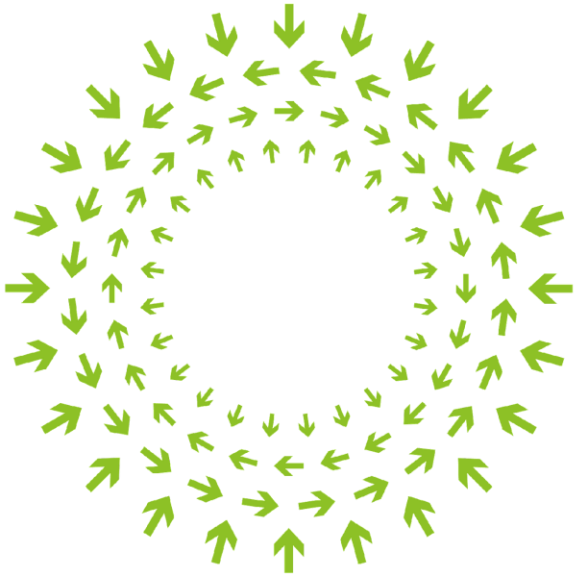


OPEN Compute Project

Celestica DS5000 64x800G Switch Specification

Version 1.2
Design Specification
January 22, 2024

Author: Jeff Catlin

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1. License

1.1. OPTION B: Open Web Foundation (OWF) CLA

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Celestica

Usage of this Specification is governed by the terms and conditions set forth in **Modified OWFa1.0.2 Final Specification Agreement (FSA) (As of June 1, 2023) ("Specification License").**

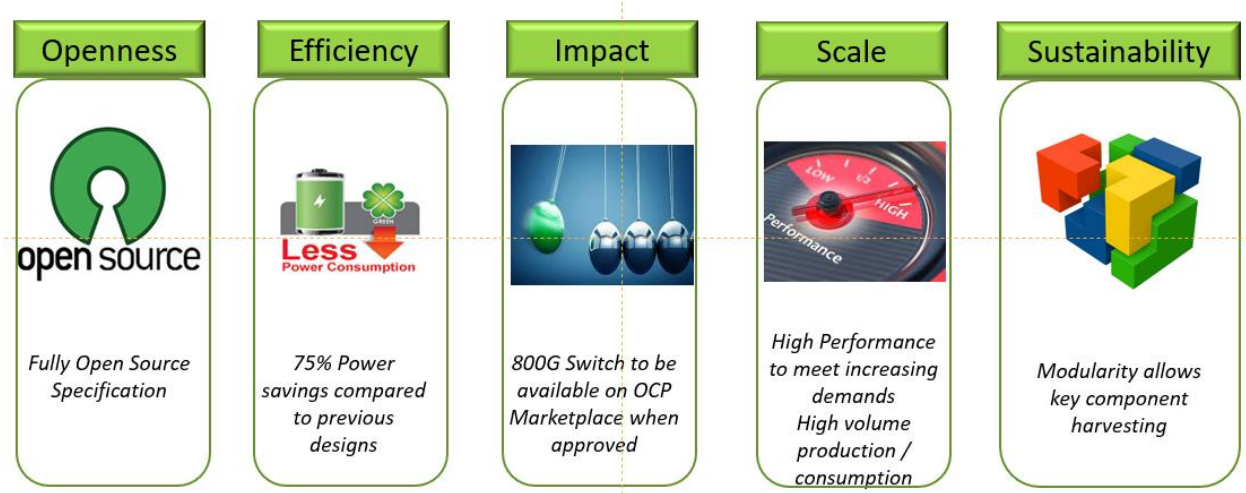
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Notes:

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2. Compliance with OCP Tenets



2.1. Openness

Fully Open Source Specification

2.2. Efficiency

Significant power savings compared to previous designs

2.3. Impact

High performance and high radix deployments for AI/ML and data center usage

2.4. Scale

High volume deployments and manufacturing

2.5. Sustainability

Key components easily harvested an end of lifecycle

3. Change Log

Date	Version #	Author	Description
10/18/2023	1.0	Jeff Catlin	Initial Release
1/18/2024	1.1	Jeff Catlin	Minor formatting updates
1/22/2024	1.2	Jeff Catlin	Final Cleanup

4. Scope

This document defines the design specification for the Celestica DS5000 64x800G Switch contributed to the Open Compute Foundation. This design specification is seeking OCP approval and the resulting product receiving OCP Inspired status.

5. Overview

This design specification describes the Celestica DS5000 64x800G Ethernet switch. The DS5000 is a high performance 51.2Tb Ethernet switch based on the Broadcom Tomahawk 5 silicon that provides 800Gb Ethernet interfaces for bandwidth intensive use cases such as AI/ML clustering. The DS5000 switch can also be configured to support higher density connectivity for 128x400G and 256x200G connectivity ports allowing for various high density high performance use cases.

5.1 Base Specification

This specification and the Celestica DS5000 64x800G switch comply with the Broadcom 64x800Gb Ethernet Switch Base Specification approved by the Open Compute Foundation in 2023.

6. Environmental Regulatory Compliance And Requirements

The DS5000 supports the following Environmental and Compliance standards:

