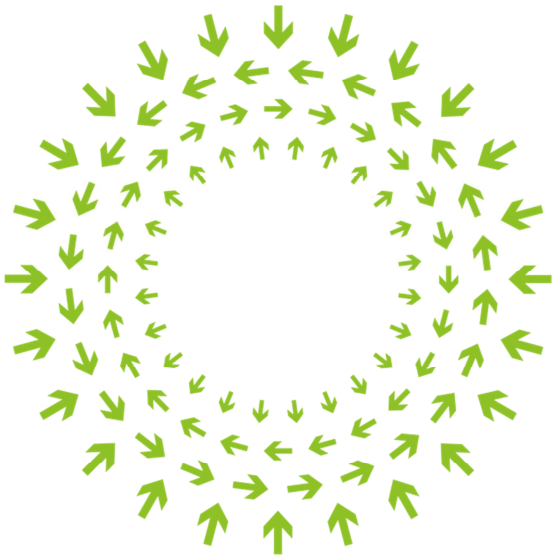

OPEN
Compute Project

Alpha Networks Inc

SNQ-60x0-320F

32-port 40G QSFP Switch
(ToR/Aggregation Switch)

Author: Damon Lee, Chloe Lin

Revision History

Version	Revised Date	Author	Content Revised
0.1	12/02/13	Damon Lee	First Drafted
0.2	12/13/13	Damon Lee	1. Updated the LED definition for MGMT and Console port
0.3	12/20/13	Damon Lee	1. Updated the LED definition for 40G and 10G mode 2. Updated the FAN module 3. Updated the schedule 4. Updated PSU detail
0.4	03/21/14	Damon Lee	1. Added Micro USB console port 2. Updated the LED definition 3. Updated front and real panel
0.5	05/28/14	Damon Lee	1. Updated the LED definition 2. Updated Power supply module 3. Updated the FAN module
0.6	09/24/14	Chloe Lin	Add Fan module connector part number

Scope

This documents defines the technical specification for SNQ-60x0-320F used in the Open Compute Project as 40G Top of the Rack (ToR) or as an aggregation switch

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Overview

The SNQ-60x0-320F Series Data Center, Top-of-Rack (ToR)/aggregation switches, with a total combined bandwidth of 1,280 Gbps, feature 32 ports of 40 Gbps Ethernet wire-speeds or up to 104 ports of 10 Gbps Ethernet wire-speeds. The Layer 3 capable, bare metal system also provides an RJ-45 and a Micro-USB console port and an Out-Of-Band (OOB) management port. The SNQ-60x0-320F switch is a PHY-less design with QSFP+ connections directly attached to the SERDES interface of Broadcom BCM56850.

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Manufacturer	Description
Broadcom	BCM56854
Intel	x86 CPU C2538-2.4GHz
Freescale	P2020NSN2MHC
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 SNQ-60x0-320F Series Data Center, Top-of-Rack (ToR) switches is a cost optimized switch, with a total combined bandwidth of 1,280 Gbps, feature 32 ports of 40 Gbps Ethernet wire-speeds or up to 104 ports of 10 Gbps Ethernet wire-speeds. The Layer 3 capable, bare metal system also provides an RJ-45 and a Micro-USB console port and an Out-Of-Band (OOB) management port. Administrators can selectively access the Command Line Interface (CLI) through either the RJ-45 console port or the Micro-USB console port by simple toggling the dip switch on the front panel of the switch.

- Modular CPU board with large flash and memory
- Temperature warning
- Software-readable thermal monitor
- Real time clock (RTC) support
- Two Hot-swappable redundant power supply
- Five redundant (4+1) fan modules
- One 10/100/1000 Mbps management port
- One RJ45 type console port in the front panel
- One Micro USB console port
- One USB port in the front panel for hosting an external USB flash
- One Reset button in the front panel

