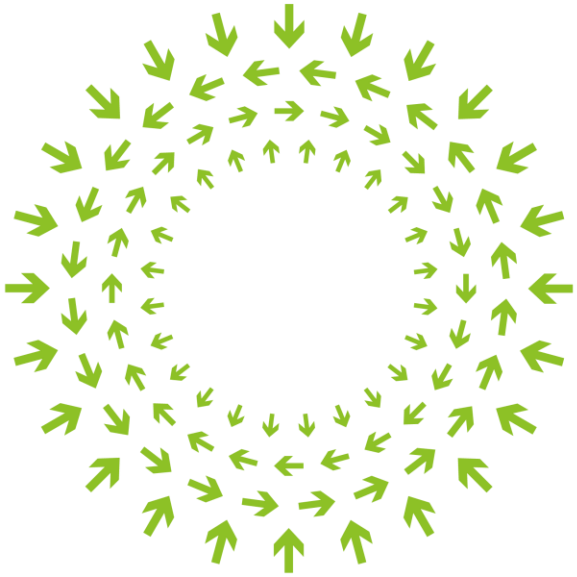

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Compute Project

SK Telecom All-Flash Storage Server SCube AF-Media

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1 Revision History

Rev.	Date	Name	Description
0.1	2016/8/10	Jungsoo Kim	Initial draft for review
0.2	2016/10/25	Jungsoo Kim	Updated license info

2 Scope

This specification describes the design of SCube AF-Media All-flash storage server. The server utilizes Intel Xeon D SoCs on the motherboard, and can be configured with either sixteen 2.5" SATA SSDs (in model S16) or two NVMe SSD cards (in model P2).

3 Contents

4 Overview

The Open Compute Project has received a lot of attention and interest from the computing industry because of its innovative transformation of data center architecture and its components. Key innovations of the OCP is a 21" rack architecture, and systems that are designed to increase computing density and energy efficiency. However, most datacenters are designed to accommodate 19" standard IT equipment and it would take tremendous time and effort to transform these to a 21" standard. For many, this transformation is not feasible. Nevertheless, the direction of technological evolution provides the guidance that it is important and necessary to inherit the OCP philosophy of building efficient systems.

The AF-Media server, developed by SK telecom, is an all-flash storage server with high density, high efficiency, and optimized to deliver media contents. To implement such an efficient system, AF-Media contains two hot-pluggable compute nodes in a 2RU form factor. This allows the nodes to share power supplies and chassis. AF-Media is designed for front access, improving serviceability. Both drives and compute nodes are hot-swappable in order to facilitate ease of maintenance and to minimize down time.

The AF-Media system is available in two models: S16 and P2. Both share a standard 19-inch EIA rack compatible chassis, a Xeon D SoC motherboard, an OCP mezzanine network card, and a power backplane board. The AF-Media S16 accommodates sixteen 2.5-inche SSDs while AF-Media P2 accommodates two AIC (Add-In Card) type PCIe SSDs as a storage medium.

4.1 License

5 System Overview

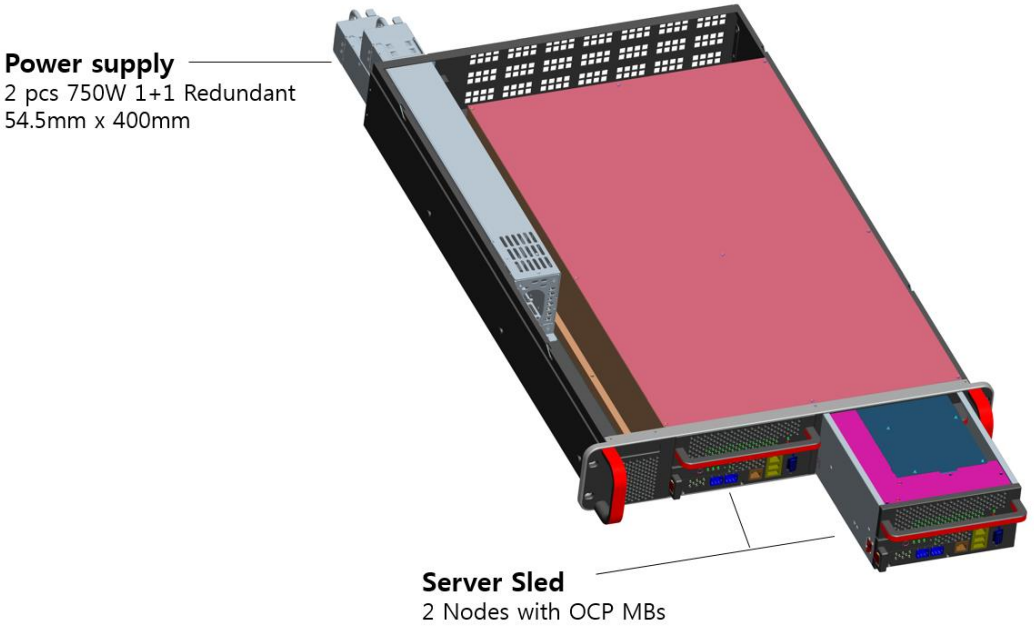
The system is a 19” 2RU rack mount design with two built-in server nodes in a single chassis. The system is available in two different models: the S16 and the P2. The S16 accommodates sixteen 2.5” SATA SSDs, and P2 accommodates two NVMe SSD Add-In Cards.

The two models have in common the motherboard, Intel Xeon D SoC, and chassis, while providing different storage options. The motherboard has 2 PCIe slots, a Base Management Controller (BMC), and an OCP mezzanine slot for an OCP network adapter. Key features of the system are highlighted in Table 1.

[Table 1] System Key Features

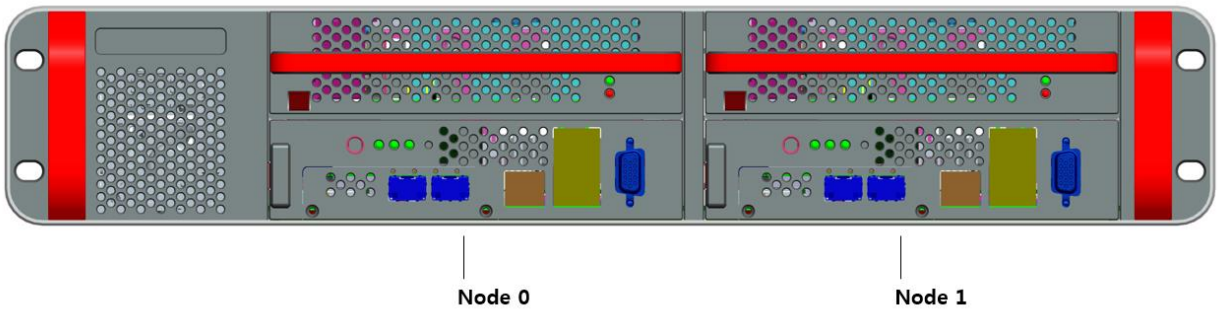
Item	Node Specification
Processor	Intel Xeon D-1548
TDP	45W
Memory	(4) DDR4 ECC RDIMM, 2133 MT/s
	up to 128GB
Storage	(1) mSATA 64GB SATA3 for OS
	(16) 2.5” SATA SSD (for S16)
	(2) HHHL PCIe NVMe SSD (for P2)
PCIe Slot	(1) PCIe 3.0 x16, (1) PCIe 2.0 x8
Network Interface	(1) Mgmt. Port IPMI v2.0/iKVM support, via AST2400
	(1) 1GbE/10GbE/40GbE OCP Mezz. V2 compliant mezzanine card
Front Panel	(1) DC Node Power Switch
	Status LEDs (PWR/OS Storage/Status)
	SSD Drive LEDs (Global Activity/Fault)
	(1) Serial port (RJ45 type)
	(1) VGA port
	(2) USB 3.0 port
Fan	(2) 6038 fans, 8000 RPM
Item	**Chassis Specification**
Form Factor	19” EIA Rack compliant 2RU
Server Node	2 Nodes
Power Supply Unit	(2) 1+1 Redundant 750W Power Supply
Dimension(mm)	440(W) x 88(H) x 708(D)
Weight	29 Kg

Figure 1 provides a system overview. Each node acts independently and supports node hot-plug.



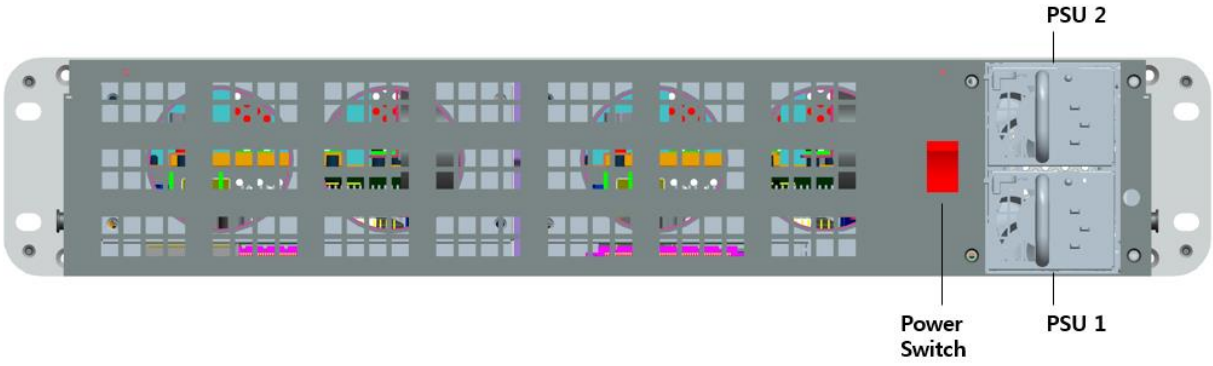
[Figure 1] System overview

Figure 2 illustrates the front view of system. The design concept of the system is front accessibility for easy maintenance and installation (except the power supply unit (PSU)).



[Figure 2] System front view

Figure 3 illustrates rear view of system. A vent hole, power switch, and redundant PSU are present in the back of the system.



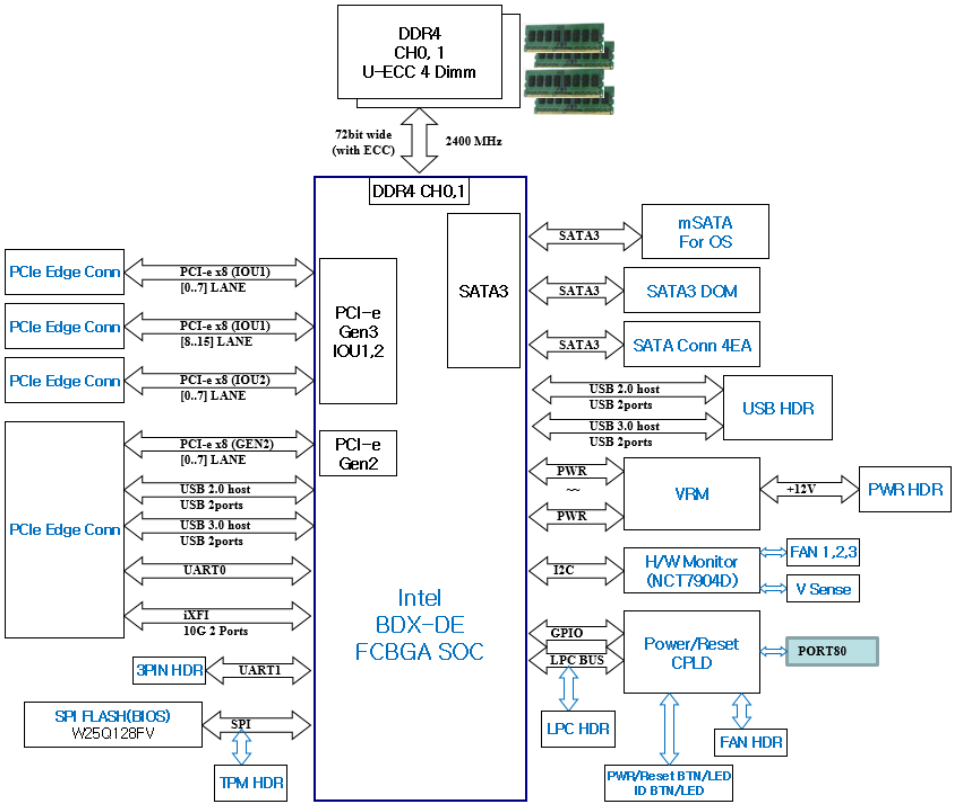
[Figure 3] System rear view

6 System Design Requirements

6.1 Motherboard

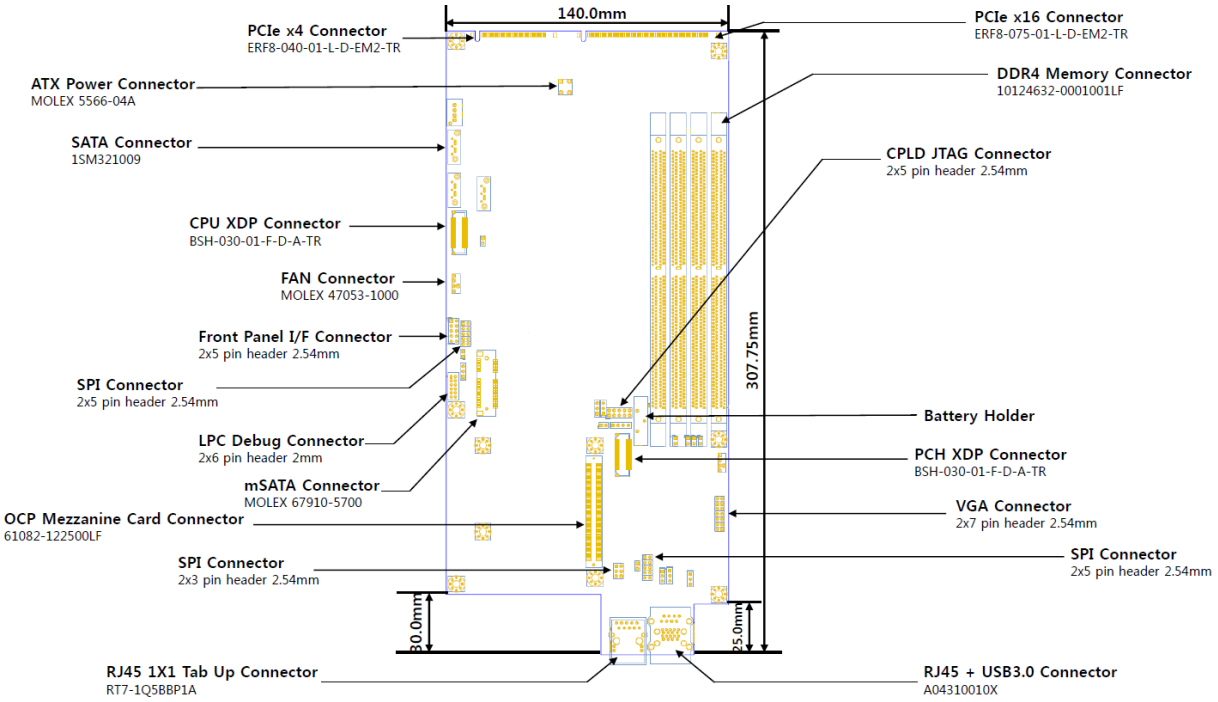
SK telecom developed an Intel Xeon D SoC motherboard specifically for its all-flash storage server. There are several reasons for developing a new motherboard, rather than adopting an existing one:

1. Rapid adoption of new CPU technology. To maximize performance while maintaining efficiency, a new Intel Xeon D processor (first released at the beginning of 2015) was rapidly incorporated into the design.
2. I/O customization. The motherboard was designed to fit into the node and provide front ports for USB, VGA, networking and management. The special PCIe edge connector was added to enable the use of either a RAID card in the S16 model, or a PCIe riser card in the P2 model.
3. Functionality. The storage server was designed to provide features that are required in general data centers: VGA graphics, USB connectivity and a Baseboard Management Controller (BMC). The system motherboard also provides an OCP mezzanine slot for a network adaptor.