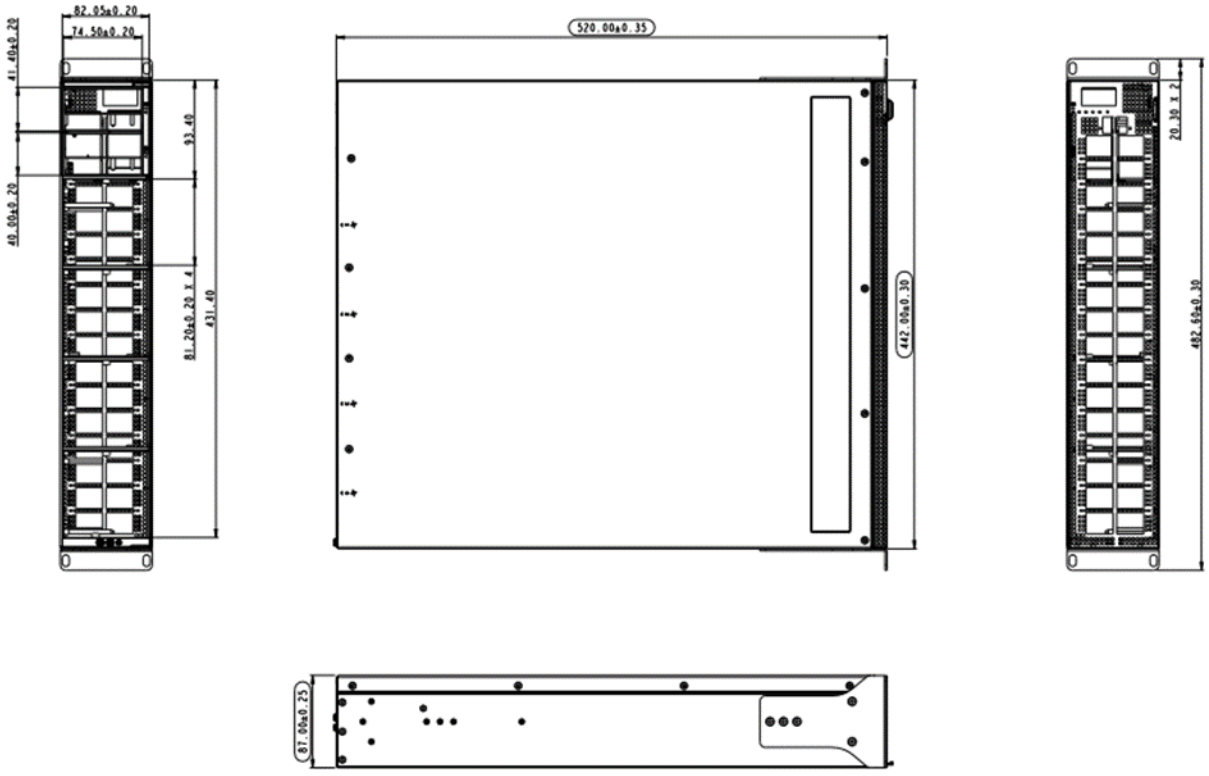
- *Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE)*
- Class A for USA, Canada, Europe, China, Japan
- Class A for Taiwan, Korea, Australia, Mexico
- UL/CSA/IEC/EN 60950-1/62368-1
- CE, CCC, KC, TUV, and BSMI
- *Operating: temperature/altitude: ASHRAE Class A3*
    - *5℃ - 40℃@900m / humidity 5%~85%*
- *Storage: temperature -40℃ ~ 70℃/ humidity 5%~95% / altitude 35,000ft (max)*
- Meets acoustical specification EN300753, 7.5 Bels sound power at 23C +/-2C

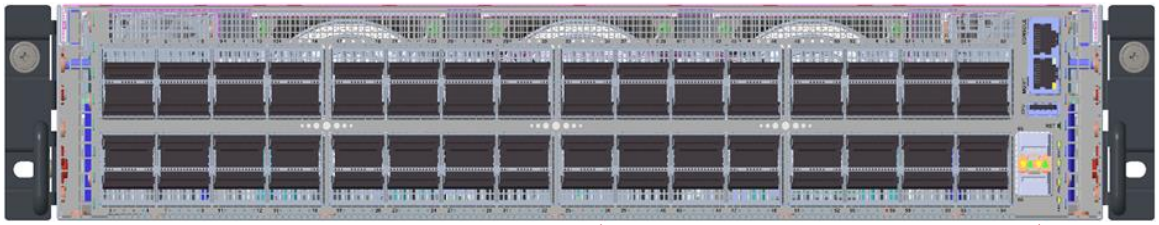
7. Physical Specifications

The DS5000 is a 2RU mechanical enclosure capable of mounting in a 19-inch equipment rack.

DS5000 Physical Dimensions

Length	520 mm
Width	442 mm
Height	82 mm





1 x RJ45 Serial
1 x RJ45 Ethernet
1 x USB 3.0
4 x Status LEDs

64 x OSFP Ports
2 x LEDs per Port

2 x SFP28



2 x PSU

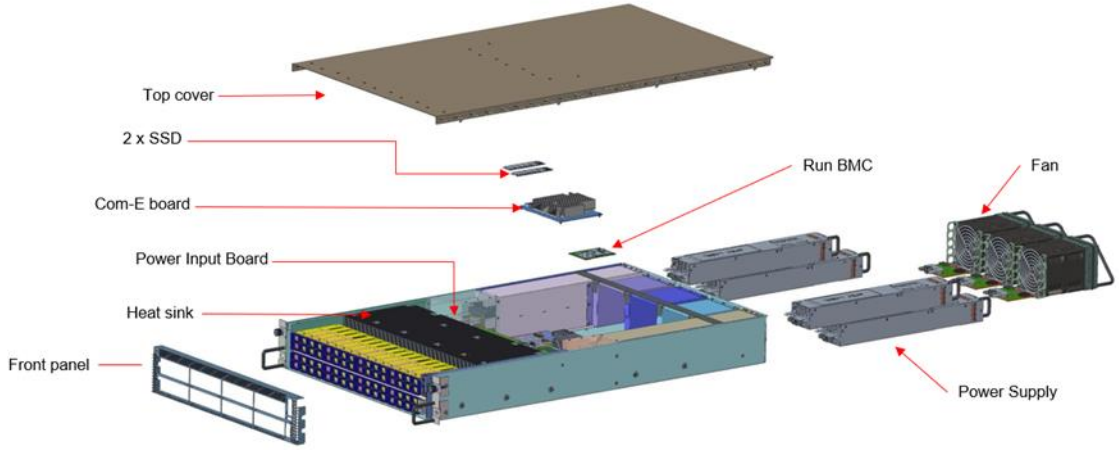
3 x Fans

2 x PSU

7.1 Mechanical

The main components of the DS5000 are listed below:

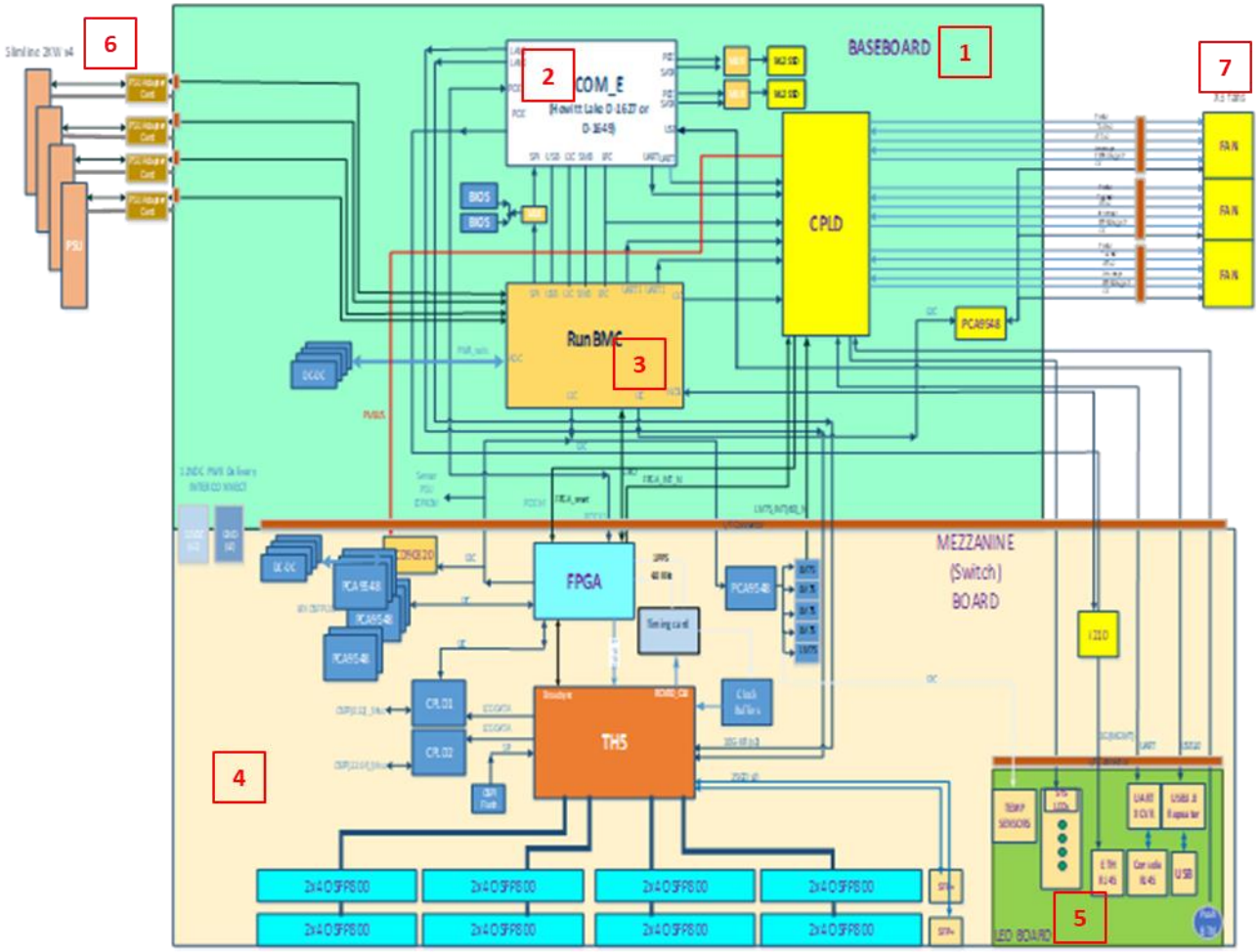
1. Hot swappable PSU (FRU)
2. Hot swappable fan module (FRU)
3. PSU Interface board or PIB (2x per chassis)
4. COM-E board
5. BMC board
6. Base board
7. Mezzanine board
8. LED board
9. FAN module board (used within the Fan module FRU)



The DS5000 has 7 PCBs listed below:

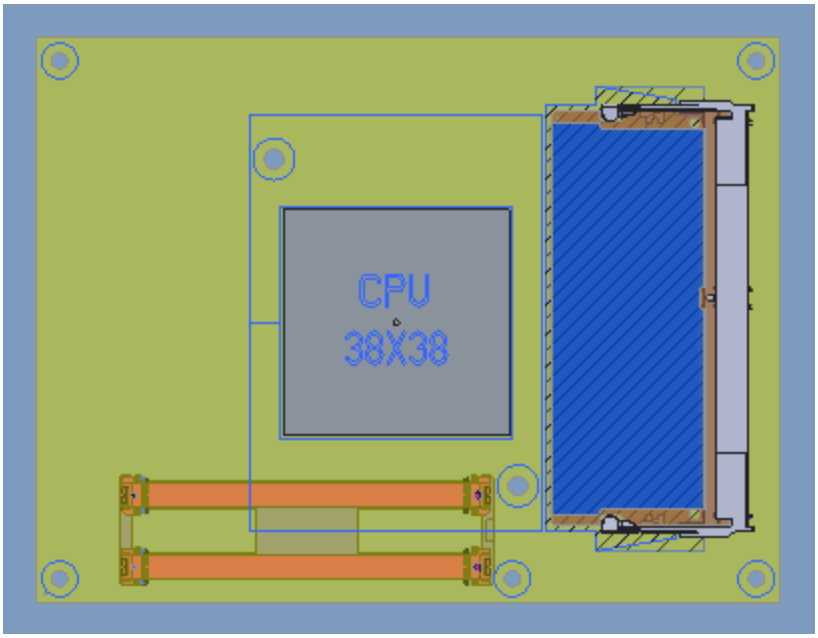
1. Base board (also called Mother board)
2. COM-E board
3. BMC board
4. Switch board (Mezzanine board)
5. LED board
6. PSU adapter board
7. Fan module board