2 Physical Overview

2.1 Mechanical Dimension

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

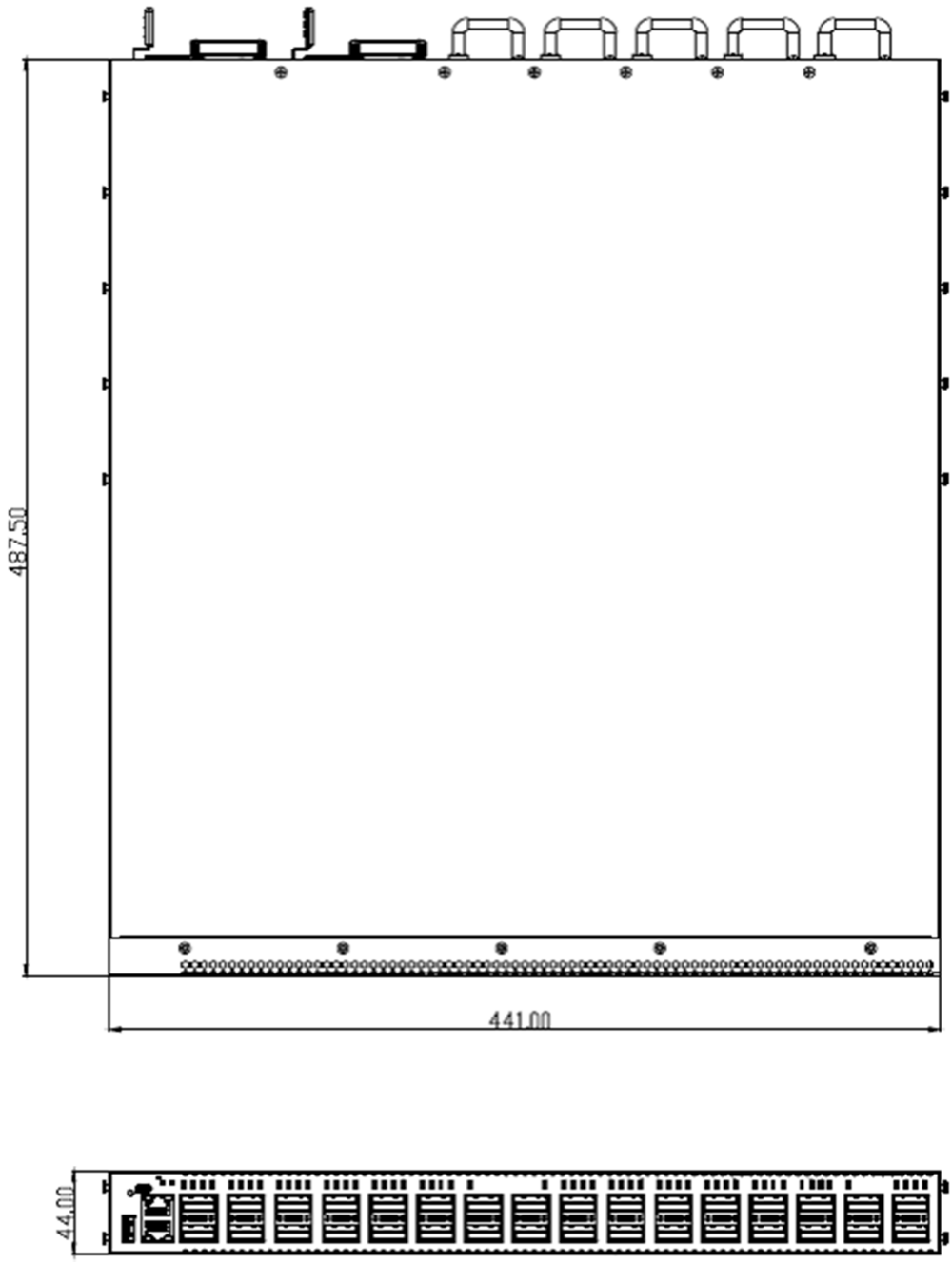
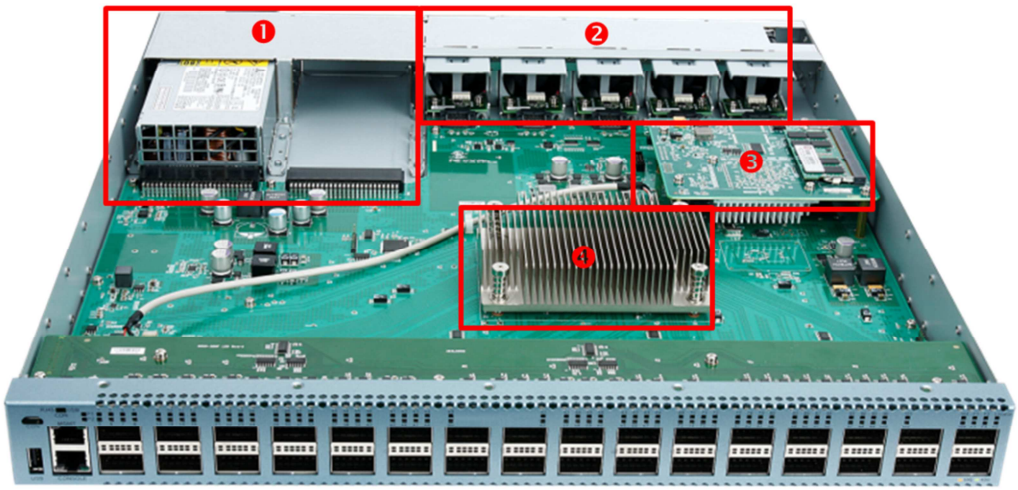