[Figure 4] Motherboard Block Diagram

Figure 5 provides a mechanical drawing of motherboard. The PCIe x16 Connector and OCP Mezzanine Card Connector supports PCIe Gen3, and the PCIe x4 connector supports PCIe Gen2. The PCIe x16 Connector is used for the RAID card or as the NVMe SSD card connection, depending upon if the model is S16 or P2. The PCIe 2.0 x4 connector is currently unused and available.

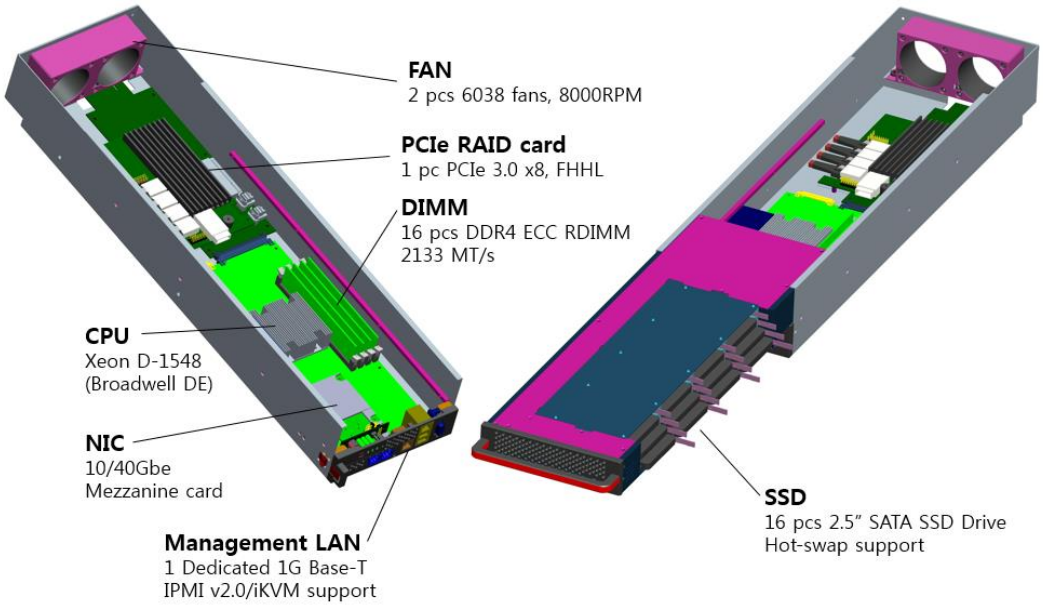


[Figure 5] Motherboard Mechanical Drawing

6.2 Server Sled

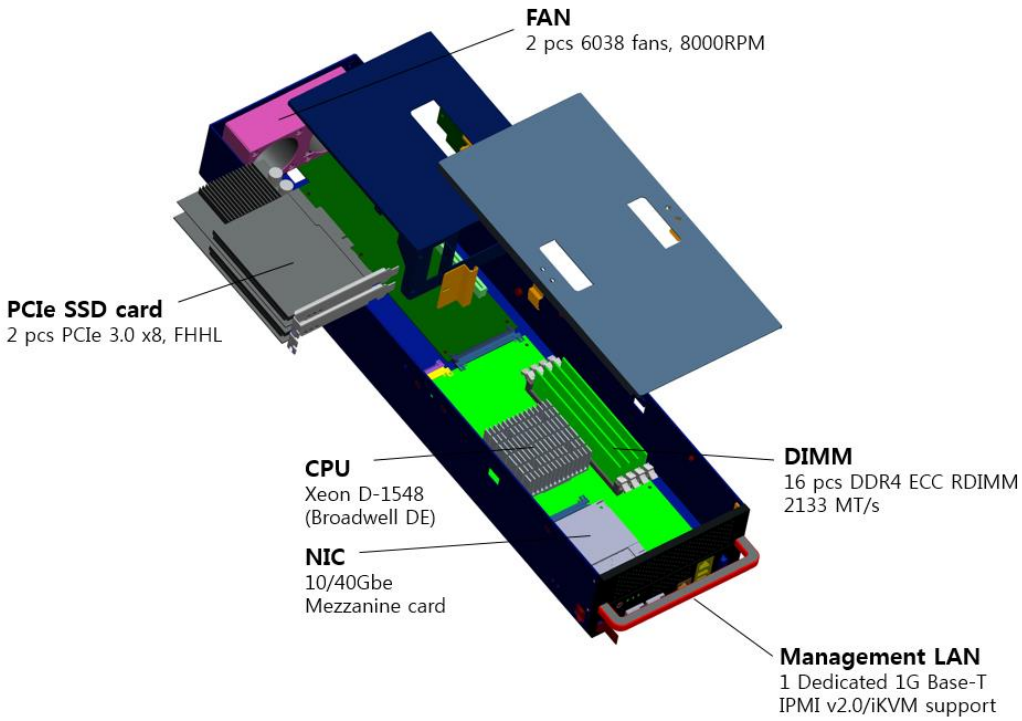
The server sled consists of the motherboard and storage components, along with two 60mm fans. The motherboard is Intel Xeon D SoC, and the storage components consist of either a RAID controller card which connects to an SSD backplane, or a PCIe riser for PCIe SSD cards. Figure 6 illustrates the AF-Media S16, and Figure 7 illustrates the AF-Media P2.

The AF-Media S16 storage sled contains 16x 2.5” SATA SSDs. A RAID controller for the SATA drives is connected to Disk Plane Board (DPB).



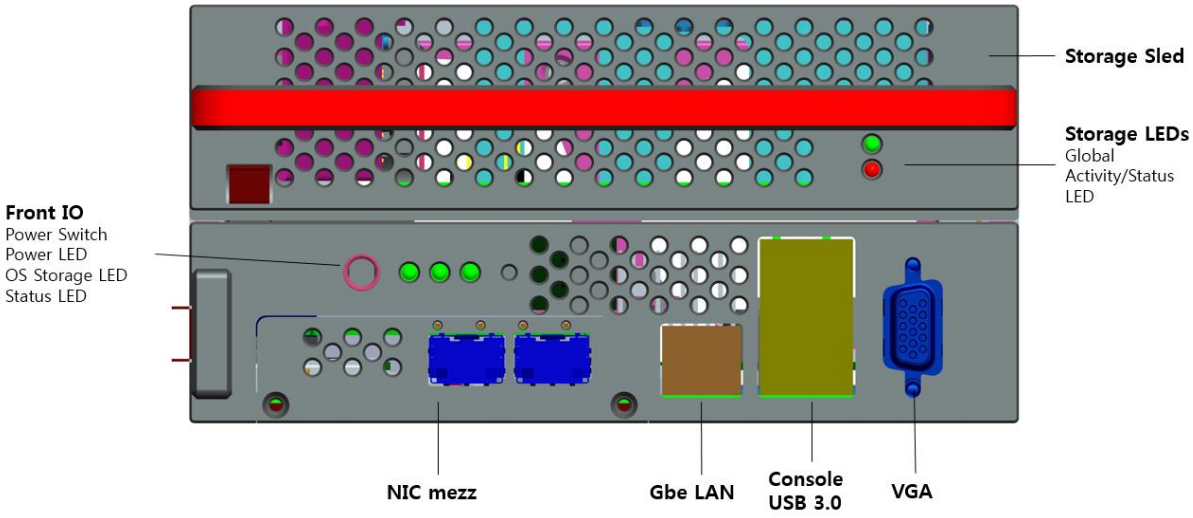
[Figure 6] Server Sled for S16

The AF-Media P2 accommodates two Full-Height Half-Length (FHHL) NVMe SSD cards as shown in Figure 7.

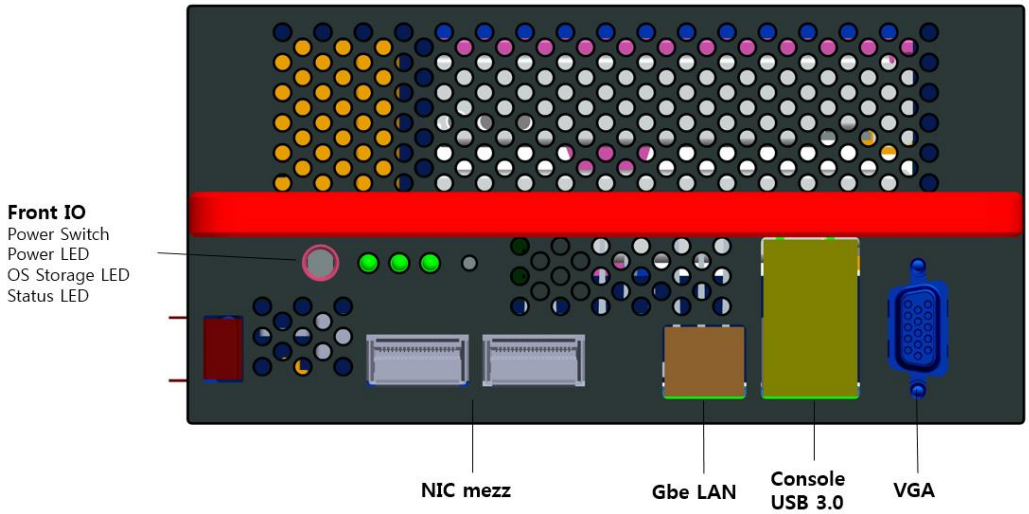


[Figure 7] Server Sled for P2

The AF-Media is designed to support front service requirements. Various ports and indicators are placed at the front of the node as shown in Figure 8 and Figure 9.



[Figure 8] Server Sled S16 Front-view



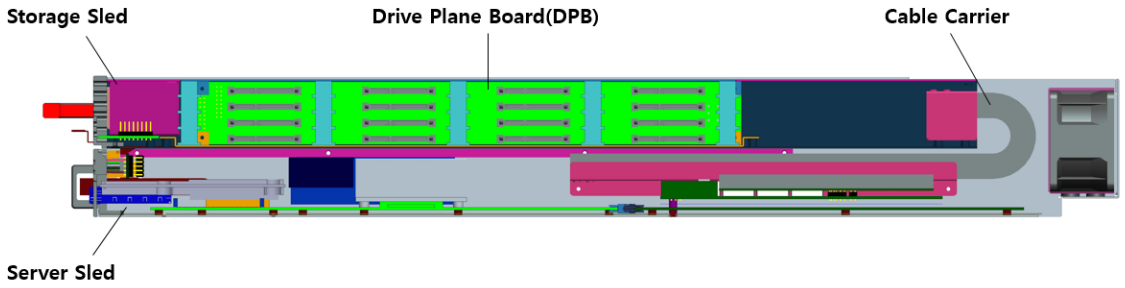
[Figure 9] Server Sled P2 Front-view

[Table 2] Node LED Definition

Location	Name	Status	LED Behavior
Front	Power	Power On	Steady (Blue)
		Power Off	Off
	OS Storage	Disk Activity	Blink (Green)
		Disk Idle	Off
	Status	Normal	Off
		Platform Error	Steady (Red)

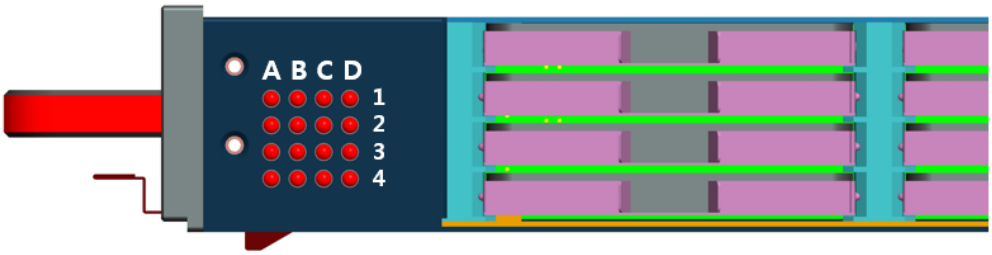
6.3 Storage Sled (S16 Model)

The upper half of the S16 server node is storage sled which accommodates 16x 7mm 2.5” SATA SSDs. Figure 10 illustrates cross section picture of storage sled. The system supports drive hot-swap using a drawer mechanism. Power and SATA signals are transmitted from the Interface Board to the Drive Plane Board (DPB) through cables. The cable carrier chain encases the 4 SAS cables and the power cable to the SSDs.

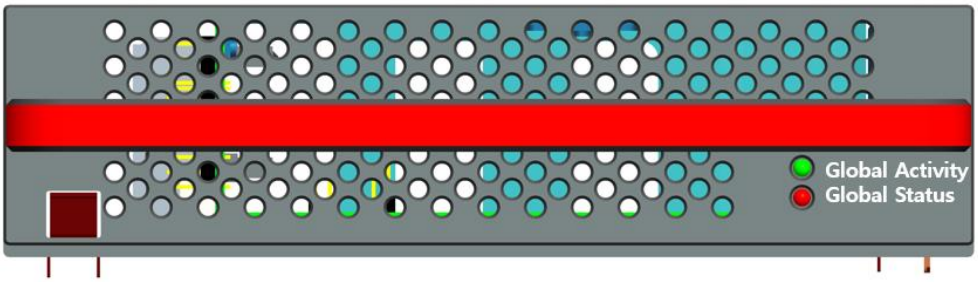


[Figure 10] Storage Sled Cross Section

On the front left side of storage sled there is 4x4 LED drive status panel that is mapped to 4x4 drives as shown in Figure 11. The global drive activity and status LEDs are placed at the front of storage sled so that an operator can recognize drive status when the sled is closed.



