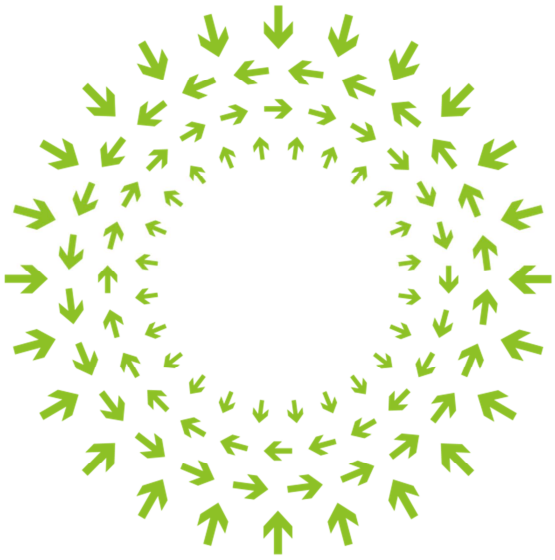

OPEN Compute Project

Alpha Networks Inc.

SNH-60A0-320F

32-port 100G QSFP28 Switch
(ToR/Aggregation Switch)

Author: Celina Hsieh, Chloe Lin

Revision History

Version	Revised Date	Author	Content Revised
0.1	01/12/16	Celina Hsieh	First Drafted
0.2	02/17/16	Celina Hsieh	Modify Figure 7 Adding PSU vendor information on section 4.1 Adding Management board and Fan board pin out information on table 14 & 15

Scope

This documents defines the technical specification for SNH-60A0-320F used in the Open Compute Project as 100G Top of the Rack (ToR) or as an aggregation switch

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Overview

The SNH-60A0-320F Series Data Center, spine/aggregation switches, with a total combined bandwidth of 3,280 Gbps, feature 32 ports of 40/100 Gbps Ethernet wire-speeds, up to 64 ports of 50 Gbps Ethernet wire-speed or up to 128 ports of 10/25 Gbps Ethernet wire-speeds. The Layer 3 capable, bare metal system also provides console port in either RJ-45 or USB Type B console port form factor, an Ethernet Out-Of-Band (OOB) management port and a dedicated BMC management port. The SNH-60A0-320F switch is a PHY-less design with QSFP28 connections directly attached to the SERDES interface of Broadcom BCM56960.

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Manufacturer	Description
Broadcom	BCM56960
Intel	x86 CPU C2558-2.4GHz
Aspeed	AST1250
Marvell	88E1112
Transcend	SODIMM TS512MSK72V3N
Transcend	SD Card TS8GUSDC10M
Macronix	Flash MX29LV640EBTI-70G
Renesas	EEPROM R1EX24002ASAS0I
Atmel	AT24C128C-SSHM-T
Lattice	LCMXO256C-3TN100C

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1 Feature Highlights

The SNH-60A0-320F Series Data Center, spine/aggregation switches, with a total combined bandwidth of 3,280 Gbps, feature 32 ports of 40/100 Gbps Ethernet wire-speeds, up to 64 ports of 50 Gbps Ethernet wire-speed or up to 128 ports of 10/25 Gbps Ethernet wire-speeds. The Layer 3 capable, bare metal system also provides console port in either RJ-45 or USB Type B console port form factor, an Ethernet Out-Of-Band (OOB) management port and a dedicated BMC management port.

The CPU subsystem is designed based on OCP micro server form factor* , this allows user the flexibility of a variety of CPU selection in the future.

- OCP micro server modular CPU board with large flash and memory
- Temperature warning via Software-readable thermal monitor
- Real time clock (RTC) support
- Two Hot-swappable redundant power supply
- Six fan modules, (5+1) redundancy
- All I/O and management ports located on the front panels:
  - One out of band 10/100/1000 Mbps RJ-45 management port
  - One 10/100 Mbps RJ-45 BMC management port
  - One RS232 in RJ45 type console port
  - One USB(Type B) console port
  - One USB(Type A) port for hosting an external USB flash
  - One Reset Button
  - One Locator LED
  - Two option BCN ports for 1588 clock input/output

2 Physical Overview

2.1 Mechanical Dimension

Dimension	
Height x Width x Depth	44mm(H)440mm(W) x 487.4 mm(D)