Figure 1: SNQ-60x0-320F Chassis dimension

2.2 Top View



❶: Hot swappable power supply

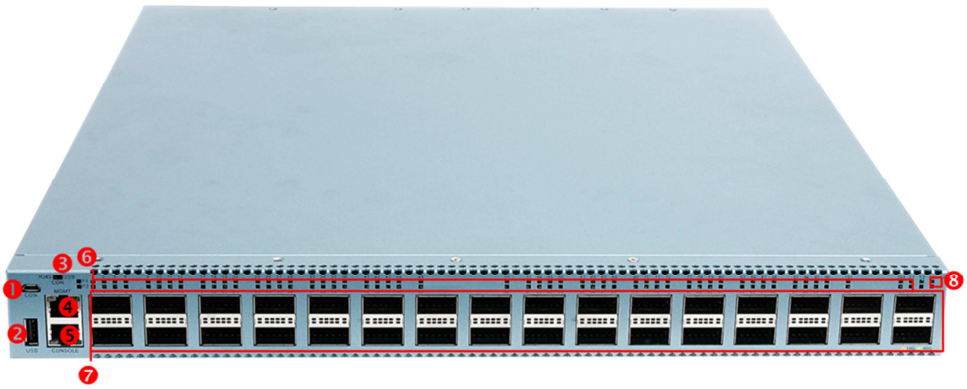
❷: Hot swappable fan modules

❸: CPU module

❹: Switch MAC – Trident 2

Figure 2: SNQ-60x0-320F top view

2.3 Front View



❶: Mini USB console port
❷: Type A USB storage port
❸: Console port selection switch
❹: Out of band management port
❺: Console port
 :QSFP ports LED
 : 40G QSFP ports
 : Blue Locator LED

Figure 3: SNQ-60x0-320F front view

2.4 Rear View

❶: Hot swappable fan modules
❷: Hot swappable power supply

Figure 4: SNQ-60x0-320F rear view

3 LED Definition

The following table defines the per device LEDs' behaviors:

LED Indication	Color	Behavior	Description
PWR	Green	Solid Light	Power On
		Off	Power Off and no power attached
	Amber	Blinking	Power supply failures, over voltage, over current, over temperature
SYST	Green	Solid Light	POST Passed, normal operation
		Blinking	POST in progress
		Light off	No power
	Amber	Blinking	POST failed or overheat or power supply failed or Fan module fail or over temperature
Locator	Blue	Blinking	Locator function is enable
		Off	Locator function is disable
FAN 1 FAN 2 FAN 3 FAN 4 FAN 5	Green	Solid Light	All diagnostics pass. The module is operational.
		Off	The module is not receiving power
	Amber	Blinking	Failure
MGMT	Green(R)	Solid Light	Link up
		Blinking	Packet transmitting or receiving
		Light off	No link up or port disable
CON	Green(R)	Solid Light	Console on
		Light off	Console off

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

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

Location	LED Indication	Color	Behavior	Description
LED number 1~48, 53~100	Link/Act/Speed	Green	Solid Light	When there is a secure 40G connection (or link)
			Blinking	Packet transmitting or

group of 4 (40Gbps)				receiving
			Light off	No link up or port disable
LED number 49~52, 101~104 (40Gbps)	Link/Act/Speed	Green	Solid Light	When there is a secure 40G connection (or link)
			Blinking	Packet transmitting or receiving
			Light off	No link up or port disable

