Continuous	Peak
+3.3 V	1.0 A	24 A	N/A
+5 V	2.0 A	30 A	N/A
+12V1	0.5 A	16 A	18 A
+12V2	1.0 A	16 A	18 A
+12V3	0.5 A	31 A	33 A
+12V4	1.0 A	16 A	18 A
-12 V	0 A	0.5 A	N/A
+5 VSB	0.1 A	3.0 A	5 A

Notes:

Maximum continuous total output power shall not exceed 670 W.

Maximum continuous load on the combined 12 V output shall not exceed 48 A.

Peak load on the combined 12 V output shall not exceed 52 A.

Peak total DC output power shall not exceed 730 W.

For 12 V, peak power and current loading shall be supported for a minimum of 12 seconds.

For 5 Vsb, 5 Vsb must withstand 5 A for 500 mS long under first turn on condition.

Combined 3.3 V and 5 V power shall not exceed 170 W.

5.1.5.3   Voltage Regulation

The output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. These limits include the peak-peak ripple/noise. All outputs are measured with reference to the return remote sense signal (Returns). The +12V3, +12V4, −12 V, and 5 VSB outputs are measured at the power supply connectors referenced to Returns. The +3.3 V, +5 V, +12V1, and +12V2 are measured at the remote sense signal located at the signal connector.

Table 21. Voltage Regulation Limits

Parameter	Tolerance	Minimum	Nominal	Maximum	Units
+3.3 V	- 5% / +5%	+3.14	+3.30	+3.46	V_{rms}
+5 V	- 5% / +5%	+4.75	+5.00	+5.25	V_{rms}
+12V1	- 5% / +5%	+11.40	+12.00	+12.60	V_{rms}
+12V2	- 5% / +5%	+11.40	+12.00	+12.60	V_{rms}
+12V3	- 5% / +5%	+11.40	+12.00	+12.60	V_{rms}
+12V4	- 5% / +5%	+11.40	+12.00	+12.60	V_{rms}
- 12 V	- 5% / +9%	- 11.40	-12.00	-13.08	V_{rms}
+5 VSB	- 5% / +5%	+4.75	+5.00	+5.25	V_{rms}

5.1.5.4   Standby Operation

The 5 V standby output is present when an AC input greater than the power supply turn on voltage is applied.

5.1.5.5   Fan-less Operation

The power supply fan is off (fan-less operation) when the power supply is in the stand-by mode of operation. The power supply will work indefinitely in stand-by mode with the input AC power on, power supply off, and the 5 V stand-by output at full load (= 3 A).

5.1.6   670-W Power Supply Protection Circuits

Protection circuits inside the power supply shall cause only the power supply's main outputs to shut down. If the power supply latches off due to a protection circuit tripping, an AC cycle OFF for 15 seconds and a PSON# cycle HIGH for 1 second shall be able to reset the power supply.

5.1.6.1   Over Current Protection (OCP)

If the current limits are exceeded, the power supply shall shutdown and latch off. You can clear the latch by toggling the PSON# signal or by an AC power interruption. The power supply shall not be damaged from repeated power cycling in this condition. -12V and 5VSB shall be protected under over-current or shorted conditions so no damage can occur to the power supply. 5VSB will be auto-recovered after removing OCP limit.

5.1.6.2   Over Voltage Protection

The power supply will shut down and latch off after an over-voltage condition occurs. The voltage shall never exceed the maximum levels when measured at the power pins of the power supply connector during any single point of fail. The voltage shall never trip any lower than the minimum levels when measured at the power pins of the power supply connector. 5 Vsb (stand-by) will be auto-recovered after removing the Over Voltage Protection limit.

5.1.6.3   Over Temperature Protection

In an Over Temperature condition, the power supply will shut down. When the power supply temperature drops to within specified limits, the power supply will restore power automatically, while the 5 VSB always remains on. The over temperature protection circuit has built-in hysteresis such that the power supply will not oscillate on and off due to a temperature recovering condition. The over temperature protection trip level shall have a minimum of 4 °C of ambient temperature hysteresis.

5.1.7   670-W Power Supply Control and Indicator Functions

The following sections define the input and output signals from the power supply.
Signals that can be defined as low true use the following convention:
Signal# = low true.

5.1.7.1   PSON# Input Signal

The PSON# signal is required for remotely turning on or off the power supply. PSON# is an active low signal that turns on the +3.3 V, +5 V, +12 V, and -12 V power rails. When this signal is not pulled low by the system or left open, the outputs (except the +5 VSB) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

5.1.7.2   PWOK (Power OK) Output Signal

PWOK is a power OK signal and is pulled HIGH by the power supply to indicate all the outputs are within the regulation limits of the power supply. When any output voltage falls below regulation limits or when AC power is removed for a time sufficiently long so that power supply operation is no longer guaranteed, PWOK is de-asserted to a LOW state. The start of the PWOK delay time shall be inhibited as long as any power supply output is in current limit.

5.1.8   670-W Power Supply Mean Time Between Failures (MTBF)

The power supply shall have a minimum MTBF at continuous operation of 100,000 hours at 75% load at 40° C, as calculated by Bell core RPP, or 250,000 hours demonstrated at 75% load at 40° C.

5.2   750-W Power Supply Module

The 750-W power supply replaceable module has two outputs: 12 V and 5 VSB. The input is power factor corrected. An IEC connector on the external face provides for AC input to the power supply. The power supply contains a cooling fan.

5.2.1   750-W Power Supply Module Mechanical Outline
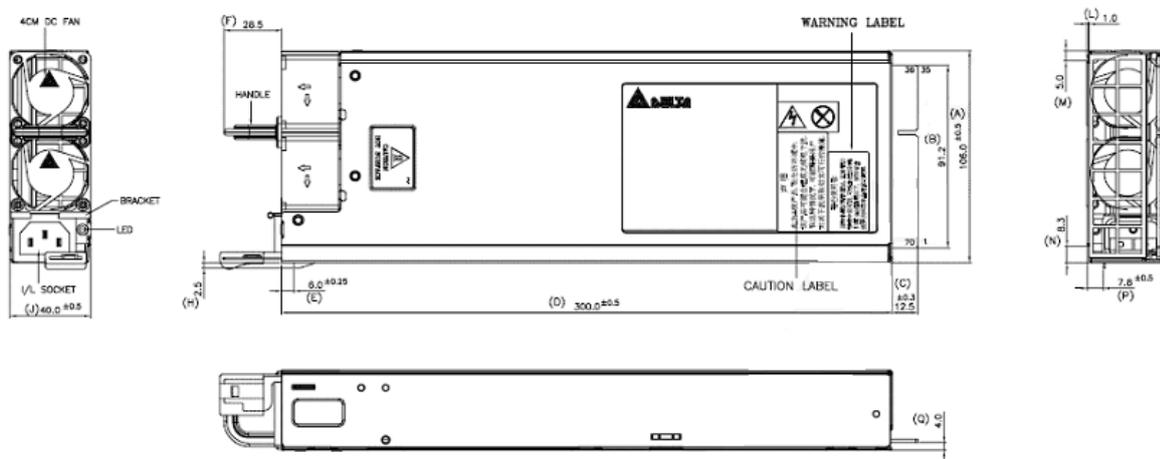
Note: All dimensions are in millimeters.

Figure 20. 750-W Power Supply Module Mechanical Drawings

5.2.1.1   Handle and Retention Mechanism

The power supply module has a handle to provide a place to grip the power supply for removal and insertion. The power supply module also has a simple retention mechanism to retain the power supply once it is inserted. The tab on the retention mechanism is **green** to indicate it is a hot-swap touch point. The latch mechanism is designed to prevent inserting the power supply with the power cord plugged in. This will aid the hot-swapping procedure: on removal, the power cord is unplugged first and then the PS is removed; on insertion, the PS is inserted first and then the power cord is plugged in. Figure 21 shows the power supply module retention mechanism.
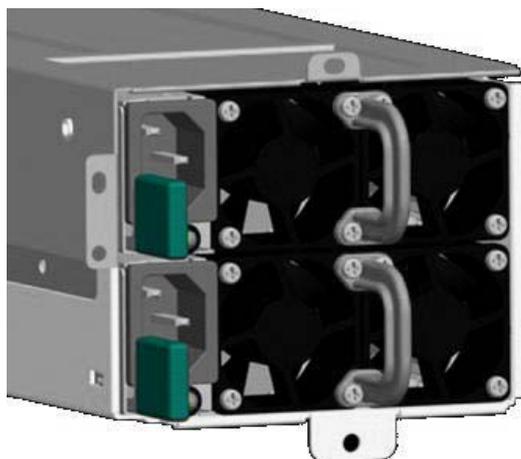
Figure 21: Power Supply Module Retention Mechanism

5.2.2   750-W Power Supply Module Output Wire Harness

The output wiring harness is part of the power distribution board (backplane) and is described in that section.

5.2.3   750-W Power Supply Module Airflow Requirements and Temperature Rise

The power supply module incorporates fans for self-cooling and system cooling. The fans will provide no less than 10 CFM airflow through the power supply when installed in the system.

5.2.3.1   Temperature Requirements

The power supply module shall operate within all specified limits over the T_{op} temperature range. All airflow shall pass through the power supply and not over the exterior surfaces of the power supply.

Table 22: Thermal Requirements

Item	Description	MIN.	MAX.	Units
T_{op}	Operating temperature range	0	45	°C
T_{non-op}	Non-operating temperature range	-40	70	°C
Altitude	Maximum operating altitude	N/A	1500	m

The power supply module meets Underwriters Laboratories (UL) enclosure requirements for temperature rise limits. All sides of the power supply, with exception to the air exhaust side, are classified as "Handle, knobs, grips, etc., held for short periods of time only."

5.2.4   750-W Power Supply Module AC Specifications

The power supply incorporates universal power input with active power factor correction, which reduces line harmonics in accordance with the EN61000-3-2 and JEIDA MITI standards. The AC input connector shall be an IEC 320 C-14 power inlet. This inlet is rated for 15 A / 250 VAC.

5.2.4.1 AC Input Voltage Specification

The power supply operates within all specified limits over the following input voltage range (see the following table). The power supply shall power off if the AC input is less than the 75 VAC+/-5 VAC range. The power supply operates properly starting at 85 VAC +/- 4 VAC input voltages.

Table 23. AC Input Rating

Parameter	Minimum	Rated	Maximum	Maximum Input Current	Start up VAC	Power Off VAC
Voltage (110)	90 V_{rms}	100-127 V_{rms}	140 V_{rms}	12 A_{rms}[1,3]	85 VAC +/-4 VAC	75 VAC +/-5 VAC
Voltage (220)	180 V_{rms}	200-240 V_{rms}	264 V_{rms}	6 A_{rms}[2,3]	N/A	N/A
Frequency	47 Hz	50/60 Hz	63 Hz	N/A	N/A	N/A

Notes:

[1] Maximum input current at low input voltage range shall be measured at 90 VAC at maximum load.

[2] Maximum input current at high input voltage range shall be measured at 180 VAC at maximum load.

[3] This requirement is not to be used for determining agency input current markings.

5.2.4.2 Efficiency

The power supply has a recommended minimum efficiency of 85% at maximum load and over the specified 230 VAC voltage.

5.2.4.3 AC Line Fuse

The power supply shall have a single line fuse on the line (Hot) wire of the AC input. The input fuse shall be a slow blow type. AC in-rush current shall not cause the AC line fuse to blow under any conditions. No protection circuits in the power supply shall cause the AC fuse to blow unless a component in the power supply has failed. This includes DC output load short conditions.

5.2.5 750-W Power Supply Module DC Specifications

5.2.5.1 Output Connector

The power supply provides card edge fingers, which mate to a female connector located on the power distribution board (PDB). This blind mating type connector connects the power supply's output voltages and signals.

Table 24. 750-W Power Supply Module Edge Finger Pin-out
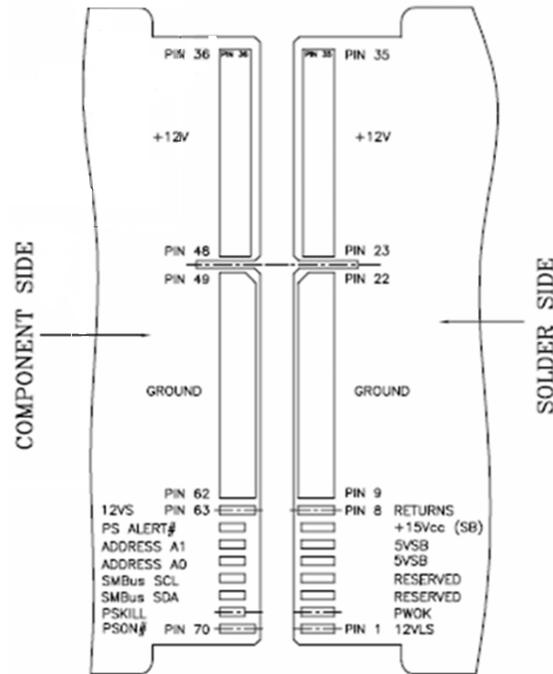
Pin	Solder Side	Pin	Component Side
1	12 VLS	70	PSON#
2	PWOK	69	PSKILL
3	Reserved	68	SMBUS SDA
4	Reserved	67	SMBUS SCL
5	5 VSB	66	Address A0
6	5 VSB	65	Address A1
7	15 Vcc(SB)	64	PSAlert#
8	Returns	63	12VS
9	Ground	62	Ground
10	Ground	61	Ground
11	Ground	60	Ground
12	Ground	59	Ground
13	Ground	58	Ground
14	Ground	57	Ground
15	Ground	56	Ground
16	Ground	55	Ground
17	Ground	54	Ground
18	Ground	53	Ground
19	Ground	52	Ground
20	Ground	51	Ground
21	Ground	50	Ground
22	Ground	49	Ground
Keying Notch			
23	+12 V	48	+12 V

Pin	Solder Side	Pin	Component Side
24	+12 V	47	+12 V
25	+12 V	46	+12 V
26	+12 V	45	+12 V
27	+12 V	44	+12 V
28	+12 V	43	+12 V
29	+12 V	42	+12 V
30	+12 V	41	+12 V
31	+12 V	40	+12 V
32	+12 V	39	+12 V
33	+12 V	38	+12 V
34	+12 V	37	+12 V
35	+12 V	36	+12 V

The ground of the pins of the output connector provides the power return path. The ground pin is connected to safety ground (power supply enclosure).