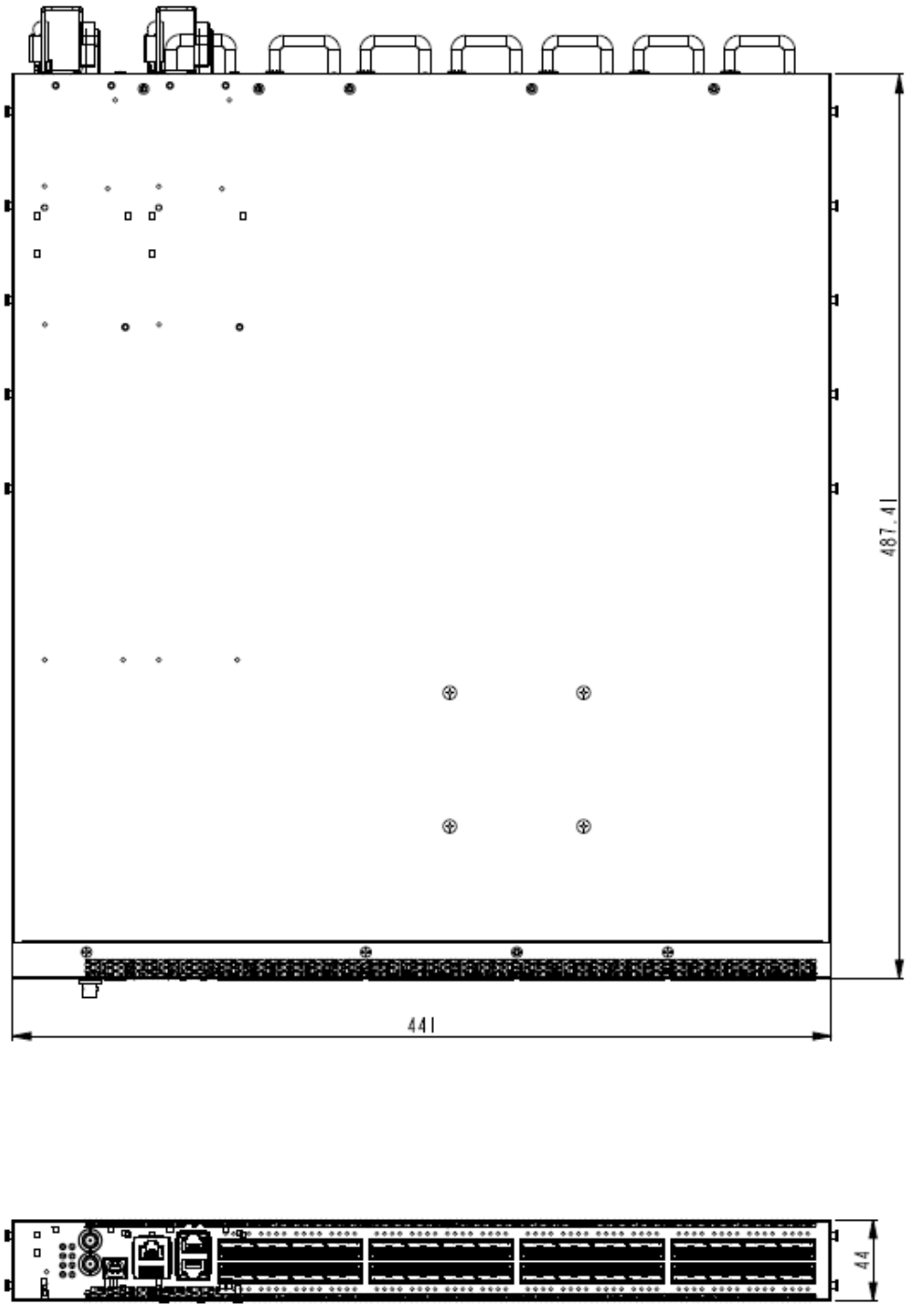

Figure 1: SNH-60A0-320F Chassis dimension

2.2 Top View

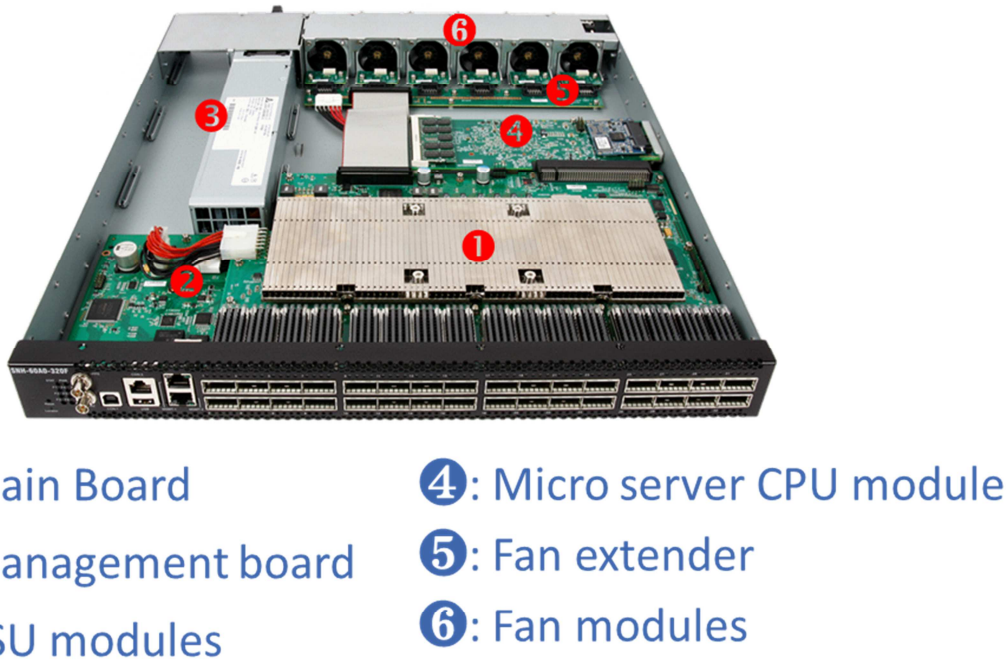

Figure 2: SNH-60A0-320F top view

2.3 Front View

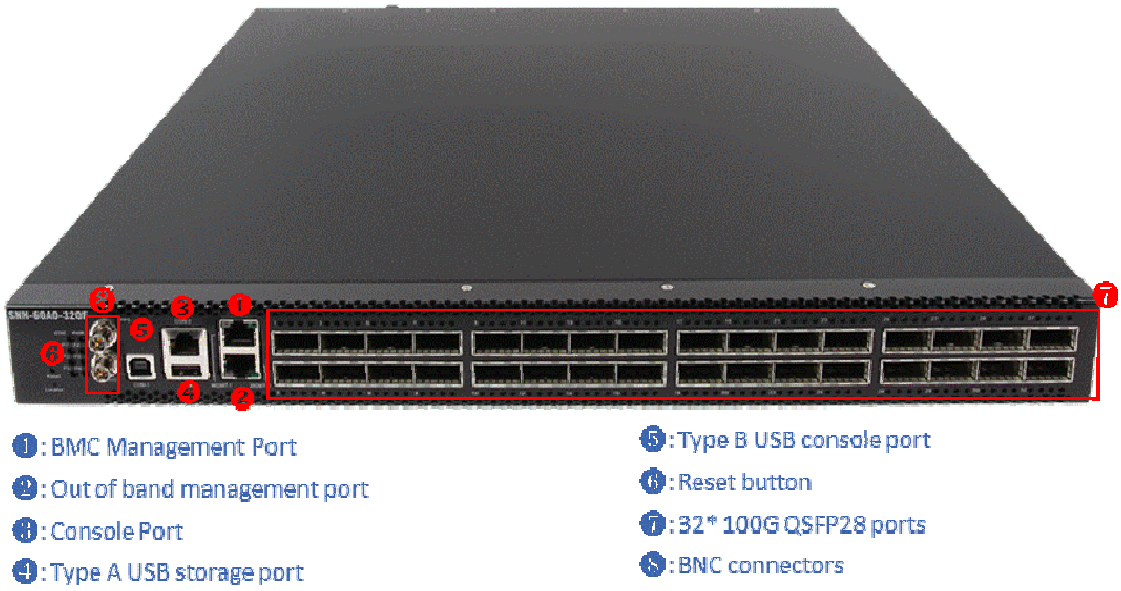

Figure 3: SNH-60A0-320F front view

2.4 Rear View

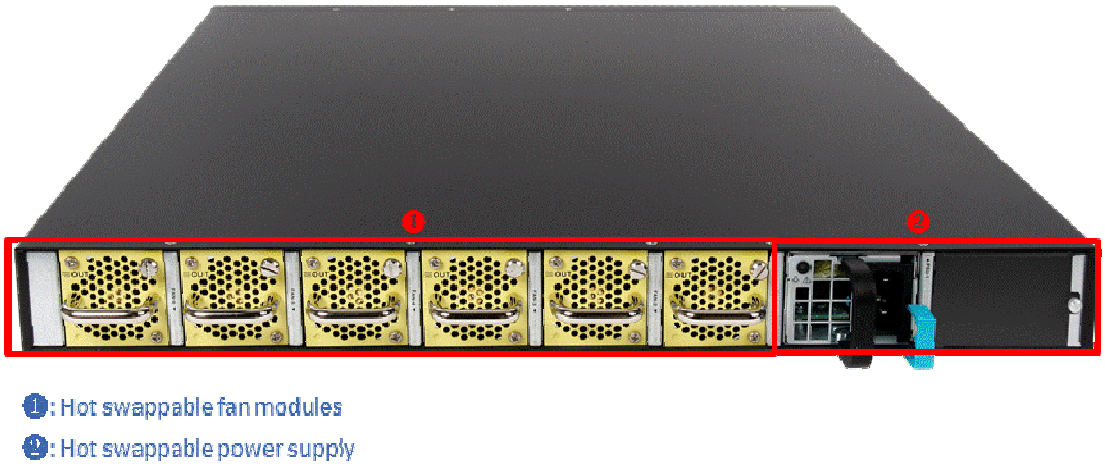

Figure 4: SNH-60A0-320F rear view

3 LED Definition

The following table defines the per device LEDs' behaviors:

Items	LED Indication	Color	Behavior	Description
1	STAT	Green	Solid Light	POST Passed, normal operation
			Blinking	POST in progress
			Light off	System No power
		Amber	Blinking	POST failed or overheat or power supply failed or Fan module fail or over temperature
2	PWR	Green	Solid Light	Power On
			Off	Power Off and no power attached
		Amber	Blinking	Power supply failures, over voltage, over current, over temperature
3	MGMT-1(BMC)	Green(R)	Solid Light	Link up
			Blinking	Packet transmitting or receiving

			Light off	No link up or port disable
4	MGMT-2(Switch)	Green(R)	Solid Light	Link up
			Blinking	Packet transmitting or receiving
			Light off	No link up or port disable
5	FAN 1 FAN 2 FAN 3 FAN 4 FAN 5 FAN6	Green	Solid Light	All diagnostics pass. The module is operational.
			Off	The module is not receiving power
		Amber	Blinking	Failure
6	Locator	Blue	Blinking	Locator function is enable
			Off	Locator function is disable

Table 1: LED behavior for Port 1~32 40G Ethernet Port

The following defines the 100G QSFP28 and 40G QSFP+ Ethernet port LEDs' behaviors:

Location	LED Indication	Color	Behavior	Description
LED number 1~32, group of 4 (100Gbps)	Link/Act/Speed	Green	Solid Light	When there is a secure 100G connection (or link)