Table 2: LED behavior for Port 1~32 40G Ethernet Port

In the case of split cable plugged in to port 1 ~ 12, and 17 ~ 28 each ports will behaves as 4 individual 10G ports. The following table defines the 10G Ethernet port LEDs' behaviors when split cables are used:

Location	LED Indication	Color	Behavior	Description
LED number 1~48, 53~100 (10Gbps)	Link/Act/Speed	Amber	Solid Light	When there is a secure 10G connection (or link)
			Blinking	Packet transmitting or receiving
			Light off	No link up or port disable

Table 3: LED behavior for Port 1~104 10G Ethernet Port

Each power supply module has a bi-color LED, which behavior is descript 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

Then SNQ-60x0-320F 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) ● DPS-460KB C ● DPS-460KB B DC version (forward and reversed airflow) ● DPS-800KB C ● DPS-800KB B
AC PSUs ● **Input voltage** ● **Frequency** ● **Efficiency**	 ● 100 to 240 VAC ● 50 to 60 Hz ● 89 to 91% at 220V
DC PSUs ● **Input voltage range** ● **Efficiency**	 ● 40.5V/23.8A 48V/19.0A -60V/15.6 ● 85 to 88%

Table 5: Power supplies details

Pin #	Descriptin	Pin #	Descriptin3
A1~9	GND	**B1~9**	GND
A10~18	+12V	**B10~18**	+12V
A19	PMBus SDA	**B19**	A0 (SMBus Address)
A20	PMBus SCL	**B20**	N/A
A21	PSON	**B21**	12VSB
A22	SMBAlert#	**B22**	Smart_on
A23	Return Sense	**B23**	12VLS
A24	+12V Remote Sense	**B24**	No Connect
A25	PWOK	**B25**	N/A

Table 6: Power supply connector pint out

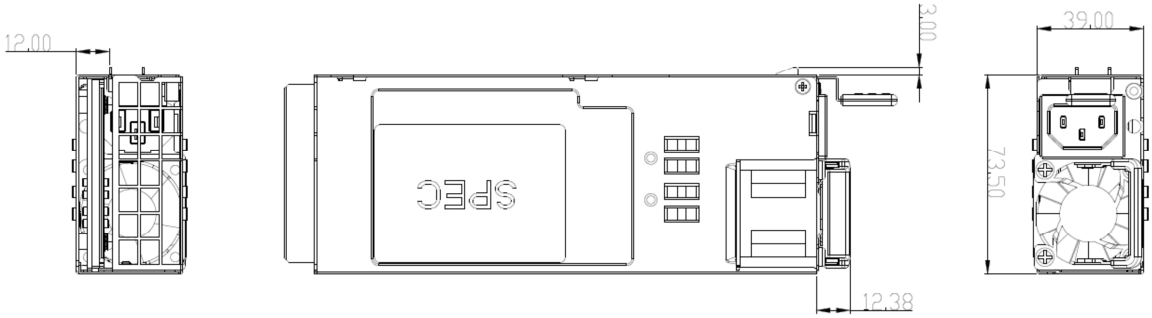


Figure 5: Power Supply Mechanical specification

4.2 Fan Modules

The SNQ-60x0-320F supports up to 5 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 DFTA0456B2UP057
Rear to Front	AVC DFTA0456B2UP058

Table 7: 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			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 8: Fan Modules connector pin out

