Open edge chassis

Revision 0.1

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# Contents

# 2 Overview

This document describes the technical specifications of the Open edge server chassis. Open edge server is a compact, high-performance server platform optimized for installation to edge sites, where facilities are limited in floor space, cooling capacity and power feed capacity.

Main features of the Open edge server chassis

- 3RU high eclosure, Depth 430 mm
- compatible with standard 19" mechanics
- support for 1U or 2U, half width sleds
- Redundant power feed, AC or DC
- Air flow direction configurable from front to rear of rear to front
- Chassis management controller, RMC

The key requirements guiding the design of Open edge chassis and sled hardware are listed below

Edge site requirements

- Limited floor space (-> small form factor)
- Varying thermal conditions (-> extended temperature range)
- Limited power feed capacity (-> system scaleability from one chassis to multiple racks)
- Varying types of power feed (-> DC, AC, 3-phase, 1-phase with PDUs)
- VRAN/ MEC accelerator capability (-> support for FHHL/FHFL upto 400/700 W power per sled)

OCP design principles

- Centralized power feed
- Front access
- Tool-les maintenance
- Vanity free design

An Open edge chassis supports upto 5 1RU, half width sleds that can have various of functions, for example servers, gateways, JBODs etc. Also 2RU sleds are supported. Chassis management (sleds, PSUs) is done in a centralized manner through a rack management controller unit (RMC) via backplane. Another function of the backplane is to feed power to the sleds, via the power distribution board.

The Open edge chassis is shown in Figure 1. All operations are done at the front side of the chassis. All units units (PSUs, RMC, sleds) are inserted and removed from the front. All interfaces are also in the front.

Figure 2 illustrates 1U and 2U server sleds.

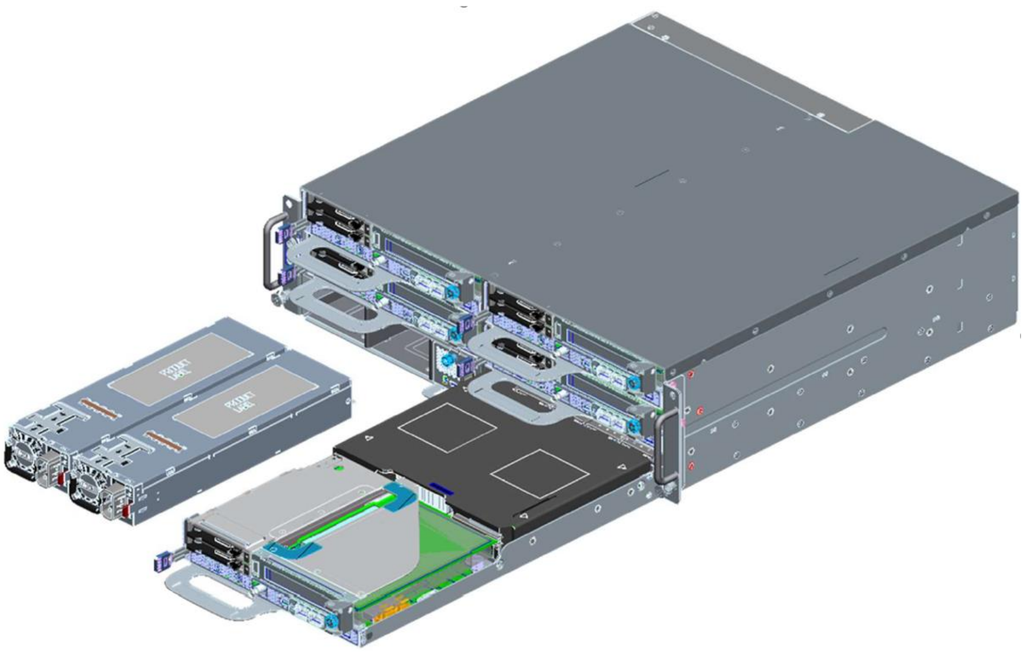

*Figure 1  Open edge server chassis*

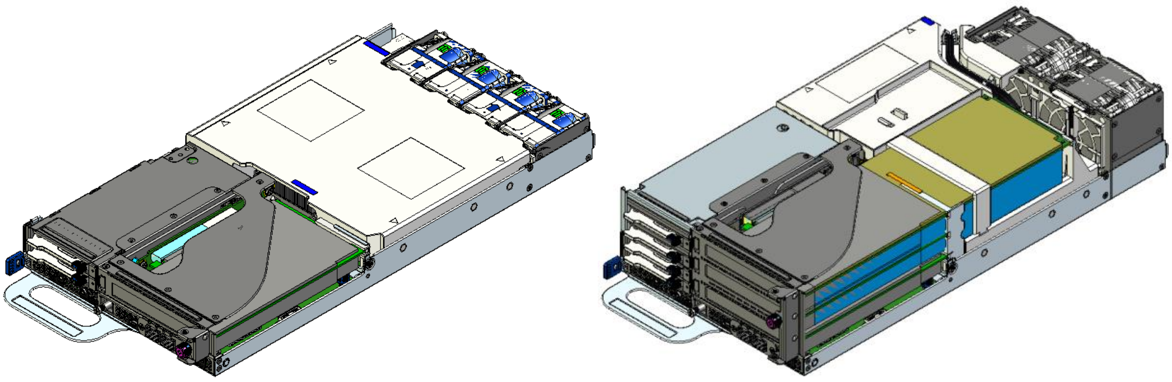

*Figure 2  Open edge server sleds, 1U (left) and 2U (right)*

# 3 Rack Compatibility

The Open edge chassis is compatible with standard 19” four-post racks (EIA-310). The chassis occupies 3 rack units (RU). The practical minimum depth for a rack is 600 mm.

Installation is done using a shelf. An adjustable shelf solution supports installation to racks having various depths. The distance between rack’s front and rear posts can vary in the range of 450 mm to 750 mm.

The Open edge chassis has front cabling, requiring 100 to 150 mm of space in front side of the rack. Depending on the site installation requirements, front posts of rack may need be recessed accordingly.

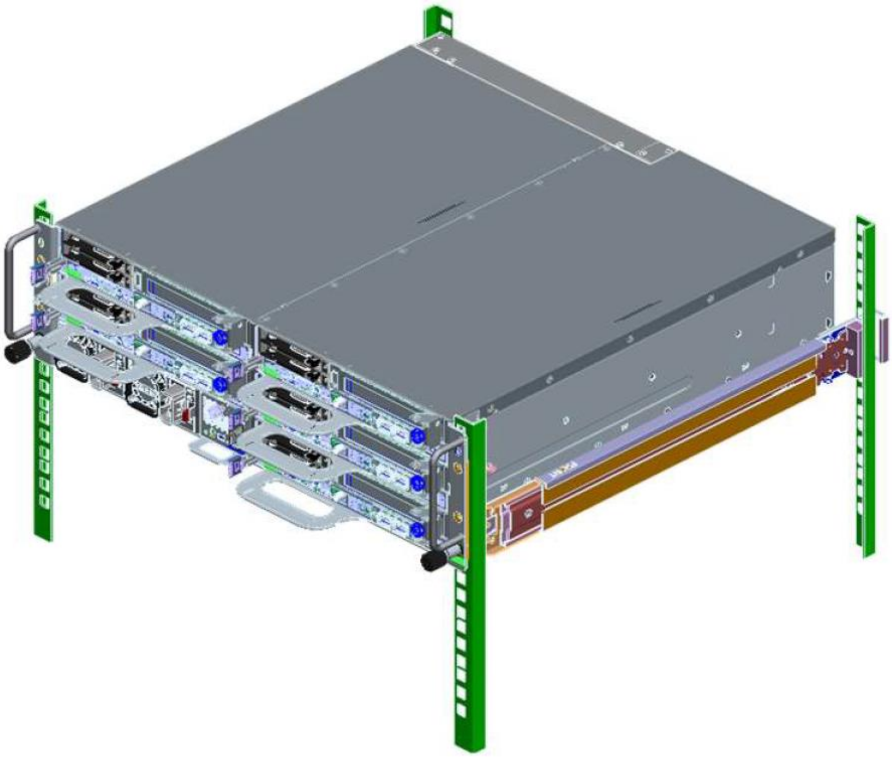

*Figure 3 Open edge chassis installed in 19” rack frame using an adjustable shelf*

# 4 Chassis Specifications

The key specifications of Open edge chassis and sleds are shown in Table 1.

*Table 1 Key specifications of Open edge chassis*

| Technical specifications | |
|---|---|
| Form factor | 3U, 19” rackmount |
| Server sled bays | Possible server configurations<br>• 5 x 1U sled<br>• 1 x 2U sled + 3 x 1U sled<br>• 2 x 2U sled + 1 x 1U sled |
| Power supply | Dual, high efficiency, 1+1 redundant, hot-plug PSUs.<br>Available PSU options<br>• 230 VAC, 80+ platinum<br>  ○ operating voltage range 180 VAC…264 VAC, output power 2000 W,<br>  ○ operating voltage range 90 VAC…140 VAC, output power 1000 W<br>• -48 VDC, 80+ platinum<br>  ○ operating voltage range -40…-72, output power 2000 W |
| Sled power feed capacity | 400 W max (1U sled), 700 W max (2U sled) |
| Cooling | Autonomous fan units on sleds and PSUs, reversable air flow |
| HW management (RMC) | Integrated HW management controller (AST2520) supporting<br>• Ethernet interface for chassis management<br>  ○ 2 x 10 Gbit/s (SFP+) and 1 x 1 Gbit/s (RJ45) front panel interfaces for uplinks or chaining for multiple chassis<br>  ○ 1 Gbit/s management Ethernet interface to RMC and all sleds via backplane<br>• USB serial port for debug<br>• Redfish, IPMI |
| Operating conditions | Chassis, PSUs, RMC:<br>• Operating temperature range: -5 C …+45 C [ETSI EN300 019-1-3 Class 3.2]<br>• Short term operating temperature: -5 C to +55 C [GR-63-CORE]<br>• Non-operating temperature *): -25 C to +70 C<br>• Operating humidity: 5 % to 95 %<br>• Non-operating humidity *): 10 % to 100 %<br>• System startup temperature: min +5 C<br>*) Non-operating means conditions during transportation and storage (device is in its transportation package) |
| Weight | 9.2 kg (empty chassis) |
| Dimensions | 440 mm x 130.55 mm x 430 (W x H x D) |

The block diagram of Open edge chassis is shown in Figure 4 Block diagram of Open edge chassis Power supplies (PSUs) connect to the system through a power distribution board (PDB). Sleds are connected through a backplane (BP). A rack management controller (RMC) has the task of managing the PSUs and providing management Ethernet connectivity to the sleds.