			Blinking	Packet transmitting or receiving
LED number 1~32, group of 4 (40Gbps)	Link/Act/Speed	Amber	Solid Light	When there is a secure 40G connection (or link)
			Blinking	Packet transmitting or receiving
1~32, group of 4			Light off	No link up or port disable

Table 2: LED behavior for Port 1~32 100G Ethernet Port

In the case of split cable plugged in to port 1 ~ 32 each 100G ports will behave as 4 individual 25G ports. When port 1 through 32 is set to be 40g mode and a split cable is used on any single port, the port will behave as four individual 10G ports. The following table defines the 25G and 10G Ethernet port LEDs' behaviors when split

cables are used:

Location	LED Indication	Color	Behavior	Description
LED 1~128 (25Gbps)	Link/Act/Speed	Green	Solid Light	When there is a secure 25G connection (or link)
			Blinking	Packet transmitting or receiving
LED 1~128 (10Gbps)	Link/Act/Speed	Amber	Solid Light	When there is a secure 10G connection (or link)
			Blinking	Packet transmitting or receiving
LED 1~128			Light off	No link up or port disable

Table 3: LED behavior for Port 1~128 at 10G/25G mode

Each power supply module has a bi-color LED, which behaves as in the following:

LED Color	Behavior	Description
Green	Solid Light	Output ON and OK
	Blinking	AC present / AC Line 12VSB Holdup
	Light off	No AC power to all power supplies
Amber	Solid Light	Power supply critical event causing a shutdown; failure, Fan Fail
	Blinking	Power supply warning events where the power supply continues to operate; high temp, high power, high current, slow fan.