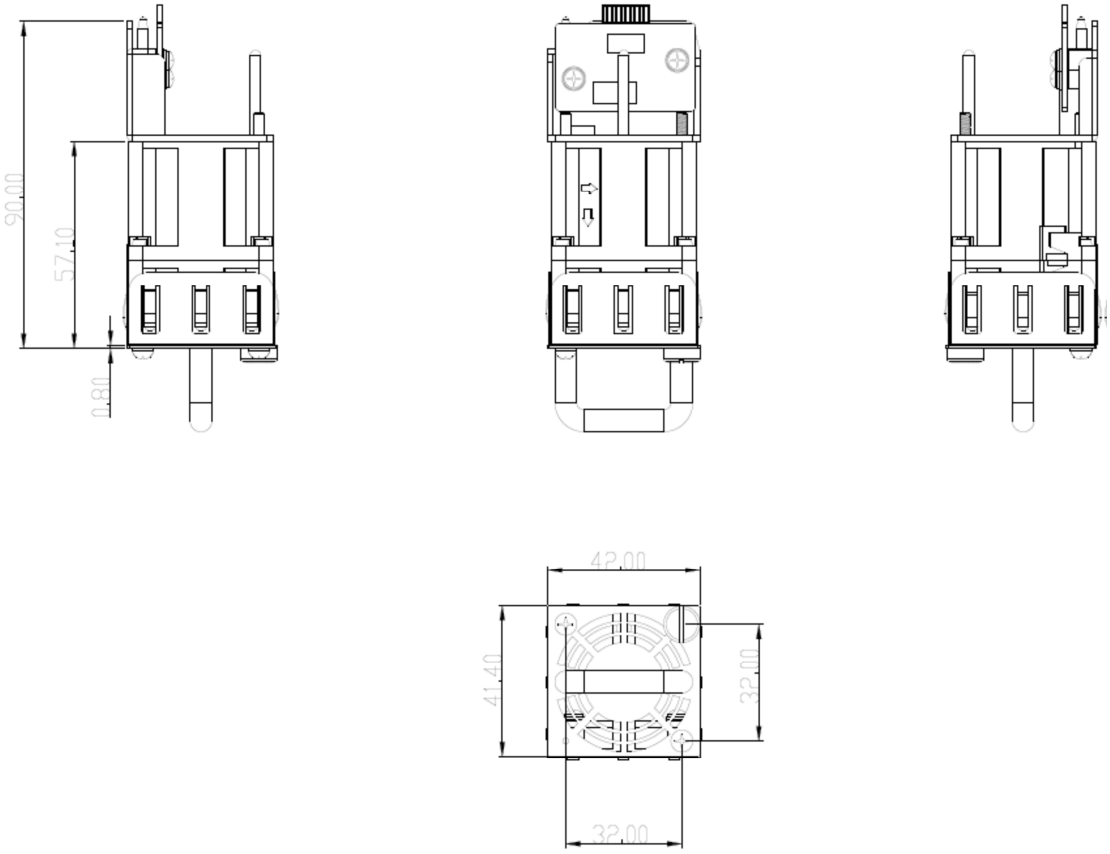


Figure 6: Fan module mechanical specification

5 System Overview

The SNQ-60x0-320F comprised of the following PCB

PCB Function	PCB Layer	Dimension (mmxmm)
Main board	12	432.5*390.6
FAN module	2	38.5*29
LED board	2	431*62
Freescale CPU board	6	120*109*1.6
Intel CPU board	12	255*165.1