[Figure 11] 4x4 LED panel for each drive location



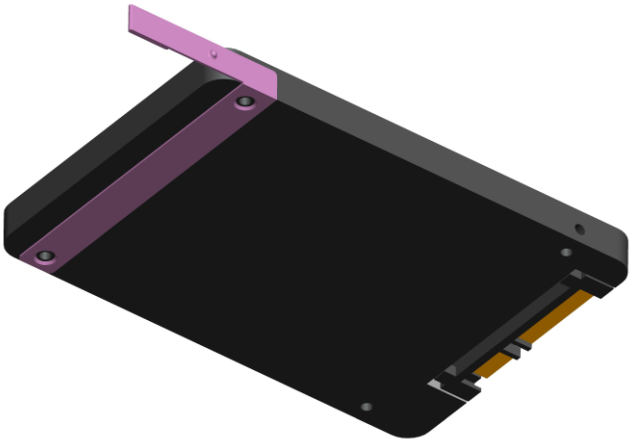
[Figure 12] Global Activity and Status LEDs

[Table 3] Storage Sled LED Definition

Location	Name	Status	LED Behavior
Front	Global Act LED	RAID Virtual Drive Activity	Blink (Green)
		RAID Virtual Drive Rebuild	Blink (Green)
		RAID Virtual Drive Idle	Off
	Global Fault LED	SSD Drive Fault	Steady (Red)
		SSD Drive Normal	Off
Side (4x4 LED)	Locate Fault LEDs	SSD Drive Fault	Steady (Red)
		SSD Drive Normal	Off
		RAID Virtual Drive Rebuild	Blink (Red)

6.3.1 2.5” SATA SSD Handle

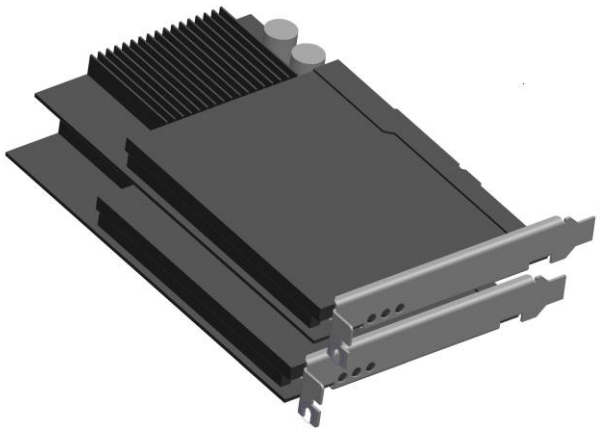
Each SSD is configured with a handle to provide easy insertion and removal from the storage sled. Figure 13 illustrates drive handle design.



[Figure 13] 2.5” SATA SSD Handle

6.3.2 PCIe SSD Add-In Card Placement

Figure 14 illustrates the NVMe SSD card placement when inserted into the PCIe riser card.

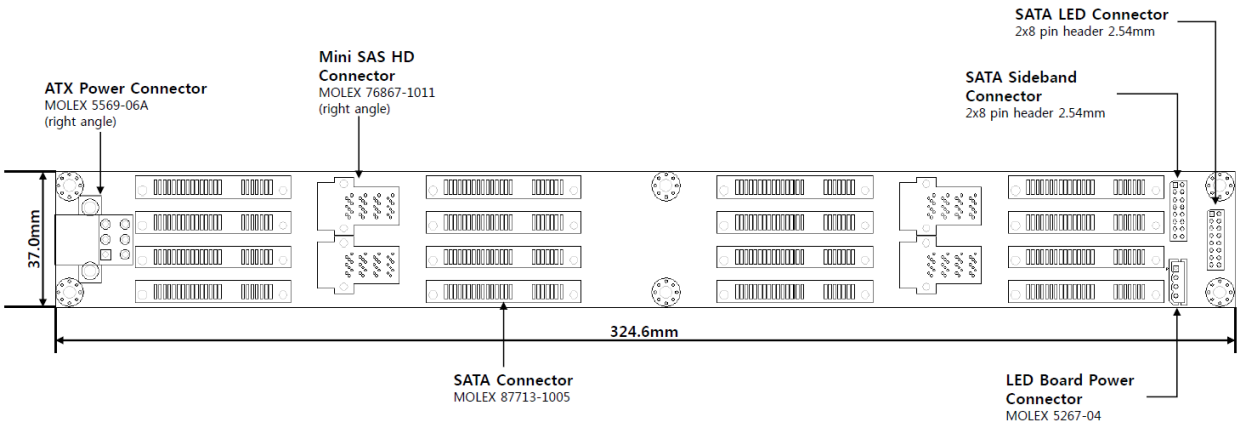


[Figure 14] PCIe SSD Add-In Card Placement

6.4 SSD Support

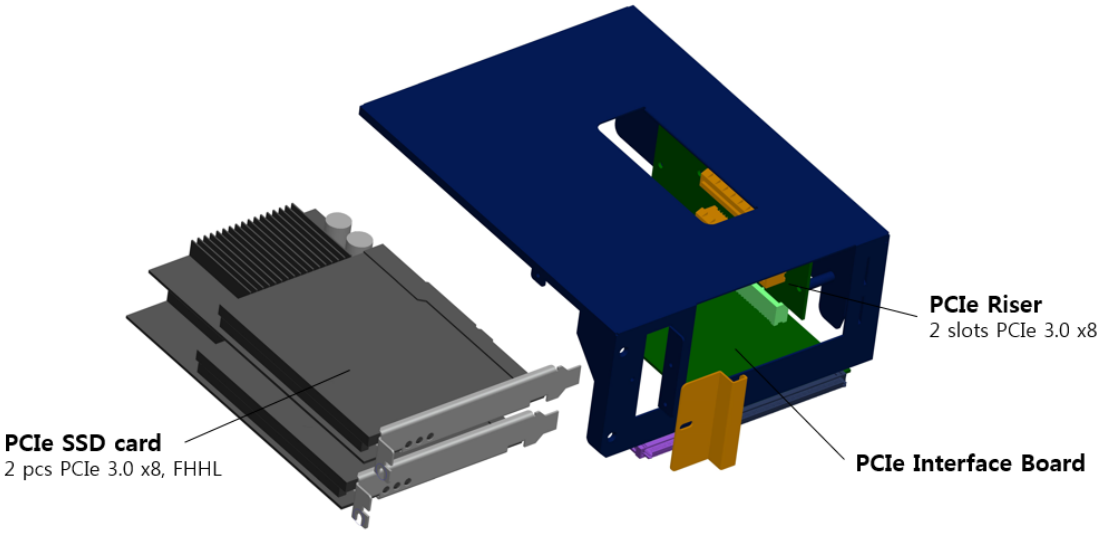
Each S16 server node supports up to 16x 2.5” 7mm height SSDs. A drive tray containing the Drive Plane Board (DPB) is used to hold these drives.

The Drive Plane Board (DPB), as shown in Figure 15, delivers power and SATA signals to SSDs. The board size is 324.6mm x 37mm.



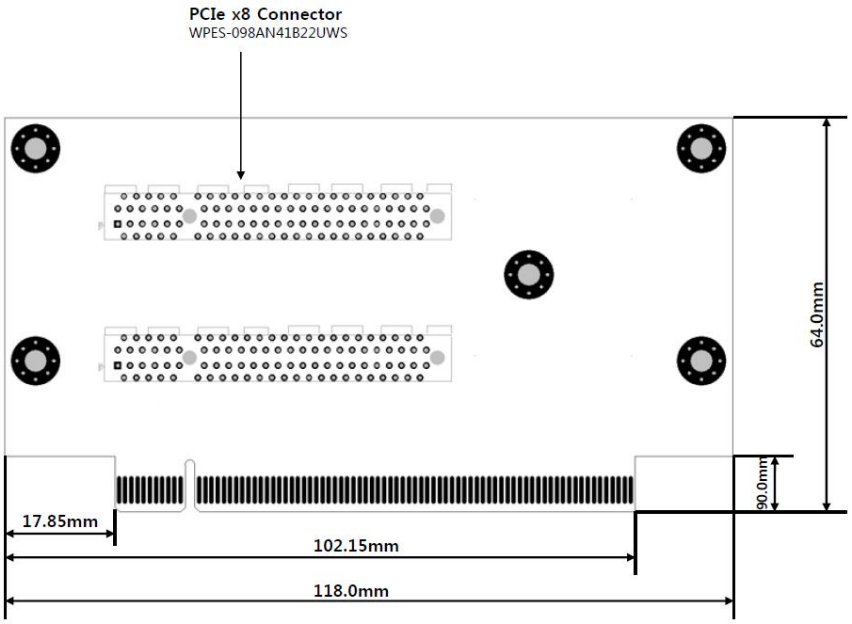
[Figure 15] S16 DPB Mechanical Design

Figure 16 illustrates the mechanical design for the PCIe SSD card and its enclosure. The P2 model supports up to 2x PCIe 3.0 x8 FHHL SSD cards.

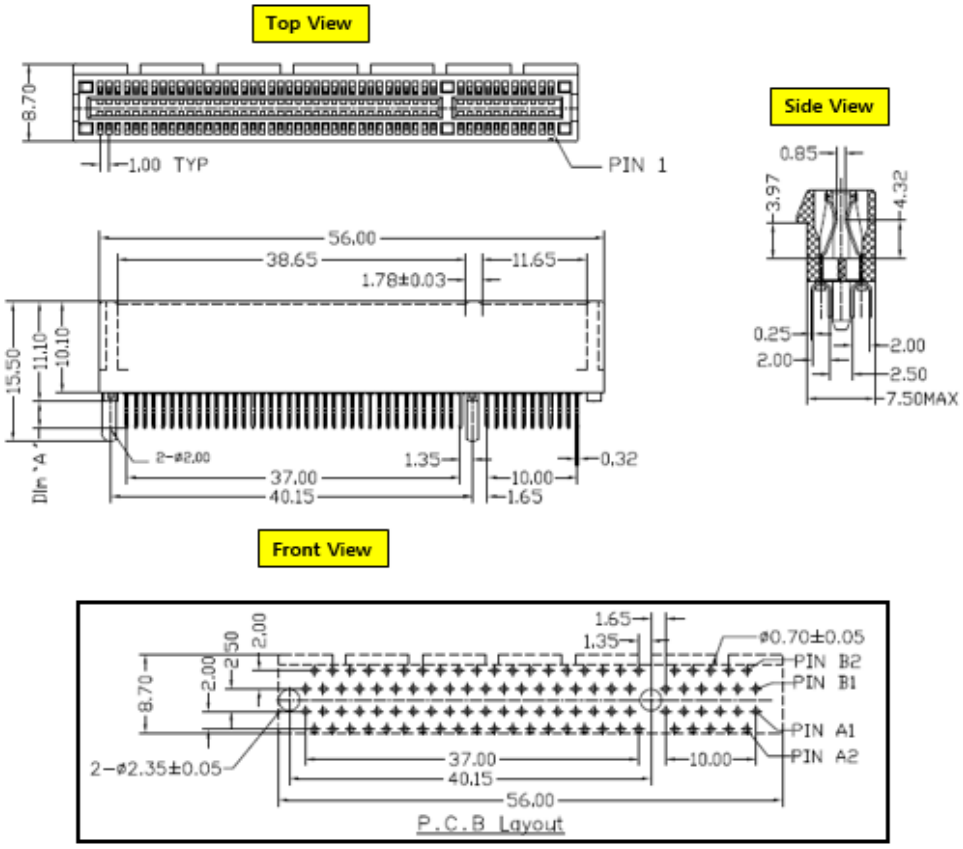


[Figure 16] P2 Internal PCIe SSD Card Support

Figure 17 illustrates mechanical design of PCIe riser card.



[Figure 17] P2 PCIe Riser Mechanical Design



[Figure 18] PCIe x8 Connector for PCIe SSD card Connection

[Table 4] P2 PCIe x8 Connector Pin Definitions

PCIe x8 Connector (DOWN) WPES-098AN41B22UWS			
Pin	**Net Name**	**Pin**	**Net Name**
A1	NC	B1	P12V_CARD
A2	P12V_CARD	B2	P12V_CARD
A3	P12V_CARD	B3	NC
A4	GND	B4	GND
A5	NC	B5	SMB_P3V3_HOST_CLK
A6	P3V3	B6	SMB_P3V3_HOST_DAT
A7	NC	B7	GND
A8	P3V3	B8	P3V3
A9	P3V3	B9	GND
A10	P3V3	B10	P3V3
A11	RST_PCIE_SLOT0_N	B11	NC
A12	GND	B12	NC
A13	PE_CLKP0	B13	GND
A14	PE_CLKN0	B14	PEX_PET_P8
A15	GND	B15	PEX_PET_N8
A16	PEX_PER_P8	B16	GND
A17	PEX_PER_N8	B17	NC
A18	GND	B18	GND
A19	NC	B19	PEX_PET_P9
A20	GND	B20	PEX_PET_N9
A21	PEX_PER_P9	B21	GND
A22	PEX_PER_N9	B22	GND
A23	GND	B23	PEX_PET_P10
A24	GND	B24	PEX_PET_N10
A25	PEX_PER_P10	B25	GND
A26	PEX_PER_N10	B26	GND
A27	GND	B27	PEX_PET_P11
A28	GND	B28	PEX_PET_N11
A29	PEX_PER_P11	B29	GND
A30	PEX_PER_N11	B30	NC
A31	GND	B31	NC
A32	NC	B32	GND
A33	NC	B33	PEX_PET_P12