DS5000 Block Diagram Overview



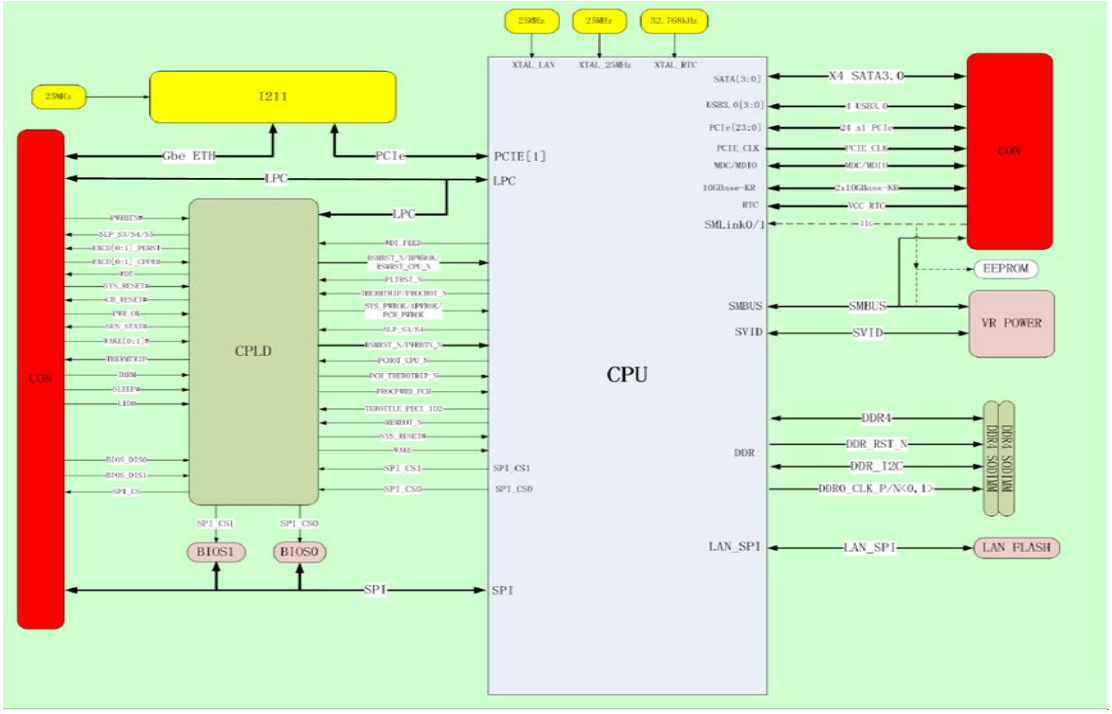
CPU Module

The DS5000 supports COM-E type 7 CPU module supporting an Intel x86 Hewitt-Lake D1627 four core processor. The PCB size is 95mmx125mm for the Hewitt-Lake D1627-4C while a smaller PCB size of 95mmx95mm is also supported to accommodate a lower power Intel Denverton class CPU option.



The CPU module supports up to two SODIMM modules with a maximum capacity of 32GB.

CPU Module Block Diagram



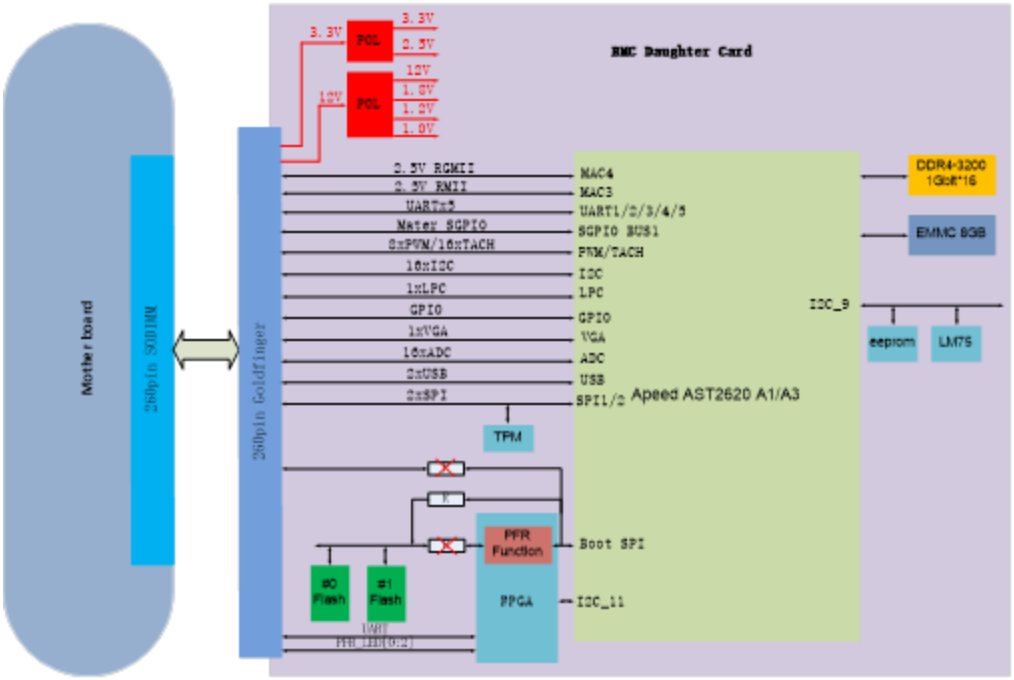
BMC Module

The DS5000 supports a BMC module based on the Open Compute RunBMC specification. This BMC module supports an AST2620 management processor from ASPEED Technology.

The main function of BMC includes:

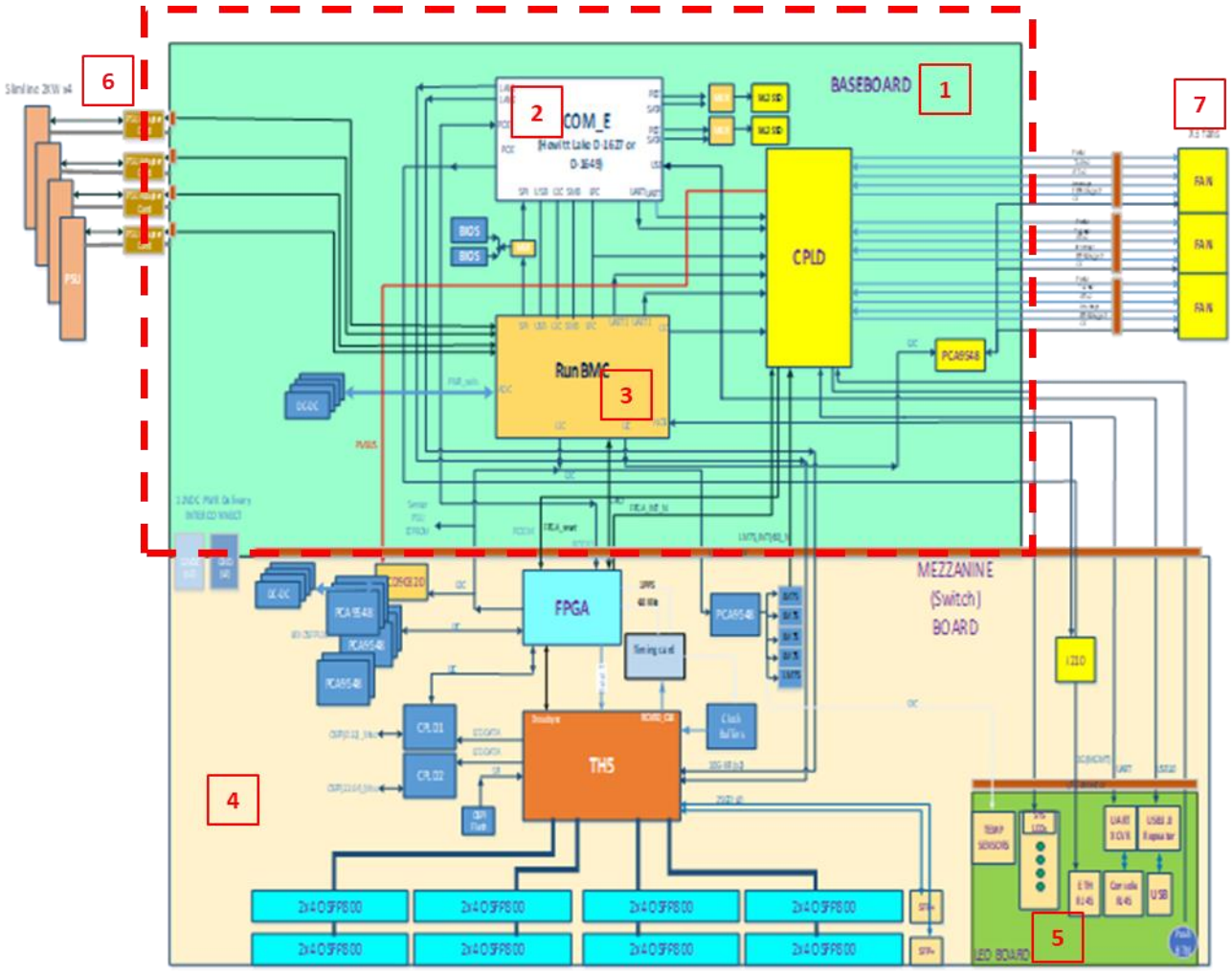
- System and board information collection
- system level status report
- On-board power monitoring
- On-board reset circuitry
- On-board alarm/error monitor
- Fan Speed controlling
- LPC accessed by CPU
- Remote access
- CPLD online upgrade
- BIOS online upgrade
- System Interrupt to CPU and from CPLD
- SOL function