Each sled has a hard-coded physical address [1…5] assigned to it through the backplane connector.

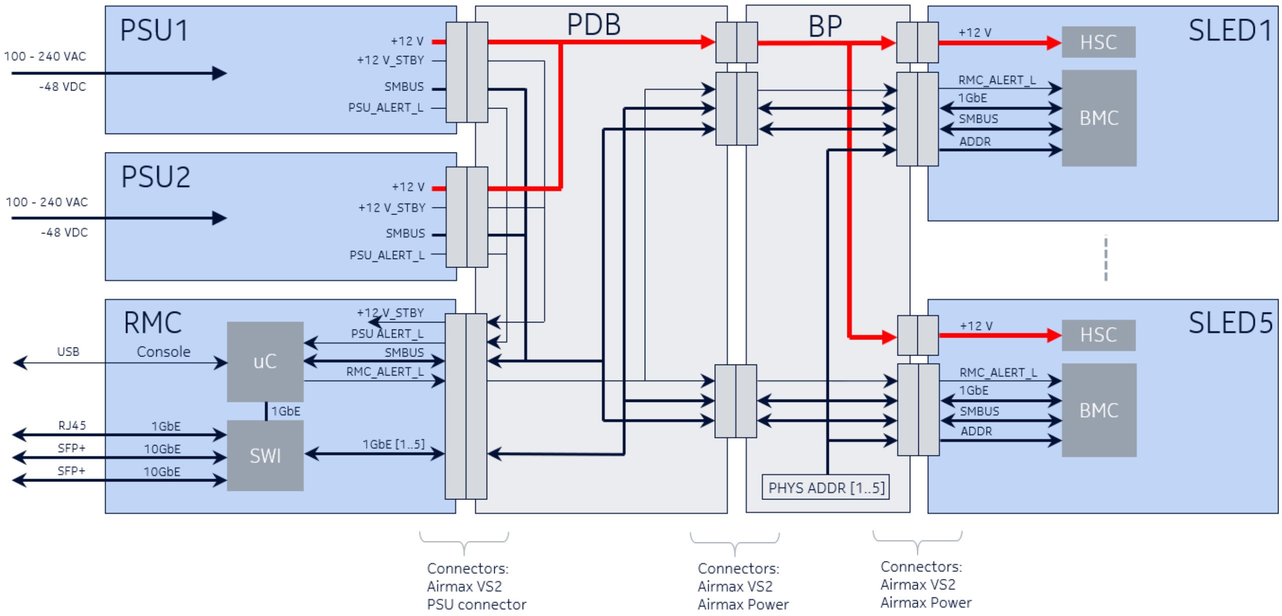


*Figure 4  Block diagram of Open edge chassis*

## 4.1 Chassis mechanics

Open edge chassis mechanical desing is simple, consisting of only few components.  The power distribution board, backplane assembly and mounting brackets are attached to a steel enclosure.

The complete chassis assembly is shown in Figure 5.

The rear wall of the chassis is perforated to allow front-to-rear or reversed cooling air flow.   For rack installation, a shelf is needed.  The mounting brackets alone are not capable of carrying the entire weight of a fully populated chassis.  A dedicated, adjustable sliding shelf is availabe for installation the Open edge chassis into a standard 19” rack, but a generic L-bracket is also usable.

The outer dimensions of the chassis are shown in Table 1.

*Table 2  Outer dimensions of the Open edge chassis*

| | Dimension |
|---|---|
| Height | 130.55 mm |
| Width | 440 mm |
| Depth | 430 mm |

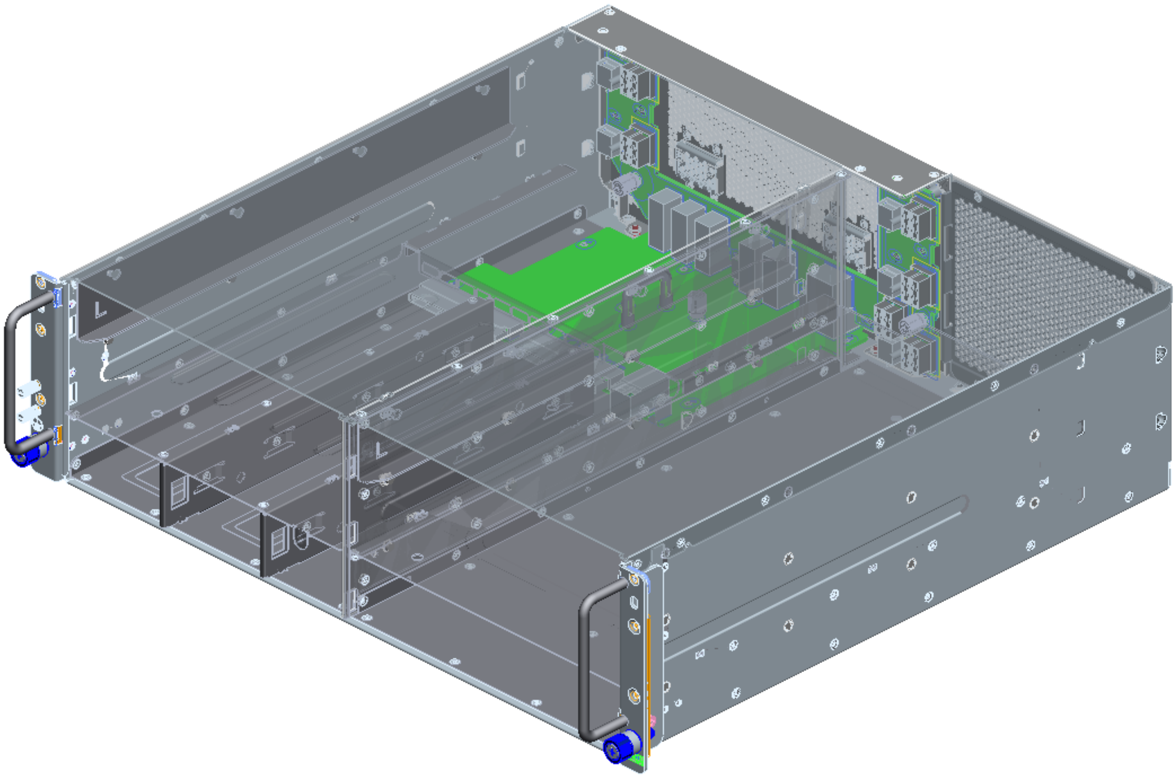

*Figure 5 Open edge chassis with power distribution board and backplane*

The Open edge chassis supports two types of sleds, 1U and 2U. One 2U sled can be installed in place of two 1U sleds in the upper locations. 1U sleds in the top row have support brackets on the inner sides of the chassis. When a 2U sled is installed, the support brackets are removed. Removal and installation is tool-les. Removal is illustrated in Figure 6.

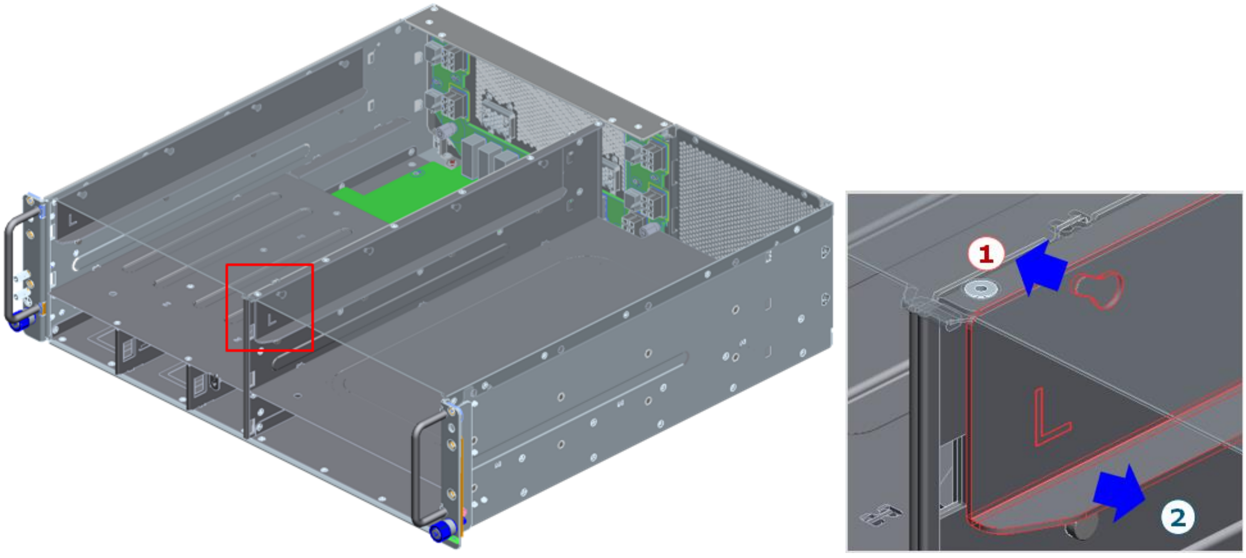


*Figure 6 Removal of support brackets of uppermost 1U sleds*

The supported combinations of 1U and 2U sleds in an Open edge chassis are shown in Figure 7, Figure 8 and Figure 9. Physical addresses for the particular sled locations is also shown.