5.2.5.2 Output Power / Currents

The following table defines the current ratings for the 750-W power supply.

Table 25. 750-W Power Supply Module Load Ratings

Voltage	Maximum Load	Minimum Dynamic Load	Minimum Static Load	Peak Load	Maximum Continuous Power	Maximum Peak Power
+12 V	62.0 A	3.0 A	0.0 A	70 A^2	744 W	840 W
+5 VSB	3.0 A	0.1 A	0.1 A	5.0 A^3	15 W	25 W
Total continuous power[1] =					750 W	
Total Peak power[2] =						865 W

Notes:

[1] Maximum continuous total DC output power shall not exceed 750 W.

[2] Peak power and peak current loading shall be supported for a minimum of 12 seconds.

[3] Peak power and peak current loading shall be supported for a minimum of 0.5 second at turn-on.

5.2.5.3 Standby Outputs / Standby Mode

The 5 VSB output shall be present when an AC input greater than the power supply turn on voltage is applied.

5.2.5.3.1 Fan Operation in Standby ModeStand By Operation

The power supply fan(s) shall continue to operate at their lowest speed when in standby mode.

5.2.5.4   Voltage Regulation

The output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense signal (Returns). The 12 V and 5 VSB outputs are measured at the power distribution output harness connector.

Table 26. Voltage Regulation Limits

Parameter	Tolerance	Minimum	Nominal	Maximum	Units
+ 12 V	-5%/+5%	+11.40	+12.00	+12.60	V_{DC}
+ 5 VSB	-5%/+5%	+4.75	+5.00	+5.25	V_{DC}

5.2.6   750-W Power Supply Module Protection Circuits

Protection circuits inside the power supply shall cause only the power supply's main output to shutdown. If the power supply latches off due to a protection circuit tripping, an AC cycle OFF for 15 seconds and a PSON# cycle HIGH for 1 second shall be able to reset the power supply.

5.2.6.1   Over Current Protection (OCP)

If the current limits are exceeded, the power supply shall shut down and latch off. The latch is cleared by toggling the PSON# signal or by an AC power interruption. The power supply shall not be damaged from repeated power cycling in this condition. The +12 V and 5 VSB shall be protected during over current or shorted conditions, so no damage can occur to the power supply.

5.2.6.2   Over Voltage Protection (OVP)

The power supply shall shut down and latch off after an over voltage condition occurs. This latch is cleared by toggling the PSON# signal or by an AC power interruption. The latch is cleared by toggling the PSON# signal or by an AC power interruption. The following table contains the over voltage limits. The values are measured at the output of the power supply's connectors.

5.2.6.3   Over Temperature Protection (OTP)

The power supply is protected against over temperature conditions caused by loss of fan cooling or excessive ambient temperature. In an Over Temperature Protection (OTP) condition, the power supply will shut down. When the power supply temperature drops to within specified limits, the power supply shall restore power automatically, while the 5 VSB remains always on. The over temperature protection circuit has built-in hysteresis such that the power supply will not oscillate on and off due to a temperature recovering condition. The over temperature protection trip level shall have a minimum of 4° C of ambient temperature hysteresis.

5.2.7   750-W Power Supply Control and Indicator Functions

5.2.7.1   PSON# Input Signal

The PSON# signal is required to turn on/off the power supply. PSON# is an active low signal that turns on the +12 V power rail. When this signal is not pulled low by the system or left open, the output (except the +5 VSB) turns off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

5.2.7.2   PWOK (Power OK) Output Signal

PWOK is a power OK signal that is pulled HIGH by the power supply to indicate all outputs are within the regulation limits of the power supply. When any output voltage falls below regulation limits or when AC power is removed for a time sufficiently long so that power supply operation is no longer guaranteed, PWOK is de-asserted to a LOW state.

5.2.7.3   PSKILL Signal Requirements

The purpose of the PSKill pin is to allow for the hot-swapping of the power supply. The PSKill pin on the power supply is shorter than the other signal pins. When a power supply is operating in parallel with other power supplies and then extracted from the system, the PSKill pin will quickly turn off the power supply and prevent arching of the DC output contacts.

5.2.8   750-W Mean Time Between Failure (MTBF)

The power supply shall have a minimum MTBF at continuous operation of 100,000 hours at 75% load and 40° C, as calculated by Bell core RPP, or 250,000 hours demonstrated at 75% load and 40° C.

5.2.9   750-W Redundant (1+1) Hot-swap Mode

In the redundant (1+1) parallel configuration (two power supply modules installed), the +12 V output shared output current is enough current to meet voltage regulation limits during hot-swapping and power supply failures. Hot-swapping a power supply is the process of inserting and extracting a power supply from an operating power system while the AC cord is unplugged. During this process, the output voltages shall remain within the limits specified. In general, you can remove a failed supply and replace it with a good power supply. Hot-swap works with operational and failed power supplies. There is a mechanical latch on the power supply to prevent the removal or insertion of a power supply while the AC power cord is plugged into the power supply.

5.3   750-W Power Distribution Board

The power distribution board (PDB) is designed to plug directly to the output connector of the power supplies and contains the DC/DC power converters required to produce the output voltages: +3.3 VDC, +5 VDC, and −12 VDC along with additional protection circuitry and a FRU EEPROM.

5.3.1   Power Distribution Mechanical Overview
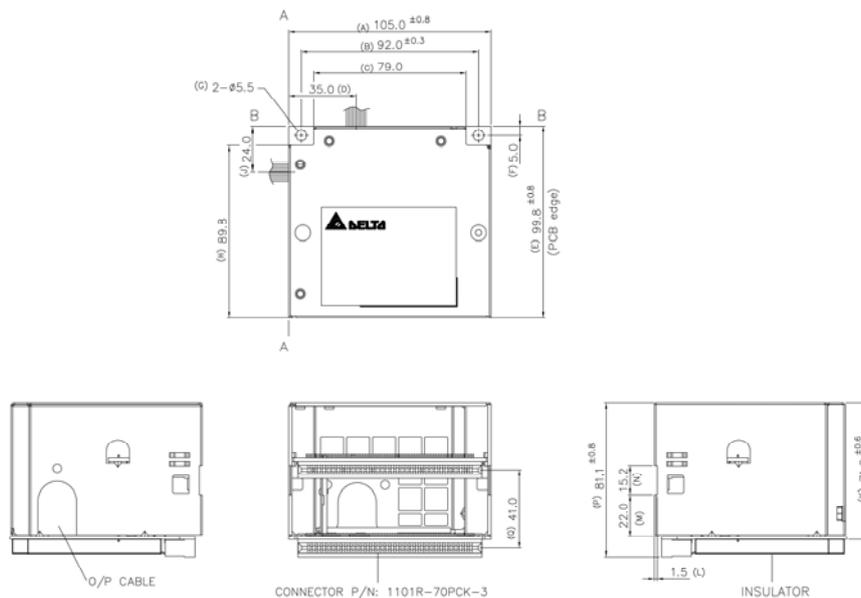
Note: All dimensions are in millimeters.

Figure 22. Power Supply Distribution

5.3.2   Temperature Operational Limits

The power supply modules provide airflow to cool the power distribution board. The power distribution board operates over the specified limits listed in the following table:

Table 27. Thermal Requirements

Item	Description	Minimum	Maximum	Units
T_{op}	Operating temperature range.	0	50	°C
T_{non-op}	Non-operating temperature range.	-40	70	°C

5.3.3   Electrical Specification

5.3.3.1   Input Connectors

Each power supply module provides card edge fingers, which mate with the female input connector on the power distribution board. This blind mating type connector connects the power supply's output voltages and signals.
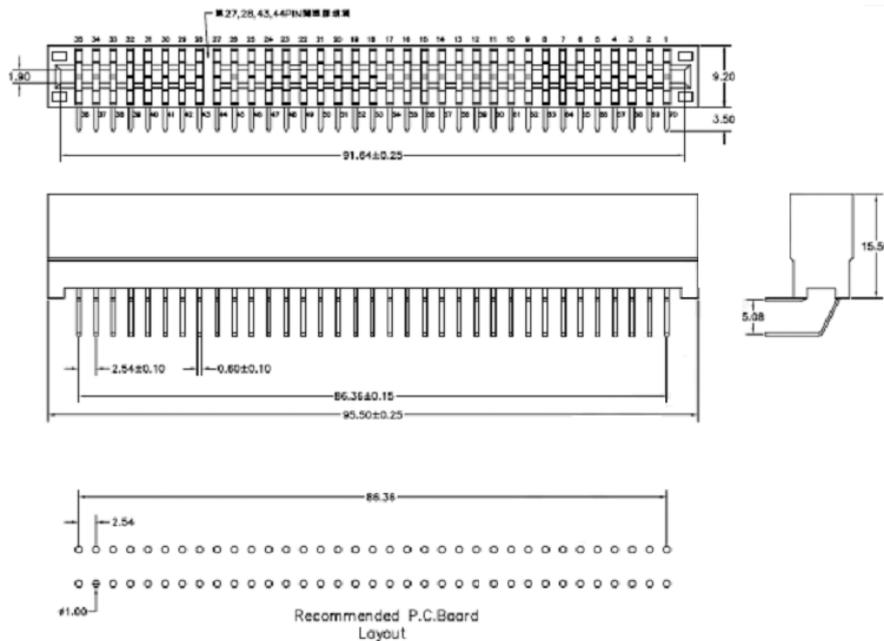
Note: All dimensions are in millimeters.

Figure 23. PDB Connector Layout

5.3.3.2   Output Wire Harness

The power distribution board connects to the system via Listed or recognized component appliance wiring material (AVLV2), CN, rated minimum 105° C, 300 VDC shall be used for all output wiring.

Table 28. 750-W PDB Cable Lengths

From	Length (mm)	To Connector Number	Number of pins	Description
Power Supply cover exit hole	800	P1	24	Baseboard Power Connector
Power Supply cover exit hole	350	P2	8	CPU 2 Power Connector
Power Supply cover exit hole	650	P3	8	CPU 1 Power Connector
Power Supply cover exit hole	350	P4	5	Power Signal Connector
Power Supply cover exit hole	250	P5	4	Peripheral Power Connector for 5.25 inch
Extension	100	P6	4	Peripheral Power Connector for 5.25 inch
Extension	100	P7	4	Peripheral Power Connector for 5.25 inch
Power Supply cover exit hole	600	P8	4	Peripheral Power Connector for HDD
Extension	75	P9	4	Right-angle Peripheral Power Connector (Cover with sleeve) for HDD
Power Supply cover exit hole	600	P10	4	Peripheral Power Connector for HDD
Extension	75	P11	4	Peripheral Power Connector for HDD
Power Supply cover exit hole	600	P12	5	Right-angle SATA Power Connector for HDD
Extension	75	P13	5	SATA Power Connector for HDD

5.3.3.2.1   Server Board Power Connector (P1)

- Connector housing: 24-Pin Molex* Mini-Fit Jr. 39-01-2245 or equivalent
- Contact: Molex Mini-Fit, HCS, Female, Crimp 44476 or equivalent

Table 29. Baseboard Power Connector

Pin	Signal	18 AWG Color	Pin	Signal	18 AWG Color
1[1]	+3.3 VDC	Orange	13	+3.3 VDC	Orange
	3.3 V RS	Orange (24AWG)			
2	+3.3 VDC	Orange	14	-12 VDC	Blue
3[1]	COM	Black	15	COM	Black
	COM RS	Black (24AWG)			
4[1]	+5 VDC	Red	16	PSON#	Green (24AWG)
	5 V RS	Red (24AWG)			
5	COM	Black	17	COM	Black
6	+5 VDC	Red	18	COM	Black
7	COM	Black	19	COM	Black
8	PWR OK	Gray (24AWG)	20	Reserved	N.C.
9	5 VSB	Purple	21	+5 VDC	Red
10	+12V3	Yellow	22	+5 VDC	Red
11	+12V3	Yellow	23	+5 VDC	Red
	+12V3 RS	Yellow (24AWG)			
12	+3.3 VDC	Orange	24	COM	Black

Note:
[1] Remote Sense wire double-crimped.

5.3.3.2.2   CPU 2 Power Connector (P2)

- Connector housing: 8-Pin Molex 39-01-2080 or equivalent
- Contact: Molex 44476-1111 or equivalent

Table 30. CPU 2 Power Connector

Pin	Signal	18 AWG Color	Pin	Signal	18 AWG Color
1	COM	Black	5	+12V1	White
2	COM	Black	6	+12V1	White
3	COM	Black	7	+12V1	White
4	COM	Black	8	+12V1	White

5.3.3.2.3   CPU 1 Power Connector (P3)

- Connector housing: 8-Pin Molex 39-01-2080 or equivalent
- Contact: Molex 44476-1111 or equivalent

Table 31. CPU1 Power Connector

Pin	Signal	18 AWG Color	Pin	Signal	18 AWG Color
1	COM	Black	5	+12V2	Brown
2	COM	Black	6	+12V2	Brown
3	COM	Black	7	+12V2	Brown
4	COM	Black	8	+12V2	Brown

5.3.3.2.4   Power Signal Connector (P4)

- Connector housing: 5-pin Molex 50-57-9405 or equivalent
- Contacts: Molex 16-02-0087 or equivalent

Table 32. Power Signal Connector

Pin	Signal	24 AWG Color
1	I2C Clock	White
2	I2C data	Yellow
3	Reserved	N.C.
4	COM	Black
5	3.3RS	Orange

5.3.3.2.5   Peripheral Power Connectors (P5, P6, P7, P8, P10, P11)

- Connector housing: Amp 1-480424-0 or equivalent
- Contact: Amp 61314-1 contact or equivalent

Table 33. Peripheral Power Connectors

Pin	Signal	18 AWG Color
1	+12V4	Green

2	COM	Black
3	COM	Black
4	+5 VDC	Red

5.3.3.2.6   *Right-angle Peripheral Power Connectors (P9)*

- Connector housing: JWT F6001HS2-4P or equivalent

Table 34. Right-Angle Peripheral Power Connectors

Pin	Signal	18 AWG Color
1	+12V4	Green
2	COM	Black
3	COM	Black
4	+5 VDC	Red

5.3.3.2.7   *Right-angle SATA Power Connector (P12)*

- Connector housing: JWT F6002HS0-5P-18 or equivalent

Table 35. Right-Angle SATA Power Connector

Pin	Signal	18 AWG Color
1	+3.3V	Orange
2	COM	Black
3	+5 VDC	Red
4	COM	Black
5	+12V4	Green

5.3.3.2.8   *SATA Power Connector (P13)*

- Connector housing: JWT A3811H00-5P or equivalent
- Contacts: JWT A3811TOP-0D contact or equivalent

Table 36. SATA Power Connector

Pin	Signal	18 AWG Color
1	+3.3 V	Orange
2	COM	Black
3	+5 VDC	Red
4	COM	Black

Pin	Signal	18 AWG Color
5	+12V4	Green

5.3.3.3 Grounding

The ground of the pins of the PDB output connectors provides the power return path. The output connector ground pins shall be connected to safety ground (PDB enclosure).