BMC Module Block Diagram



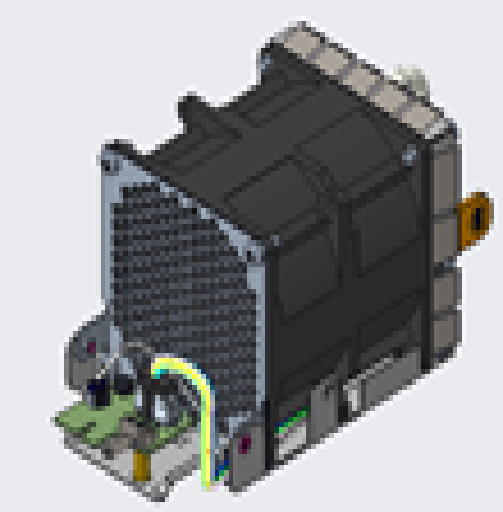
Baseboard

The DS5000 Baseboard provides connectivity for the COM-E Module, BMC Module, Switch Board, PSU Board(s), and Fan modules.



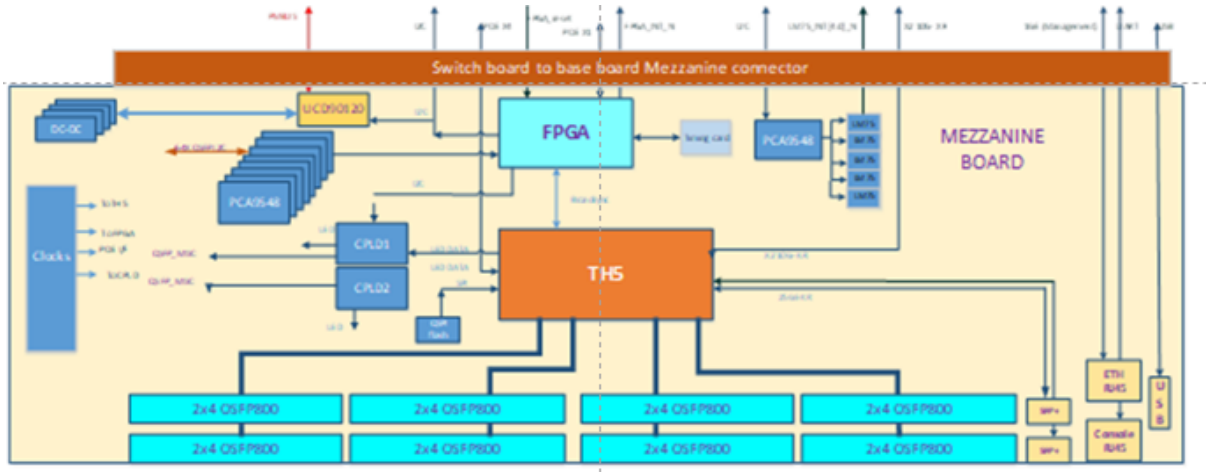
Fan Module Board

The DS5000 supports three field replaceable fan modules as shown below. Each fan module incorporates a small fan board to connect the fan and associated circuitry to the fan module board.



Switch Board

The DS5000 Switch Board supports the main switching silicon, front panel connectivity port cages, and other associated circuitry.



PSU Adapter Board

The DS5000 has four (identical) PSU adapter boards. Each PSU module is connected to the Baseboard via the adapter board to power the system. The adapter board is a passive board with only connectors and busbars. The Busbars are used to supply 12V power directly to the base board and the Mezzanine board. The connectors are used for signal transfer between PSU and baseboard (eventually to CPLD and BMC).

7.2 Rack Compatibility

The DS5000 is designed to be mounted in a standard 19 inch equipment rack. Mounting in the 19 inch rack may be accomplished through the included rack mounting brackets.

8. Electrical Requirements

The DS5000 supports four 2000 Watt AC power supply modules each accepting input voltage ranging from 100V-240V.