Table 4: Power supply LED definition

4 Field Replaceable Components

4.1 Power Supply Modules

SNH-60A0-320F supports two hot swappable power supplies plugged in at the same time for redundancy. The details of the power supplies are as following:

Power Supply	
Number of power supply	2
Power supply types	AC version (forward and reversed airflow) ● Delta DPS770GB1A ● Delta DPS770GBE

	DC version (forward and reversed airflow) • Delta DPS-1100GB B • Delta DPS1100GB1A
AC PSUs • **Input voltage** • **Frequency** • **Efficiency**	 • 100 to 240 VAC • 50 to 60 Hz • 90 to 94% at 230V
DC PSUs • **Input voltage range** • **Efficiency**	 • 40, 48~60, 72 VDC • 88 to 92%

Table 5: Power supplies details

Power Supply connector: Molex 459844343

Pin #	Descriptin	Pin #	Descriptin	Pin #	Descriptin
S1	+12VRS+	**S10**	A1	**P1, P2**	+12_VOUT
S2	+12VRS-	**S11, S12**	5VSB	**P3, P4**	SGND
S3	12LS	**S13**	NA		
S4	SMB Alert	**S14**	SGND		
S5	SDA	**S15**	A0		
S6	SCL	**S16**	NA		
S7	PSKILL	**S17**	Vs		
S8	PSON	**S18~S22**	NA		
S9	PW OK	**S23, S24**	+5VSB		

Table 6: Power supply connector pin out

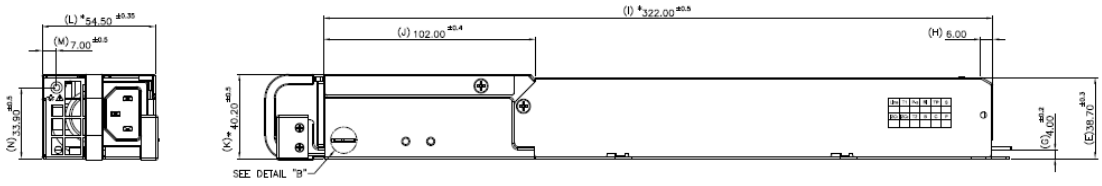

Figure 5: Power Supply Mechanical specification

LED definition on power supply

Power Supply Condition	LED Status
No AC power to all power supplies	OFF
PSU is OFF but 5VSB is on	Blinking (1Hz) -Green

PSU warning event	Blinking (1Hz) -Amber
PSU is switched and is running	ON -Green
PSU critical event causing a shutdown	ON -Amber

Table 7: LED definition on power supply

FRU

FRU data format compliant with IPMI ver 1.0 (per rev 1.1 from Sept. 25, 1999) specification. The FRU device will implement the same protocols as the commonly used AT24C02 device, including the Byte Read, Sequential Read, Byte Write and Page Read protocols.

The EEPROM content is as following

Area Type	Description
Common Header	As defined by the FRU document
Internal Use Area	Not required, do not reserve
Chassis Info Area	Not applicable, do not reserve
Board Info Area	Not applicable, do not reserve
Product Info Area	As defined by the IPMI FRU document. Product information is defined as following
Field name	Field Description
Manufacturer Name	{Formal name of manufacturer}
Product Name	{Manufacturer's model number}
Product part/model number	Customer part number
Product Version	Customer current revision
Product Serial Number	{Defined at time of manufacture}
Asset Tag	{Not used, code is zero length byte}
FRU File ID	{Not required}
PAD Bytes	{Added as necessary to allow for 8-bype offset to next area}
Multi-Record Area	As defined by the IPMI FRU documentation. The following information shall be used by this power supply: Power Supply Information (Record type 0x00) DC Output (Record Type 0x01) No other record types are required for power supply Multi-Record information shall be defined as following
Field Name (PS Info)	Field Information Definition

Overall Capacity (watts)	460
Peak VA	1070
Inrush current (A)	55
Inrush interval (msec)	5
Low end input voltage range 1	90
High end input voltage range 1	140
Low end input voltage range 2	180
High end input voltage range 2	264
A/C dropout total (msec)	20
Binary flags	Set for: Hot Swap support, Auto switch and PFC
Peak Wattage	Set for 575 Watts
Combined wattage	None
Predictive fail tach support	Supported
Field Name (Output)	Field Description : Two output are to be defined from #1 to #2, as follows: +12V and +12VSB
Output Information	Set for: Standby on +12VSB, no 12VSB on all others
All other output fields	Format per IPMI specification , using parameters in this specification

Table 8: Power Supply EEPROM FRU data format

4.2 Fan Modules

The SNH-60A0-320F supports up to 6 fan modules. For front to rear and rear to front air flow, different types of fan modules are required.