*Figure 7 Open edge chassis with five 1U sleds*

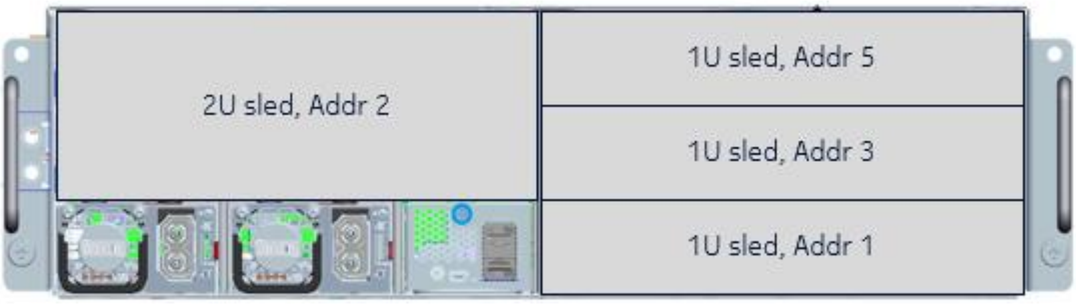


*Figure 8 Open edge chassis with three 1U sleds and one 2U sled*

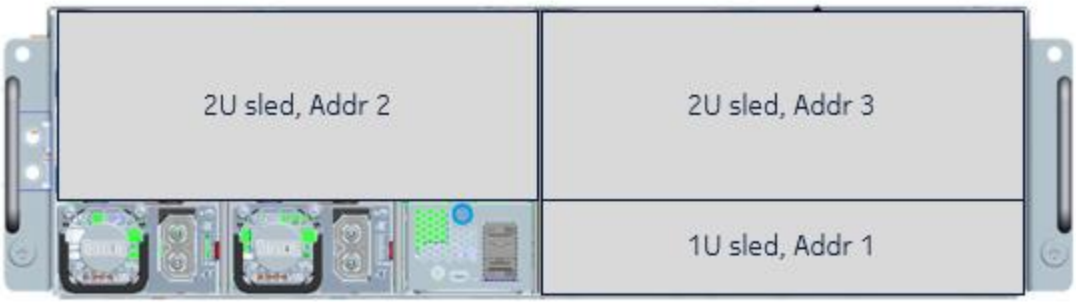


*Figure 9 Open edge chassis with one 1U sled and two 2U sleds*

For an ampty 1U slot in the chassis, a filler sled is used. The purpose of the filler sled is to act as an EMI shield, serve as an air blocker for the server sled below and to provide protection against fire spread.

## 4.2 Sled mechanics

The sled consists of a sheet metal tray with a handle, and the release latch mechanism. Other key aspects of the sled design are location of backplane connectors (Figure 10), vertical positioning of the circuit board and release latch (Figure 11) and the latch design overall (Figure 12).

It is critical from the point of view of system interoperability that these details are implemented according to the mechanical specifications of the sled. In other respects the tray can be designed mechanically to meet other product requirements, such as location of circuit board support pillars, fixing points for sub-assemblies or front panel design.

The front panel of the sled shall provide the necessary EMC shielding.

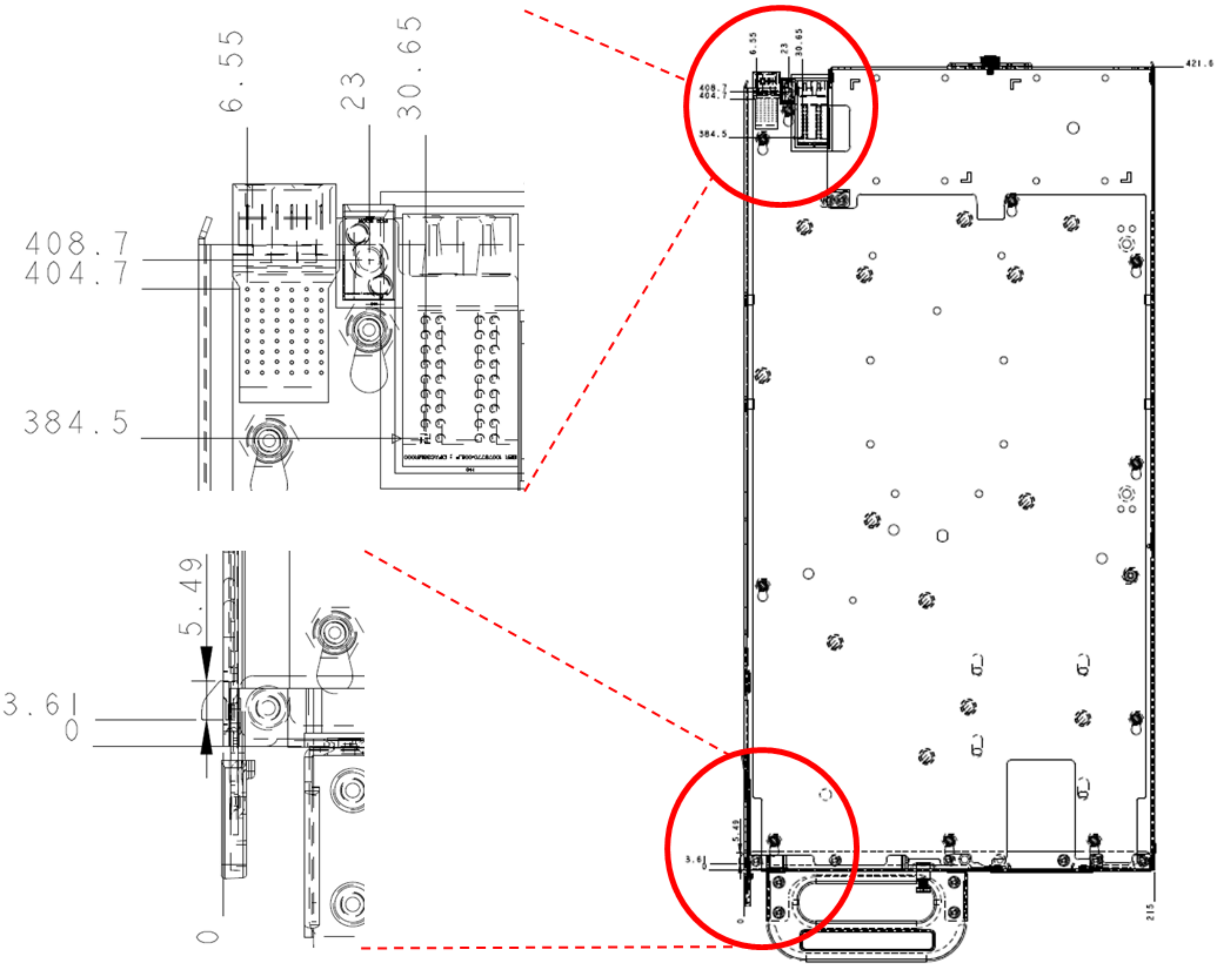


*Figure 10 Open edge sled connector locations*

*Table 3 Outer dimensions of the Open edge sled*

| | Dimension, max |
|---|---|
| Height | 41 mm (1U), 83.55 mm (2U) |
| Width | 215 mm |
| Depth | 427.5 mm |