9. Thermal Design Requirements

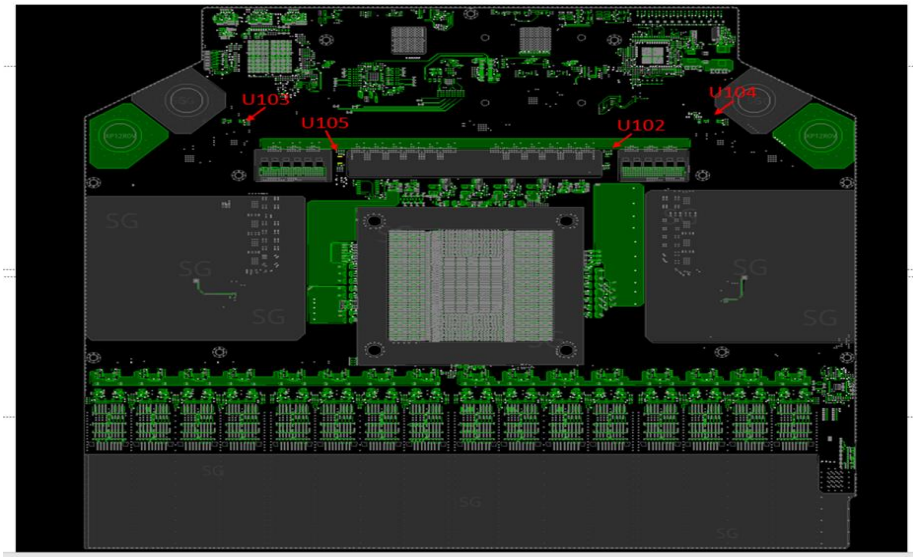
The DS5000 supports three system fan modules. These fan modules draw air in from the front of the unit (port side) and discharge the heated air from the rear of the unit (power side). The switch board contains four thermal sensors which are used to monitor the temperature of the DS5000 system. In addition to these four temperature sensors located on the switch board a temperature sensor is located within the main switching silicon ASIC, a sensor located on the LED Board, and a sensor located near the fans on the Base Board. The rotational speed of the system fans is adjusted based upon the reading of these temperature sensors. If the system is determined to be in an over temperature condition power to the switching silicon and COM-E module will be removed and restored after a system power reset.

80mm x 80mm Fans for system cooling. The Fan part number is AVC DFPB0886B2UY001.

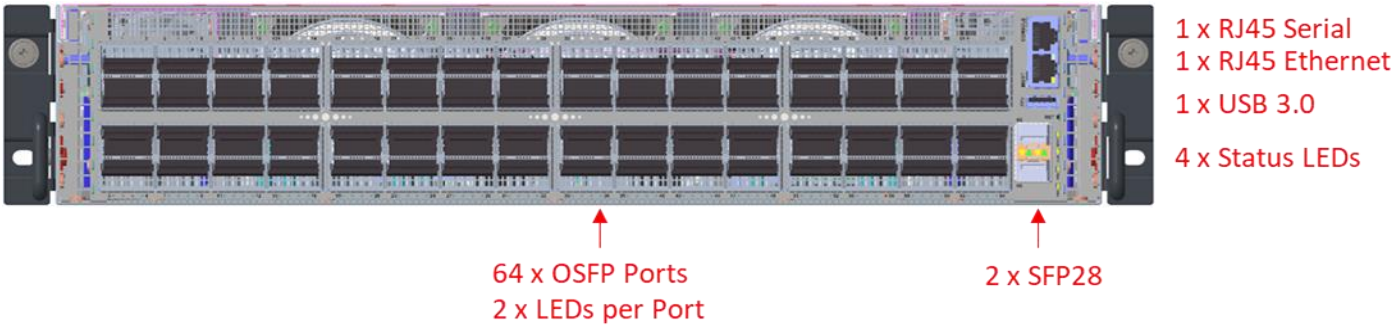
(AT Ta=25°C)

	ITEM	SPEC.		
2-1.	RATED VOLTAGE	12		VDC
2-2.	OPERATION VOLTAGE	10.8 ~ 13.2		VDC
2-3.	RATED CURRENT (IN FREE AIR)	10.5 (14.0 MAX.)		A (AVERAGE)
2-4.	CURRENT ON LABEL	14.00		A
2-5.	RATED POWER (IN FREE AIR)	126.0 (168.0 MAX.)		W
2-6.	SPEED (IN FREE AIR)	INLET	18000±10%	R.P.M
		OUTLET	16000±10%	R.P.M
2-7.	SPEED CONTROL TYPE	PWM CONTROLLER		
2-8.	SIGNAL OUTPUT	FREQUENCY GENERATOR (FG)		
2-9.	MAX. AIR FLOW (AT ZERO STATIC PRESSURE)	5.204 (4.684 MIN.) 183.83(165.44 MIN.)		M^3/MIN CFM
2-10.	MAX. AIR PRESSURE (AT ZERO FLOW)	258.24(209.17 MIN.) 10.16 (8.235 MIN.)		mm−H_2O inch−H_2O
2-11.	ACOUSTICAL NOISE	83.5 (87.5 MAX.)		dB−A
2-12.	START PEAK CURRENT (IN FREE AIR)	18.8 MAX A		

Temperature sensor locations Switch board



10. Interfaces



The DS5000 supports the following interfaces located on the front of the unit:

Physical ports

- 64 x OSFP ports each ports delivering 8 x 112G serdes (800G) links from the main switching silicon. Each of these physical ports can be configured to operate as 1x800G, 2x400G, 4x200G, or 8x100G (maximum 320x100G ports per system). Each OSFP port is capable of supporting optical modules with a 20 watt power requirement with the two leftmost and rightmost OSFP ports supporting 26 watt optical modules.
- 2xSFP 28 ports which connect directly to the COM-E module. These two SFP28 ports support 25G/10G/1G plug in modules.
- 1xRJ45 1G port connecting internally to the COM-E /BMC module
- 1xRJ45 Serial port connecting internally to the COM-E /BMC module
- 1xUSB 3.0 type A port connecting internally to the COM-E module

LEDs

OSFP Ports

Each OSFP port has two bi-colored LEDs to indicate port status:

1. Solid Green = Port linked operating at max port speed, for example, 100G per lane on OSFP port (1*800GE, 2*400GE, 4*200GE, 8*100GE).

2. Solid Amber = Port linked operating at lower speed, for example, running 50G per lane on OSFP port (1*400GE, 2*200GE, 4*100GE, 5*50GE).

3. Blink Green (blink with 33ms on and 33ms off) = Port Activity operating at max port speed, for example, OSFP port activity at 1*800GE, 2*400GE, 4*200GE, 5*100GE

4. Blink Amber (blink with 33ms on and 33ms off) =Port Activity operating at lower speed, for example, running 50G per lane on OSFP (1*400GE, 2*200GE, 4*100GE, 5*50GE).

5. Off = link down.

6. For one port module, only the 1st LED is used. For a module which can break down to 2 ports, the 1st LED covers port1, the 2nd LED covers port2. For a module which can break down to 4 ports, the 1st LED covers port1~2, the 2nd LED covers port3~4. For a module which can break down to 8 ports, the 1st LED covers port1~4, the 2nd LED covers port5~8.

7. If one LED indicates the status of a group of ports, then the LED is solid on when any one port link on, and the LED blink as only as one of ports have traffic, the LED off as all ports link down.