Air Flow Direction	Part Number
Front to Rear	AVC DFTA0456B2UP11
Rear to Front	AVC DFTA0456B2UP136A

Table 9: Fan Modules part number

Fan module connector: LCU SM401V-20P

#	NAME	Description	#	NAME	Description
1	FAN_CON_TACH_0	FAN tachometer 0	11	FAN_DIR	FAN Direction
2	GND	GND	12	GND	GND
3	FAN_12VIN	12V	13	FAN_12VIN	12V
4	FAN_CON_PWM_0	PWM control for FAN0	14	EE_GND	EEPROM GND
5	NA	NA	15	EE_SDA	EEPROM SDA

6	EE_SCL	EEPROM SCL	16	EE_VDD	EEPROM VDD
7	EE_A0	EEPROM ADDR_0	17	FAN_CON_PWM_1	PWM control for FAN1
8	FAN_12VIN	12V	18	FAN_12VIN	12V
9	GND	GND	19	GND	GND
10	FAN_PRESENT#	Exist FAN module	20	FAN_CON_TACH_1	FAN tachometer 0

Table 10: Fan Modules connector pin out

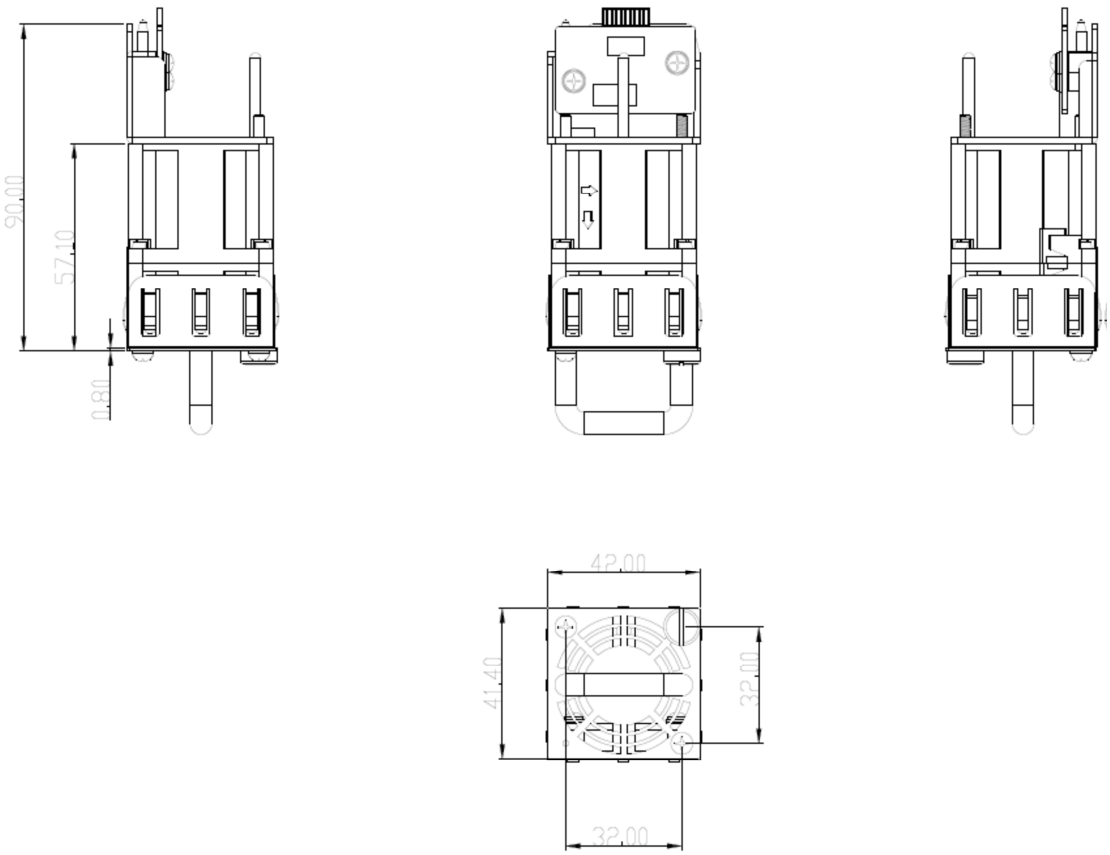

Figure 6: Fan module mechanical specification

5 System Overview

The SNH-60A0-320F comprised of the following PCB

PCB Function	PCB Layer	Dimension (mmxmm)
Main board	14	325*225
FAN extender	2	277*30
MGMT board	6	158.5*118
Intel CPU board	12	210*73.8

Table 11: PCBs for SNH-60A0-320F

5.1 Main PCB

The main PCB is a 14 layer PCB where the switch MAC resides. It also supports the following functions:

- Networking I/O ports
- Management ports
- LED
- Connectivity to power supply and fan
- Power conversion circuit
- etcs