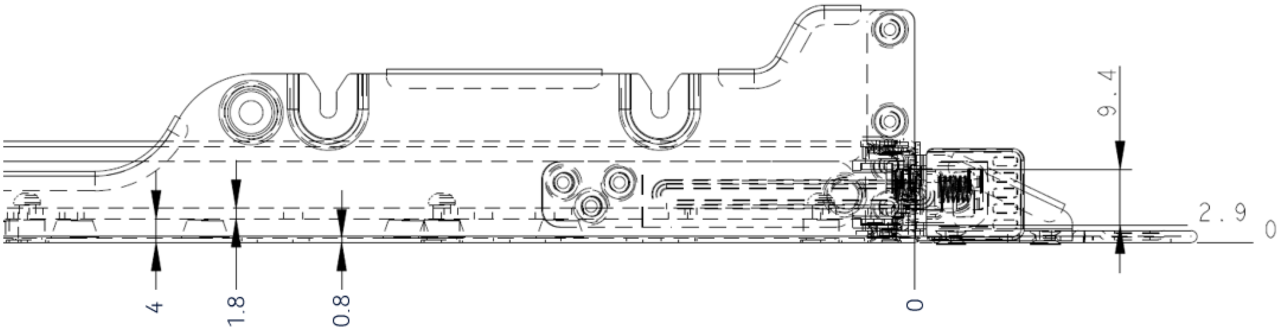


*Figure 11 Vertical displacement of PCB and release latch tongues*

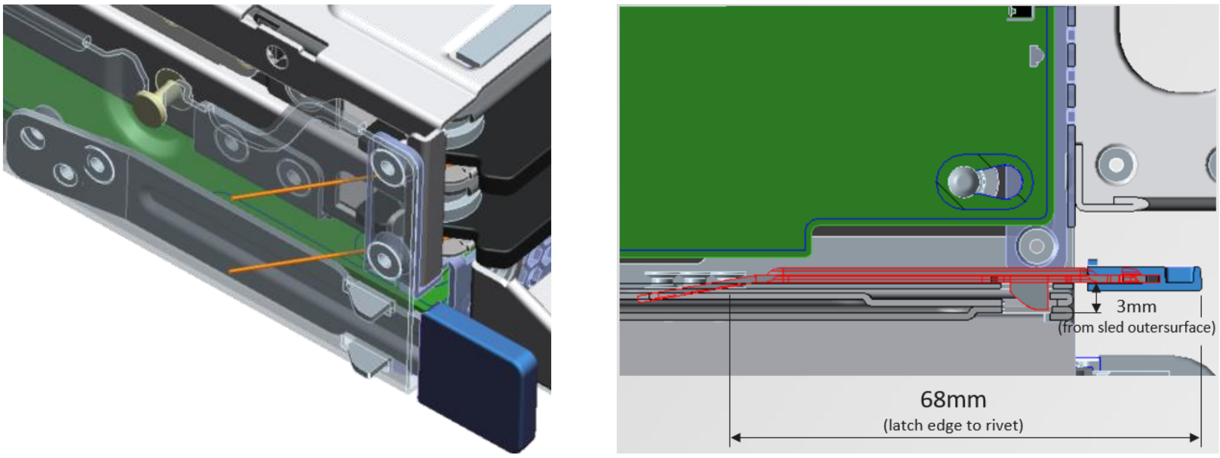


*Figure 12 Sled release latch*

## 4.3 Chassis backplane

The Open edge chassis backplane provides power feed to the sleds and signaling between the sleds and RMC. There is one power connector and one signal connector for interfacing each sled. Sled 1 has an extra power connector for possible future use.

The backplane connects directly to the power distribution board via AirMax power and signal connectors. The board has 8 layers for power delivery. Thickness of copper is 70 um/ 2 Oz.

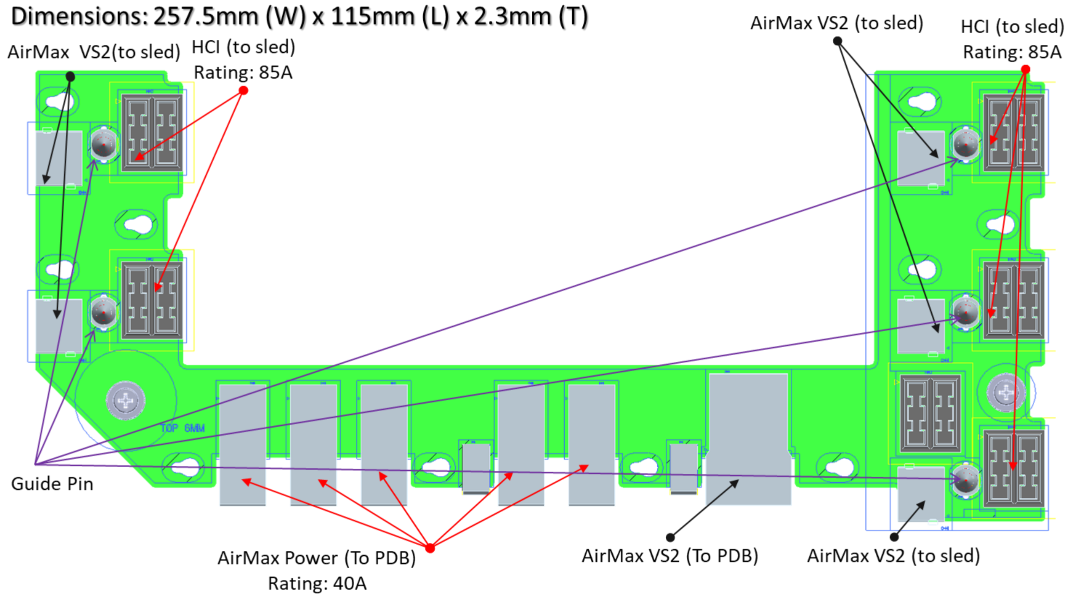


*Figure 13 3U backplane connector placement*

| STACKUP | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Target Z (ohms) - MicroStrip | 50 | Breakout |
| | | | | | | | Target Z (ohms) - StripLine | 50 | |
| | | | | | | | Z tolerance | ±10% | |
| | | | | | | | Z Type | Single | Single |
| Layer# | Material | Description | Copper Weight (oz) | Thickness (mil) | Tolerance (mil) | Glass Fabric | Er | Width | Width |
| | | Soldermask | | 0.60 | | | 3.8 | | |
| 1 | | TOP | 0.5+plating | 1.95 | | | | 4.5 | 4 |
| | IT-170GRA1 | PP | | 2.70 | ±0.709 | 1080x1 | 3.8 | | |
| 2 | | GND | 2 (RTF) | 2.60 | | | | | |
| | IT-170GRA1 | CORE | | 4.00 | ±0.709 | 106x2 | 3.8 | | |
| 3 | | IN1 | 2 (RTF) | 2.60 | | | | 5 | 4 |
| | IT-170GRA1 | PP | | 14.25 | ±1.97 | 2116x3 | 3.9 | | |
| 4 | | VCC | 2 (RTF) | 2.60 | | | | | |
| | IT-170GRA1 | CORE | | 28.00 | ±2.52 | 7628x4 | 4.1 | | |
| 5 | | VCC1 | 2 (RTF) | 2.60 | | | | | |
| | IT-170GRA1 | PP | | 14.25 | ±1.97 | 2116x3 | 3.9 | | |
| 6 | | IN2 | 2 (RTF) | 2.60 | | | | 5 | 4 |
| | IT-170GRA1 | CORE | | 4.00 | ±0.709 | 106x2 | 3.8 | | |
| 7 | | GND1 | 2 (RTF) | 2.60 | | | | | |
| | IT-170GRA1 | PP | | 2.70 | ±0.709 | 1080x1 | 3.8 | | |
| 8 | | BOTTOM | 0.5+plating | 1.95 | | | | 4.5 | 4 |
| | | Soldermask | | 0.60 | | | 3.8 | | |
| | | | Total | 90.60 | ±10% | | | | |

*Table 4 PCB stackup of 3U backplane board*

### 4.3.1 Backplane power connector

The chassis backplane will distribute +12 V power to the sleds.  Power feed capacity is 400 W for a 1U sled and 700 W for a 2U sled.  Power is fed through HCI High Power connector (FCI 10078768-001LHLF, or equivalent) having current capacity of 85 A.

The corresponding power connector on the sled is FCI 10078770-002LHLF, or equivalent.

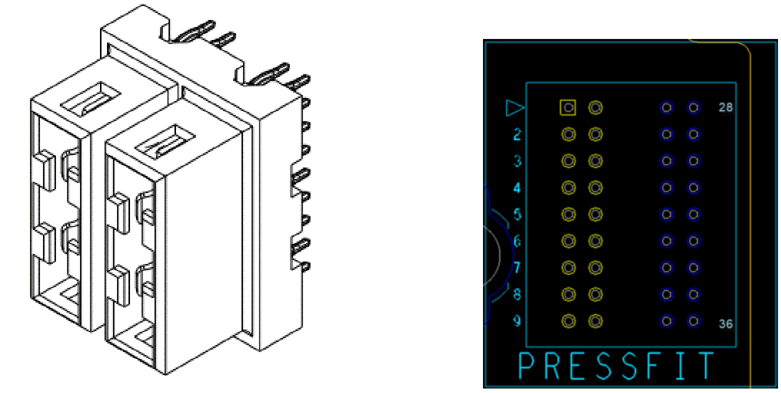


*Figure 14 Backplane power connector (HCI) with board layout*

*Table 5  Pin assignment of backplane power connector*

| Pin | Signal name | Description |
|---|---|---|
| 1-18 | P12V_PSU | +12 V power feed to sled |
| 19-36 | GND | Ground, +12 V return |

### 4.3.2 Backplane signal connector

The signal connector between backplane and sled is a 6 x 9 pin Airmax VS2 connector (FCI 10130665-102LF, or equivalent).  The corresponding signal connector on the sled is FCI 10124149-102LF, or equivalent.  The backplane connector is shown in Figure 15.

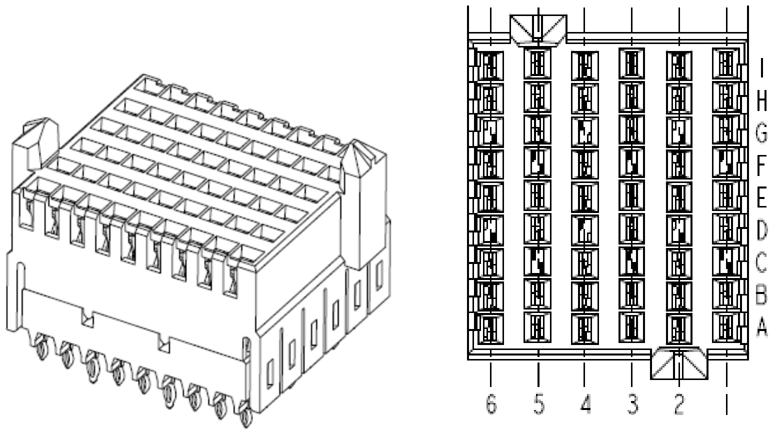

*Figure 15 Backplane signal connector with pin map*

*Table 6 Pin assignment of backplane signal connector*

| | | | | | | |
|---|---|---|---|---|---|---|
| GND (sled only) | NC | GND (sled only) | NC | GND (sled only) | NC | J |
| PD_SLED1_PRSNT_RETURN | GND | NC | GND | LAN_SLED1_MDIN3 | GND | I |
| PD_BBU_A0 | SMB_SLED_BUF_SDA | PD_SLED1_CHASSIS_INTRUSION | FM_BMC_SLED1_READY_N | LAN_SLED1_MDIP3 | LAN_SLED1_MDIN2 | H |
| GND | SMB_SLED_BUF_SCL | GND | FM_RMC_GPIO_2 | GND | LAN_SLED1_MDIP2 | G |
| FM_BBU_PRSNT_N | GND | NC | GND | NC | GND | F |
| SMB_BBU_ALERT_R_N | NC | NC | FM_RMC_GPIO_1 | SB_SLED1_ADDR_2 | LAN_SLED1_MDIN1 | E |
| GND | NC | GND | FM_RMC_GPIO_0 | GND | LAN_SLED1_MDIP1 | D |
| SMB_PMBUS_BBU_SDA | GND | NC | GND | SB_SLED1_ADDR_1 | GND | C |
| SMB_PMBUS_BBU_SCL | NC | NC | FM_SLED1_PRSNT_N | SB_SLED1_ADDR_0 | LAN_SLED1_MDIN0 | B |
| GND | | GND | IRQ_RMC_ALERT_N | GND | LAN_SLED1_MDIP0 | A |
| 6 | 5 | 4 | 3 | 2 | 1 | |