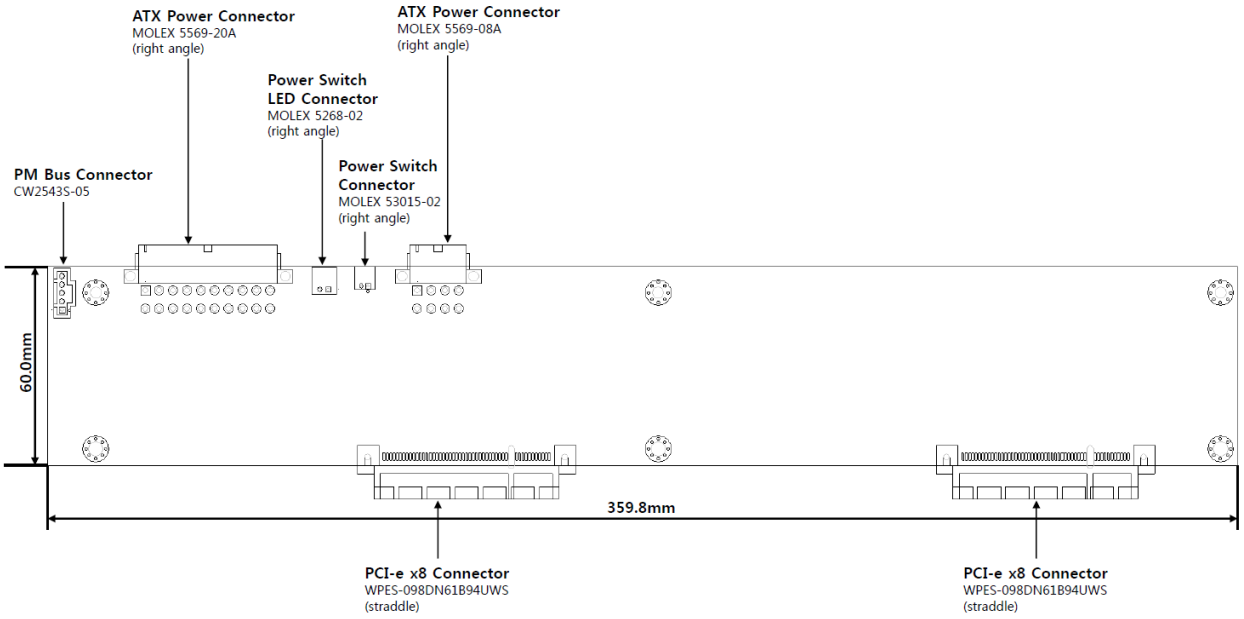
PCIe x8 Connector (UP) WPES-098AN41B22UWS			
Pin	**Net Name**	**Pin**	**Net Name**
A1	NC	B1	P12V_CARD
A2	P12V_CARD	B2	P12V_CARD
A3	P12V_CARD	B3	NC
A4	GND	B4	GND
A5	NC	B5	SMB_P3V3_HOST_CLK
A6	P3V3	B6	SMB_P3V3_HOST_DAT
A7	NC	B7	GND
A8	P3V3	B8	P3V3
A9	P3V3	B9	GND
A10	P3V3	B10	P3V3
A11	RST_PCIE_SLOT0_N	B11	NC
A12	GND	B12	NC
A13	PE_CLKP1	B13	GND
A14	PE_CLKN1	B14	PEX_PET_P16
A15	GND	B15	PEX_PET_N16
A16	PEX_PER_P16	B16	GND
A17	PEX_PER_N16	B17	NC
A18	GND	B18	GND
A19	NC	B19	PEX_PET_P17
A20	GND	B20	PEX_PET_N17
A21	PEX_PER_P17	B21	GND
A22	PEX_PER_N17	B22	GND
A23	GND	B23	PEX_PET_P18
A24	GND	B24	PEX_PET_N18
A25	PEX_PER_P18	B25	GND
A26	PEX_PER_N18	B26	GND
A27	GND	B27	PEX_PET_P19
A28	GND	B28	PEX_PET_N19
A29	PEX_PER_P19	B29	GND
A30	PEX_PER_N19	B30	NC
A31	GND	B31	NC
A32	NC	B32	GND
A33	NC	B33	PEX_PET_P20

A34	GND	B34	PEX_PET_N12
A35	PEX_PER_P12	B35	GND
A36	PEX_PER_N12	B36	GND
A37	GND	B37	PEX_PET_P13
A38	GND	B38	PEX_PET_N13
A39	PEX_PER_P13	B39	GND
A40	PEX_PER_N13	B40	GND
A41	GND	B41	PEX_PET_P14
A42	GND	B42	PEX_PET_N14
A43	PEX_PER_P14	B43	GND
A44	PEX_PER_N14	B44	GND
A45	GND	B45	PEX_PET_P15
A46	GND	B46	PEX_PET_N15
A47	PEX_PER_P15	B47	GND
A48	PEX_PER_N15	B48	NC
A49	GND	B49	GND

A34	GND	B34	PEX_PET_N20
A35	PEX_PER_P20	B35	GND
A36	PEX_PER_N20	B36	GND
A37	GND	B37	PEX_PET_P21
A38	GND	B38	PEX_PET_N21
A39	PEX_PER_P21	B39	GND
A40	PEX_PER_N21	B40	GND
A41	GND	B41	PEX_PET_P22
A42	GND	B42	PEX_PET_N22
A43	PEX_PER_P22	B43	GND
A44	PEX_PER_N22	B44	GND
A45	GND	B45	PEX_PET_P23
A46	GND	B46	PEX_PET_N23
A47	PEX_PER_P23	B47	GND
A48	PEX_PER_N23	B48	NC
A49	GND	B49	GND

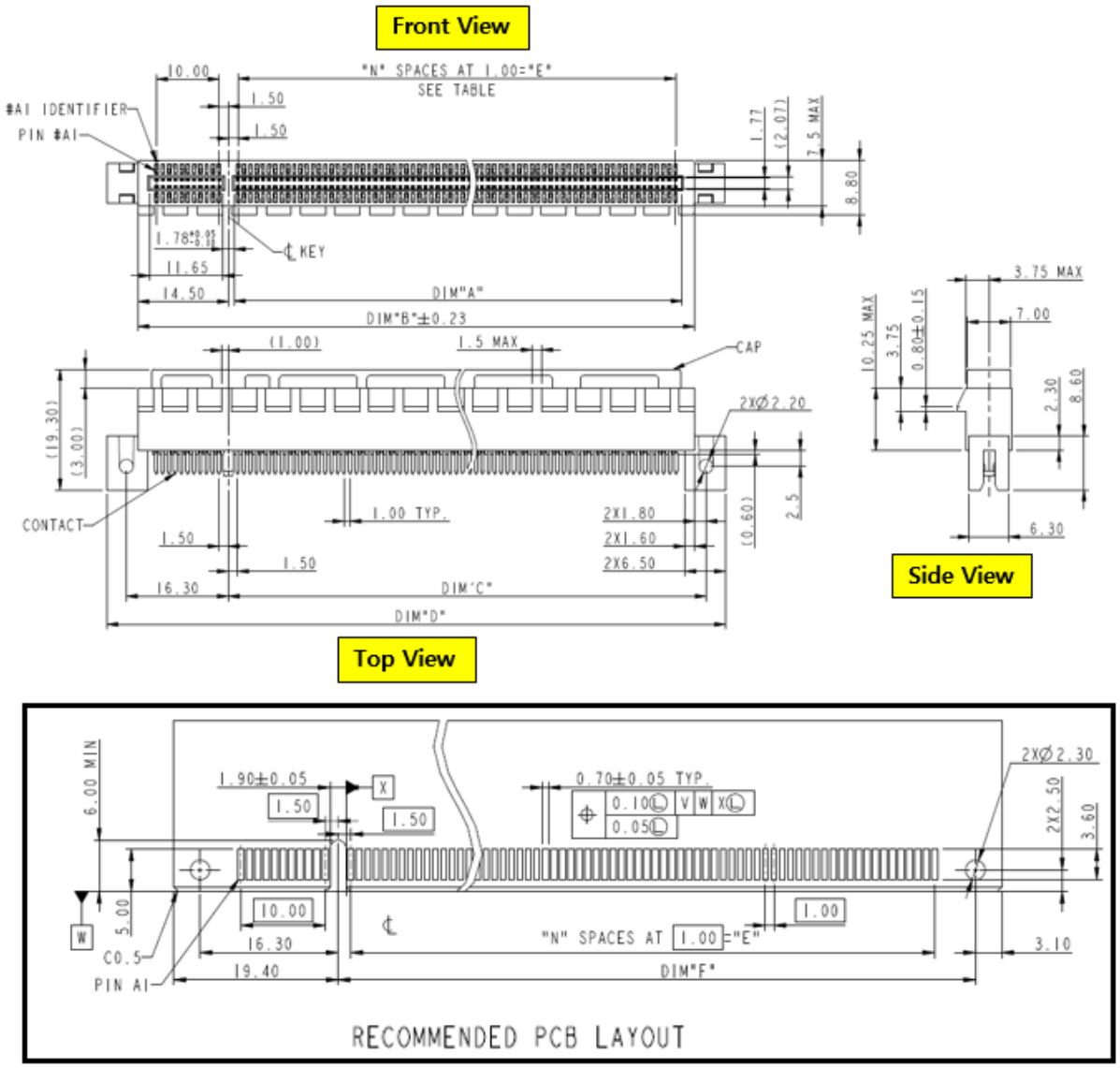
6.5 Power Backplane Board

The Power Backplane Board (PBB) is a 359.8mm x 60mm PCB which provides connections to the server sleds.



[Figure 19] Power Backplane Board

The PCIe x8 connector and associated labeling for the PBB and server sled interface boards are shown in Figure 20.



[Figure 20] PBB to Server Sled Interface Board Connections

The pin definitions for the signal connectors on the PBB are listed in Table 5.

[Table 5] PBB Signal Connector Pin Definitions

PCIe x8 Connector (Left) WPES-098DN61B94UWS			
Pin	Net Name	Pin	Net Name
A1	P12V_ATX	B1	P12V_ATX
A2	P12V_ATX	B2	P12V_ATX
A3	P12V_ATX	B3	P12V_ATX
A4	P12V_ATX	B4	P12V_ATX
A5	P12V_ATX	B5	P12V_ATX
A6	P12V_ATX	B6	P12V_ATX
A7	P12V_ATX	B7	P12V_ATX
A8	P12V_ATX	B8	P12V_ATX
A9	P12V_ATX	B9	P12V_ATX
A10	P12V_ATX	B10	P12V_ATX
A11	NC	B11	P12V_DET
A12	GND	B12	NC
A13	NC	B13	GND
A14	NC	B14	NC
A15	GND	B15	NC
A16	NC	B16	GND
A17	NC	B17	NC
A18	GND	B18	GND
A19	NC	B19	NC
A20	GND	B20	NC
A21	PMBUS_CLK_SLOT0	B21	GND
A22	PMBUS_DATA_SLOT0	B22	GND
A23	GND	B23	SIO_GP20_SLOT0
A24	GND	B24	SIO_GP21_SLOT0
A25	PMBUS_ALERT_SLOT0	B25	GND
A26	NC	B26	GND
A27	GND	B27	NC
A28	GND	B28	NC
A29	NC	B29	GND
A30	NC	B30	GND
A31	GND	B31	GND
A32	GND	B32	GND
A33	P12V_ATX	B33	P12V_ATX
A34	P12V_ATX	B34	P12V_ATX
A35	P12V_ATX	B35	P12V_ATX
A36	P12V_ATX	B36	P12V_ATX
A37	P12V_ATX	B37	P12V_ATX

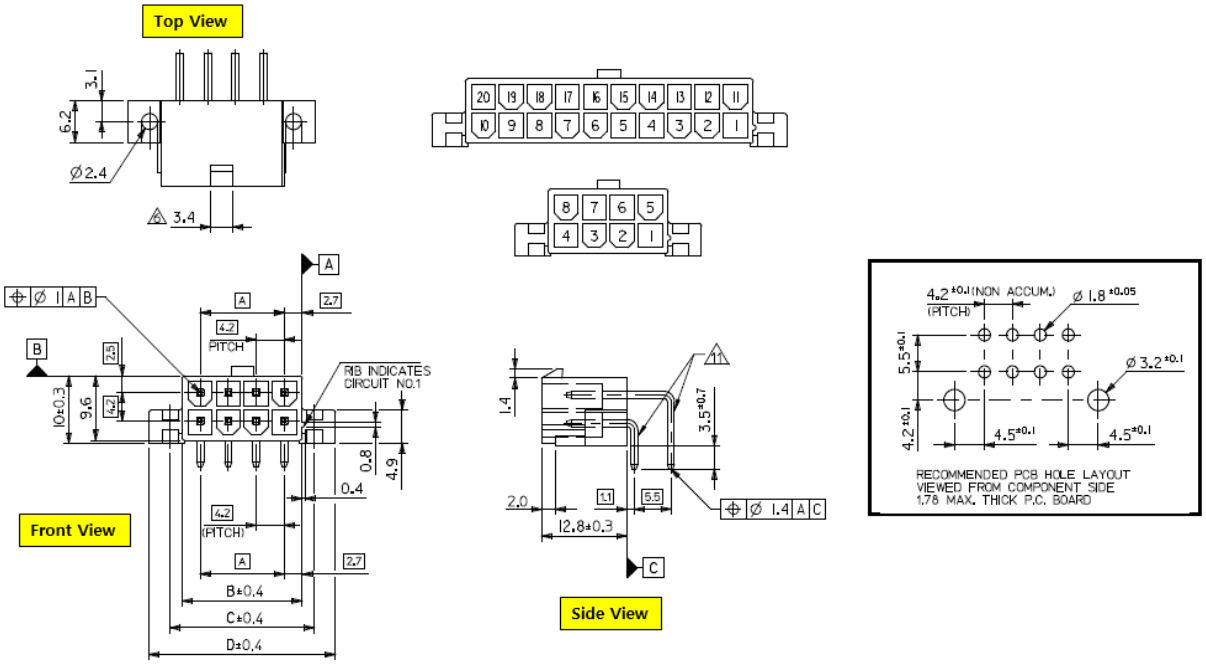
PCIe x8 Connector (Right) WPES-098DN61B94UWS			
Pin	Net Name	Pin	Net Name
A1	P12V_ATX	B1	P12V_ATX
A2	P12V_ATX	B2	P12V_ATX
A3	P12V_ATX	B3	P12V_ATX
A4	P12V_ATX	B4	P12V_ATX
A5	P12V_ATX	B5	P12V_ATX
A6	P12V_ATX	B6	P12V_ATX
A7	P12V_ATX	B7	P12V_ATX
A8	P12V_ATX	B8	P12V_ATX
A9	P12V_ATX	B9	P12V_ATX
A10	P12V_ATX	B10	P12V_ATX
A11	NC	B11	P12V_DET
A12	GND	B12	NC
A13	NC	B13	GND
A14	NC	B14	NC
A15	GND	B15	NC
A16	NC	B16	GND
A17	NC	B17	NC
A18	GND	B18	GND
A19	NC	B19	NC
A20	GND	B20	NC
A21	PMBUS_CLK_SLOT1	B21	GND
A22	PMBUS_DATA_SLOT1	B22	GND
A23	GND	B23	SIO_GP20_SLOT1
A24	GND	B24	SIO_GP21_SLOT1
A25	PMBUS_ALERT_SLOT1	B25	GND
A26	NC	B26	GND
A27	GND	B27	NC
A28	GND	B28	NC
A29	NC	B29	GND
A30	NC	B30	GND
A31	GND	B31	GND
A32	GND	B32	GND
A33	P12V_ATX	B33	P12V_ATX
A34	P12V_ATX	B34	P12V_ATX
A35	P12V_ATX	B35	P12V_ATX
A36	P12V_ATX	B36	P12V_ATX
A37	P12V_ATX	B37	P12V_ATX

A38	P12V_ATX	B38	P12V_ATX
A39	P12V_ATX	B39	P12V_ATX
A40	P12V_ATX	B40	P12V_ATX
A41	P12V_ATX	B41	P12V_ATX
A42	GND	B42	GND
A43	GND	B43	GND
A44	GND	B44	GND
A45	GND	B45	GND
A46	GND	B46	GND
A47	GND	B47	GND
A48	GND	B48	GND
A49	GND	B49	GND

A38	P12V_ATX	B38	P12V_ATX
A39	P12V_ATX	B39	P12V_ATX
A40	P12V_ATX	B40	P12V_ATX
A41	P12V_ATX	B41	P12V_ATX
A42	GND	B42	GND
A43	GND	B43	GND
A44	GND	B44	GND
A45	GND	B45	GND
A46	GND	B46	GND
A47	GND	B47	GND
A48	GND	B48	GND
A49	GND	B49	GND

6.5.1 DC Input Connection

The DC power input connection on PBB is via an ATX type connector (Molex P/N 5569-20A, 5569-08A). The PBB routes power to the sleds. There are two horizontal-type power connectors installed on the PBB; each of the connectors can deliver up to 13A of power, for a total of 16A for each server sled.