SFP28 Port LEDs

One Bi-color LED Green/Amber for each SFP28 port.

1. For port link at 25G/10G mode:
    a. Port link up: Green ON
    b. Port link activity: Green Blink
    c. Port link down: LED Off
2. For port link at 1G mode:
    a. Port link up: Amber ON
    b. Port link activity: Amber Blink
    c. Port link down: LED Off

System Status LEDs

The DS5000 supports four system status LEDs to indicate various status conditions:

1. One Bicolor LED (Green/Amber) for PSU Status indicate.
    - Green - Both PSU Present and status are correct
    - Amber - One PSU Absent or any one of the PSU status is incorrect
    - PSU Status LED Off is not allowed

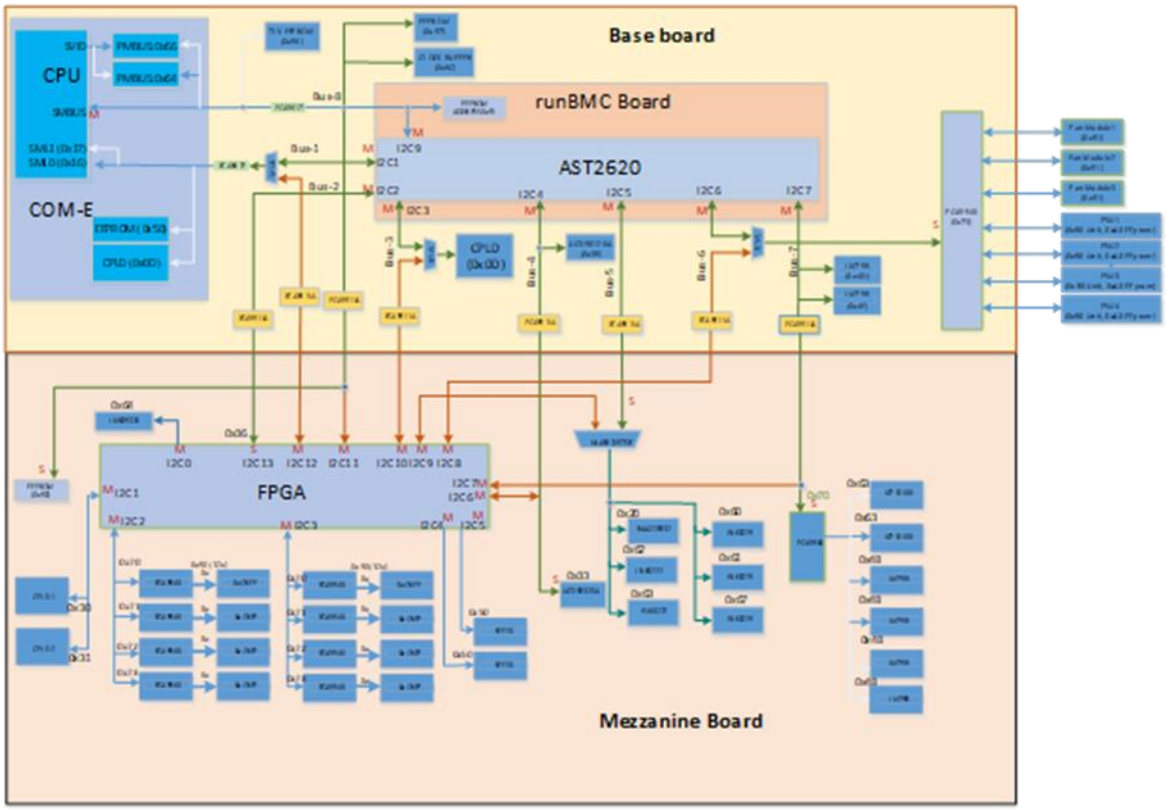
2. One Bicolor LED (Green/Amber) for System Status
    - For ONIE installed system, after ONIE boot success, ONIE will set the LED to Green and Amber LED Alternate 1Hz Blinking.
    - For NOS installed system, the System Status LED will be controlled by the NOS

3. One Bicolor LED (Green/Amber) for Alarm Status indicate.
    - Green LED on (No Alarm)
    - Amber LED on (Critical Alarm)
    - Amber LED 4Hz Blinking (Major Alarm)
    - Amber LED 1Hz Blinking (Minor Alarm)

4. One Bicolor LED (Green/Amber) for FAN Status.
    - Green - All FAN Present and status are normal
    - Amber - Any one of the FAN is absent, or any of the FAN status is abnormal