Table 9: PCBs for SNQ-60x0-320F

5.1 Main PCB

The main PCB is a 12 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

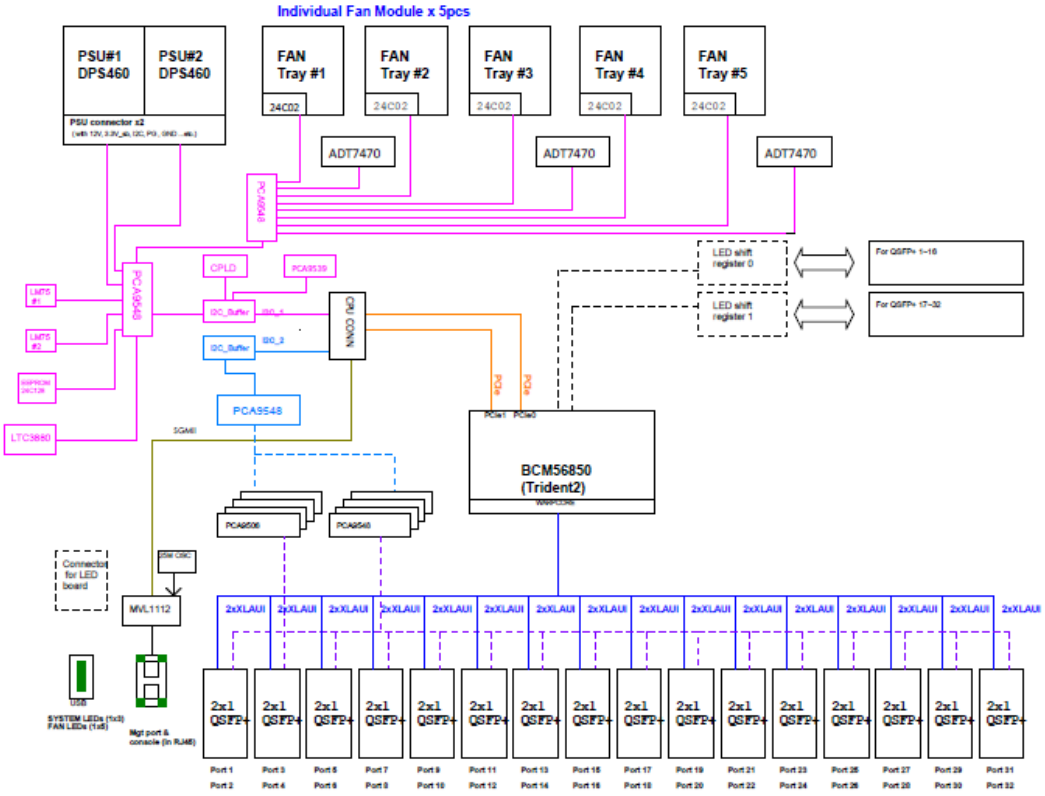


Figure 7: Main board block diagram

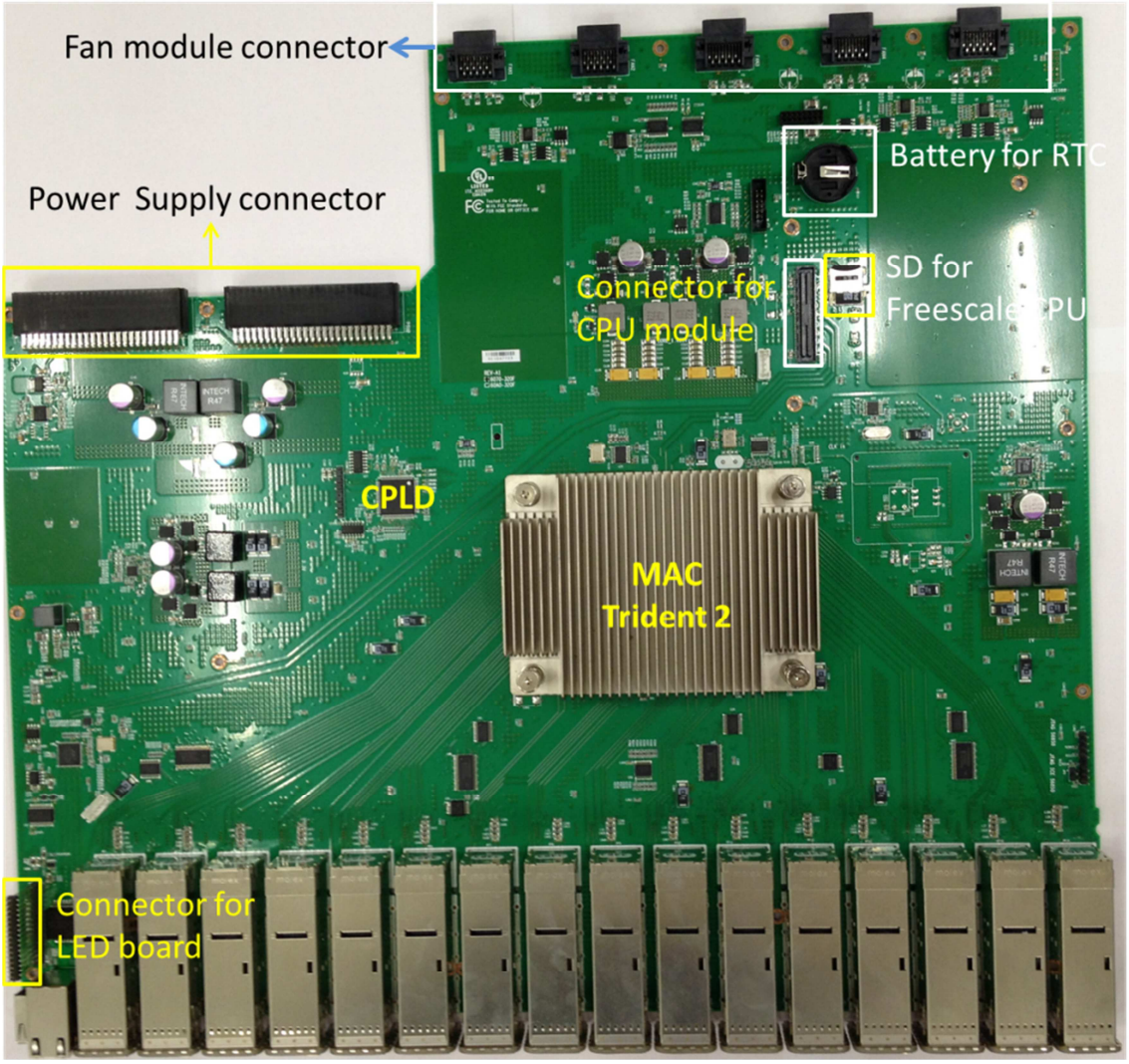


Figure 8: Main PCB top view

5.1 CPU Subsystem

The SNQ-60x0-320F offers CPU in modular form to allows the flexibility for different CPU preference. Currently two types of CPU modules are supported, and the detail is provided in the following table and sections.

Items		Detailed Description
Freescale		
Modular CPU board (Option 1)	CPU	Freescale P2020,1.2GHz with PCIe connector to main board
	RAM	DDR3 4GB for Freescale CPU
	Flash	Micro-SD Card 8GB for Freescale CPU
	Boot Flash	8MB for Freescale CPU