[Figure 21] PBB PSU Connector

Pin definitions for the power connectors on the PBB are shown in Table 6.

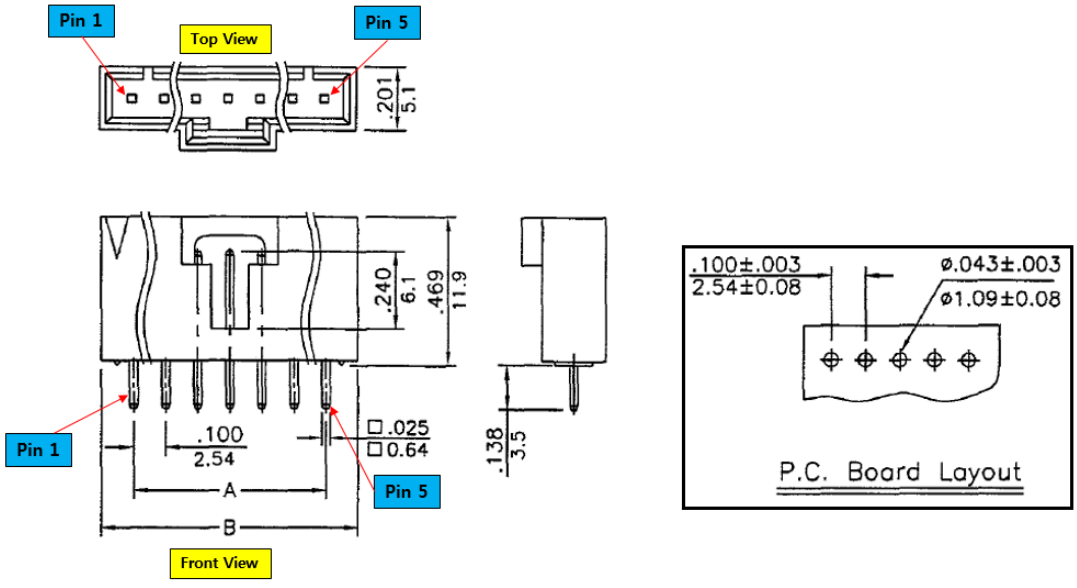
[Table 6] PBB Power Connector Pin Definitions

ATX Power Connector MOLEX 5569-20A	
Pin	Net Name
1	P12V_ATX
2	P12V_ATX
3	GND
4	P12V_ATX
5	GND
6	P12V_ATX
7	GND
8	NC
9	P5V_STBY
10	P12V_ATX
11	P12V_ATX
12	P12V_ATX
13	P12V_ATX
14	P12V_ATX
15	GND
16	PSON#
17	GND
18	GND
19	GND
20	NC

ATX Power Connector MOLEX 5569-08A	
Pin	Net Name
1	GND
2	GND
3	GND
4	GND
5	P12V_ATX
6	P12V_ATX
7	P12V_ATX
8	P12V_ATX

6.5.2 PMBus and Power Switch Connector

Figure 22 illustrates the PMBus connector, and Table 5 shows its pin definitions.

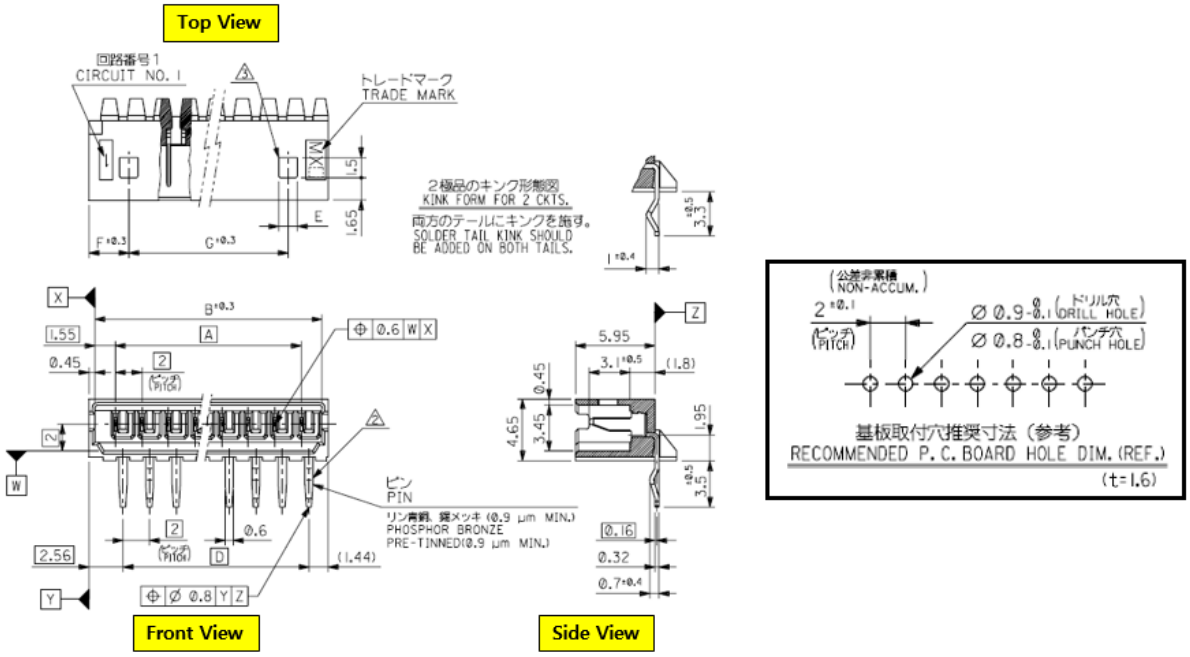


[Figure 22] PBB PMBus Connector

[Table 7] PBB PMBus Connector Pin Definitions

PM Bus Connector CW2543S-05	
Pin	**Net Name**
1	SCL
2	SDA
3	INT_IN#
4	GND
5	NC

Figure 23 illustrates the Power Switch connector, and Table 6 shows its pin definitions.



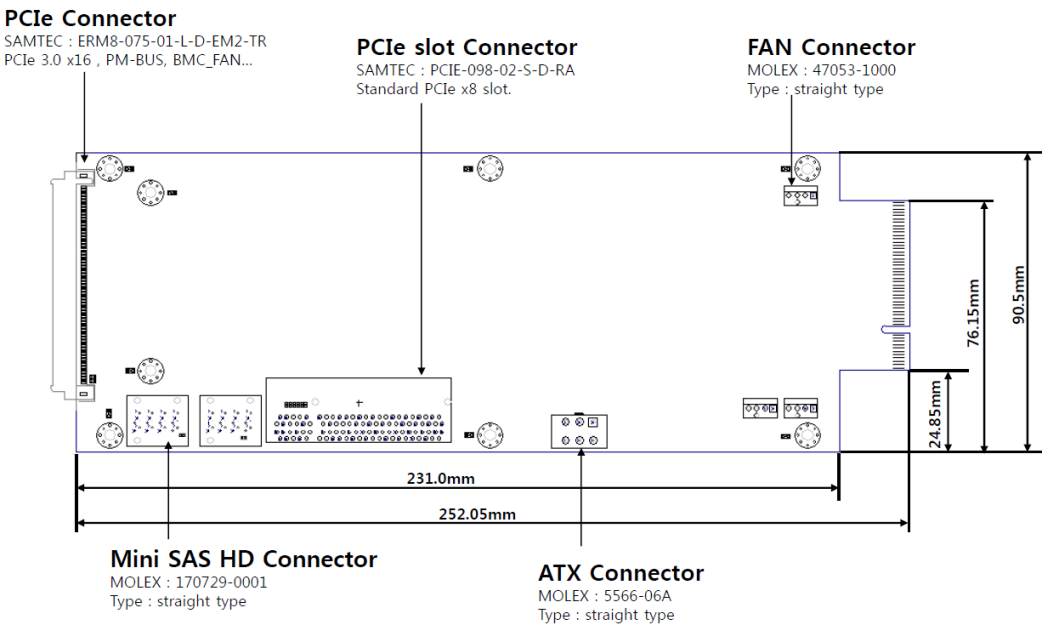
[Figure 23] PBB Power Switch Connector

[Table 8] PBB Power Switch Connector Pin Definitions

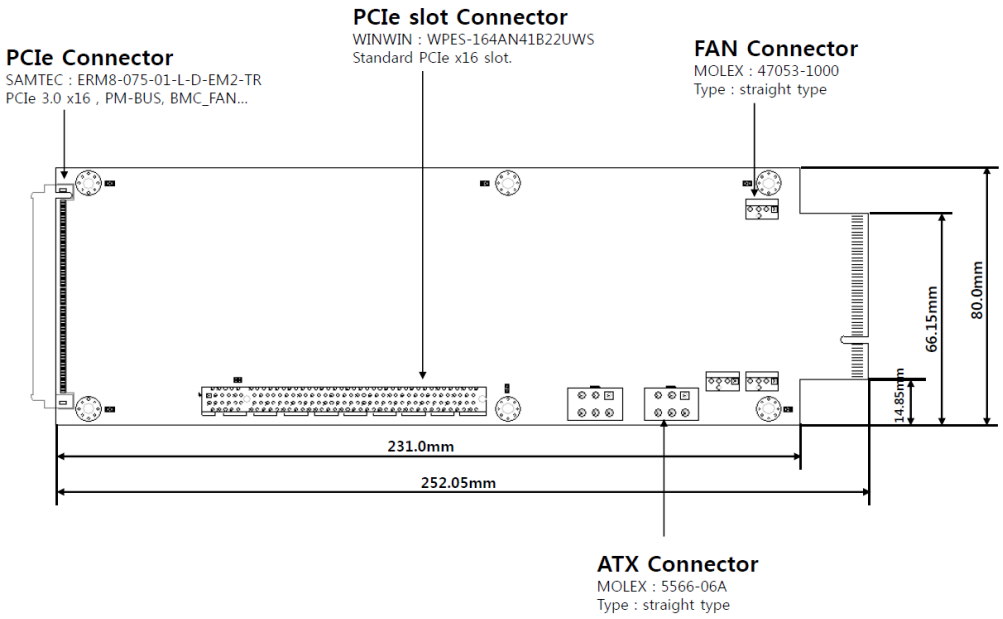
Power Switch Connector MOLEX 53015-02	
Pin	**Net Name**
1	PSON#
2	GND

6.6 Server Sled Interface Board Placement

The Server Sled Interface Board acts as a connection between the motherboard and the PCIe riser for Raid Controller (S16) or PCIe SSD (P2) cards. Figures 24 and 25 illustrate the S16 and P2 model's interface board layout.



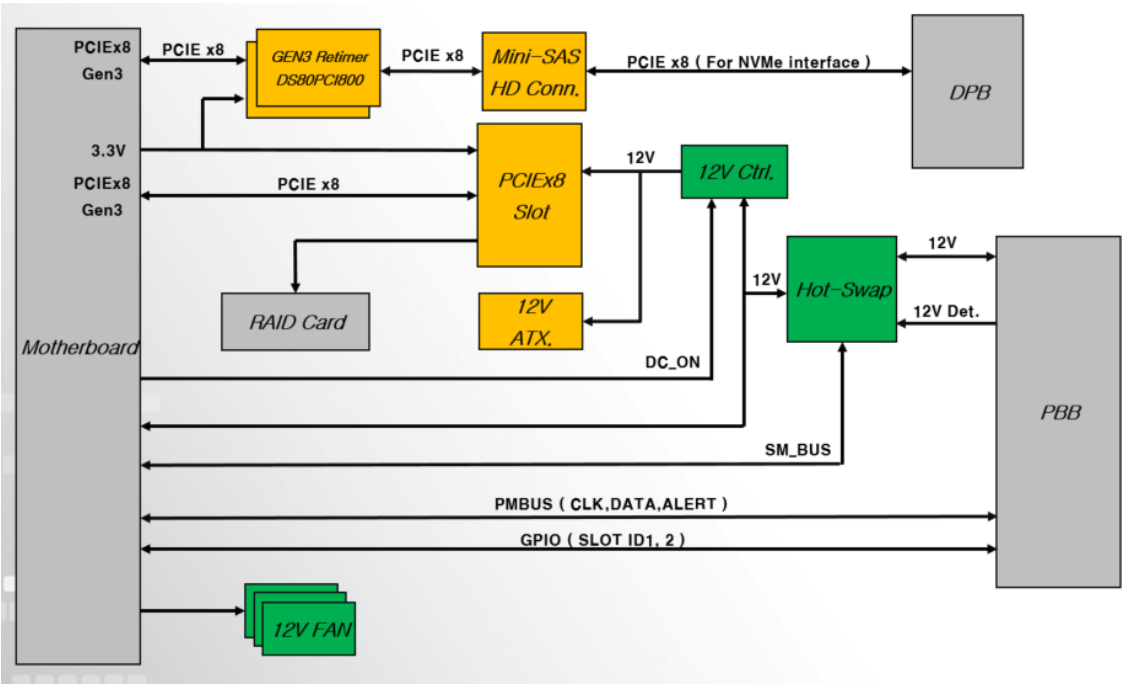
[Figure 24] S16 Server Sled Interface Board



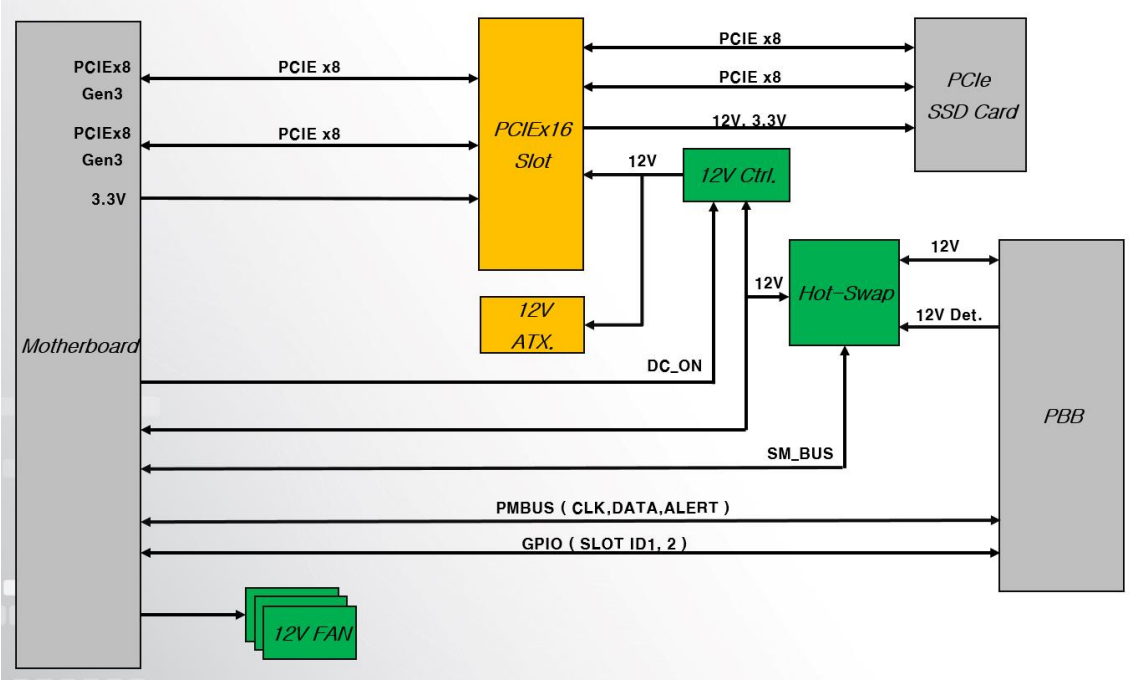
[Figure 25] P2 Server Sled Interface Board

6.6.1 Hot Swap Controller

The Hot Swap Controller implementation follows the motherboard's design specification.