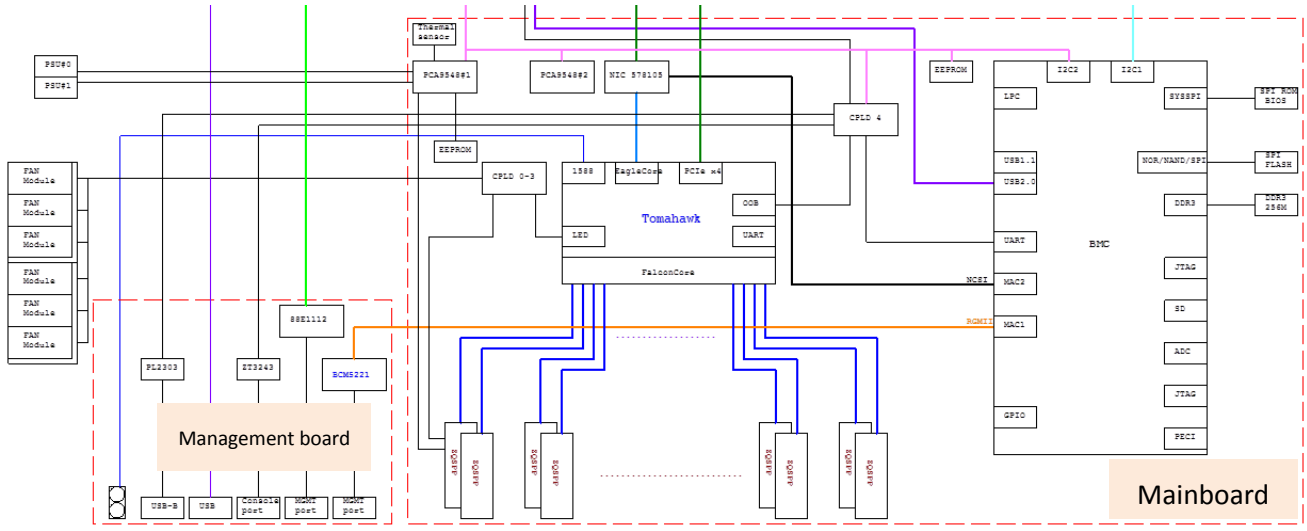

Figure 7: Main board and Management board block diagram

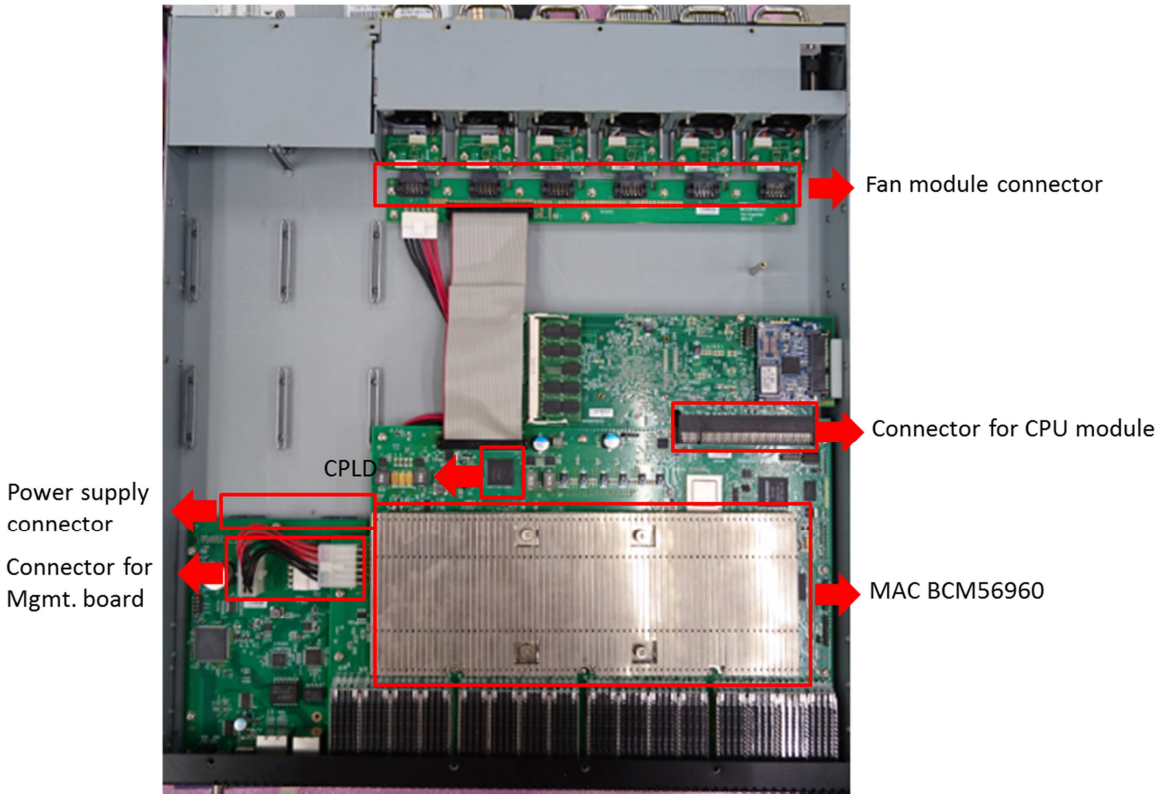

Figure 8: Main PCB top view

5.1 CPU Subsystem

The SNH-60A0-320F offers CPU in modular form to allow the flexibility for different CPU preference. Currently one type of CPU module is supported, and the details are provided in the following table and sections.

Items		Detailed Description
Intel		
Modular CPU board	CPU	Intel Rangeley C2558 4 Cores/2.4G
	RAM	DDR3 4GB for Intel Rangeley CPU
	Flash	SSD 16GB for Intel Rangeley CPU
	Boot Flash	8MB for Intel Rangeley CPU