*Table 7 Backplane signal connector descriptions (signal direction I/O/bidir form backplane perspective)*

| Signal | Type | Description |
|---|---|---|
| SB_SLED1_ADDR_[2..0] | Output | Physical address from backplane to sled. |
| LAN_SLED1_MDIP[3..0]<br>LAN_SLED1_MDIN[3..0] | Bidir | 1000BASE-T between RMC and sled. Magnetics required on sled. |
| FM_RMC_GPIO_[2:0] | Output | General purpose I/O signals from RMC to sleds (common to all sleds). |
| FM_BMC_SLED1_READY_N | Input | BMC status signal from sled to RMC. Active low. |
| FM_SLED1_PRSNT_N | Input | Sled presence info from sled to RMC. Active low. |
| PD_SLED1_PRSNT_RETURN | Output | Connects to ground in backplane, pulling FM_SLED1_PRSNT_N (or FM_BBU_PRSNT_N) low when sled is inserted to chassis. |
| IRQ_RMC_ALERT_N | Output | Alert signal from RMC to sleds (common to all sleds). Active low. |
| PD_SLED1_CHASSIS_INTRUSION | Ouput | Signal used to detect removal of sled. Connects to GND in backplane. Active high. |
| SMB_SLED_BUF_SDA | Bidir | SMBUS data between RMC and sleds (common to all sleds). |
| SMB_SLED_BUF_SCL | Output | SMBUS clock from RMC to sleds (common to all sleds). |
| PD_BBU_A0 | Output | Physical address bit used only by BBU unit. Signal present for sled1 only. Signal used with BBU only. |
| FM_BBU_PRSNT_N | Input | BBU presence info from to RMC. Active low.<br>Signal present for sled1 only. Signal used with BBU only. |

| | | |
|---|---|---|
| SMB_BBU_ALERT_R_N | Input | Alert signal from BBU to RMC. Active low.<br>Signal present for sled1 only. Signal used with BBU only. |
| SMB_PMBUS_BBU_SDA | Bidir | SMBUS data between RMC and BBU.<br>Signal present for sled1 only. Signal used with BBU only. |
| SMB_PMBUS_BBU_SCL | Out | SMBUS clock from RMC to BBU.<br>Signal present for sled1 only. Signal used with BBU only. |

## 4.4 Backplane guide pin

A guide pin in the backplane enables reliable mating of power and signal connectors between the backplane and sled. The guide pin is of type Starconn D11402-200000-Z1, or equivalent. The receptable on the sled is of type Starconn D11403-000A00-Z1, or equivalent.

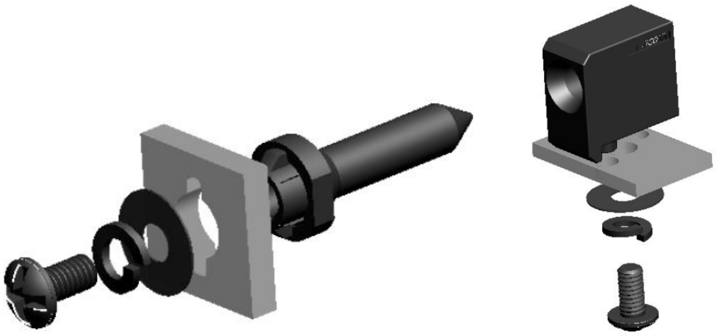

*Figure 16 Guide pin in backplane and receptable on sled board.*

## 4.5 Chassis power distribution board

The power distribution board connects PSUs and RMC to rest of the system. The backplane is attached vertically to AirMax rear power and signal connectors.

The board has 8 layers for power delivery. Thickness of copper is 70 um/ 2 Oz.

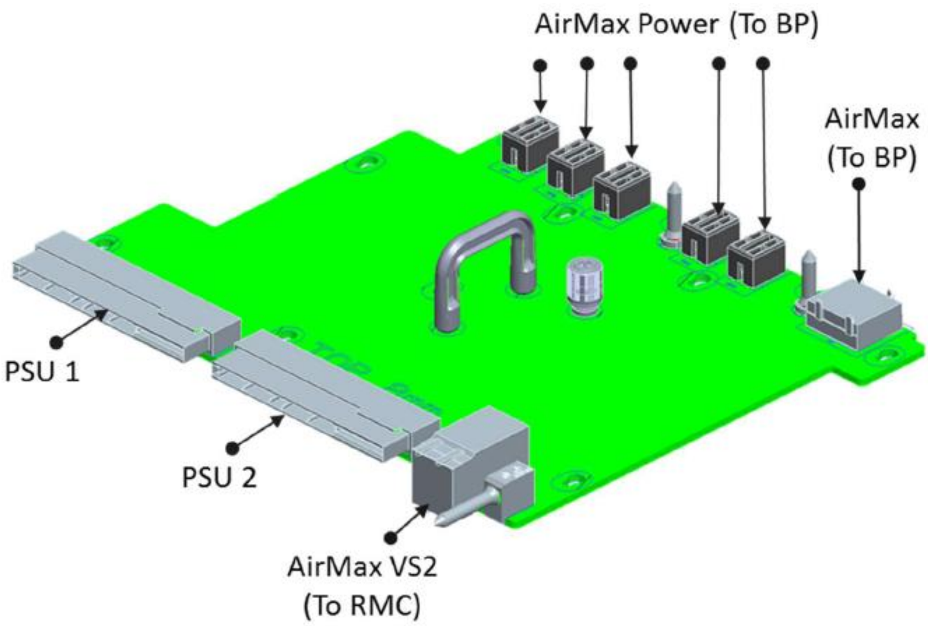


*Figure 17 Open edge power distribution board*

| STACKUP | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Target Z (ohms) - MicroStrip | 50 | Breakout |
| | | | | | | | Target Z (ohms) - StripLine | 50 | |
| | | | | | | | Z tolerance | ±10% | |
| | | | | | | | Z Type | Single | Single |
| **Layer#** | **Material** | **Description** | **Copper Weight (oz)** | **Thickness (mil)** | **Tolerance (mil)** | **Glass Fabric** | **Er** | **Width** | **Width** |
| | | Soldermask | | 0.60 | | | 3.8 | | |
| 1 | | TOP | 0.5+plating | 1.95 | | | | 4.5 | 4 |
| | IT-170GRA1 | PP | | 2.70 | ±0.709 | 1080x1 | 3.8 | | |
| 2 | | GND | 2 (RTF) | 2.60 | | | | | |
| | IT-170GRA1 | CORE | | 4.00 | ±0.709 | 106x2 | 3.8 | | |
| 3 | | IN1 | 2 (RTF) | 2.60 | | | | 5 | 4 |
| | IT-170GRA1 | PP | | 14.25 | ±1.97 | 2116x3 | 3.9 | | |
| 4 | | VCC | 2 (RTF) | 2.60 | | | | | |
| | IT-170GRA1 | CORE | | 28.00 | ±2.52 | 7628x4 | 4.1 | | |
| 5 | | VCC1 | 2 (RTF) | 2.60 | | | | | |
| | IT-170GRA1 | PP | | 14.25 | ±1.97 | 2116x3 | 3.9 | | |
| 6 | | IN2 | 2 (RTF) | 2.60 | | | | 5 | 4 |
| | IT-170GRA1 | CORE | | 4.00 | ±0.709 | 106x2 | 3.8 | | |
| 7 | | GND1 | 2 (RTF) | 2.60 | | | | | |
| | IT-170GRA1 | PP | | 2.70 | ±0.709 | 1080x1 | 3.8 | | |
| 8 | | BOTTOM | 0.5+plating | 1.95 | | | | 4.5 | 4 |
| | | Soldermask | | 0.60 | | | 3.8 | | |
| | | | **Total** | **90.60** | **±10%** | | | | |

*Table 8 PCB stackup of power distribution board*

# 5 Power feed

Power feed of Open edge chassis is described in this chapter.

## 5.1 Power supplies

The open edge server chassis provides a redundant power feed. Both AC and DC power supplies are supported. Nominal output power is 2000 W. If one power feed or PSU fails, the remaining PSU is able to feed all power to the chassis.

There are PSU variants for front-to-rear air flow and rear-to-front air flow. The selection is made based on site cooling requirements. The primary direction of air flow is from front to rear.

### 5.1.1 PSU dimensions

The outer dimensions of Open edge power supplies are shown in Table 9. Drawings of PSU are shown in Figure 18, Figure 19 and Figure 20.