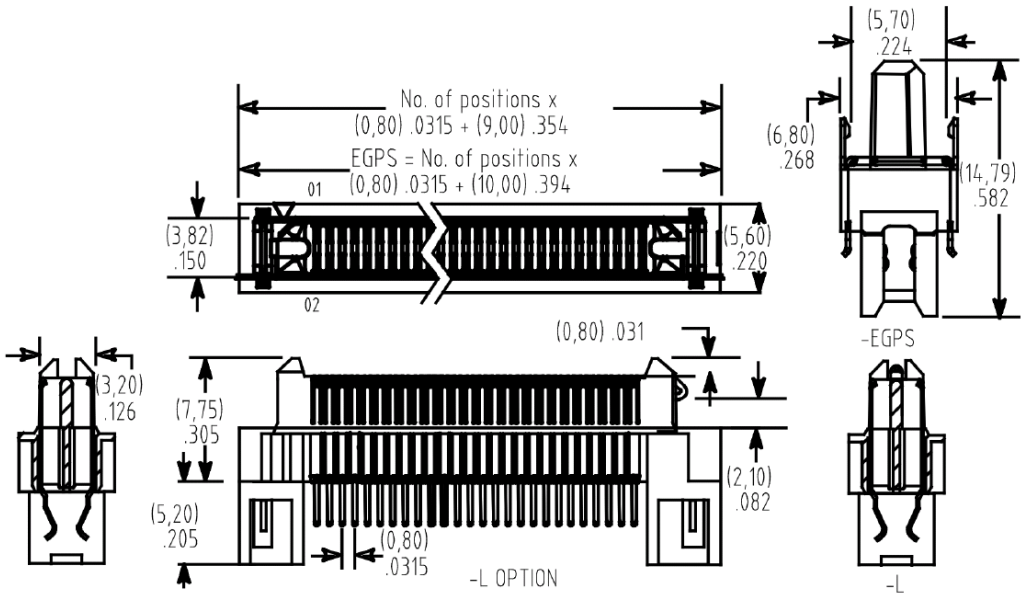
[Figure 26] S16 Hot Swap Controller Block Diagram



[Figure 27] P2 Hot Swap Controller Block Diagram

6.6.2 PCIe Connectors

Figure 28 illustrates the PCIe connector which connects the server sled interface board to motherboard. Its pin definitions are given in Table 7.



[Figure 28] Server Sled Interface Board to Motherboard Connector

[Table 9] Server Sled Interface Board Pin Definitions

A1	P12V_HSW
A2	P12V_HSW
A3	P12V_HSW
A4	P12V_HSW
A5	P12V_HSW
A6	P3V3_MB
A7	P3V3_MB
A8	P3V3_MB
A9	P3V3_MB
A10	NC
A11	PCIE_RESET_N
A12	GND
A13	100M_CLK_SLOT0_DP
A14	100M_CLK_SLOT0_DN
A15	GND
A16	PCIE_RX_O_DP0
A17	PCIE_RX_O_DN0
A18	GND
A19	PCIE_RX_O_DP1
A20	PCIE_RX_O_DN1
A21	GND
A22	PCIE_RX_O_DP2
A23	PCIE_RX_O_DN2
A24	GND
A25	PCIE_RX_O_DP3
A26	PCIE_RX_O_DN3
A27	GND
A28	PCIE_RX_O_DP4
A29	PCIE_RX_O_DN4
A30	GND
A31	PCIE_RX_O_DP5
A32	PCIE_RX_O_DN5
A33	GND
A34	PCIE_RX_O_DP6
A35	PCIE_RX_O_DN6
A36	GND
A37	PCIE_RX_O_DP7
A38	PCIE_RX_O_DN7
A39	GND
A40	NC
A41	NC
A42	GND
A43	PCIE_RX_O_DP8
A44	PCIE_RX_O_DN8
A45	GND
A46	PCIE_RX_O_DP9
A47	PCIE_RX_O_DN9

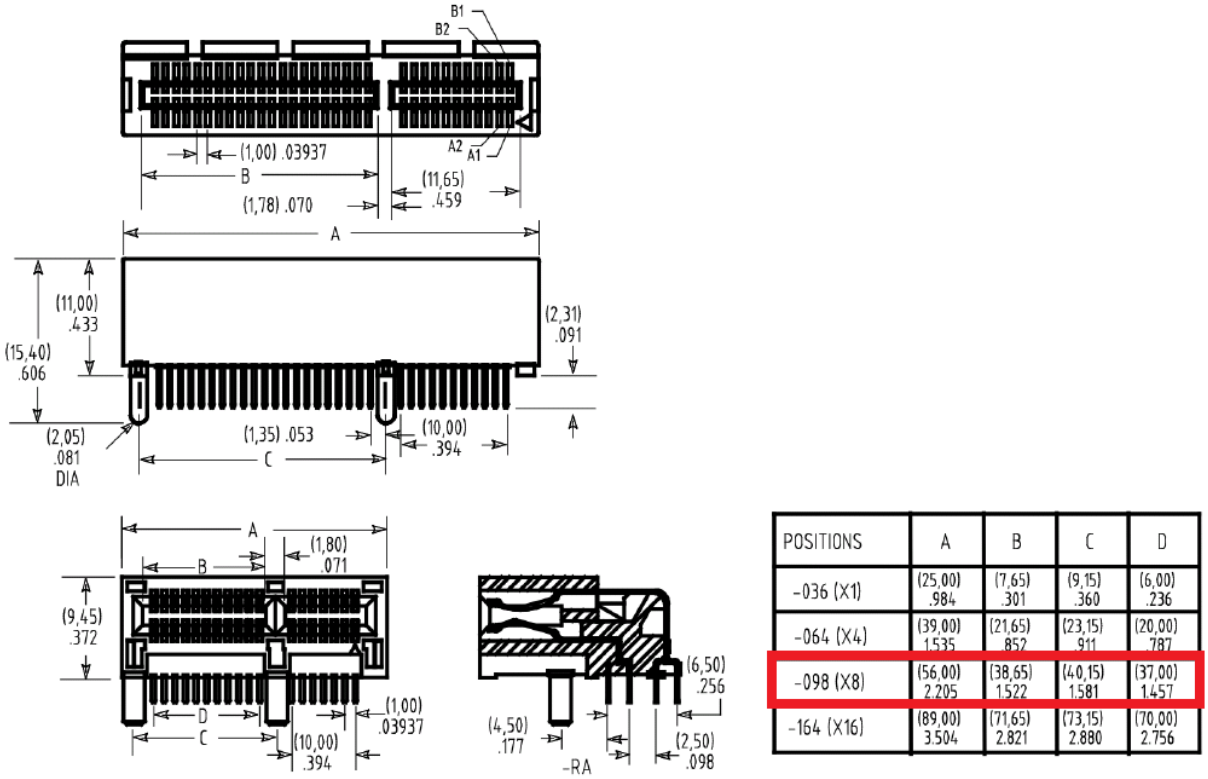
B1	P12V_HSW
B2	P12V_HSW
B3	P12V_HSW
B4	P12V_HSW
B5	P12V_HSW
B6	NC
B7	SMB_CLK0
B8	SMB_DAT0
B9	P3V3_MB
B10	P3V3_AUX
B11	GND
B12	PCIE_TX_O_DP0
B13	PCIE_TX_O_DN0
B14	GND
B15	PCIE_TX_O_DP1
B16	PCIE_TX_O_DN1
B17	GND
B18	PCIE_TX_O_DP2
B19	PCIE_TX_O_D2
B20	GND
B21	PCIE_TX_O_DP3
B22	PCIE_TX_O_DN3
B23	GND
B24	NC
B25	NC
B26	GND
B27	PCIE_TX_O_DP4
B28	PCIE_TX_O_DN4
B29	GND
B30	PCIE_TX_O_DP5
B31	PCIE_TX_O_DN5
B32	GND
B33	PCIE_TX_O_DP6
B34	PCIE_TX_O_DN6
B35	GND
B36	PCIE_TX_O_DP7
B37	PCIE_TX_O_DN7
B38	GND
B39	PCIE_TX_O_DP8
B40	PCIE_TX_O_DN8
B41	GND
B42	PCIE_TX_O_DP9
B43	PCIE_TX_O_DN9
B44	GND
B45	PCIE_TX_O_DP10
B46	PCIE_TX_O_DN10
B47	GND

A48	GND
A49	PCIE_RX_O_DP10
A50	PCIE_RX_O_DN10
A51	GND
A52	PCIE_RX_O_DP11
A53	PCIE_RX_O_DN11
A54	GND
A55	PCIE_RX_O_DP12
A56	PCIE_RX_O_DN12
A57	GND
A58	PCIE_RX_O_DP13
A59	PCIE_RX_O_DN13
A60	GND
A61	PCIE_RX_O_DP14
A62	PCIE_RX_O_DN14
A63	GND
A64	PCIE_RX_O_DP15
A65	PCIE_RX_O_DN15
A66	GND
A67	NC
A68	NC
A69	NC
A70	NC
A71	PMBUS_CLK
A72	PMBUS_DATA
A73	PMBUS_ALERT
A74	SLOT_ID0
A75	SLOT_ID1

B48	PCIE_TX_O_DP11
B49	PCIE_TX_O_DN11
B50	GND
B51	NC
B52	NC
B53	GND
B54	PCIE_TX_O_DP12
B55	PCIE_TX_O_DN12
B56	GND
B57	PCIE_TX_O_DP13
B58	PCIE_TX_O_DN13
B59	GND
B60	PCIE_TX_O_DP14
B61	PCIE_TX_O_DN14
B62	GND
B63	PCIE_TX_O_DP15
B64	PCIE_TX_O_DN15
B65	GND
B66	LBOARD_BMC_PWM3
B67	LBOARD_BMC_TACH3
B68	GND
B69	LBOARD_BMC_PWM4
B70	LBOARD_BMC_TACH4
B71	GND
B72	LBOARD_BMC_PWM5
B73	LBOARD_BMC_TACH5
B74	GND
B75	DC_ON

6.6.3 Interface Board PCIe Slot Connector

Figure 29 illustrates the Interface Board PCIe slot connector for the RAID card (S16 model). Its pin definitions are given in Table 8.



POSITIONS	A	B	C	D
-036 (X1)	(25,00) .984	(7,65) .301	(9,15) .360	(6,00) .236
-064 (X4)	(39,00) 1.535	(21,65) .852	(23,15) .911	(20,00) .787
-098 (X8)	(56,00) 2.205	(38,65) 1.522	(40,15) 1.581	(37,00) 1.457
-164 (X16)	(89,00) 3.504	(71,65) 2.821	(73,15) 2.880	(70,00) 2.756

[Figure 29] RAID Card PCIe Slot Connector

[Table 10] Signal Connector Pin Definitions for the S16 PCIe Slot

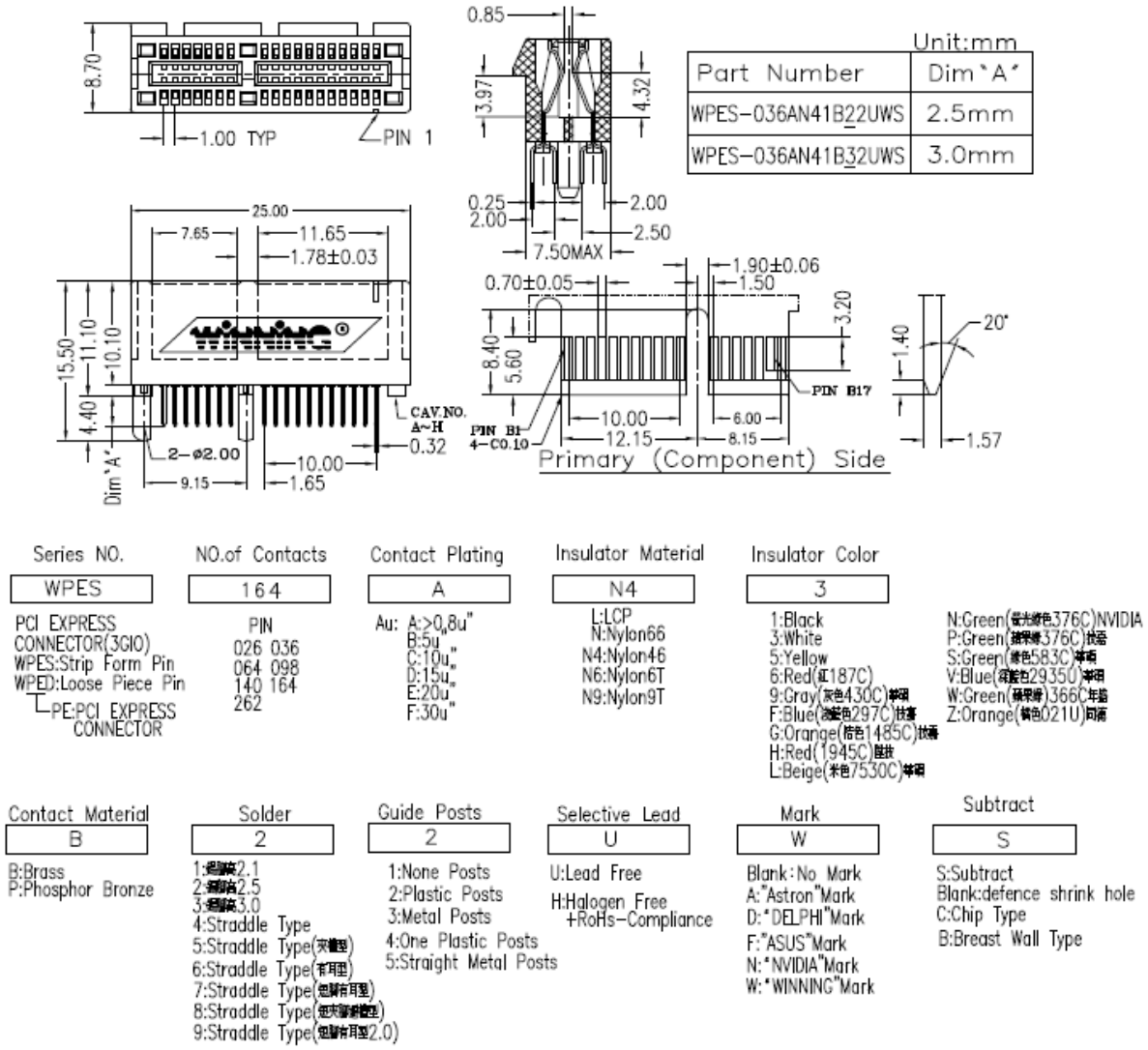
A1	NC
A2	P12V_SLOT
A3	P12V_SLOT
A4	GND
A5	JTAG/TCK
A6	JTAG/TDI
A7	JTAG/TDO
A8	JTAG/TMS
A9	P3V3