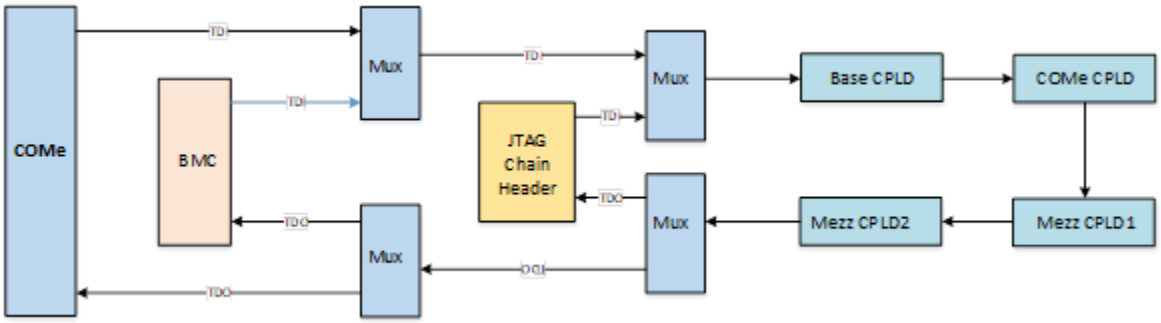
10.1 Signal List

System I2C

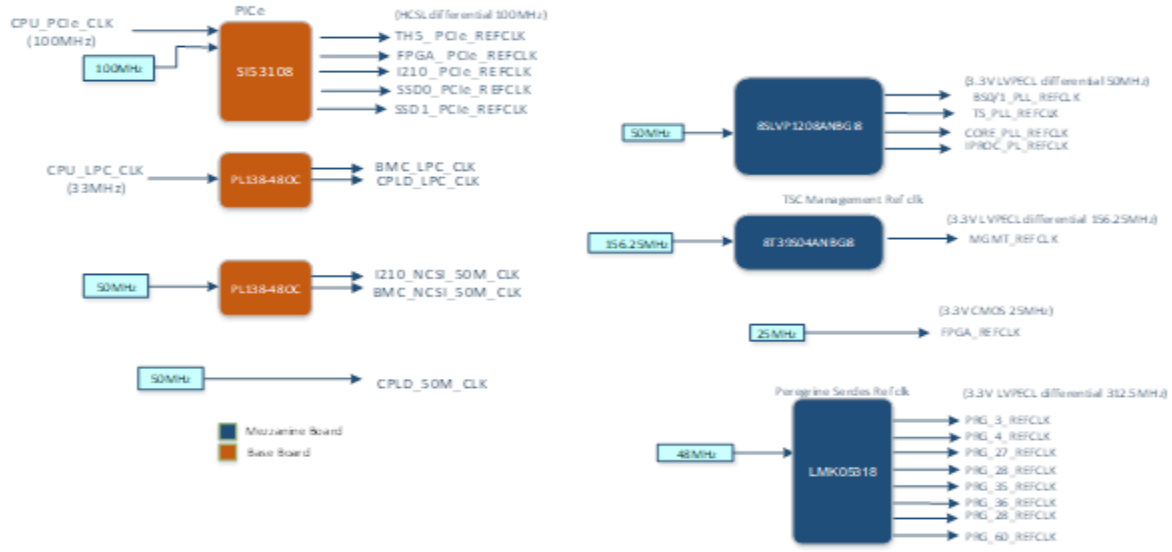


System CPLD Upgrade

The DS5000 includes five CPLD, they can be upgraded online by the COME or BMC. As the picture below shows, a MUX is controlled by BMC GPIO.



Clock Topology



10.2 Rear Side Power, I/O, Expansion Board and Midplane Subsystems



2 x PSU 3 x Fans 2 x PSU

Fan Tray

The DS5000 supports three redundant (2+1) fan modules located in the rear of the chassis:

Fan tray LED

One Bicolor (Green/Amber) LED of each Fan module is provided for FAN Status indication:

- FAN Absent. FAN Status LED Off.
- FAN Present and status normal. FAN Status LED Green On.
- FAN Present and status abnormal (Mismatch or Break). FAN Status LED Amber On.

Power Supply Modules

The DS5000 supports four redundant (2+2) 2000 watt power supply modules located in the rear of the chassis. Each power supply module accepts 100V-240V AC power input.

Power Supply - Delta Power TDPS-2000LB

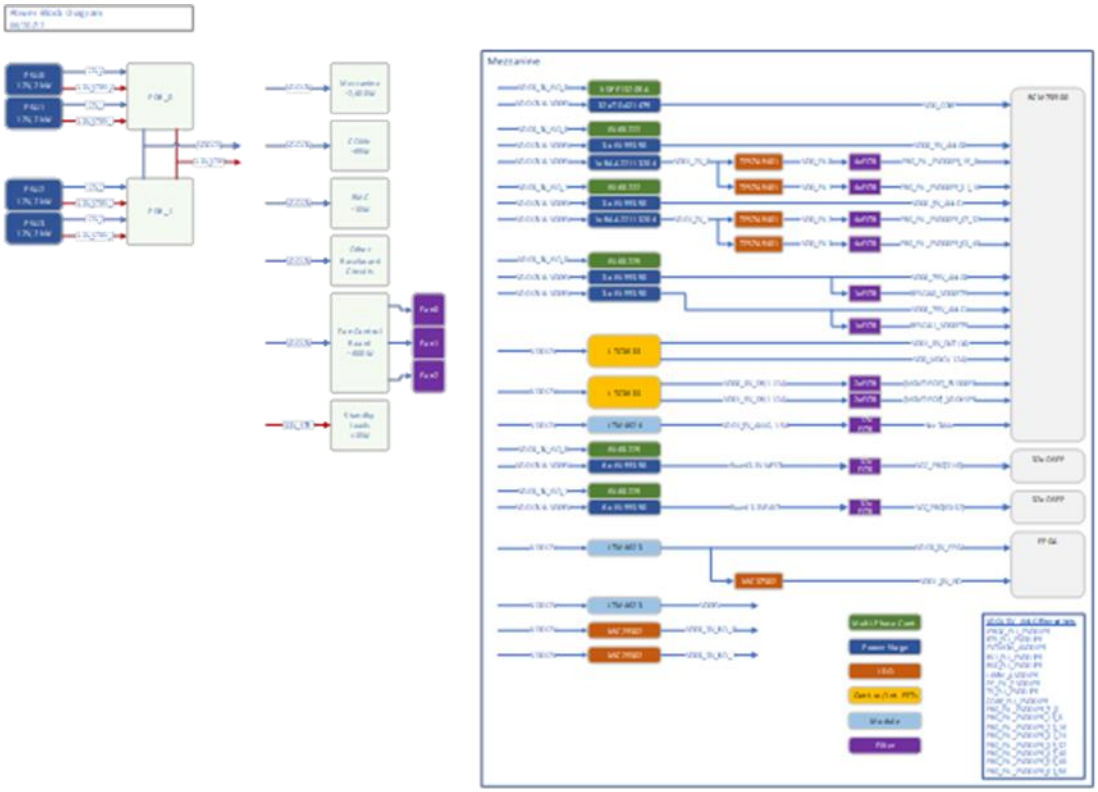
Power supply LED

Each power supply module contains a single LED to indicate status of the power supply module:

- Green – Normal operation
- Red – Fault condition

11. Onboard Power System

System Power Overview



12. System Firmware

The DS5000 supports a commercial BIOS from AMI.

13. Hardware Management

The DS5000 supports out of band management through a RunBMC module supporting an ASPEED AST2620 processor.

- RedFish management along with the Open Compute Baseline Redfish profile is supported

14. Security

TPM

The DS5000 supports a TPM 2.0 module located on the Main PCB.

15. Software Support (recommended)

The DS5000 supports the following software:

- OpenBMC
- Open Network Install Environment – ONIE
- Open Networking Linux – ONL
- Software for Open Networking In the Cloud – SONiC

Appendix A - Checklist for IC approval of this Specification (to be completed by contributor(s) of this Spec)

Complete all the checklist items in the table with links to the section where it is described in this spec or an external document .

Item	Status	Link to detailed explanation
Has this contribution been presented to an OCP Project group during a project call or engineering workshop?	Yes	
Approval by Project Leads	Yes	
Is this contribution entered into the OCP Contribution Portal?	Yes	
Was it approved in the OCP Contribution Portal?	Yes	