*Table 9 Outer dimensions of the PSU*

| | Dimension, max |
|---|---|
| Height | 40 mm |
| Width | 73.5 mm |
| Depth | 265 mm |

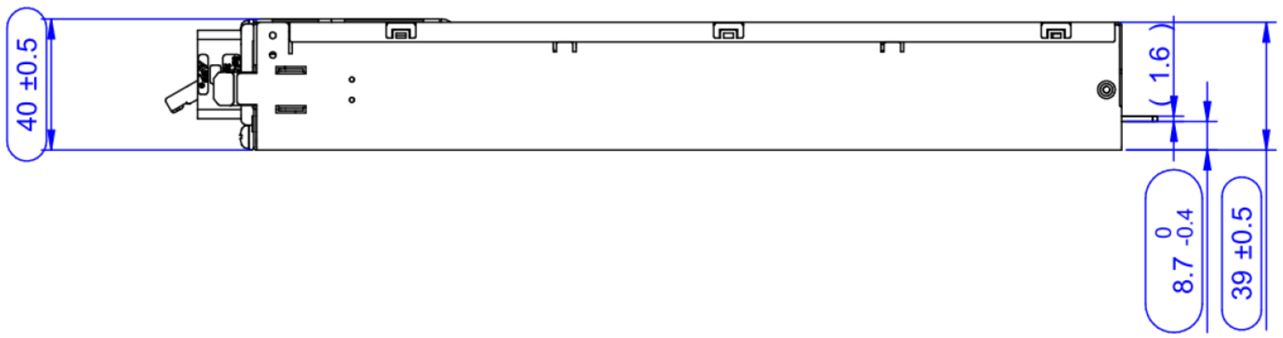


*Figure 18 PSU side view*

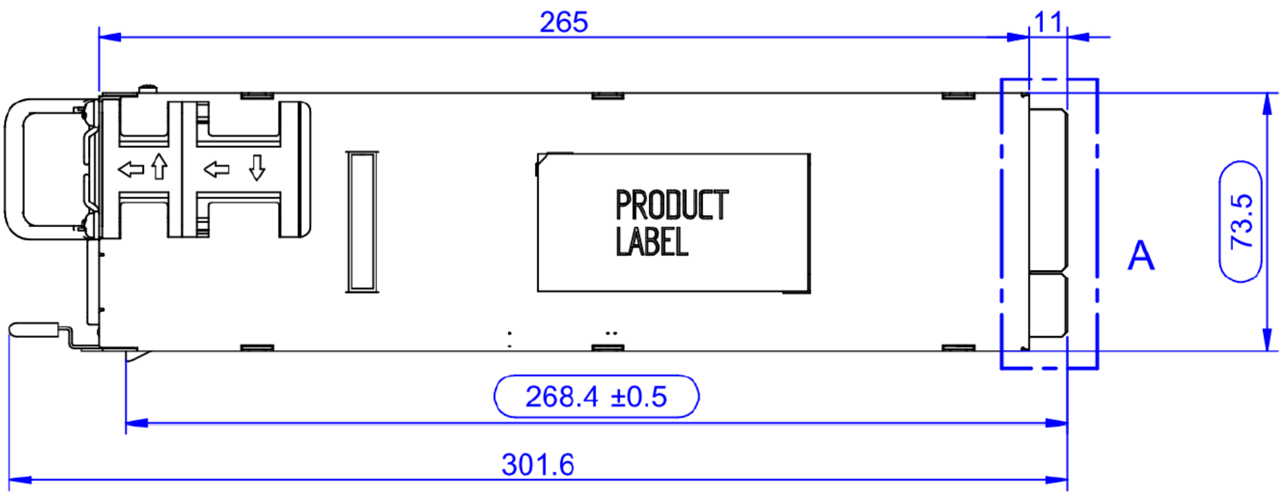


*Figure 19 PSU top view*

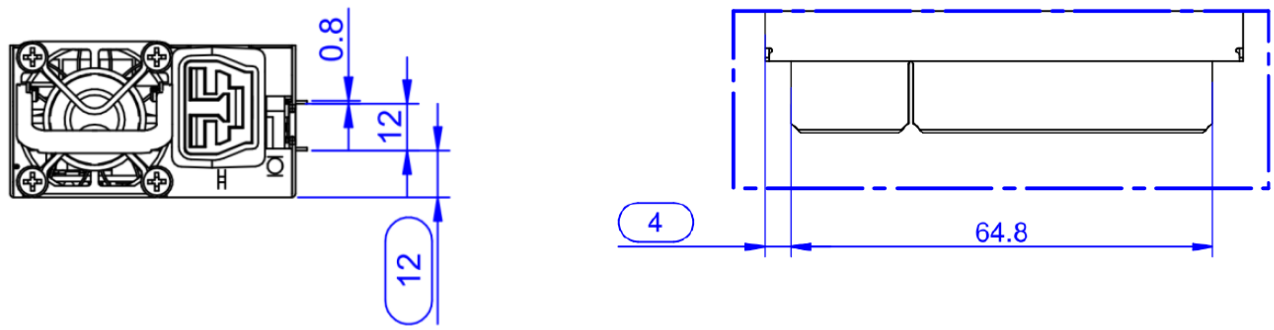


*Figure 20 PSU front view (left), detail A of PSU edge connector (right)*

### 5.1.2 PSU mating connector on power backplane

The mating connector on Open edge power distribution board is shown in Figure 21. The connector type is High Power Card Edge (FCI 10130248-005LF, or equivalent), having separate power (P) and signal (S) contact zones. Pin assignment of the connector is shown in Table 10.

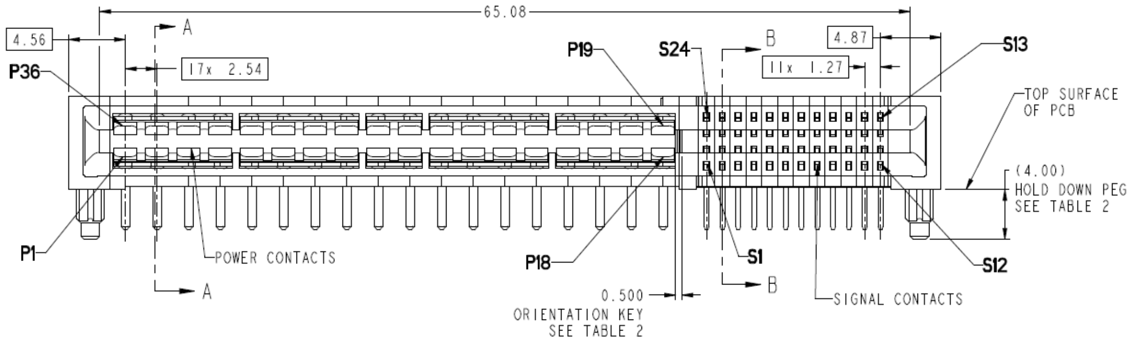


*Figure 21 PSU mating connector*

*Table 10 Pin assignment of PSU mating connector on Open edge power distribution board*

| Pin | Signal name | Description | Mating order *) |
|---|---|---|---|
| P1-P10 | GND | Power and signal ground (return) | 1 |
| P29-P36 | GND | Power and signal ground (return) | 1 |
| P11-P18 | P12_PSU | +12 VDC main input | 2 |
| P19-P28 | P12_PSU | +12 VDC main input | 2 |
| S1 | PD_PSU_A0 | SMBUS address output | 2 |
| S2 | PD_PSU_A1 | SMBUS address output | 2 |
| S3-S4 | P12V_PSU_STBY | +12 VDC stand-by input | 2 |
| S21-S22 | P12V_PSU_STBY | +12 VDC stand-by input | 2 |
| S5 | PSU_HOTSTANDBYEN_H | Hot standby enable ouput, active-high | 2 |
| S6 | PSU_ISHARE | Analog current share bus | 2 |
| S7 | N.C. | Not connected | 2 |
| S8 | FM_PSU_PRSNT_R_N | Power supply seated input, active-low | 3 |
| S9 | PD_PSU_A2 | SMBUS address output | 2 |
| S10-S15 | GND | Power and signal ground (return) | 1 |
| S16 | PWR_PSU_PWROK_R | Power OK signal input, active-high | 2 |
| S17 | PSU_REMOTE_SENSE_P | Main output positive sense | 2 |
| S18 | PSU_REMOTE_SENSE_R | Main output negative2 sense | 2 |
| S19 | RQ_PSU_ALERT_R_N | SMBUS Alert signal input, active-low | 2 |
| S20 | PD_PSU_PSON_N | PSU on output, active-low | 3 |
| S23 | SMB_PSU_SCL | SMBUS clock | 2 |
| S24 | SMB_PSU_SDA | SMBUS data | 2 |

*) 1 = first, 3 = last

## 5.2 Sled backplane power feed specifications

An Open edge sled design must allow safe removal and insertion without disturbing the rest of the system. All sled desings shall have a hot-swap controller (HSC) circuitry, such as the one used on Tioga Pass OCP server sled. The main tasks of the HSC include

- inrush current limiting during sled insertion and power-up
- overcurrent protection (OCP)
- undervoltage protection (UVP), overvoltage protection OVP)
- voltage and current metering
- power metering

The following tables provide specifications for the voltage range, nominal current and over current protection limits for Open edge 1U and 2U sleds.