B1	P12V_SLOT
B2	P12V_SLOT
B3	P12V_SLOT
B4	GND
B5	SMB_CLK0
B6	SMB_DAT0
B7	GND
B8	P3V3
B9	Reserved

A10	P3V3
A11	PCIE_RESET_N
A12	GND
A13	100M_CLK_SLOT0_DP
A14	100M_CLK_SLOT0_DN
A15	GND
A16	PCIE_RX_O_DP_0
A17	PCIE_RX_O_DN_0
A18	GND
A19	NC
A20	GND
A21	PCIE_RX_O_DP_1
A22	PCIE_RX_O_DN_1
A23	GND
A24	GND
A25	PCIE_RX_O_DP_2
A26	PCIE_RX_O_DN_2
A27	GND
A28	GND
A29	PCIE_RX_O_DP_3
A30	PCIE_RX_O_DN_3
A31	GND
A32	NC
A33	NC
A34	GND
A35	PCIE_RX_O_DP_4
A36	PCIE_RX_O_DN_4
A37	GND
A38	GND
A39	PCIE_RX_O_DP_5
A40	PCIE_RX_O_DN_5
A41	GND
A42	GND
A43	PCIE_RX_O_DP_6
A44	PCIE_RX_O_DN_6
A45	GND
A46	GND
A47	PCIE_RX_O_DP_7
A48	PCIE_RX_O_DN_7
A49	GND

B10	P3V3_AUX
B11	NC
B12	NC
B13	GND
B14	PCIE_TX_O_DP0
B15	PCIE_TX_O_DN0
B16	GND
B17	NC
B18	GND
B19	PCIE_TX_O_DP1
B20	PCIE_TX_O_DN1
B21	GND
B22	GND
B23	PCIE_TX_O_DP2
B24	PCIE_TX_O_DN2
B25	GND
B26	GND
B27	PCIE_TX_O_DP3
B28	PCIE_TX_O_DN3
B29	GND
B30	NC
B31	NC
B32	GND
B33	PCIE_TX_O_DP4
B34	PCIE_TX_O_DN4
B35	GND
B36	GND
B37	PCIE_TX_O_DP5
B38	PCIE_TX_O_DN5
B39	GND
B40	GND
B41	PCIE_TX_O_DP6
B42	PCIE_TX_O_DN6
B43	GND
B44	GND
B45	PCIE_TX_O_DP7
B46	PCIE_TX_O_DN7
B47	GND
B48	NC
B49	GND

Figure 30 illustrates the PCIe slot connector for the NVME SSD Riser Card (P2 model). Table 9 shows its pin definitions.



[Figure 30] PCIe Connector for the Riser Card (P2 Model)

[Table 11] Riser Card (P2 Model) Signal Connector Pin Definitions

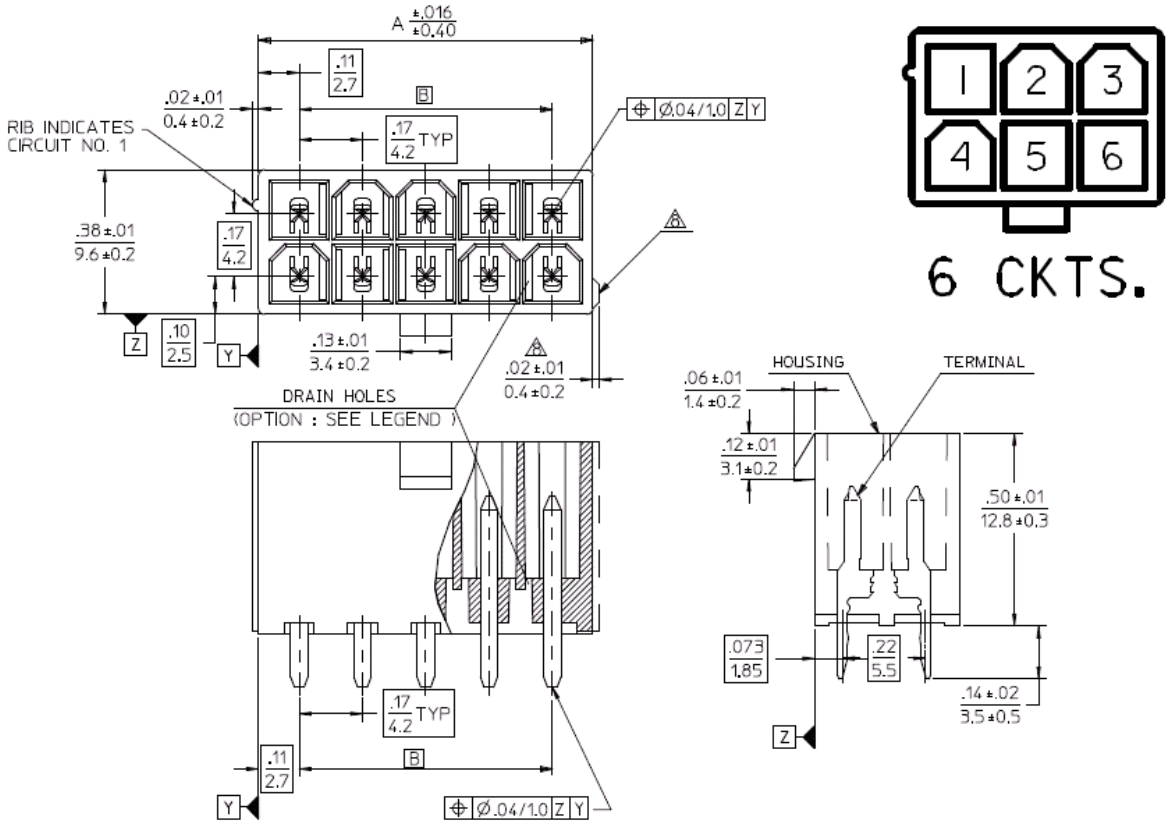
A1	P12V_SLOT
A2	P12V_SLOT
A3	P12V_SLOT
A4	GND
A5	NC
A6	NC
A7	NC
A8	NC
A9	P3V3
A10	P33
A11	PCIE_RESET_N
A12	GND
A13	100M_CLK_SLOT0_DP
A14	100M_CLK_SLOT0_DN
A15	GND
A16	PCIE_RX_O_DP0
A17	PCIE_RX_O_DN0
A18	GND
A19	NC
A20	GND
A21	PCIE_RX_O_DP1
A22	PCIE_RX_O_DN1
A23	GND
A24	GND
A25	PCIE_RX_O_DP2
A26	PCIE_RX_O_DN2
A27	GND
A28	GND
A29	PCIE_RX_O_DP3
A30	PCIE_RX_O_DN3
A31	GND
A32	100M_CLK_SLOT1_DP
A33	100M_CLK_SLOT1_DN
A34	GND
A35	PCIE_RX_O_DP4
A36	PCIE_RX_O_DN4
A37	GND
A38	GND
A39	PCIE_RX_O_DP5
A40	PCIE_RX_O_DN5
A41	GND
A42	GND
A43	PCIE_RX_O_DP6
A44	PCIE_RX_O_DN6
A45	GND
A46	GND
A47	PCIE_RX_O_DP7

B1	P12V_SLOT
B2	P12V_SLOT
B3	P12V_SLOT
B4	GND
B5	SMB_CLK0
B6	SMB_DAT0
B7	GND
B8	P3V3
B9	
B10	P3V3_AUX
B11	NC
B12	P12V_SLOT
B13	GND
B14	PCIE_TX_O_DP0
B15	PCIE_TX_O_DN0
B16	GND
B17	P12V_SLOT
B18	GND
B19	PCIE_TX_O_DP1
B20	PCIE_TX_O_DN1
B21	GND
B22	GND
B23	PCIE_TX_O_DP2
B24	PCIE_TX_O_DN2
B25	GND
B26	GND
B27	PCIE_TX_O_DP3
B28	PCIE_TX_O_DN3
B29	GND
B30	P12V_SLOT
B31	P12V_SLOT
B32	GND
B33	PCIE_TX_O_DP4
B34	PCIE_TX_O_DN4
B35	GND
B36	GND
B37	PCIE_TX_O_DP5
B38	PCIE_TX_O_DN5
B39	GND
B40	GND
B41	PCIE_TX_O_DP6
B42	PCIE_TX_O_DN6
B43	GND
B44	GND
B45	PCIE_TX_O_DP7
B46	PCIE_TX_O_DN7
B47	GND

A48	PCIE_RX_O_DN7
A49	GND
A50	NC
A51	GND
A52	PCIE_RX_O_DP8
A53	PCIE_RX_O_DN8
A54	GND
A55	GND
A56	PCIE_RX_O_DP9
A57	PCIE_RX_O_DN9
A58	GND
A59	GND
A60	PCIE_RX_O_DP10
A61	PCIE_RX_O_DN10
A62	GND
A63	GND
A64	PCIE_RX_O_DP11
A65	PCIE_RX_O_DN11
A66	GND
A67	GND
A68	PCIE_RX_O_DP12
A69	PCIE_RX_O_DN12
A70	GND
A71	GND
A72	PCIE_RX_O_DP13
A73	PCIE_RX_O_DN13
A74	GND
A75	GND
A76	PCIE_RX_O_DP14
A77	PCIE_RX_O_DN14
A78	GND
A79	GND
A80	PCIE_RX_O_DP15
A81	PCIE_RX_O_DN15
A82	GND

B48	P12V_SLOT
B49	GND
B50	PCIE_TX_O_DP8
B51	PCIE_TX_O_DN8
B52	GND
B53	GND
B54	PCIE_TX_O_DP9
B55	PCIE_TX_O_DN9
B56	GND
B57	GND
B58	PCIE_TX_O_DP10
B59	PCIE_TX_O_DN10
B60	GND
B61	GND
B62	PCIE_TX_O_DP11
B63	PCIE-TX_O_DN11
B64	GND
B65	GND
B66	PCIE_TX_O_DP12
B67	PCIE_TX_O-DN12
B68	GND
B69	GND
B70	PCIE_TX_O_DP13
B71	PCIE_TX_O_DN13
B72	GND
B73	GND
B74	PCIE_TX_O_DP14
B75	PCIE_TX_O_DN14
B76	GND
B77	GND
B78	PCIE_TX_O_DP15
B79	PCIE_TX_O_DN15
B80	GND
B81	NC
B82	NC

6.6.4 ATX Connectors



[Figure 31] ATX Power Connector for the DPB (S16) and PCIe SSD (P2)

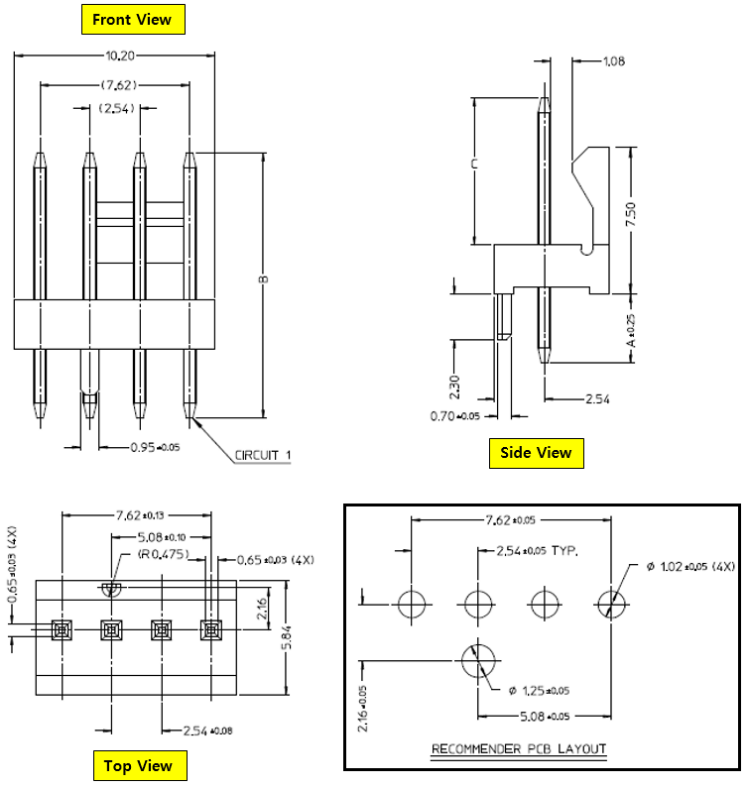
[Table 12] ATX Power Connector Pin Definitions

1	GND
2	GND
3	GND

4	P12V_SLOT
5	P12V_SLOT
6	P12V_SLOT

6.6.5 Fan Connectors

The Molex 47053-1000, shown in Figure 32, is used as a 4-pin Fan Connector. The Fan Connector signals follow the "4-wire Pulse Width Modulation (PWM) Controlled Fans Specification" Revision 1.3, September 2005, published by Intel Corporation. Each node has two fan connectors. The Fan Connector Power, PWM and Tachometer signals are connected to the BMC (AST2400). The PWM control signal is shared but the Tachometer signals are read separately by BMC. The Fan power should not be turned off when the server node is in the working state (S0).