5.3.3.4 Remote Sense

The PDB has remote sense return (ReturnS) to regulate out ground drops for all output voltages; +3.3V, +5V, +12V1, +12V2, +12V3, 12V4, -12V, and 5VSB. The PDB uses remote sense (3.3VS) to regulate out drops in the system for the +3.3V output. The +5V, +12V1, +12V2, +12V3, 12V4, –12V, and 5VSB outputs only use remote sense referenced to the ReturnS signal.

5.3.3.5 +12 V Outputs Loading

This describes the +12V outputs loading from the power distribution board with a single or two ERP700W power supply plugged into the input of the power distribution board.

Table 37: +12 V Outputs Loading

	+12V1/2/3/4 combined output limit = 48A / 60A pk max			
	+12V1	+12V2	+12V3	+12V4
Maximum Load	24A	24A	16A	16A
Minimum Static Load	0.0A	0.0A	0.0A	0.0A
Peak load (See Note)	N/A	N/A	18A	18A
Maximum Output Power[1]	288W	288W	192W	192W

Note:

1. The peak current shall be supplied for a minimum duration of 12 seconds.
2. The combined continuous total power limit for all outputs is 725-W maximum.

5.3.3.6 DC/DC Converters Loading

The following table defines the power and current ratings of the three DC/DC converters located on the power distribution board, each powered from the +12 V rail. The three converters must meet both static and dynamic voltage regulation requirements for the minimum and maximum loading conditions.

Table 38. DC/DC Converters Load Ratings

	+12 VDC Input DC/DC Converters		
	+3.3 V Converter	+5 V Converter	-12 V Converter
Maximum Load	24.0 A	30.0 A	0.5 A
Minimum Static / Dynamic Load	0.0 A	0.0 A	0.0 A
Maximum Output Power[1]	3.3x24=79.2 W	5x30=150 W	0.5x12=6 W

Note:

1. The straight sum of the three maximum powers = 235.2 W, but considering the 3.3/5 V power limit, it may be 176-W maximum combined power.

2. 3.3 V / 5 V combined power limit is 170 W maximum.

5.3.3.7   DC/DC Converters Voltage Regulation

The DC/DC converters' output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. These limits include the peak-peak ripple/noise specified. All outputs are measured with reference to the return remote sense signal (Returns). The 3.3 V and 5 V output is measured at the remote sense points; all other voltages are measured at the output harness connectors.

Table 39. Voltage Regulation Limits

Converter Output	Tolerance	Minimum	Nominal	Maximum	Units
+ 3.3 VDC	- 5% / +5%	+3.14	+3.30	+3.465	VDC
+ 5 VDC	- 5% / +5%	+4.75	+5.00	+5.25	VDC
+12 VDC (12V1/2/3/4)	-5%/ +5%	+11.40	+12.00	+12.60	VDC
- 12 VDC	- 5% / +9%	-11.40	-12.00	-13.08	VDC
5 VSB	-5% / +5%	+4.75	+5.00	+5.25	VDC

5.3.3.8   Fan-less Operation in Stand-by Mode

The power supply will work indefinitely in standby mode with power on, power supply plus power distribution board off, and the 5 VSB at full load under environmental conditions (temperature, humidity, and altitude) as specified.

5.3.4   Protection Circuits

Protection circuits inside the power distribution board (and the power supply) cause one of the following:

- The power supply's main +12 V output to shutdown, which in turn shuts down the other three outputs on the power distribution board.
- Shut down any of the three outputs on the power distribution board, which in turn also shuts down the entire power supply combo.

If the power supply latches off due to a protection circuit tripping, an AC cycle OFF for 15 seconds minimum and a PSON# cycle HIGH for 1 second shall be able to reset the power supply and the power distribution board.

5.3.4.1   Over Current Protection (OCP)

Each DC/DC converter output on the power distribution board has individual OCP protection circuits. The power supply will shutdown and latch off after an over current condition occurs. This latch is cleared by toggling the PSON# signal or by an AC power interruption. If the limit is exceeded, current sensors and limit circuits shut down the entire power supply.

5.3.4.2   Over Voltage Protection (OVP)

Each DC/DC converter output on the power distribution board has individual OVP protection circuits built in and locally sensed. The power supply shall shut down and latch off after an over voltage condition occurs. This latch can be cleared by toggling the PSON$^{\#}$ signal or by an AC power interruption. The values are measured at the power distribution board harness connectors. The voltage shall never exceed the maximum levels when measured at the power pins of the output harness connector during any single point of fail. The voltage shall never trip any lower than the minimum levels when measured at the power pins of the power distribution board connector.

5.3.5   Control and Indicator Functions

The following sections define the input and output signals from the power distribution board.

Signals that can be defined as low true use the following convention:

signal$^{\#}$ = low true

5.3.5.1   PSON$^{\#}$ Input and Output Signals

The PSON$^{\#}$ signal is required to remotely turn on/off the power supply. There is the PSON# Input receiving the signal from the system and there is the PSON# Output signal leading from the PDB to both power supplies (in 1+1 configuration).

5.3.5.2   PSKILL

The purpose of the PSKill pin is to allow for hot-swapping of the power supply. The mating pin of this signal on the power distribution board input connector should be tied to ground, and its resistance shall be less than 5 ohms.

5.3.5.3   PWOK (Power OK) Input and Output Signals

PWOK is a Power ok signal, which will be pulled HIGH by the power supply to indicate its +12 V output is within its regulation limits. When its +12 V output voltage falls below regulation limits or when AC power is removed for a time sufficiently long enough so that the power supply operation is no longer guaranteed, PWOK is de-asserted to a LOW state.

5.3.5.4   SMBALERT$^{\#}$ Output Signal

This signal indicates the power supply is experiencing a problem the user should investigate. The SMBALERT# output signal going to the system (an interrupt) is the AND function of the following nine logic signals:

1. PSAlert#_1
2. PSAlert#_2
3. 12V1_OCP
4. 12V2_OCP
5. 12V3_OCP
6. 12V4_OCP

7. 3.3V_PWOK
8. 5V_PWOK
9. −12V_PWOK

5.3.6   Mean Time Between Failures (MTBF)

The power supply shall have a minimum MTBF at continuous operation of 100,000 hours at 75% load and 40° C, as calculated by Bell core RPP, or 250,000 hours demonstrated at 75% load and 40° C.

5.3.7   PMBus-Compliant

The 750-W power supplies are PMBus-compliant and implement the specification based on the PMBus specification parts I and II, revision 1.2.

The 750-W power supplies are also compatible with both SMBus 2.0 "high power" specification for I^2C V_{dd} based power and drive (for $V_{dd} = 3.3$ V). This bus operates at 3.3 V. The SMBus pull-ups are located on the server board.

6. Hot-swap Hard Disk Drive Bays

The chassis can support either an Active SAS/SATA or a Passive SAS/SATA backplane. The backplanes provide the platform support for hot-swap SAS or SATA hard drives.

The passive backplane acts as a "pass-through" for the SAS/SATA data from the drives to the SAS/SATA controller on the baseboard or a SAS/SATA controller add-in card. It provides the physical requirements for the hot-swap capabilities.

The active backplane has a built-in SAS expander controller that requires a SAS controller on the baseboard or a SAS add-in card for communication. The Active SAS/SATA backplane reduces the number of required cables by only using two SAS/SATA connectors to drive up to six hard drives.

When the hot-swap drive bay is installed, a bi-color hard drive LED located on each drive carrier indicates specific drive failure or activity. For pedestal systems, these LEDs are visible when the front bezel door is open.

6.1   Intel® Server Chassis SC5600 4HDD and 6HDD Passive SAS/SATA Hot-swap Back Plane (HSBP) Overview

The Intel® Server Chassis SC5600 4-drive or 6-drive Passive SAS/SATA hot-swap Backplane (HSBP) is a monolithic printed circuit board (PCB). The architecture is based on the Vitesse Server Board and storage management controller VSC410* and supports up to four or six SAS/SATA drives.

The 4HDD and 6HDD SAS/SATA HSBP supports the following feature set:

- Vitesse Server Board and storage management controller VSC410*
- Serial Flash memory
- I^2C EEPROM
- Temperature Sensor
- Four I^2C interfaces
- One SGPIO Interface
- Compliance with SCSI Accessed Fault Tolerant Enclosures (SAF-TE) specification, version 1.00 and addendum
- Compliance with SCSI Enclosure Service (SES) specification.
- Compliance with Intelligent Platform Management Interface (IPMI) 1.5.
- Support for up to four or six SAS1.5/3.0Gbps, SATA I or SATA II Drives
- Hot-swap Drive support
- Two 4-pin Standard HD Power Connectors

The following figure shows the functional blocks of the passive 6HDD SAS/SATA HSBP.
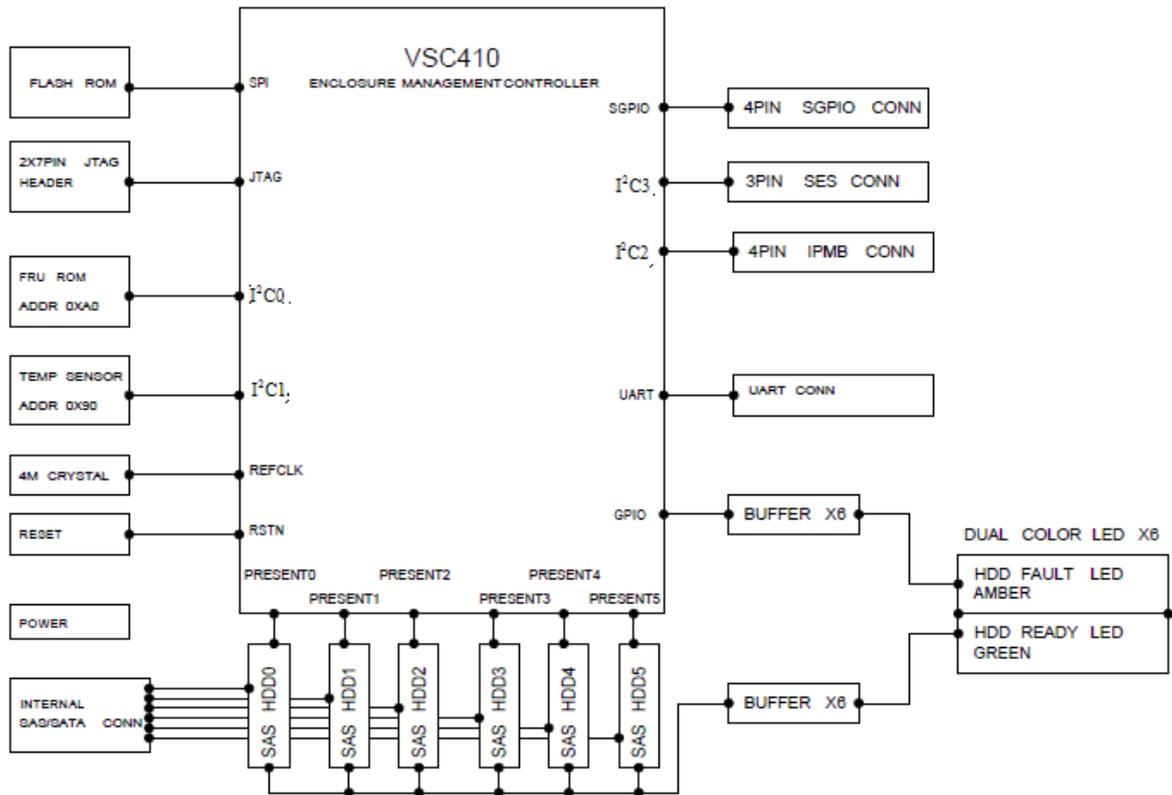
Figure 24. 6HDD Passive SAS/SATA HSBP Block Diagram

6.1.1   Server Board and Storage Management Controller VSC410*

The Vitesse baseboard and storage management controller VSC410* for the SAS/SATA backplane monitors various aspects of the storage enclosure. The chip provides out-of-band SAF-TE, SES management through the SAS/SATA Host I^2C interface, and HDD fault LED status management through the SGPIO interface. The VSC410* also supports the IPMI specification by providing management data to a server board management controller through the IPMB.

The VSC410* controller has many general purpose input and output pins (GPIOs) that allow customization. Some of these GPIOs are used for hard disk drive detection and driving hard disk drive FAULT LEDs.

The VSC410* controller comes in a 64-pin Low Profile Quad Flat Pack (LQFP) package, operates from 3.3 V and has an input clock frequency of 4 MHz.

6.1.1.1 I²C Serial Bus Interface

The VSC410* controller supports four independent I²C interfaces with bus speed of up to 400 Kbits. The I²C bus 0 supports an AT24C64* EEPROM or equivalent I²C -based EEPROM used as FRU. The I²C bus 1 supports a TI TMP75* or equivalent I²C -based temperature sensor. This enables actual temperature value readings to be returned to the host. The Intelligent Platform Management Bus (IPMB) is supported through the I²C port 2. The SCSI Enclosure Service (SES) interface is supported through the I²C port 3.