*Table 11 Power feed specifications for 1U sled*

| Nominal input voltage | Minimum operating input voltage | Maximum operating input voltage | Maximum input current | Overcurrent limit, recommended |
|---|---|---|---|---|
| 12.0 V DC | 10.8 V DC | 13.2 V DC | 37 A | 42 A |

*Table 12 Power feed specifications for 2U sled*

| Nominal input voltage | Minimum operating input voltage | Maximum operating input voltage | Maximum input current | Overcurrent limit, recommended |
|---|---|---|---|---|
| 12.0 V DC | 10.8 V DC | 13.2 V DC | 65 A | 72 A |

## 5.3 Grounding

Open edge chassis has two grounding points, one in the front and another in the rear side. Suitable grounding point can be selected based on the used rack and grounding solution. A grounding cable is connected to the chassis using a tw-hole lug. Stud spacing is 16 mm and stud size 6 mm.

When DC power feed is used, grounding the chassis to site ground is mandatory. Grounding path is from PSU GND output to chassis via power distribution board.

The front and rear grounding points are shown in Figure 22 Open edge chassis front (left) and rear (right) grounding points

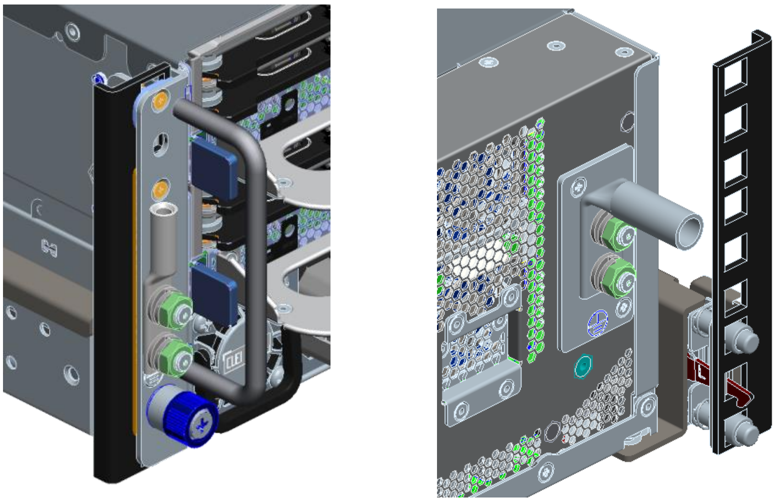

*Figure 22 Open edge chassis front (left) and rear (right) grounding points*

# 6 Chassis HW management

HW management functions of Open edge chassis are performed via the rack management controller (RMC) unit. The main task of RMC is to manage the PSUs. In addition, RMC provides management Ethernet connectivity to all sleds via a single interface.

Note, that other than providing Ethernet connectivity, RMC is not involved in HW management of sleds. Instead, it is the responsibility of a higher layer datacenter management software entity.

RMC is hot-swappable. In case the RMC is removed during a maintenance operation, PSUs and all sleds will continue to operate normally.

A high-level block diagram of RMC and the connectivity between RMC and sleds is shown in Figure 23 Sled HW management

## 6.1 Sled HW management

As mentioned above, RMC provides HW management connectivity to the sleds, but the responsibility of the management function lies elsewhere in the system. The RMC contains an unmanaged Ethernet switch that provides connectivity from the front panel to the BMC of all sleds and the microcontroller of RMC. The physical media withing the chassis is 1000BASE-T. Magnetics are used at RMC and sleds.

There is also an SMBUS interface from RMC's microcontroller to the sleds that could act as a backup connection or it could be used for simple housekeeping tasks in case the sled has no BMC. In addition, there are few I/O pins connected from RMC to sleds for future use.

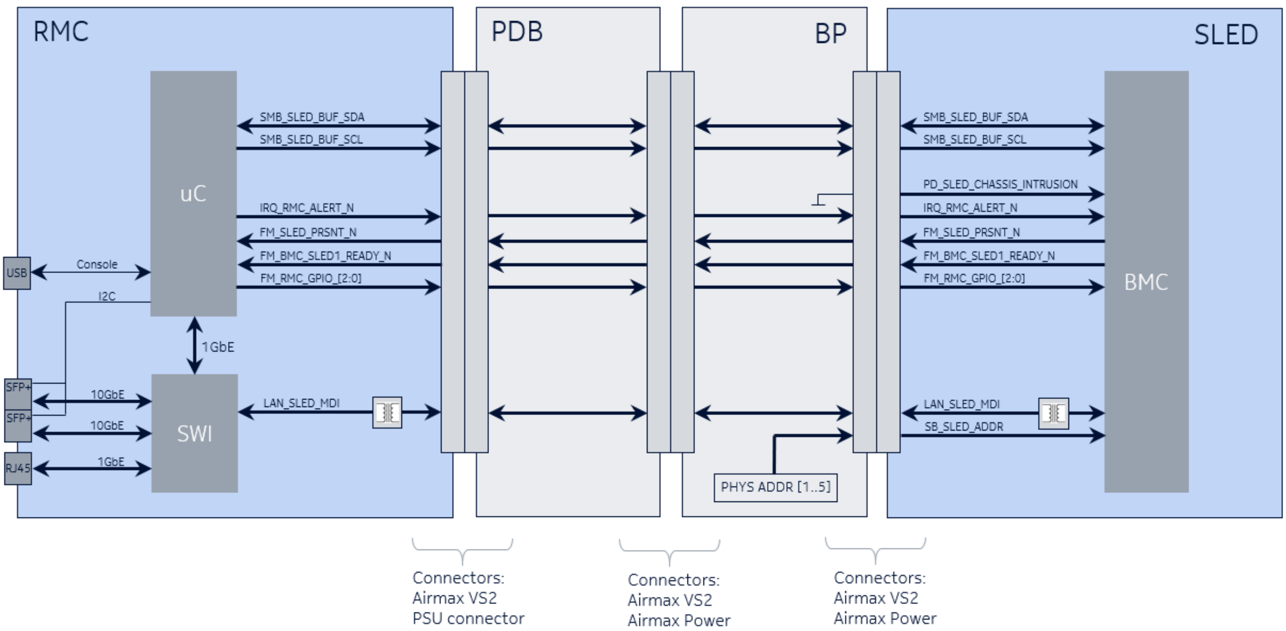


*Figure 23 Sled HW management connectivity*

In larger systems, multiple chassis can be chained together using the dual 10 Gbit/s Ethernet ports in the RMC front panel. This provides an alternative to using an external HW management switch to implement the required connectivity.

## 6.2 PSU HW management

HW management of PSUs is performed by the RMC unit. The interface is PMBUS and an alert or interrupt signal. In addition, PSUs inditate power OK/NOK using a hardwired signal. The RMC is powered from the stand-by power output of the PSUs.

The RMC monitors various PSU sensors, such as temperatures, input /output voltages, input /output currents, input power and fan speed. The RMC can also command a PSU to enter/exit stand-by mode and upgrade firmware.

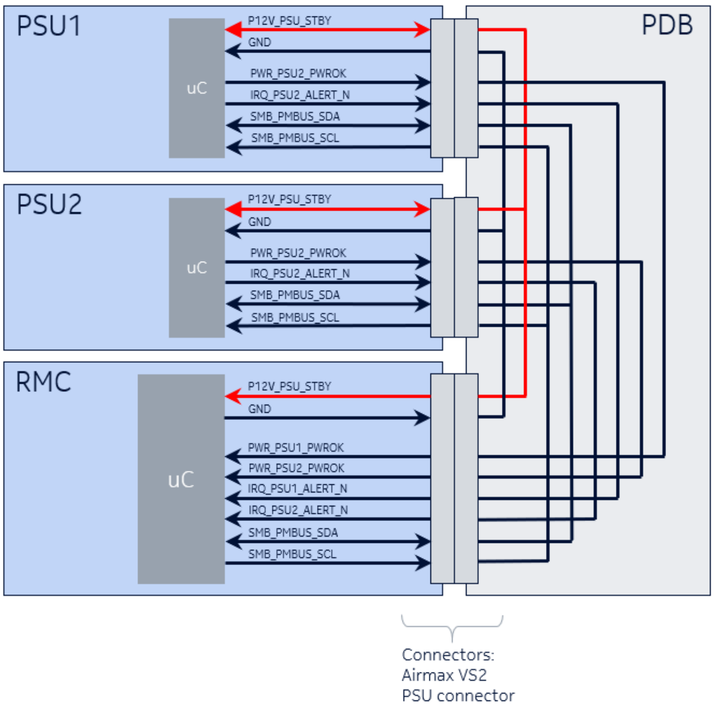


*Figure 24 PSU management*

## 6.3 RMC mechanics

The RMC consists of the circuit board and a metal enclosure. It's located on the right side of the PSUs, connecting to the power distribution board (PDB).

The outer dimensions of the RMC are shown in Table 13 Outer dimensions of the RMC

*Table 13  Outer dimensions of the RMC*

| | Dimension, max |
|---|---|
| Height | 41 mm |
| Width | 58 mm |
| Depth | 270 mm |

The connector between the RMC and power distribution board is a 8 x 13 Airmax VS2 (FCI 10133027-101LF, or equivalent). The corresponding connector on the RMC is FCI 10136593-102LF, or equivalent. The connector is shown in Figure 25  RMC signal connector with pin map.