Table 12: CPU subsystem key Components

5.1.1 Intel CPU (C2558)

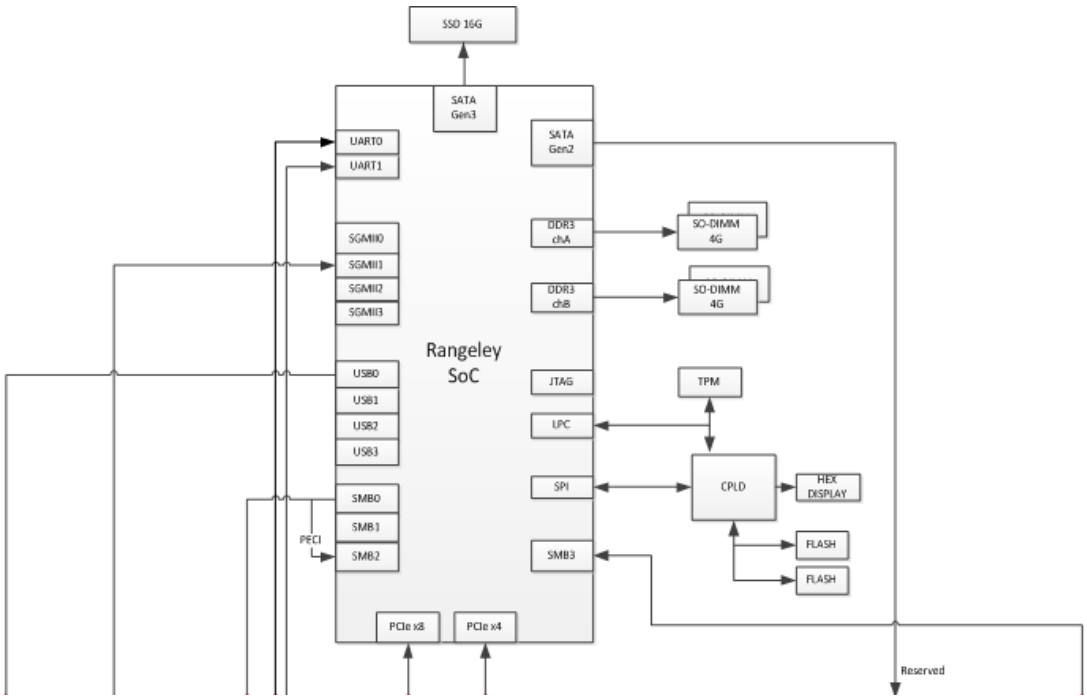

Figure 9: Intel CPU board block diagram

Intel CPU module connector: FCI SMT connector 10061913-112TLF

Default Pin-out			
Pin Name	Side B	Side A	Pin Name
P12V	1	1	PRSNT#
P12V	2	2	P12V
P12V	3	3	P12V
GND	4	4	GND
I2C_SCL	5	5	SVR_ID0/GPIO0
I2C_DATA	6	6	SVR_ID1/GPIO1
GND	7	7	COM_TX
PWR_BTN#	8	8	COM_RX
USB_P	9	9	SVR_ID2/GPIO2

USB_N	10	10	SVR_ID3/GPIO3
SYS_RESET#	11	11	PCIE0_RESET#
I2C_ALERT#	12	12	GND
GND	13	13	PCIE0_REFCLK_P
GND	14	14	PCIE0_REFCLK_N
PCIE0_TX0_P	15	15	GND
PCIE0_TX0_N	16	16	GND
GND	17	17	PCIE0_RX0_P
GND	18	18	PCIE0_RX0_N
PCIE0_TX1_P	19	19	GND
PCIE0_TX1_N	20	20	GND
GND	21	21	PCIE0_RX1_P
GND	22	22	PCIE0_RX1_N
PCIE0_TX2_P	23	23	GND
PCIE0_TX2_N	24	24	GND
GND	25	25	PCIE0_RX2_P
GND	26	26	PCIE0_RX2_N
PCIE0_TX3_P	27	27	GND
PCIE0_TX3_N	28	28	GND
GND	29	29	PCIE0_RX3_P
GND	30	30	PCIE0_RX3_N
SATA0_TX_P	31	31	GND
SATA0_TX_N	32	32	GND
GND	33	33	SATA0_RX_P
GND	34	34	SATA0_RX_N
PCIE1_REFCLK_P	35	35	GND
PCIE1_REFCLK_N	36	36	GND
GND	37	37	PCIE2_REFCLK_P
GND	38	38	PCIE2_REFCLK_N
PCIE1_RESET#	39	39	GND
PCIE2_RESET#	40	40	GND
GND	41	41	RFU

GND	42	42	NIC_SMBUS_ALERT#
NIC_SMBUS_SCL	43	43	GND
NIC_SMBUS_SDA	44	44	GND
GND	45	45	GE0_RX_P
GND	46	46	GE0_RX_N
GE0_TX_P	47	47	GND
GE0_TX_N	48	48	GND
GND	49	49	PCIE0_RX4_P
GND	50	50	PCIE0_RX4_N
PCIE0_TX4_P	51	51	GND
PCIE0_TX4_N	52	52	GND
GND	53	53	PCIE0_RX5_P
GND	54	54	PCIE0_RX5_N
PCIE0_TX5_P	55	55	GND
PCIE0_TX5_N	56	56	GND
GND	57	57	PCIE0_RX6_P
GND	58	58	PCIE0_RX6_N
PCIE0_TX6_P	59	59	GND
PCIE0_TX6_N	60	60	GND
GND	61	61	PCIE0_RX7_P
GND	62	62	PCIE0_RX7_N
PCIE0_TX7_P	63	63	GND
PCIE0_TX7_N	64	64	GND
GND	65	65	PCIE1_RX0_P
GND	66	66	PCIE1_RX0_N
PCIE1_TX0_P	67	67	GND
PCIE1_TX0_N	68	68	GND
GND	69	69	PCIE1_RX1_P
GND	70	70	PCIE1_RX1_N
PCIE1_TX1_P	71	71	GND
PCIE1_TX1_N	72	72	GND
GND	73	73	PCIE1_RX2_P