The following figure provides a block diagram of I²C bus connection implemented on the 4HDD and 6HDD passive SAS/SATA HSBP.
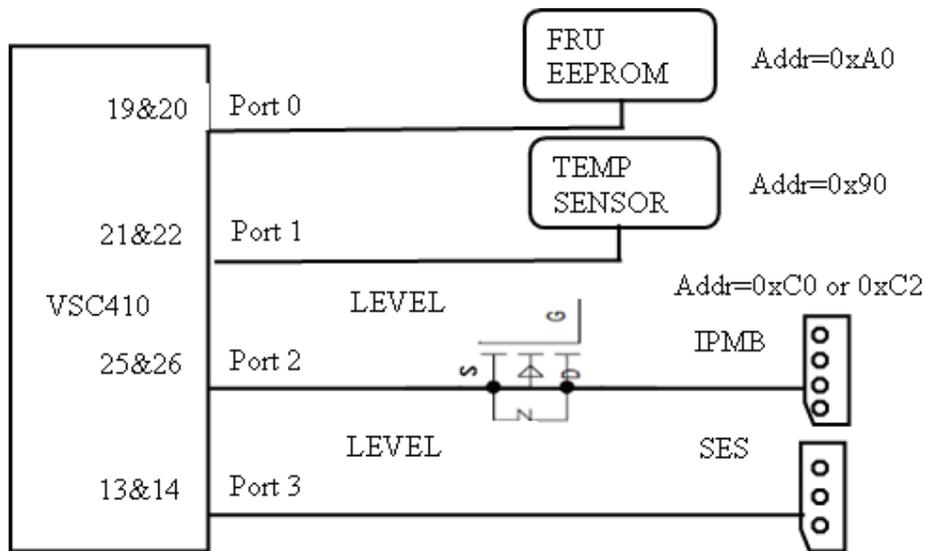
Figure 25. Passive SAS/SATA HSBP I²C Bus Connection Diagram

6.1.1.2 I²C Bus Address and Loading

Table 40. I²C Bus Addressing

TMP75* I²C Address	AT24C64* I²C Address	VSC410* I²C port2
90h	A0h	C0h or C2h

Table 41. 6HDD I²C Bus Loading

Device	Power Well	V$_{IH}$	V$_{IL}$	V$_{OL}$	I$_{leak}$	CAP	I²C Address	I²C Bus Name
TMP75*	P3V3	0.7 VCC	0.3 VCC	0.4 V/3 mA	1 uA	3 PF	90h	SMB_LOCAL_CLK SMB_LOCAL_DAT
VSC410*	P3V3	2.0 V	0.8 V	0.4 V/4 mA	10 uA	N/A	N/A	SMB_LOCAL_CLK SMB_LOCAL_DAT
AT24C64*	P3V3	0.7 VCC	0.3 VCC	0.4 V/2.1 mA	3 uA	8 PF	A0h	SMB_EEPROM_CLK SMB_EEPROM_DAT
VSC410*	P3V3	2.0 V	0.8 V	0.4 V/4 mA	10 uA	N/A	N/A	SMB_EEPROM_CLK SMB_EEPROM_DAT
VSC410*	P3V3	2.0 V	0.8 V	0.4 V/4 mA	10 uA	N/A	C0h or C2h	SMB_3V3_IPMB_CLK SMB_3V3_IPMB_DAT
MMBF170(S)*	P3V3	N/A	N/A	N/A	N/A	N/A	N/A	SMB_3V3_IPMB_CLK SMB_3V3_IPMB_DAT
MMBF170(D)*	P5V	N/A	N/A	N/A	N/A	N/A	N/A	SMB_5VSTB_IPMB_CLK SMB_5VSTB_IPMB_DAT
J4D1	P5V	0.7 VCC	0.3 VCC	0.4 V/3 mA	10 uA	4/8 P	N/A	SMB_5VSTB_IPMB_CLK SMB_5VSTB_IPMB_DAT
VSC410*	P3V3	2.0 V	0.8 V	0.4 V/4 mA	10 uA	N/A	N/A	SMB_3V3_I2C_CLK SMB_3V3_I2C_DAT
MMBF170(S)*	P3V3	N/A	N/A	N/A	N/A	N/A	N/A	SMB_3V3_I2C_CLK SMB_3V3_I2C_DAT
MMBF170(D)*	P5V	N/A	N/A	N/A	N/A	N/A	N/A	SMB_HBA_I2C_CLK SMB_HBA_I2C_DAT
J4E3	P5V	0.7 VCC	0.3 VCC	0.4 V/3 mA	10 uA	4/8 P	N/A	SMB_HBA_I2C_CLK SMB_HBA_I2C_DAT

6.1.1.3   Temperature Sensor

The 4HDD and 6HDD passive SAS/SATA HSBP provides a TI TMP75* or equivalent temperature sensor. The host can query the TMP75* at any time to read the temperature.

The temperature sensor has an I²C address of 0x90h on Port 1 of the VSC410* controller.

6.1.1.4   Serial EEPROM

The 4HDD and 6HDD SAS/SATA HSBP provides an Atmel AT24C64* or equivalent serial EEPROM for storing the FRU information. The AT24C64* EEPROM provides 64K bits of serial electrically erasable and programmable read-only memory.

The serial EEPROM has an I²C address of 0xA0h and resides on Port 0 of the VSC410* controller.

6.1.2　General Purpose Input/Output (GPIO)

The VSC410* controller supports customizable GPIO pins. The following table lists the GPIO pins and their assigned functions.

Table 42. 6HDD VSC410* Controller GPIO Assignment

VSC410* Pin Name	I/O Type	Power Well	Programming Description	System Function	Connection
P0_0	O	3.3 V	U3B1 FLASH ROM and U3C1 EEPROM write protect control	FM_EEPROM_WP	Pull up 4.7 K to 3.3 V
P0_1	I	3.3 V	IPMB Address allocation input	SMB_3V3_IPMB_ADD	Pull up 4.7 K to 3.3 V
P0_2	O	3.3 V	HDD0 Fault LED control	LED_DRV0_FLT_N	Pull up 4.7 K to 3.3V
P0_3	I	3.3 V	HDD0 Present detection	FM_DRV0_PRSNT_N	Pull up 4.7 K to 3.3 V
P0_4	O	3.3 V	HDD1 Fault LED control	LED_DRV1_FLT_N	Pull up 4.7 K to 3.3 V
P0_5	I	3.3 V	HDD1 Present detection	FM_DRV1_PRSNT_N	Pull up 4.7 K to 3.3 V
P0_6	O	3.3 V	HDD2 Fault LED control	LED_DRV2_FLT_N	Pull up 4.7 K to 3.3 V
P0_7	I	3.3 V	HDD2 Present detection	FM_DRV2_PRSNT_N	Pull up 4.7 K to 3.3 V
P1_0	O	3.3 V	HDD3 Fault LED control	LED_DRV3_FLT_N	Pull up 4.7 K to 3.3 V
P1_1	I	3.3 V	HDD3 Present detection	FM_DRV3_PRSNT_N	Pull up 4.7 K to 3.3 V
P1_2	O	3.3 V	HDD4 Fault LED control	LED_DRV4_FLT_N	Pull up 4.7 K to 3.3 V
P1_3	I	3.3 V	HDD4 Present detection	FM_DRV4_PRSNT_N	Pull up 4.7 K to 3.3 V
P1_4	O	3.3 V	HDD5 Fault LED control	LED_DRV5_FLT_N	Pull up 4.7 K to 3.3 V
P1_5	I	3.3 V	HDD5 Present detection	FM_DRV5_PRSNT_N	Pull up 4.7 K to 3.3 V
P1_6	O	3.3 V	Test Point	TP_LED_DRV6_FLT_N	N/A
P1_7	O	3.3 V	Test Point	TP_FM_DRV6_PRSNT_N	N/A
P2_0	O	3.3 V	Test Point	TP_LED_DRV7_FLT_N	N/A
P2_1	O	3.3 V	Test Point	TP_FM_DRV7_PRSNT_N	N/A
P2_2	O	3.3 V	Test Point	TP_LED_DRV8_FLT_N	N/A
P2_3	O	3.3 V	Test Point	TP_FM_DRV8_PRSNT_N	N/A
P2_4	O	3.3 V	Test Point	TP_LED_DRV9_FLT_N	N/A
P2_5	O	3.3 V	Test Point	TP_FM_DRV9_PRSNT_N	N/A
P2_6	O	3.3 V	Test Point	TP_LED_DRV10_FLT_N	N/A
P2_7	O	3.3 V	Test Point	TP_FM_DRV10_PRSNT_N	N/A
P3_0	I/O	3.3 V	Clock signal of SGPIO interface	SGPIO_CLK	N/A
P3_1	I/O	3.3 V.	Load signal of SGPIO interface	SGPIO_LOAD	N/A
P3_2	I/O	3.3 V	SDATAIN signal of SGPIO interface	SGPIO_DATAOUT0	N/A
P3_3	I/O	3.3 V	SDATAOUT signal of SGPIO interface	SGPIO_DATAOUT1	N/A

6.1.3   External Memory Device

The 4HDD and 6HDD passive SAS/SATA HSBP contains a non-volatile 8 Mbit Serial SPI FLASH Memory for Boot and Run-Time/Configuration code storage. The device resides on the SPI interface of VSC410* controller.

The Serial SPI Flash memory operates from the 3.3 V rail.

6.1.4   LEDs

The 4HDD and 6HDD passive SAS/SATA HSBP contain a green STATUS LED and amber FAULT LED for each of the six hard disk drives. The STATUS LED is driven by the SAS/SATA hard drive. The FAULT LED is driven by the VSC410* controller whenever a condition, as defined by the firmware, is detected.

Table 43. LED Function

Status LED	Condition	Definition
Green	On	HDD Active
	Blink (0.5 s on 0.5 s off, 50% duty cycle of a 1 s)	Spin up/spin down (SAS HDD)
	Blink (1 s on 1 s off, 50% duty cycle of a 2 s)	Formatting (SAS HDD)
Amber	On	HDD Fail
	Blink	Rebuild

Note: For SAS drives, the green LED is on when the drive is installed and ready. For SATA drives, the green LED is off when the drive is installed and ready.

6.1.5   SAS/SATA Drive Connectors

The 4HDD and 6HDD SAS/SATA HSBP provides four or six 22-pin SAS/SATA connectors for hot-swap hard disk drives supporting a 1.5 GHz and 3.0 GHz transfer rate.

Table 44. 22-pin SAS/SATA Connector Pin-out

Connector Contact Number	Signal Name
S1	GND
S2	SATA_DRVnA_RX_P
S3	SATA_DRVnA_RX_N
S4	GND
S5	SATA_DRVnA_TX_N
S6	SATA_DRVnA_TX_P
S7	GND
P1	TP_DRVn_P1
P2	TP_DRVn_P2
P3	TP_DRVn_P3
P4	GND
P5	GND
P6	FM_DRVn_PRSNT_N
P7	P5V_DRVn_PRECHG
P8	P5V
P9	P5V
P10	GND
P11	LED_DRVn_READY_N
P12	GND
P13	P12V_DRVn_PRECHG
P14	P12V
P15	P12V

6.1.6   Power Connectors

The 4HDD and 6HDD passive SAS/SATA HSBP provides two standard 4-pin hard disk drive power connectors. The following table defines the pin-out of the 4-pin Power Connectors.

Table 45. Power Connector Pin-out

Pin	Signal
1	P12V
2	GND
3	GND
4	P5V

6.1.7   Clock Generation and Distribution

The 4HDD and 6HDD SAS/SATA HSBP provides one clock source. A 4-MHz crystal provides clock to the VSC410* controller.

6.1.8   7-Pin SAS/SATA Host Connectors

The 4HDD and 6HDD passive SAS/SATA HSBP provides four or six 7-pin SAS/SATA connectors that are connected to the host interface of the server board or HBA using a mated cable.

The following table defines the pin-out of the 7-pin SAS/SATA host connector.

Table 46. 7-pin SAS/SATA Connector Pin-out

Connector Contact Number	Signal Name
S1	GND
S2	SATA_DRVnA_RX_P
S3	SATA_DRVnA_RX_N
S4	GND
S5	SATA_DRVnA_TX_N
S6	SATA_DRVnA_TX_P
S7	GND

Note: n=0, 1, 2, 3, 4, 5

6.1.9   IPMB Header - IPMB

The following table defines the pin-out of the 4-pin IPMB Header. This connector is white in color.

Table 47. IPMB Header Pin-out

Pin	Signal Name	Description
1	SMB_5VSTB_IPMB_DAT	Data
2	GND	GND
3	SMB_5VSTB_ IPMB_CLK	Clock
4	SMB_5VSTB_ IPMB_ADDR	IPMI interface address selection. Primary (Low)= 0xC0, Secondary (High) = 0xC2

6.1.10   SGPIO Header - SGPIO

The following table defines the pin-out of the 4-pin SGPIO Header. This connector is black in color.

Table 48. SGPIO Header Pin-out

Pin	Signal Name	Description
1	SGPIO_CLK	Clock
2	SGPIO_LOAD	Load
3	SGPIO_DATAOUT0	DATAIN
4	SGPIO_DATAOUT1	DATAOUT

6.1.11   SES Header - SES

The following table defines the pin-out of the 3-pin SES Header. This connector is white in color.