Intel		
Modular CPU board (Option 2)	CPU	Intel Rangeley C2558 4 Cores/2.4G
	RAM	DDR3 4GB for Intel Rangeley CPU
	Flash	SSD 8GB for Intel Rangeley CPU
	Boot Flash	8MB for Intel Rangeley CPU

Table 10: CPU subsystem key Components

5.1.1 Freescale CPU (P2020)

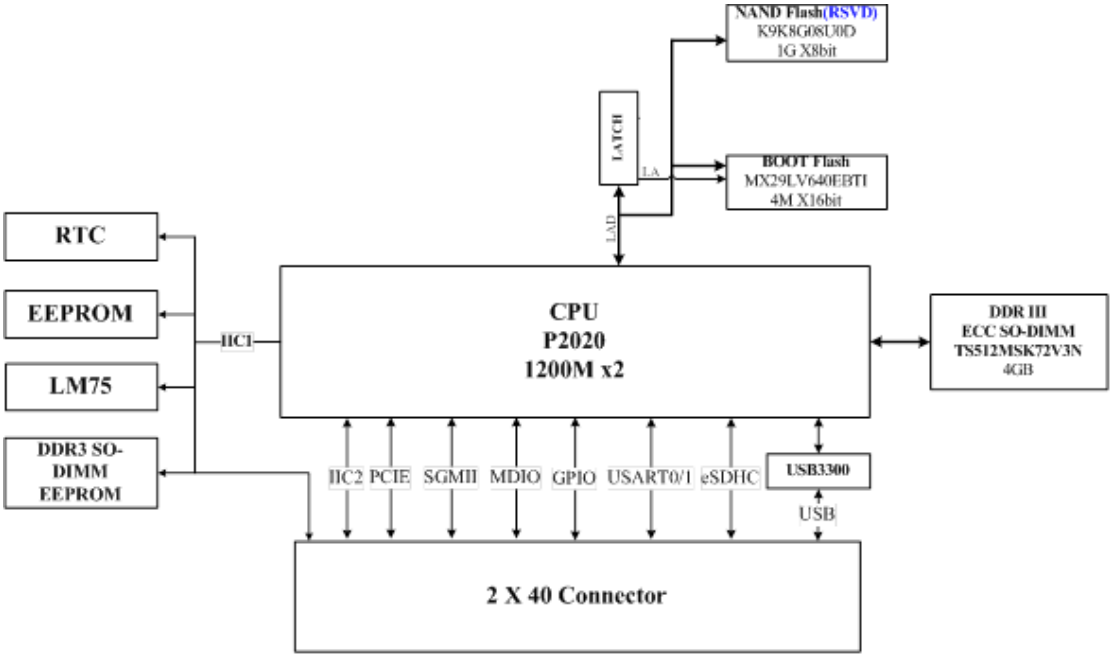


Figure 9: Freescale CPU board block diagram

5.1.1.1 DDR3 SDRAM

The Freescale DDR SDRAM controller supports most JEDEC standard ×8, ×16, ×32, or ×64 DDR2 and DDR3 memories available. Built-in error checking and correction (ECC) ensures very low bit-error rates for reliable high-frequency operation. Dynamic power management and auto-precharge modes simplify memory system design. The DDR memory controller includes these distinctive features:

- Support for DDR2 and DDR3 SDRAM
- 64-/72-bit SDRAM data bus, 32-/40-bit SDRAM for DDR2 and DDR3
- Support for up to 32Gbits of memory

5.1.1.2 PCIe Interface

The P2020 supports three PCI Express interfaces that are compliant with the PCI

Express Base Specification Revision 1.0a. The physical layer of the PCI Express interface operates at a transmission rate of 2.5 Gbaud (data rate of 2.0 Gbps) per lane. The theoretical unidirectional peak bandwidth is 2 Gbps per lane. Receive and transmit ports operate independently, resulting in an aggregate theoretical bandwidth of 4 Gbps per lane.

5.1.2 Intel CPU (C2558)

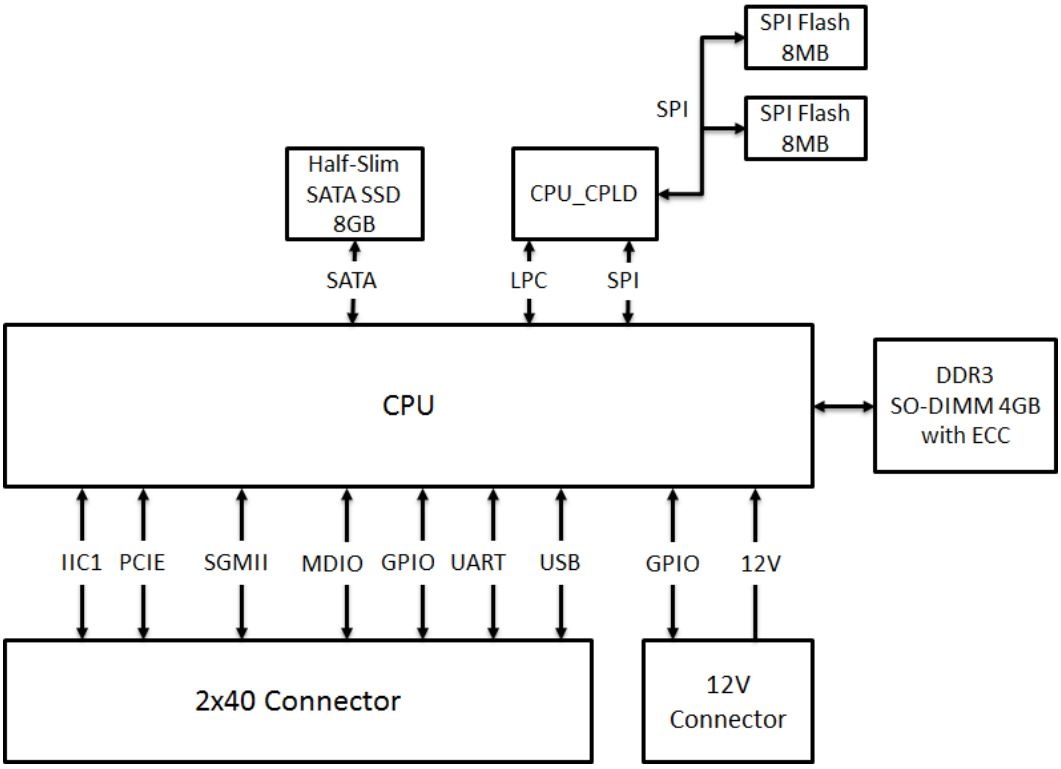


Figure 10: Intel CPU board block diagram

5.1.2.1 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.

5.1.2.2 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 to 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. 353 (W)
Maximum power	456 watts (W) (from Power supply)
Maximum heat dissipation	Max. 1206 BTU/hr
Environment	
Dimensions (height x width x depth)	44mm(H)440mm(W) x 487.4 mm(D)
Weight	Around 9.29kg, include 2 PSU and 5 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 11: 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 12: Regulatory Standards Compliance table