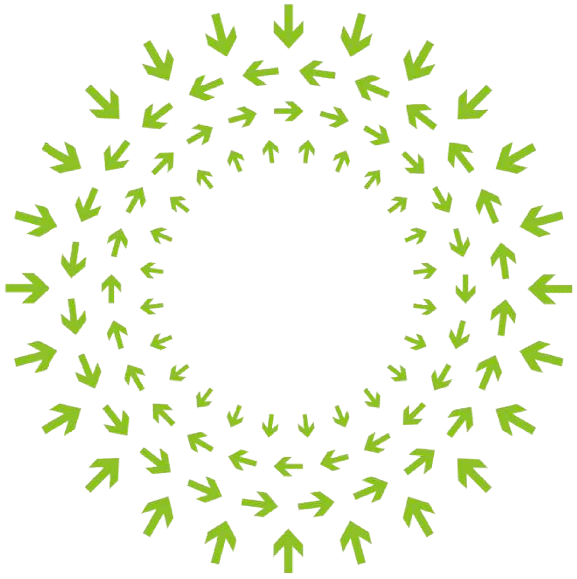

OPEN

Compute Project

Inventec DCS7032Q28
ToR/Spine Switch Specification

Revision History

Revision	Date	Author	Description
.01	3/30/2015	Alex Johnstone	Initial Release
.02	5/28/2015	Alex Johnstone	Incorporated Engineering feedback. First version submitted to the OCP.

Author: Alex Johnstone

Contents

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Description	**Manufacturer**	**Part Number**
X86 CPU	Intel	C2538-2.4GHz FH8065501516762S R1S9
DDR3 8GB SO-DIMM w/ECC	Hynix	HMT41GA7BFR8A-PB
8GB SATA DOM	ADATA	ISMS312-008GWH
SPI NOR Flash 8MB	MXIC	MX25L6406EM2I-12G
pSoc	Cypress	CY8C3246LTI-149
CPLD	Lattice	LCMXO2-2000HC-4FTG256C
P2041 CPU	Freescale	P2041NSN7PNC 1.5GHz 1.0V FCPBGA780 FREESCALE
4GB USB DOM	ADATA	IUM01-004GFHS
AC Power Supply	LITEON	CPR-4011-4M11 Front to back airflow CPR-4011-4M21 Back to front airflow
Switching chip TD2	Broadcom	BCM56854
10/100/1000 NIC	Intel	WGI210AT S LJXQ
Fan	Delta	GFB0412EHS-AA04 (Front to Back airflow) GFB0412EHS-AA04 (Back to Front airflow)
Cage/Conn. QSFP28 2x2 (x8)	Molex	U172564-2001
Connector RJ45 2x1 (x1)	Amphenol	RJMG221MD44B9ER

Table 1 – Licensed Components

1.1 License

As of May 25, 2015, the following persons or entities have made this Specification available under the Open Compute Project Hardware License (Copyleft) Version 1.0 (**OCPHL-P),** which is available at http://www.opencompute.org/community/getinvolved/spec-submission-process/

INVENTEC CORPORATION

This specification is being submitted under the Open Compute Project Hardware License (Permissive)

Scope

This document defines the technical specifications for the Inventec DCS7032Q28 submitted to the Open Compute Foundation.

Overview

The Inventec DCS7032Q28 is a 1U-chassis system, which is targeted at the of TOR (Top-of-Rack)/Spine application and is a PHY-less switch solution. The port configurations on the Redwood switch are thirty-two 100G QSFP28 ports. They can achieve a maximum bandwidth of 3200 Gbps. The user interfaces contain one GbE management ports, one console port, one micro SD card and one USB 2.0 port.

The Inventec DCS7032Q28 contains one CPU board, one Switch board, one FAN board and one daughter board. There are also five 2-rotor fans and two 550W PSUs installed in the box on the rear side of chassis. The PSUs and fans are all hot-swappable.

BCM56960, Tomahawk, is the switch chip used to provide the high bandwidth switching. Since the Inventec DCS7032Q28 uses a PHY-less solution, the Tomahawk is connected directly to thirty-two 100G QSFP28 ports.

The Freescale P2041 is the embedded processor. One memory slot channel of DDR3 SO-DIMM is supported, and maximum capacity is 8GBytes (1x8GBytes). The system boots from BIOS located in SPI memory, and then run OS from either a USB DOM or from a micro SD card.

For redundancy in the design, the Redwood system supports 1+1 PSU redundancy and 4+1 fan redundancy. In addition, it has a backup SPI FLASH which will be activated in the case that the primary SPI image is corrupted.