Table 49. SES Header Pin-out

Pin	Signal Name	Description
1	SMB_HBA_I2C_DAT	Data
2	GND	Ground
3	SMB_HBA_I2C_CLK	Clock

6.1.12   Board Layouts

The following figure shows the board layout and connector placement of the 6HDD passive SAS/SATA hot-swap backplane.
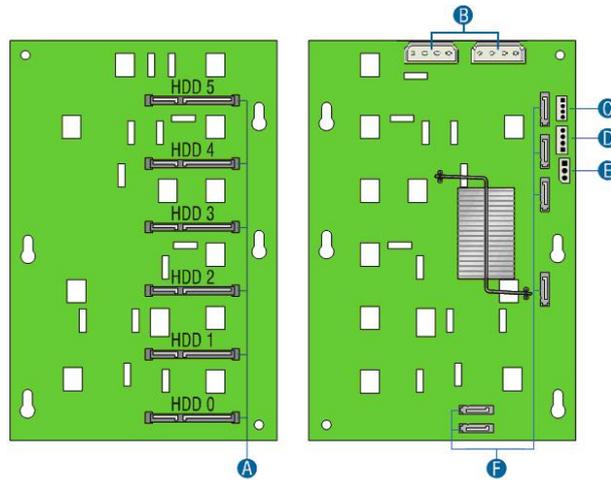
A: SATA/SAS hot-swap drive connectors
B: Power connectors
C: IPMB header
D: SGPIO header
E: SES header
F: SATA/SAS cable connectors
Note: Secondary side is mirrored

Figure 26. 6HDD Passive SAS/SATA HSBP Board Layout

The following figure shows the board layout and connector placement of the 4HDD passive SAS/SATA hot-swap backplane.

A: SATA/SAS hot-swap drive connectors
B: SATA/SAS cable connectors

C: SES header
D: SGPIO header
E: IPMB header
F: Power connectors
Note: Secondary side is mirrored

Figure 27. 4HDD Passive SAS/SATA HSBP Board Layout

6.1.13   Connector Specifications

Table 50. 6HDD Passive SAS/SATA Hot-swap Backplane Connector Specifications

Quantity	Manufacturer and Part Number	Description	Color	Reference
2	Molex 15-24-4744	CONN,PWR,4P,STD,PLG,VT,0.2,093ST,DISK D	Black	J3F1,J4F1
6	LOTES ABA-SAT-032-T01*	CONN,MISC,22 P,THM SATA, VT	Black	J3L1,J3M1,J3N1,J3P1,J3R1,J3T1
2	Foxconn LD1807V-S52TC*	CONN,MISC,7 P,THMT SATA,VT, SHRD	Black	J2E1, J3B1, J3B2, J3C1, J3D1, J3E1
1	Wieson G2420C888-006H*	CONN,HDR,1 X 4,PLG,VT,2MM,093ST,KP PG	White	J4D1
1	Wieson G2420C888-008H*	CONN,HDR,1 X 4,PLG,VT,2MM,093ST,KP PG	Black	J4E1
1	Wieson G2420C888-005H*	CONN,HDR,1 X 3,PLG,VT,2MM,093ST,KP PG	White	J4E3

Table 51. 4HDD Passive SAS/SATA Hot-swap Backplane Connector Specifications

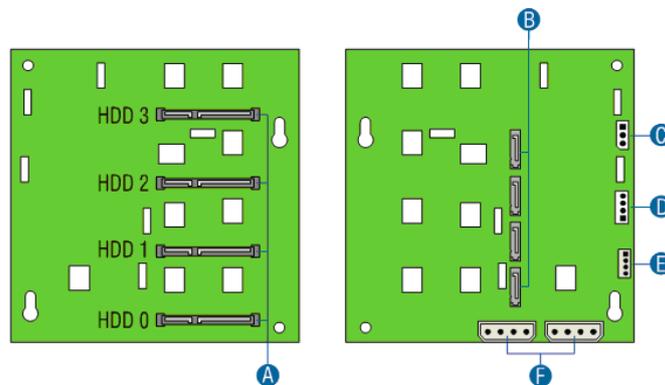| Quantity	Manufacturer and Part Number	Description	Color	Reference
2	Molex 15-24-4744	CONN,PWR,4P,STD,PLG,VT,0.2,093ST,DISK D	Black	J3D1,J3D2
4	LOTES ABA-SAT-032-T01*	CONN,MISC,22 P,THM SATA, VT	Black	J3L1,J3M1,J3N1,J3P1
2	Foxconn LD1807V-S52TC*	CONN,MISC,7 P,THMT SATA,VT, SHRD	Black	J3B1, J3B2, J3C1, J3C2
1	Wieson G2420C888-006H*	CONN,HDR,1 X 4,PLG,VT,2MM,093ST,KP PG	White	J4C2
1	Wieson G2420C888-008H*	CONN,HDR,1 X 4,PLG,VT,2MM,093ST,KP PG	Black	J4B3
1	Wieson G2420C888-005H*	CONN,HDR,1 X 3,PLG,VT,2MM,093ST,KP PG	White	J4B1

6.1.14   Passive SAS/SATA Hot-swap Drive Cage Kit

The passive 4HDD and 6HDD SAS/SATA drive cage upgrade kit allows for installation of up to 10 hot-swap SAS/SATA drives in the server. The kit includes a SAS/SATA hot-swap drive bay with mounting hardware.

With this kit, the SAS/SATA hot-swap drive cage can be connected to the SAS/SATA connectors on the server board or to a SAS/SATA RAID card through the mated cable. The

supported RAID level depends on the feature set of the SAS or SATA controller. The kit order codes are listed:

- AXX4DRV3GR (4HDD Passive SAS/SATA drive cage kit)
- AXX6DRV3GR (6HDD Passive SAS/SATA drive cage kit)

6.2   Intel® Server Chassis SC5600 4HDD and 6HDD Active SAS/SATA Hot-swap Back Plane (HSBP) Overview

The Intel® Server Chassis SC5600 4HDD or 6HDD Active SAS/SATA Hot-swap Backplane (HSBP) is a monolithic PCB. The architecture is based on the Vitesse VSC7161* SAS Expander with enclosure management controller and has support for up to six SAS or SATA drives.

The 4HDD and 6HDD SAS/SATA HSBP supports the following feature set:

- 1.5 Gbps and 3.0 Gbps self-configuring Serial Attached SCSI (SAS) Expander with embedded v3000 processor (Vitesse* Stanford-I 32-bit RISC CPU) for local control and Expander or enclosure management functions
- Non-volatile SPI Flash
- I^2C_based EEPROM
- Temperature Sensor
- Two I^2C interfaces
- SAS, SATA, and SATA II extension-compatible
- Compliance with SCSI Enclosure Service (SES) specification
- Compliance with Intelligent Platform Management Interface (IPMI) 1.5
- Support for up to six SAS 3.0 GHz/1.5 GHz, SATA II or SATA I Drives
- Hot-swap Drive support
- Two 4-pin Standard HD Power Connectors

The following figure shows the functional blocks of the Active 6HDD SAS/SATA HSBP.
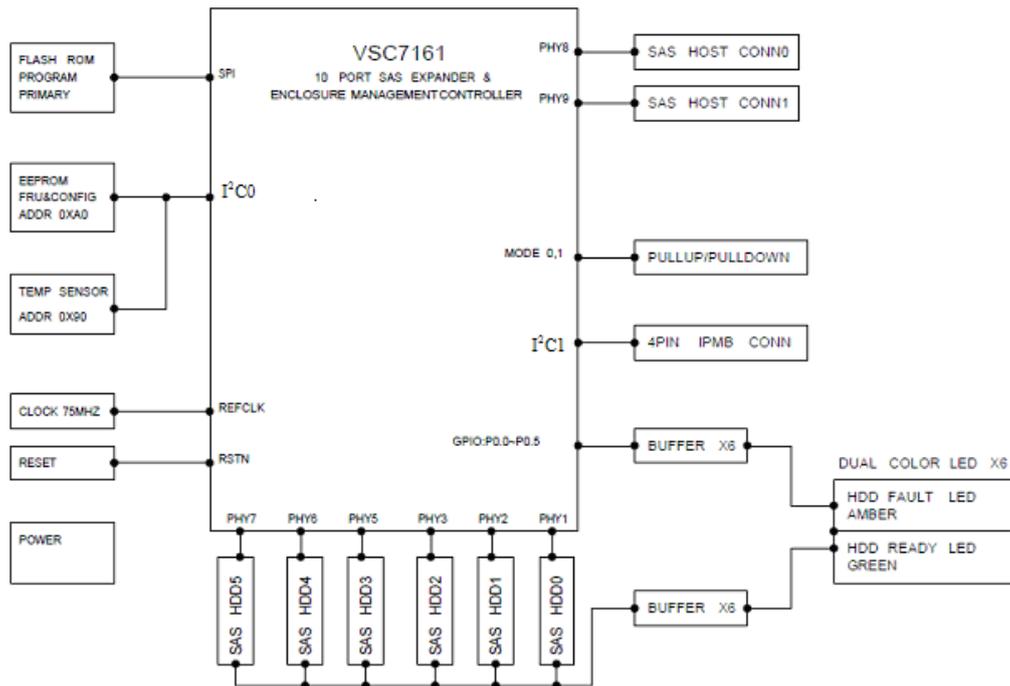
Figure 28. 6HDD Active SAS/SATA HSBP Block Diagram

6.2.1   SAS Expander Vitesse VSC7161*

The Vitesse VSC7161* device is a 10-port, self-configuring SAS Expander that supports 1.5 Gbps and 3.0 Gbps. This device is used for server and enclosure applications for mid-range and enterprise storage systems requiring active SAS port expansion. The features include:

- 1.5 Gbps and 3.0 Gbps 10-port self-configuring Serial Attached SCSI (SAS) Expander
- Automatic link speed detection and negotiation
- ANSI T10 SAS 1.1 compliant
- Software compatible with other Vitesse* Enclosure Management processors for SCSI, Fiber Channel, Serial ATA (SATA), SFF-8067*, IPMI, and others
- SMP virtual PHY target capability
- STP/SATA bridging support (one per PHY)
- STP Initiator
- Integrated SSP Engine for in-band SES
- Two multimaster two-wire serial interfaces
- Flexible General Purpose I/O for LEDs, Fan Tach, and other functions

The VSC7161* contains all the functions needed to implement a SAS enterprise server or JBOD system. Typically, this device distributes SAS signals to an array of disk drives in either a server or an external enclosure. The embedded v3000 CPU serves as an SMP management application client and can provide enclosure management functions using a two-wire serial interface or vendor-specific SMP implementation. As the SMP management application client, the CPU (in Master mode) handles all SMP initiator requests and all SMP response functions.

6.2.1.1   Expander Management (EM) subsystem of SAS Expander

The Vitesse VSC7161* Serial Attached SCSI Expander embeds an Expander Management (EM) subsystem that implements SMP dual-function target and initiator ports for in-band, vendor-unique enclosure management control.

A 75 MHz v3000 CPU with 32 KB of zero wait-state internal SRAM is included in the Expander Management (EM) subsystem. An external flash ROM stores the code for the v3000 CPU. In Master mode HSBP adopts the v3000 CPU provides all Enclosure Management services using the Vitesse* Software Development Kit (SDK).

The v3000 CPU communicates with other devices in the enclosure through several two-wire serial interface ports, general purpose I/O, and LED drivers. It assembles enclosure status for transmission to the host controller through vendor-unique SMP frames or SSP frames for in-band SCSI Enclosure Services (SES) or through a two-wire serial interface port.

The following figure shows the architecture of Expander Management (EM) subsystem.
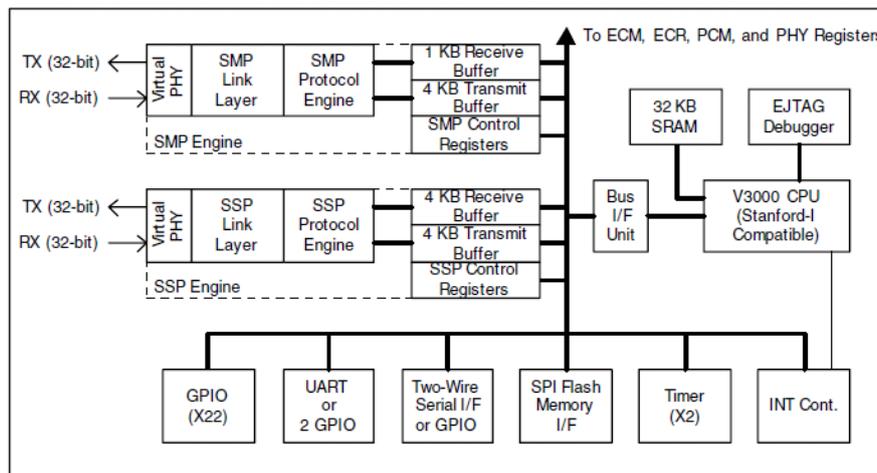
Figure 29. Expander Management (EM) subsystem

6.2.1.2   SAS Host Interface

Port 8 and Port 9 of the Vitesse VSC7161* SAS Expander are only used as SAS host interfaces. Each port connects to the SAS controller on the server board or HBA via a separate 7-pin SAS connector.

The following table defines pin-out of the 7-pin SAS connector:

Table 52. 7-pin SAS Connector Pin-out

Connector Contact Number	Signal Name
1	GND
2	SASn_EP_RX_P
3	SASn_EP_RX_N
4	GND
5	SASn_EP_TX_N
6	SASn_EP_TX_P
7	GND

6.2.1.3 I²C Serial Bus Interface

The Vitesse VSC7161* SAS Expander supports two independent I²C interface ports with bus speed of up to 400 Kbits. The I²C bus at port 0 supports a TI TMP75* or equivalent I²C-based temperature sensor. This enables actual temperature value readings to be returned to the host. This bus also supports an AT24C64* EEPROM or equivalent I²C –based EEPROM used as a FRU. The Intelligent Platform Management Bus (IPMB) is supported through I²C port 1.