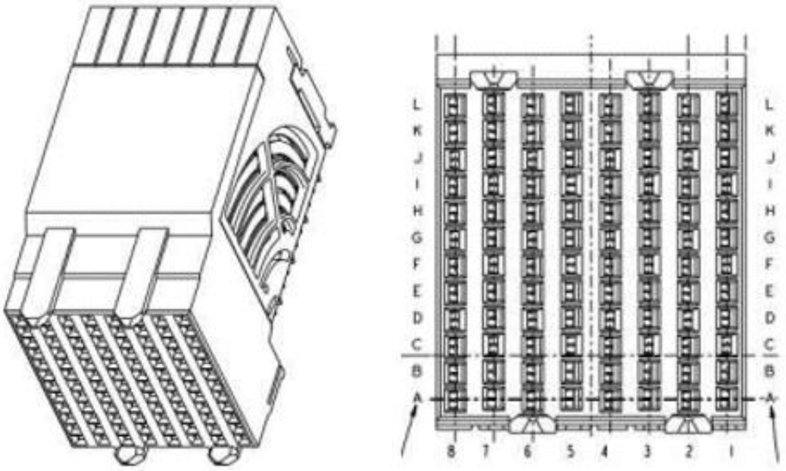


*Figure 25  RMC signal connector with pin map*

Pin assignment of the connector interface is shown in Table 14 Pin assignment of backplane signal connector.

*Table 14 Pin assignment of backplane signal connector*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| GND | | GND | | GND | | GND | | M |
| SMB_SLED_COMBINE_SDA | FM_SLED1_PRSNT_N | FM_RMC_GPIO_2 | GND | LAN_SLED4_MDIP3 | GND | LAN_SLED2_MDIN3 | GND | L |
| SMB_SLED_COMBINE_SCL | IRQ_RMC_ALERT_N | FM_RMC_GPIO_1 | LAN_SLED5_MDIP3 | LAN_SLED4_MDIP3 | LAN_SLED3_MDIP3 | LAN_SLED2_MDIP3 | LAN_SLED1_MDIP3 | K |
| FM_PSU2_PRSNT_N | IRQ_PSU2_ALERT_N | FM_RMC_GPIO_0 | LAN_SLED3_MDIN3 | GND | LAN_SLED3_MDIN3 | GND | LAN_SLED1_MDIN3 | J |
| FM_BBU_PRSNT_N | GND | FM_BMC_SLED5_READY_N | GND | LAN_SLED4_MDIN2 | GND | LAN_SLED2_MDIN2 | GND | I |
| SMB_BBU_ALERT_N | IRQ_PSU1_ALERT_N | FM_BMC_SLED4_READY_N | LAN_SLED5_MDIN2 | LAN_SLED4_MDIN2 | LAN_SLED3_MDIN2 | LAN_SLED2_MDIN2 | LAN_SLED1_MDIN2 | H |
| FM_PSU1_PRSNT_N | PWR_PSU2_PWROK | FM_BMC_SLED3_READY_N | LAN_SLED5_MDIP2 | GND | LAN_SLED3_MDIP2 | GND | LAN_SLED1_MDIP2 | G |
| SMB_PMBUS_SDA | GND | FM_BMC_SLED2_READY_N | GND | LAN_SLED4_MDIP1 | GND | LAN_SLED2_MDIN1 | GND | F |
| SMB_PMBUS_SCL | PWR_PSU1_PWROK | FM_BMC_SLED1_READY_N | LAN_SLED5_MDIN1 | LAN_SLED4_MDIN1 | LAN_SLED3_MDIN1 | LAN_SLED2_MDIP1 | LAN_SLED1_MDIN1 | E |
| GND | P12V_PSU_STBY | FM_SLED5_PRSNT_N | LAN_SLED5_MDIP1 | GND | LAN_SLED3_MDIP1 | GND | LAN_SLED1_MDIP1 | D |
| P12V_PSU_STBY | GND | FM_SLED4_PRSNT_N | GND | LAN_SLED4_MDIP0 | GND | LAN_SLED2_MDIN0 | GND | C |
| P3V3_RMC_STBY | P12V_PSU_STBY | FM_SLED3_PRSNT_N | LAN_SLED5_MDIN0 | LAN_SLED4_MDIN0 | LAN_SLED3_MDIP0 | LAN_SLED2_MDIP0 | LAN_SLED1_MDIN0 | B |
| GND | P12V_PSU_STBY | FM_SLED2_PRSNT_N | LAN_SLED5_MDIN0 | GND | LAN_SLED3_MDIN0 | GND | LAN_SLED1_MDIP0 | A |
| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |

*Table 15 RMC pin assignment in power distribution board (signal direction I/O/bidir form PDB perspective)*

| Signal | Type | Description |
|---|---|---|
| LAN_SLED[5..1]_MDIP[3..0]<br>LAN_SLED[5..1]_MDIN[3..0] | Bidir | 1000BASE-T between RMC and sled. Magnetics required on sled. |
| FM_RMC_GPIO_[2:0] | input | General purpose signals from RMC to sleds (common to all sleds). |
| FM_BMC_SLED[5..1]_READY_N | Output | BMC status signal from sled to RMC. Active low. |
| FM_SLED1_PRSNT_N | Output | Sled presence info from sled to RMC. Active low. |
| IRQ_RMC_ALERT_N | Input | Alert signal from RMC to sleds e.g. at the event of PSU failure (common to all sleds). Active low. |
| IRQ_PSU[2..1]_ALERT_N | Output | Alert signal from PSU to RMC. Active low. |
| PWR_PSU[2..1]_PWROK | Output | Power OK signal from PSU to RMC. Active low. |
| SMB_SLED_COMBINE_SDA | Bidir | SMBUS data between RMC and sleds (common to all sleds). |
| SMB_SLED_COMBINE_SCL | Input | SMBUS clock from RMC to sleds (common to all sleds). |
| FM_BBU_PRSNT_N | Output | BBU presence info from to RMC. Active low.<br>Signal present for sled1 only. Signal used with BBU only. |
| SMB_BBU_ALERT_N | Output | Alert signal from BBU to RMC. Active low.<br>Signal present for sled1 only. Signal used with BBU only. |
| SMB_PMBUS_SDA | Bidir | SMBUS data between RMC and PSU/BBU. |
| SMB_PMBUS_SCL | Input | SMBUS clock from RMC to PSU/BBU. |

| | | |
|---|---|---|
| P12V_PSU_STBY | Power | +12 V standby voltage from PSUs to RMC. Power feed of RMC. |
| GND | Power | +12 V return, signal ground |

# 7 Cooling

The open edge chassis supports both front-to-rear and rear-to-front cooling. The chassis does not have fans, instead fans are integrated on sleds and PSUs. The design of sleds and PSUs must support both air flow directions.

Rear wall of the chassis is perforated with honey comb pattern in the areas shown in Figure 26. Perforation ratio is 64.4%. There are no air filters in Open edge HW.

*Figure 26 Chassis rear wall with backplane in place, front view (top), rear view (bottom)*

## 7.1 Thermal design considerations for sled

Each sled has its own, independent fan control. A sled must be able to operate at full specified capacity within the specified environmental conditions, including operating temperature, humidity and altitude.

Fan control must adapt to the environmental conditions in a way that provides adequate cooling with minum fan power consumption and acoustic noise.

A sled must be able to tolerate failure of a single fan.

At high or low temperatures, the sled must remain operational as long as possible. A thermal shutdown should be performed only when critical temperature levels of components are exceeded. A shutdown should not be performed based on sled's inlet temperature.

The height of Open edge sleds of 41 mm (1U) and 83.55 mm (2U) allow using single or dual rotor fan modules with heights 38/40 mm and 80 mm, respectively.

### 7.2 Air flow direction

Depending on the site installation requirements, e.g. concerning hot/cold isle arrangements of the equipment room, the direction of cooling air through the Open edge chassis may need to configured to be either from front to rear or from rear to front.

Air flow direction of a sled should be selectable as a factory option. It is recommended that air flow direction is configurable also in the field, because sometimes the site requirements are not fully known at the time of ordering the HW. Also for PSUs, field-configurability of air-flow direction is the preference, but if this is not feasible, different SKUs with different air flow options should be made available.

The sled itself must be aware of the selected air flow direction and provide the information as a sensor value. When needed, the sled must automatically re-define the roles of sensors, e.g. inlet and outlet temperature sensors.

Typical Open edge sled designs may have hot-plug storage and networking interfaces in the front panel and the CPU and memories at the rear of the unit. Depending on air flow direction, components either get fresh or pre-heated cooling air. During sled development both air-flow directions shall be crefully evaluated. Any limitations to sled configurations, performance or environmental conditions shall be stated by the sled supplier.

# 8 Environmental and regulatory specifications

Edge servers can be located in varying environments, where datacenter or central office-like conditions may not be always quaranteed. Hence environmental requirements are set slightly higher than for typical datcenter server products. Also seismic tolerance is addressed.

Table 16 summarizes the key environmental and regulatory specifications for Open edge chassis and sleds.

*Table 16 Key environmental and regulatory specifications of Open edge chassis and sleds*

| | Specification |
|---|---|
| Operating conditions | Operating temperature range: -5 C …+45 C [ETSI EN300 019-1-3 Class 3.2]<br>Short term operating temperature: -5 C to +55 C [GR-63-CORE]<br>Operating humidity: 5 % to 95 % |
| Storage | ETSI EN 300 019-1-1, Class 1.2 (weather protected, not temperature-controlled storage) |
| Transport | ETSI EN 300 019-1-2, Class 2.2 (careful transportation) |
| Seismic tolerance | Earthquake risk zone 4 [GR-63-CORE] |
| Safety | IEC 62368-1:2014<br>GR-1089-CORE (electrical safety, grounding and bonding) |
| Fire resistance | GR-63-CORE (shelf level criteria) |
| EMC | EN300386 (v1.6.1)<br>FCC CFR47 15 (class A), CISPR 22 (class A) CISPR 24<br>TEC/EMI/TEL-001/01/FEB-09 and TEC/IR/SWN-2MB/07/MAR-10<br>GR-1089-CORE |
| Acoustic noise | GR-63-CORE (equipment room criteria) |
| Material safety | RoHS 2011/65/EU, Article 7b (EN 50581, 2012) |