Table 13: Intel CPU module connector pin out

Pin	Signal		Signal	Pin
B1	5V_STB		UART1_2303_TXD	A1
B2	5V_STB		UART1_2303_RXD	A2
B3	5V_STB		GND	A3
B4	NC		UART1_3243_TXD	A4
B5	NC		UART1_3243_RXD	A5
B6	NC		GND	A6
B7	BIAS3V3		CPLD_FRAME	A7
B8	BIAS3V3		CPLD_CLK	A8
B9	BIAS3V3		CPLD_DATA	A9
B10	GND		GND	A10
B11	AUX1V8		NC	A11
B12	AUX1V8		NC	A12
B13	RMIITXD1		RMIIRXD1	A13
B14	RMIITXD0		RMIIRXD0	A14
B15	NC		RMIICRSDV	A15
B16	RMIITXEN		RMIIRXER	A16
B17	GND		GND	A17
B18	3.3V		2.5V	A18
B19	3.3V		1.2V	A19
B20	3.3V		GND	A20
B21	PSU_I2C_SCL		88E1112_25M_REFCLK	A21
B22	PSU_I2C_SDA		GND	A22
B23	GND		USB1_DM	A23
B24	5221_50M_RMII_REFCLK		USB1_DP	A24
B25	GND		GND	A25
B26	MDIO_88E1112		MDIO_5221	A26
B27	MDC_88E1112		MDC_5221	A27
B28	GND		GND	A28
B29	CPU_PHY_SGMII_N		PHY_CPU_SGMII_N	A29
B30	CPU_PHY_SGMII_P		PHY_CPU_SGMII_P	A30

Table 14: Management board pin out

Pin	Signal		Signal	Pin
1	FAN_PRESENT5		FAN_TACH_11	2
3	FAN_DIRECTION_5		FAN_PWM_5	4
5	FAN_PRESENT4		FAN_TACH_10	6
7	FAN_DIRECTION_4		FAN_TACH_9	8
9	FAN_PRESENT3		FAN_PWM_4	10
11	FAN_DIRECTION_3		FAN_TACH_8	12
13	FAN_PRESENT2		FAN_TACH_7	14
15	FAN_DIRECTION_2		FAN_PWM_3	16
17	FAN_PRESENT1		FAN_TACH_6	18
19	FAN_DIRECTION_1			
21	FAN_PRESENT0		FAN_TACH_5	22
23	FAN_DIRECTION_0		FAN_PWM_2	24
25	BIAS3V3_VCC		FAN_TACH_4	26
27	BIAS3V3_VCC		FAN_TACH_3	28
29	BIAS3V3_VCC		FAN_PWM_1	30
31	GND		FAN_TACH_2	32
33	GND		FAN_TACH_1	34
35	GND		FAN_PWM_0	36
37	SMBus0_SDA		FAN_TACH_0	38
39	SMBus0_SCL		GND	40

Table 15: Fan board pin out

5.1.1.1 DDR3 SDRAM

The Rangeley Memory Controller supports up to 64 GB. The memory controller supports a 64-bit data bus with 8-bit ECC. When only one of the two memory channels is used in a platform board design, Channel 0 must be used. In all designs, Channel 0 must be populated by DRAM devices. Within each memory channel DIMMs are populated in slot order; slot 0 is populated first and slot 1 last. If a DIMM has two ranks, the ranks must be symmetrical (same chip width, same chip density, and same total memory size per rank). If both memory channels of the memory controller are used, then both channels must be populated identically. The CPU board is used a DDR3-1333 4GB SO-DIMM.

5.1.1.2 PCIe Interface

The Rangeley has up to 16 PCIe ports. Each port consists of a Transmitter differential pair and a Receiver differential pair which are in the 1.0-Volt Core power well of the SoC. The Rangeley supports devices with 5.0 GT/s and 2.5 GT/s capabilities.

6 IO and Connectors

6.1 RS232 Interface

- Baud Rate: s/w define
- Data bits: 8
- Stop Bit: 1
- Parity: None
- Flow control: None

6.2 Management Ethernet Interfaces

There are one single PHY on front panel PCBA, use SGMII interface from CPU module convert to 10/100/1000 RJ-45 GbE Management port. The PHY used is Marvell 88E1112.

6.3 USB Interface

The CPU contains one Enhanced Host Controller Interface (EHCI) and complies with the EHCI 1.0 Specification. The EHCI supports up to four USB 2.0 root ports. USB 2.0 allows data transfers up to 480 Mbps. The controller integrates a Rate-Matching Hub (RMH) to support USB 1.1 devices. The USB Port 1 interface is configured by the debug software to be a debug port.

7 Power/Environmental/Agency Certifications

Power	
Number of power supply	2 (default in Power 2 only)
Max. Operating power	Max. 483.5 (W)
Maximum power	770 watts (W) (from Power supply)
Maximum heat dissipation	Max. 1617.70 BTU/hr
Environment	
Dimensions (height x width x depth)	44mm(H)440mm(W) x 487.4 mm(D)
Weight	Around 10.5kg, include 2 PSU and 6 FANs
Operating temperature	0~45°C
Storage temperature	-40~70°C
Operating relative humidity	0%-95% RH

Storage relative humidity	0%~95% RH
Altitude	3,000 meters (9,850 feet)
Acoustic Noise Test Result	All FB fan modules are running at high speed: around 76.1dB All FB fan modules are running at low speed: around 59.5dB

Table 16: Power consumption and environment table

Regulatory Standards Compliance	
Regulatory compliance	Comply with CE markings per directives 2004/108/EC and 2006/95/EC FCC/IC Report Class A BSMI UL/cUL Listed Mark CCC CB
Safety	IEC60950-1 FCC/IC Report Class A EN 60950-1 FCC/IC Report Class A UL/CSA 60950-1 CNS 14336-1 GB4943.1
EMC	EN 55022/EN 55024, Class A FCC CFR47, Part 15B, Class A ICES-003, Class A CNS 13438, Class A GB9254 YDT993

RoHS Requirement		
#	**Description**	**Limitation/ ppm**
1	Cadmium/ Cadmium Compounds	80
2	Hexavalent Chromium/ Hexavalent Chromium Compounds	800
3	Lead/ Lead Compounds	800
4	Mercury/ Mercury Compounds	800
5	Polybrominated Biphenyls (PBBs)	800
6	Polybrominated Diphenylethers (PBDEs)	800

Table 17: Regulatory Standards Compliance table