The following figure provides a block diagram of the I²C bus connection implemented on the 4HDD and 6HDD Active SAS/SATA HSBP.
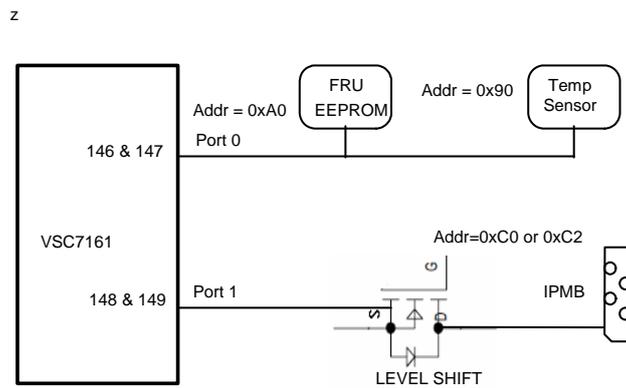
Figure 30. Active SAS/SATA HSBP I²C Bus Connection Diagram

6.2.1.4 I²C Bus Address and Loading

Table 53. I²C Bus Addressing

TMP75* I²C Address	AT24C64* I²C Address	VSC410* I²C port2
90h	A0h	C0h or C2h

Table 54. 6HDD I²C Bus Loading

Device	Power Well	V_{IH}	V_{IL}	V_{OL}	I_{leak}	CAP	I²C Address	I²C Bus Name
TMP75*	P3V3	0.7 VCC	0.3 VCC	0.4 V/3 mA	1 uA	3 PF	90h	SAS_I2C0_DAT, SAS_I2C0_CLK
VSC7161*	P3V3	2.0 V	0.8 V	0.4 V/4 mA	10 uA	N/A	N/A	SAS_I2C0_DAT, SAS_I2C0_CLK
AT24C64*	P3V3	0.7 VCC	0.3 VCC	0.4 V/2.1 mA	3 uA	8 PF	A0h	SAS_I2C0_DAT, SAS_I2C0_CLK
VSC7161*	P3V3	2.0 V	0.8 V	0.4 V/4 mA	10 uA	N/A	C0h or C2h	SAS_I2C1_DAT, SAS_I2C1_CLK
MMBF170(S)*	P3V3	N/A	N/A	N/A	N/A	N/A	N/A	SAS_I2C1_DAT, SAS_I2C1_CLK
MMBF170(D)*	P5V	N/A	N/A	N/A	N/A	N/A	N/A	SMB_IPMB_5V_CLK, SMB_IPMB_5V_DAT
J4D2	P5V	0.7 VCC	0.3 VCC	0.4 V/3 mA	10 uA	4/8 P	N/A	SMB_IPMB_5V_CLK, SMB_IPMB_5V_DAT

6.2.1.5   Temperature Sensor

The 4HDD and 6HDD active SAS/SATA HSBP provides a TI TMP75* or equivalent temperature sensor. The host can query the TMP75* at any time to read the temperature.

The temperature sensor has an I²C address of 0x90h on Port 0 of the VSC7161* SAS Expander.

6.2.1.6   Serial EEPROM

The 4HDD and 6HDD active SAS/SATA HSBP provides an Atmel AT24C64* or equivalent serial EEPROM for storing the FRU information. The AT24C64* EEPROM provides 64 K bits of serial electrically erasable and programmable read-only memory.

The serial EEPROM has an I²C address of 0xA0h and resides on Port 0 of the VSC7161* SAS Expander.

6.2.2   General Purpose Input/Output (GPIO)

The Vitesse VSC7161* SAS Expander supports GPIO pins that are customizable. The following table lists the GPIO pins with their assigned functions.

Table 55. VSC7161* SAS Expander GPIO Assignment

VSC7161* PIN Name	I/O Type	Power Well	Programming Description	System Function	Connection
P0_0	O	3.3 V	HDD0 Fault LED control	LED_DRV0_FLT_N	Pull up 4.7 K to 3.3 V
P0_1	O	3.3 V	HDD1 Fault LED control	LED_DRV1_FLT_N	Pull up 4.7 K to 3.3 V
P0_2	O	3.3 V	HDD2 Fault LED control	LED_DRV2_FLT_N	Pull up 4.7 K to 3.3 V
P0_3	O	3.3 V	HDD3 Fault LED control	LED_DRV3_FLT_N	Pull up 4.7 K to 3.3 V
P0_4	O	3.3 V	HDD4 Fault LED control	LED_DRV4_FLT_N	Pull up 4.7 K to 3.3 V
P0_5	O	3.3 V	HDD5 Fault LED control	LED_DRV5_FLT_N	Pull up 4.7 K to 3.3 V

VSC7161* PIN Name	I/O Type	Power Well	Programming Description	System Function	Connection
P0_6	O	3.3 V	Test Point P0_6	TP_EP_P0_6	
P0_7	O	3.3 V	Test Point P0_7	TP_EP_P0_7	
P0_8	O	3.3 V	FLASH(U3B1) write protect control	FM_ROM0_WP_N	Pull up 4.7 K to 3.3 V
P0_9	O	3.3 V	U3B2(not stuffed) write protect control	FM_ROM1_WP_N	Pull up 4.7 K to 3.3 V
P0_10	O	3.3 V	FRU(U3E2) write protect control	FM_FRU_WP	Pull up 4.7 K to 3.3 V
P0_11	O	3.3 V	Test Point P0_11	TP_EP_P0_11	
P0_12	OI	3.3 V	Test Point P0_12	TP_EP_P0_12	
P0_13	OI	3.3 V	Test Point P0_13	TP_EP_P0_13	
P0_14	OI	3.3 V	Test Point P0_14	TP_EP_P0_14	
P0_15	OI	3.3 V	Test Point P0_15	TP_EP_P0_15	
P0_16	I	3.3 V	IPMB Address allocation input	SMB_IPMB_ADDR	Pull up 4.7 K to 3.3 V
P0_17	OI	3.3 V	Test Point P0_17	TP_EP_P0_17	
P0_18	O	3.3 V	Test Point P0_18	TP_EP_P0_18	
P0_19	OI	3.3 V	Test Point P0_19	TP_EP_P0_19	
P0_22	O	3.3 V	Test Point P0_22	TP_EP_P0_22	
P0_23	O	3.3 V	Test Point P0_23	TP_EP_P0_23	

6.2.3   External Memory Device

The 4HDD and 6HDD active SAS/SATA HSBP contains a non-volatile 8 Mbit Serial SPI FLASH Memory for Boot and Run-Time/Configuration code storage. The device resides on the SPI interface of VSC7161* SAS Expander.

The Serial SPI Flash memory operates from the 3.3 V rail.

6.2.4   LEDs

The 4HDD and 6HDD Active SAS/SATA HSBP contains a green STATUS LED and amber FAULT LED for each of the six hard disk drives. The SAS/SATA hard drive drives the STATUS LED. The FAULT LED is driven by the VSC410* controller whenever a condition, as defined by the firmware, is detected.

Table 56. LED Function

Status LED	Condition	Definition
Green	On	HDD Active
	Blink (0.5 s on 0.5 s off, 50% duty cycle of a 1 s)	Spin up/spin down (SAS HDD)
	Blink (1 s on 1 s off, 50% duty cycle of a 2 s)	Formatting (SAS HDD)
Amber	On	HDD Fail
	Blink	Rebuild

Note: For SAS drives, the Green LED is on when the drive is installed and ready. For SATA drives, the Green LED is off when drive is installed and ready.

6.2.5   SAS/SATA Drive Connectors

The 4HDD and 6HDD active SAS/SATA HSBP provides four or six 22-pin SAS/SATA connectors for hot-swap hard disk drives supporting a 1.5 GHz and 3.0 GHz transfer rate.

The following table defines the pin-out of the 22-pin SAS/SATA Drive Connector:

Table 57. 22-pin SAS/SATA Connector Pin-out

Connector Contact Number	Signal Name
S1	GND
S2	DRVnA_RX_P
S3	DRVnA_RX_N
S4	GND
S5	DRVnA_TX_N
S6	DRVnA_TX_P
S7	GND
P1	TP_DRVn_P1
P2	TP_DRVn_P2
P3	TP_DRVn_P3
P4	GND
P5	GND
P6	GND
P7	P5V_DRVn_PRECHG
P8	P5V
P9	P5V
P10	GND
P11	LED_DRVn_READY_N
P12	GND
P13	P12V_DRV2_PRECHG
P14	P12V
P15	P12V

6.2.6   Power Connectors

The 4HDD and 6HDD active SAS/SATA HSBP provides two standard 4-pin hard disk drive power connectors. The following table defines the pin-out of the 4-pin Power Connectors.

Table 58. Power Connector Pin-out

Pin	Signal
1	P12V
2	GND
3	GND

4	P5V

6.2.7   Clock Generation and Distribution

The 4HDD and 6HDD active SAS/SATA HSBP provides one clock source. A 75-MHz oscillator provides the clock to the VSC7161* SAS Expander.

6.2.8   IPMB Header - IPMB

The following table defines the pin-out of the 4-pin IPMB Header.

Table 59. IPMB Header Pin-out

Pin	Signal Name	Description
1	SMB_IPMB_5V_DAT	Data
2	GND	GND
3	SMB_IPMB_5V_CLK	Clock
4	SMB_IPMB_5V_ADDR	IPMI interface address selection. Primary (Low) = 0xC0, Secondary (High) = 0xC2

6.2.9   Active Hot-swap Backplane (HSBP) Cables Explained

Expander backplanes ship with only one cable (IPMB). You should use this cable in the following manner:

6.2.9.1   IPMB Cable

- Always Installed, connect the white 4-pin IPMB connector on the HSBP to the white 4-pin IPMB connector on the motherboard.
- If using one HSBP (Primary), connect the cable to HSBP_A on the motherboard.
- If using two HSBPs (Primary and Secondary), connect the second cable to HSBP_B on the motherboard.

6.2.10   Board Layouts

The following figures show the board layout and connector placement of the 6HDD active SAS/SATA hot-swap backplane.

A: SATA/SAS hot-swap drive connectors
B: SATA/SAS cable connectors
C: IPMB header
D: Power connectors
Note: The secondary side is mirrored

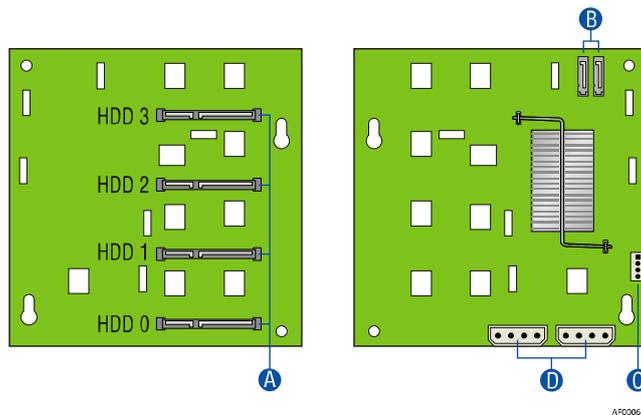**Figure 31. 6HDD Active SAS/SATA HSBP Board Layout**

The following figures show the board layout and connector placement of the 4HDD active SAS/SATA hot-swap backplane.

A: SATA/SAS hot-swap drive connectors
B: SATA/SAS cable connectors

C: IPMB header
D: Power connectors
Note: The secondary side is mirrored

Figure 32. 4HDD Active SAS/SATA HSBP Board Layout

6.2.11   Connector Specifications

Table 60. 6HDD Active SAS/SATA Hot-swap Backplane Connector Specifications

Quantity	Manufacturer and Part Number	Description	Color	Reference
2	Molex 15-24-4744	CONN,PWR,4P,STD,PLG,VT,0.2,093ST,DISK D	Black	J3F1,J4F1
6	Foxconn LD2822H-SO5*	CONN,MISC,22 P,VT,SATA,THM,EXT HT	Black	J3L1,J3M1,J3N1,J3P1,J3R1,J3T1
2	Foxconn LD1807V-S52UC*	CONN,MISC,7 P,THMT SATA,VT, SHRD	Blue	J4B1,J4B2
1	Wieson G2420C888-006H*	CONN,HDR,1 X 4,PLG,VT,2MM,093ST,KP PG	White	J4D2

Table 61. 4HDD Active SAS/SATA Hot-swap Backplane Connector Specifications

Quantity	Manufacturer and Part Number	Description	Color	Reference
2	Molex 15-24-4744	CONN,PWR,4P,STD,PLG,VT,0.2,093ST, DISK D	Black	J3F1,J4F1
4	Foxconn LD2822H-SO5*	CONN,MISC,22 P,VT,SATA,THM,EXT HT	Black	J3L1,J3M1,J3N1,J3P1, J3R1,J3T1
2	Foxconn LD1807V-S52UC*	CONN,MISC,7 P,THMT SATA,VT, SHRD	Blue	J4B1,J4B2
1	Wieson G2420C888-006H*	CONN,HDR,1 X 4,PLG,VT,2MM,093ST,KP PG	White	J4D2

6.2.12   Active SAS/SATA Hot-swap Drive Cage Kit

The Active SAS/SATA drive cage upgrade kit allows for installation of up to 10 SAS/SATA drives in the server. The kit includes a SAS/SATA hot-swap drive bay with mounting hardware.

With this kit, you can connect the SAS/SATA hot-swap drive cage to the SAS/SATA connectors on the server board, or to a SAS/SATA RAID card, through the mated cable. The feature set of the SAS or SATA controller determines the supported RAID level.