[Figure 32] Fan Connector Drawing

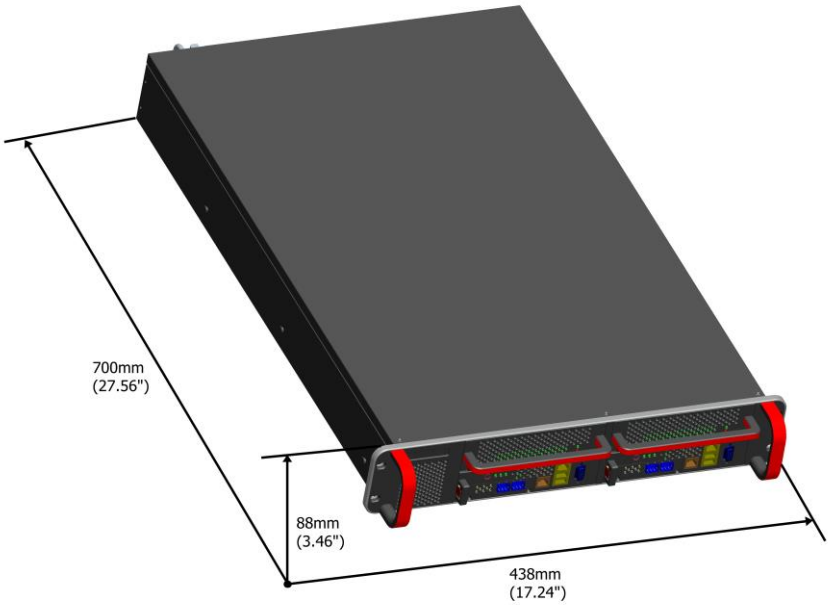
The pin definitions for the Fan Connectors (FAN1 and FAN2) on the server sled Interface Board are shown in Table 11.

[Table 13] FAN Connector Pin Definition

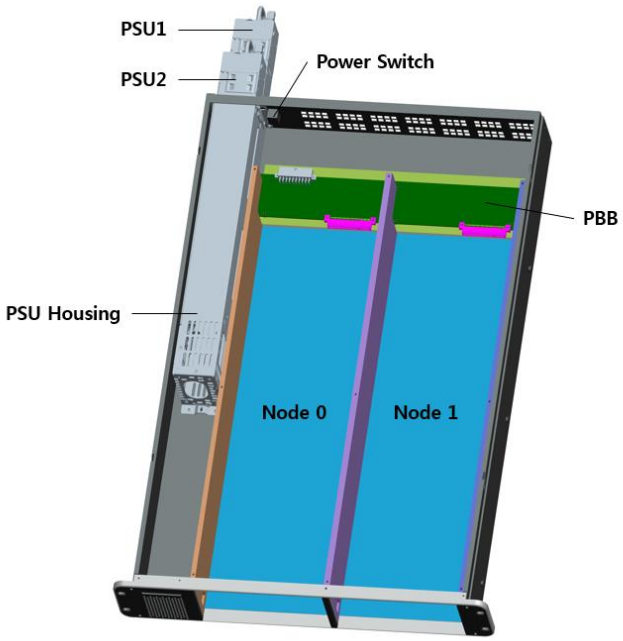
FAN Connector MOLEX 47053-1000	
Pin	**Net Name**
1	GND
2	P12V_FAN
3	FAN_TACH_CPU
4	FAN_PWM_CPU

6.7 Chassis

The AF-Media chassis is 19” 2 RU rack mountable design with the dimensions 438mm(W) x 88mm(H) x 700mm(D), as shown in Figure 33. The chassis accommodates two server sleds, 1 Power Backplane Board, 2 PSUs and other mechanical elements as shown in Figure 34. These mechanical elements are used to simplify assembly by acting as component installation guides.



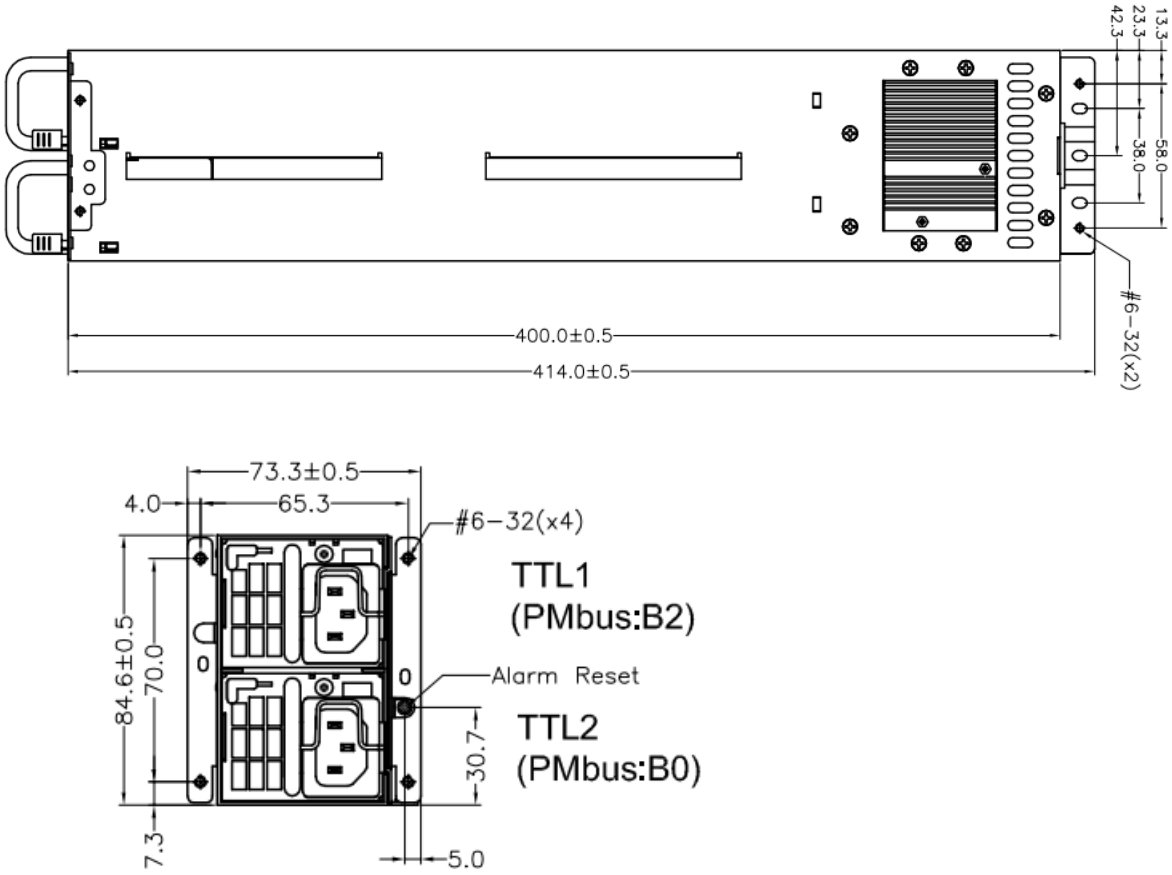
[Figure 33] AF-Media Chassis



[Figure 34] Chassis Components

6.8 Power Supply

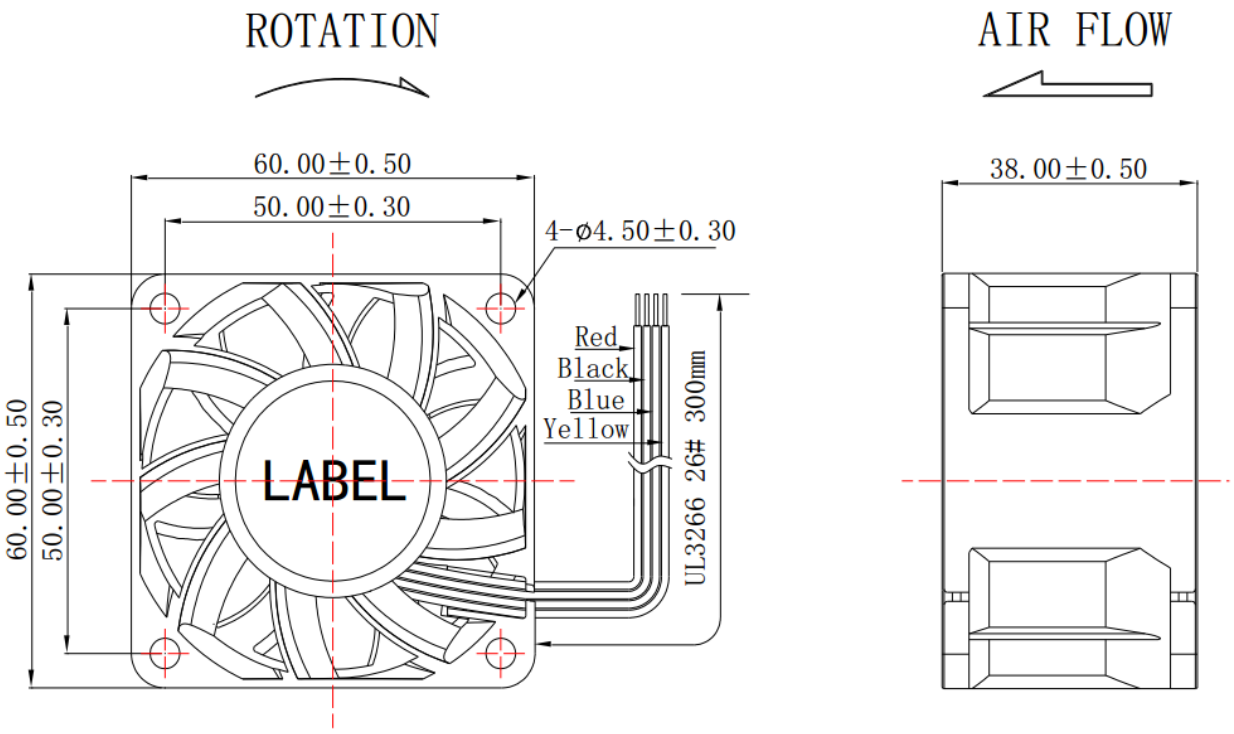
The AF-Media uses two 750W 1+1 Redundant Power Supply Units (PSU), Zippy part number M1U2-5750V4V.



[Figure 35] Power Supply Units

6.9 Fans

The fans used in the chassis are Shenzhen Huaxia Hengtai Electronic Co., Ltd model DZ06038B12MG (60mm x 60mm x 38mm). Two fans are installed in each node. The fan controller is the AST2400 BMC.



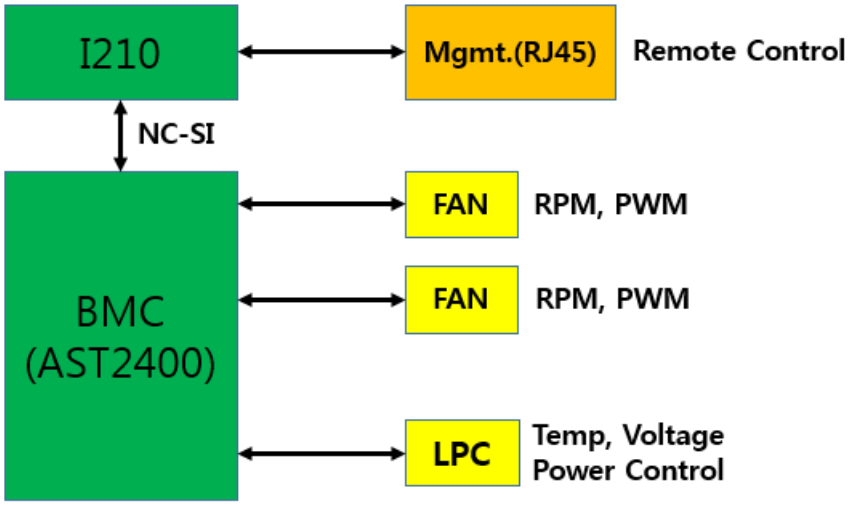
[Figure 36] Fan Module

6.9.1 CFM

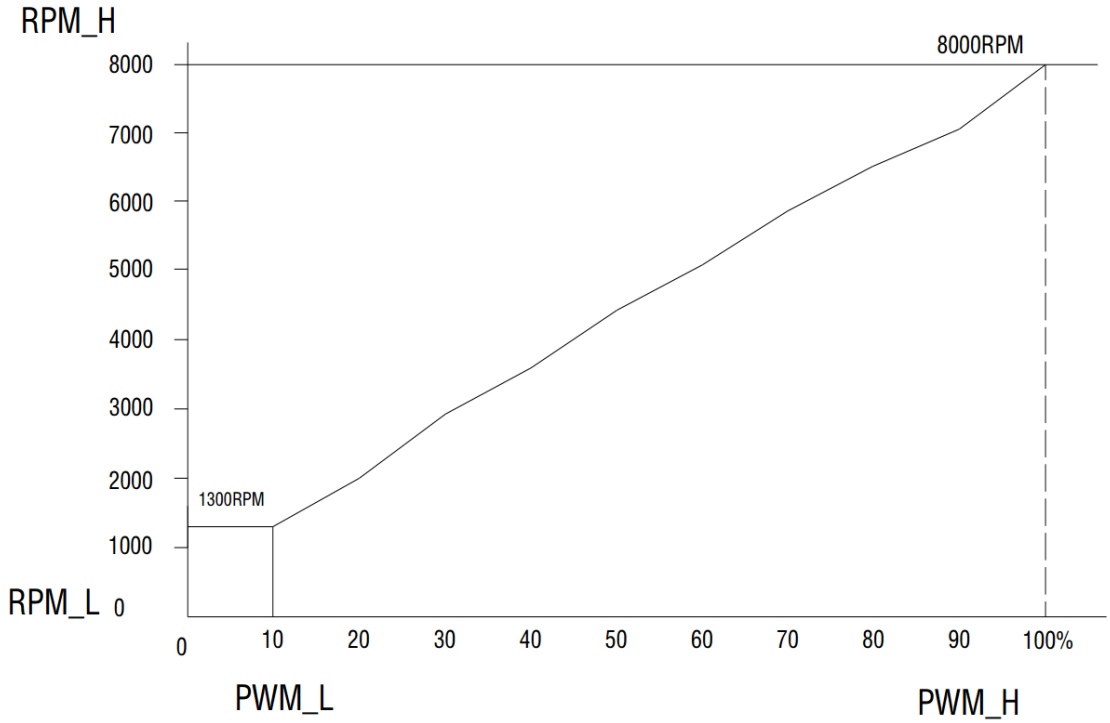
Each fan has a maximum air flow of 44.52 CFM. This is sufficient to cool a CPU with a Thermal Design Power (TDP) of 45W when operating at maximum 35 ℃ ambient temperature.

6.9.2 Fan Control

The AST2400 BMC on the motherboard is used to control the fan signals. Figure 37 and Figure 38 illustrate the fan signal control mechanism. All fans run at the same speed and are managed by the highest PWM of server nodes.



[Figure 37] Fan Control Diagram



[Figure 38] Fan PWM-curve Graph

6.10 Environmental Requirements

The system meets the following environmental requirements:

- Ambient operating temperature range: -5 to +35 degree C
- Storage relative humidity: 10% to 90% (non-condensing)
- Storage temperature range: -20 to +70 degree C
- Operating altitude with no de-ratings to 1000m (3300 feet)

6.11 Regulations

Planned certifications are listed below:

- EMC : CE, FCC, VCCI, KCC, CCC
- Safety: CB, UL

The system should be compliant with RoHS and WEEE

6.12 Operating System Compatibility

The System needs to be compatible with the following operating systems:

- RedHat Enterprise Linux 7.0
- CentOS 6.7 (64bits)
- Windows Server 2012 R2

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