The upgrade kit order codes are as follows:

- AXX6DRV3GEXP (Active 6HDD SAS/SATA drive cage kit)
- AXX4DRV3GEXP (Active 4HDD SAS/SATA drive cage kit)

7.   Chassis Interconnect

The following figures illustrate the connections between components of the Intel® Server Chassis SC5600 and a server baseboard. Components include the front panel, hard drive bays, 5.25-inch drives, chassis fans, and power supply.
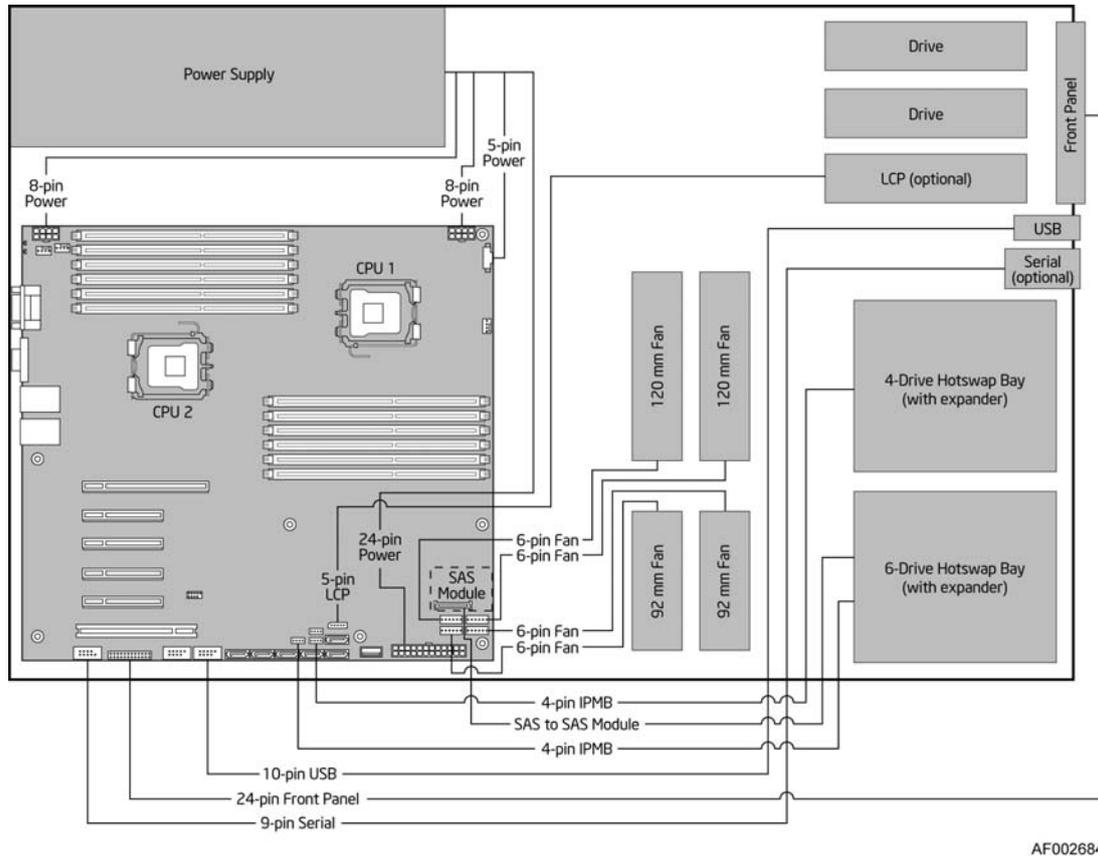
Figure 33. Chassis Interconnect Diagram (SC5600LX w/Expander Backplanes)

7.1   Chassis Internal Cables

The following cables are provided as part of the chassis kit and accessories.

Table 62. Intel® Server Chassis SC5600 System Cables

Cable Description	Source
Front panel 24-pin cable	Intel® Server Chassis SC5600 (BASE, BRP and LX)
Fan cable for 92 mm Hot-swap Fan (2 ea)	Intel® Server Chassis SC5600LX
Fan cable for 120 mm Hot-swap Fan (2 ea)	Intel® Server Chassis SC5600LX
SAS/SATA data cables for Hot-swap drive bays	AXX4DRV3GR, AXX6DRV3GR, AXX4DRV3GEXP, AXX6DRV3GEXP Accessories
SES 3-pin cable	AXX4DRV3GR, AXX6DRV3GR Accessory
IPMB 4-pin cable	AXX4DRV3GR, AXX6DRV3GR, AXX4DRV3GEXP, AXX6DRV3GEXP Accessories
SGPIO 4-pin cable	AXX4DRV3GR, AXX6DRV3GR Accessories
SATA cables for fixed drives	Boxed Board
Local Control Panel (LCP) I²C cable	Accessory
USB cable	Intel® Server Chassis SC5600 (BASE, BRP and LX)
Serial COM cable	Intel® Server Chassis SC5600 (BASE, BRP and LX)

7.1.1   Front Panel Cable

A 24-conductor ribbon cable with 24-pin IDC connectors links the front panel and SSI Revision 3.61-compliant server board.
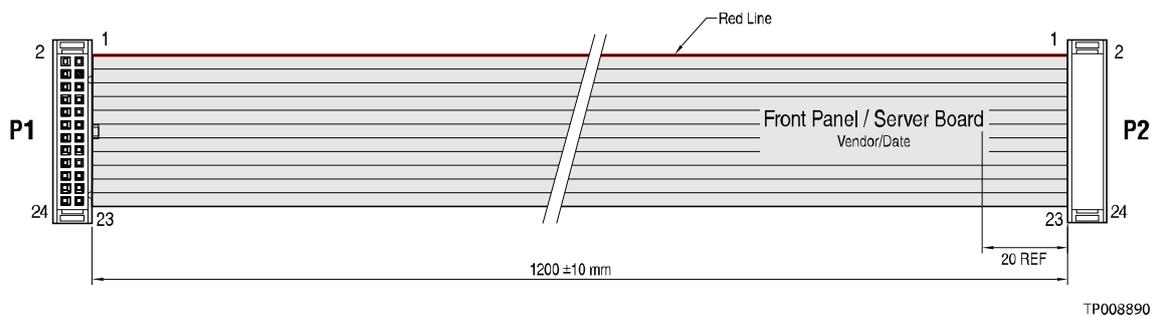
Figure 34. Chassis Front Panel Cable

7.1.2 USB Cable and Connectors

A 10-conductor USB cable with 10-pin connectors is used for connecting the front panel-mounted USB connector to the server board.
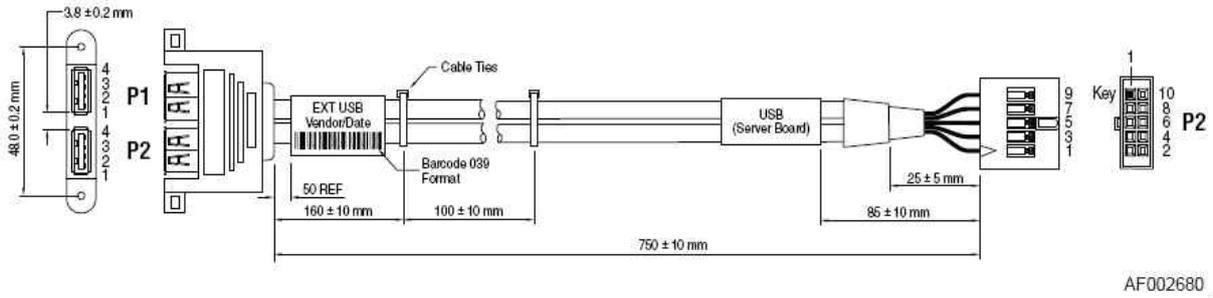
Figure 35. USB Cable Drawing
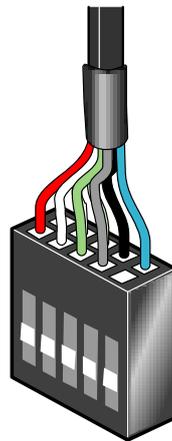
Figure 36. USB Connector

7.1.3   Hot-swap Fan Cables and Connectors

There are four hot-swap fans. The 92 mm fans are labeled fans 1 and 2 and use a white 6-pin connector. The 120 mm fans are labeled fans 3 and 4 and use a 6-pin blue connector.
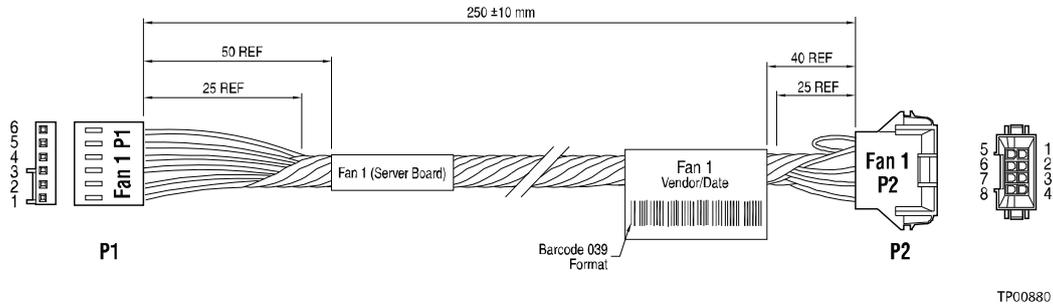
Figure 37. Hot-swap Fan Cable
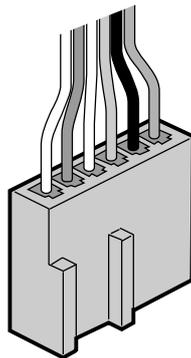
Figure 38. Hot-swap Fan 6-pin Cable Connector
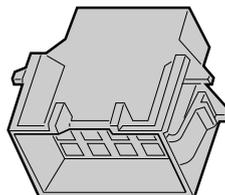
Figure 39. Hot-swap 8-pin Fan Cable Connectors

7.1.4   Serial Cable

The 8-conductor cable provided is terminated in a 2x5 header at one end and a 9-pin panel mount D-sub connector on the other.
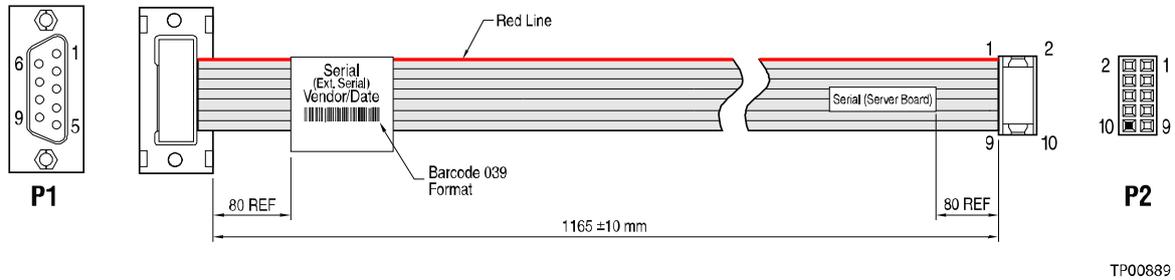
Figure 40. Serial Cable

7.1.5   IPMB cable for Drive Bays (4-pin)

The IPMB cable is used for communication between the backplane firmware and the baseboard. Communication events include fan control, drive insertion, drive removal, and drive failures. This interface is also used to update backplane firmware.
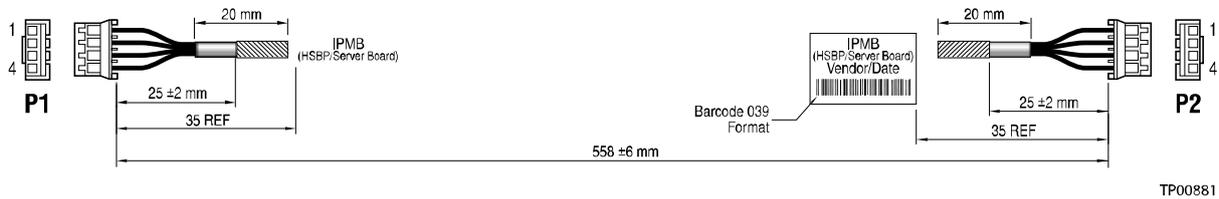
Figure 41. IPMB Cable

7.1.6   SES Cable for Drive Bays (3-pin)

The SES cable is a private I^2C bus between I/O controller (HW or SW RAID) and backplane used for enclosure management communication.
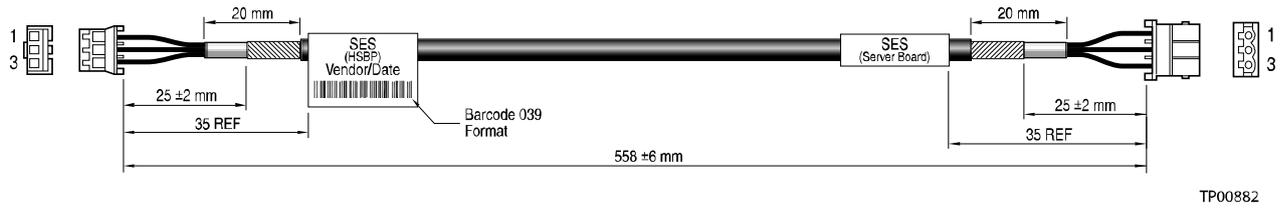
Figure 42. SES Cable

7.1.7   SGPIO Cable for Drive Bays (4-pin)

The SGPIO cable acts as an enclosure management interface between ESB2 and the backplane and is used by SW RAID to provide basic array device status indication via visual LEDs.
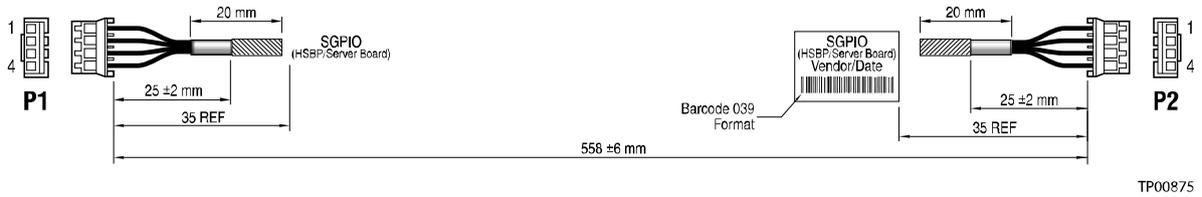
Figure 43. SGPIO Cable

8.   System-Compatible Server Boards

The Intel® Server Chassis SC5600 series support the following Intel® server boards:

Compatible Intel® Server Board (Y: Compatible; N: Not compatible)	Intel® Server Chassis SC5600BASE	Intel® Server Chassis SC5600BRP	Intel® Server Chassis SC5600LX
Intel® Server Board S5520HC	Y	Y	Y
Intel® Server Board S5500HCV	Y	Y	Y
Intel® Workstation Board S5520SC	Y	N	N

Note: The use of Quad-Rankx4 8GB Registered DDR3 DIMMs with the Intel® Server Chassis SC5600LX is not supported.

9.   Upgrade Accessories

Principle upgrades include the tool-less four-drive fixed drive bay, four- and six-drive SAS/SATA hot-swap drive bays, and rack mount conversion kit.

9.1   Passive SAS/SATA Hot-swap Drive Bays - AXX6DRV3GR and AXX4DRV3GR

The optional hot-swap SAS/SATA hard disk drive bays, AXX6DRV3GR and AXX4DRV3GR, are available for all Intel® Server Chassis SC5600 configurations. It is compatible with either SAS or SATA 3.5-inch hard drives. The kits include the following:

- Drive rails
- Data cables
- Drive mounting bay
- IPMB cable
- SES cable
- SGPIO cable
- Common installation guide
- SATA/SAS configuration label

9.2   Active SAS/SATA Hot-swap Drive Bays - AXX6DRV3GEXP and AXX4DRV3GEXP

The optional hot-swap Expander SAS/SATA hard disk drive bays, AXX6DRV3GEXP and AXX4DRV3GEXP, are available for all the Intel® Server Chassis SC5600 configurations. It is compatible with either SAS or SATA 3.5-inch hard drives. The kits include the following:

- Drive rails
- Data cables
- Drive mounting bay
- IPMB cable
- Common installation guide
- SATA/SAS configuration label

9.3   Rack Conversion Kit - ARIGRACK

The Rack Conversion Kit includes all parts needed to convert a pedestal chassis into a rack mount chassis. The conversion kit includes rack bezel plastic parts, rack handles, and rack mounting rails.

10. Reliability, Serviceability, and Availability

10.1 Mean Time Between Failure

The following is the calculated Mean Time Between Failures (MTBF) at maximum configuration at 35°C (ambient air). These values are derived using a historical failure rate and multiplied by factors for application, electrical and/or thermal stress and for device maturity. MTBF estimates should be viewed as "reference numbers" only.

- Calculation Model: Telcordia Issue 1, method I case 3
- Operating Temperature: Server in 35 ℃ ambient air
- Operating Environment: Ground Benign, Controlled
- Duty Cycle: 100%
- Quality Level: II

Table 63. Calculated Mean Time Between Failure

Subassembly (Server in 35℃ ambient air)	Server Model					
	Intel® Server Chassis SC5600BASE		Intel® Server Chassis SC5600BRP		Intel® Server Chassis SC5600LX	
	MTBF	FIT	MTBF	FIT	MTBF	FIT
	(Hours)	(Failures/10^9 hrs)	(Hours)	(Failures/10^9 hrs)	(Hours)	(Failures/10^9 hrs)
Power Supply (670 W)	220,000	4,545	N/A	N/A	N/A	N/A
Power Supply (750 W + dist.module)	N/A	N/A	208,000	4,808	208,000	4,808
Cooling fans (Non-redundant)	250,000	4,000	250,000	4,000	N/A	N/A
Cooling fans (Redundant)	N/A	N/A	N/A	N/A	125,000	8,000
Backplane	1,300,000	769	1,300,000	769	1,300,000	769
Front Panel board	5,000,000	200	5,000,000	200	5,000,000	200
Intrusion Switch	20,000,000	50	20,000,000	50	20,000,000	50
Totals without motherboard =	104,500	9,565	101,700	9,827	72,300	13,827

10.2 Serviceability

The system is designed for service by qualified technical personnel only.

The desired Mean Time To Repair (MTTR) of the system is 30 minutes including the diagnosis of the system problem. To meet this goal, the system enclosure and hardware were designed to minimize the mean time to repair.

The following are the maximum times a trained field service technician should take to perform the listed system maintenance procedures after diagnosis of the system.

Table 64. Maximum Maintenance Procedure Times

Remove Cover	Time
Remove and replace fixed hard disk drive	3 minutes
Remove and replace hot-swap hard disk drive	1 minute
Remove and replace 5.25-inch peripheral device	2 minutes
Remove and replace fixed power supply	8 minutes
Remove and replace hot-swap power supply module	15 seconds
Remove and replace hot-swap power supply cage	11 minutes
Remove and replace fixed fan (Front 120-mm fan)	3.5 minutes
Remove and replace fixed fan (Front 92-mm fan)	3 minutes
Remove and replace hot-swap fan	20 seconds
Remove and replace expansion board (PCI Adaptor Card)	1 minute
Remove and replace front panel board	2 minutes
Remove and replace server board (with no expansion boards)	15 minutes
Overall Mean Time To Repair (MTTR)	30 minutes

11. Environmental Limits

11.1 System Office Environment

Table 65. System Office Environment Summary

Parameter	Limits
Operating temperature	+5°C to +35°C with the maximum rate of change not to exceed 10°C per hour.
Non-operating temperature	-40°C to +70°C
Non-operating humidity	90%, non-condensing @ 30°C
Acoustic noise	6.0 BA LWA in a typical office ambient temperature (18-25°C)
Operating shock	No errors with a half sine wave shock of 2 G (with 11 ms duration).
Package shock	Operational after a free fall of 18 – 24-inches depending on the weight
ESD	15 kV per Intel Environmental Test Specification

11.2 System Environmental Testing

The system will be tested per the Environmental Standards Handbook, Intel Doc 25-GS0009. These tests shall include:

- Temperature operating and non-operating
- Humidity non-operating
- Packaged and unpackaged shock
- Packaged and unpackaged vibration
- AC voltage, frequency, and source interrupt
- AC surge
- Acoustics
- Electrostatic discharge (ESD)
- EMC radiated

12. Product Regulatory Compliance

The Intel® Server Chassis SC5600 is designed and tested to meet the standards and regulations listed below when configured with the specified Intel® server boards.

12.1 Product Safety Compliance

The Intel® Server Chassis SC5600 complies with the following safety requirements:

- UL60950 - CSA 60950 (USA / Canada)
- EN60950 (Europe)
- IEC60950 (International)
- CB Certificate & Report, IEC60950 (report to include all country national deviations) GS License (Germany)
- GOST R 50377-92 - License (Russia)
- Belarus License (Belarus)
- Ukraine License (Ukraine)
- CE - Low Voltage Directive 73/23/EEE (Europe)
- IRAM Certification (Argentina)

12.2 Product EMC Compliance

The system has been tested and verified to comply with the following EMC regulations when configured with the specified Intel® Server Boards. For information on compatible server boards, refer to Intel's Server Builder web site (http://www.intel.com/go/serverbuilder) or contact your local Intel representative.

- FCC (Class A Verification) – Radiated and Conducted Emissions (USA)
- ICES-003 (Class A) – Radiated and Conducted Emissions (Canada)
- CISPR 22, 3rd Edition (Class A) – Radiated and Conducted Emissions (International)
- EN45022 (Class A) – Radiated and Conducted Emissions (European Union)
- EN45024 (Immunity) (European Union)
- EN6100-3-2 and -3 (Power Harmonics and Fluctuation and Flicker)
- CE – EMC Directive (89/33/EEC) (European Union)
- VCCI (Class A) – Radiated and Conducted Emissions (Japan)
- RRL (Class A) – Radiated and Conducted Emissions (Korea)

12.3 Product Ecology Requirements

All materials, parts and subassemblies must not contain restricted materials as defined in Intel's Environmental Product Content Specification of Suppliers and Outsourced Manufacturers. Substances banned under Restriction of Hazardous Substances (RoHS) European Directive are included in the Intel's Environmental Product Content Specification.

Restriction of Hazardous Substances (RoHS) Compliance: Intel has a system in place to restrict use of banned substances per in accordance to the European Directive 2002/95/EC. Compliance is based on materials banned in the RoHS Directive are either (1) below all applicable substance threshold limits or (2) an approved/pending RoHS exemption applies.

Note:
> RoHS implementing details are not fully defined and may change.

Threshold limits and banned substances are noted below:

- Quantity limit of 0.1% by mass (1000 PPM) for: Lead; Mercury; Hexavalent Chromium; Polybrominated Biphenyls Diphenyl Ethers (PBDE); and Quantity limit of 0.01% by mass (100 PPM) for Cadmium.
- All plastic parts shall not use brominated flame retardant or any other halogenated retardants that are not accepted by environmental programs such as Blue Angels, Nordic White Swan, and Swedish TCO.
- All plastic parts that weigh >25 gm shall be marked with the ISO11469 requirements for recycling. Example >PC/ABS<.
- Packaging materials may not contain more than 100 ppm (total) of lead, cadmium, chromium or mercury.
- If sold as a retail product, packaging materials must be marked with applicable recycling logos for Europe (green dot) and Japan (Eco-marks).
- Product documentation shall incorporate all safety-required information to conform to certifiers and regulators and the certifications issued for the product.
- All cords and cables shall contain < 100 ppm of cadmium.

12.4 Product Regulatory Compliance Markings

This product is provided with the following Product Certification Markings:

- UL / cUL Listing Mark
- CE Mark
- German GS Mark
- Russian GOST Mark
- FCC, Class A Verification Marking
- ICES-003 (Canada EMC Compliance Marking)
- VCCI, Class A Mark
- Australian C-Tick Mark
- Taiwan BSMI Certification Number and Class A Warning

12.5 Electromagnetic Compatibility Notices

12.5.1   USA

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

For questions related to the EMC performance of this product, contact:

Intel Corporation
5200 N.E. Elam Young Parkway
Hillsboro, OR 97124
1-800-628-8686

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment to an outlet on a circuit other than the one to which the receiver is connected.

Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment. The customer is responsible for ensuring compliance of the modified product.

Only peripherals (computer input/output devices, terminals, printers, etcetera) that comply with FCC Class B limits may be attached to this computer product. Operation with noncompliant peripherals is likely to result in interference to radio and TV reception.

All cables used to connect to peripherals must be shielded and grounded. Operation with cables, connected to peripherals that are not shielded and grounded, may result in interference to radio and TV reception.

12.5.2   FCC Verification Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference
- This device must accept any interference received, including interference that may cause undesired operation.

For questions related to the EMC performance of this product, contact:

Intel Corporation
5200 N.E. Elam Young Parkway
Hillsboro, OR 97124-6497

Phone: 1 (800)-INTEL4U or 1 (800) 628-8686

12.5.3   ICES-003 (Canada)

Cet appareil numérique respecte les limites bruits radioélectriques applicables aux appareils numériques de Classe A prescrites dans la norme sur le matériel brouilleur: "Appareils Numériques", NMB-003 édictée par le Ministre Canadian des Communications.

English translation of the above notice:

"This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the interference-causing equipment standard entitled "Digital Apparatus," ICES-003 of the Canadian Department of Communications."

12.5.4   Europe (CE Declaration of Conformity)

This product has been tested in accordance to, and complies with the Low Voltage Directive (73/23/EEC) and EMC Directive (89/336/EEC). The product has been marked with the CE Mark to illustrate its compliance.

12.5.5   Japan EMC Compatibility

Electromagnetic Compatibility Notices (International):

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準
に基づくクラスＡ情報技術装置です。この装置を家庭環境で使用すると電波
妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ず
るよう要求されることがあります。

English translation of the preceding notice:

This is a Class A product based on the standard of the Voluntary Control Council for Interference (VCCI) from Information Technology Equipment. If this is used near a radio or television receiver in a domestic environment, it may cause radio interference. Install and use the equipment according to the instruction manual."

12.5.6   BSMI (Taiwan)

The BSMI Certification number and the following warning are located on the product safety label, which is located on the bottom side (pedestal orientation) or side (rack mount configuration).

警告使用者：
這是甲類的資訊產品，在居住的環境中使用時，
可能會造成射頻干擾，在這種情況下，使用者會
被要求採取某些適當的對策

Glossary

Word / Acronym	Definition
ACA	Australian Communication Authority
ANSI	American National Standards Institute
ATA	Advanced Technology Attachment
ATX	Advanced Technology Extended
Auto-Ranging	Power supply that automatically senses and adjust itself to the proper input voltage range (110 VAC or 220 VAC). No manual switches or manual adjustments are needed.
BMC	Baseboard Management Controller
CFM	Cubic Feet per Minute (airflow)
CMOS	Complementary Metal Oxide Silicon
Dropout	A condition that allows the line voltage input to the power supply to drop to below the minimum operating voltage.
EEB	Entry-level Electronics Bay
EM	Expander Management
EMC	Electromagnetic compatibility,
EMI	Electromagnetic Interference
EMP	Emergency Management Port
ESD	Electrostatic Discharge
FIT	Failures In Time
FP	Front Panel
FRB	Fault Resilient Booting
FRU	Field Replaceable Unit
GPIO	General Purpose Input and Output
HSBP	Hot-swap Backplane
I/O	Input/Output
I^2C	Inter-Integrated Circuit
IPMB	Intelligent Platform Management Bus
IPMI	Intelligent Platform Management Interface
Latch Off	A power supply, after detecting a fault condition, shuts itself off. Even if the fault condition disappears, the supply does not restart unless manual or electronic intervention occurs. Manual intervention commonly includes briefly removing and then reconnecting the supply, or using a switch. Electronic intervention can be completed by electronic signals in the Server System.
LCD	Liquid Crystal Display
LCP	Local Control Panel
LPC	Low-Pin Count
LQFP	Lower Profile Quad Flat Pack
Monotonically	A waveform changes from one level to another in a steady fashion, without intermediate retrenchment or oscillation.
MTBF	Mean Time Between Failure
MTTR	Mean Time to Repair
Noise	The periodic or random signals over frequency band of 10 Hz to 20 MHz
OCP	Over Current Protection
OTP	Over Temperature Protection

Word / Acronym	Definition
Over-current	A condition in which a supply attempts to provide more output current than the amount for which it is rated. This commonly occurs if there is a 'short circuit' condition in the load attached to the supply.
OVP	Over Voltage Protection
PDB	Power Distribution Board
PFC	Power Factor Correction
PMBus	Power Management Bus
PSU	Power Supply Unit
PWM	Pulse Width Modulate
ppm	Parts per million
PWOK	A typical logic level output signal provided by the supply that signals the Server System that all DC output voltages are within their specified range
RI	Ring Indicate
Ripple	The periodic or random signals over frequency band of 10 Hz to 20 MHz.
Rise Time	The time it takes any output voltage to rise from 10% to 95% of its nominal voltage.
Sag	The condition where the AC line voltage drops below the nominal voltage conditions
SAS	Serial Attached SCSI
SATA	Serial ATA
SCA	Single Connector Attachment
SCSI	Small Computer System Interface
SDK	Software Development Kit
SDR	Sensor Data Record
SE	Single-Ended
SES	SCSI Enclosure Service
SGPIO	Serial General Purpose Input/Output
SMBUS	System Management Bus
SSI	Server System Infrastructure
Surge	AC line voltage rises above nominal voltage
TACH	Tachometer
THD	Total Harmonic Distortion
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus
VCCI	Voluntary Control Council for Interference
VSB or Stand By	An output voltage that is present whenever AC power is applied to the AC inputs of the supply.