Physical Overview

1.2 Dimensions

	Inches	**Millimeters**
Length	17.0	431.93
Width	17.32	440
Height	1.7	43.18

Table 2 - Inventec DCS7032Q28 Physical Dimensions

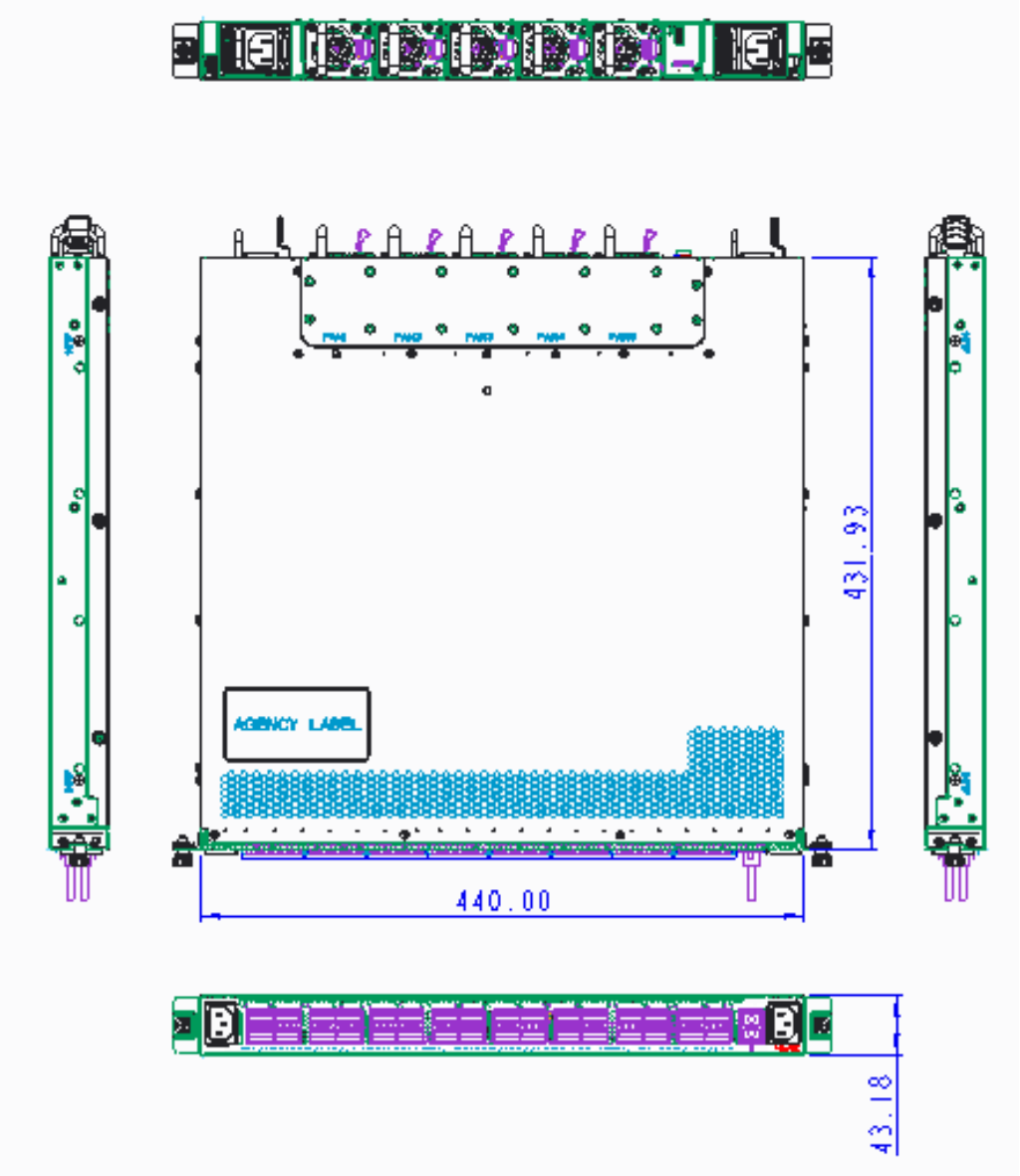


Figure 1 - Inventec DCS7032Q28 Physical Dimensions

1.3 Top View

The top view of the Inventec DCS7032Q28 shows the Printed Circuit Boards, and other chassis components of the system. Locations of the CPLDs, ASIC, and CPU Module are also highlighted.

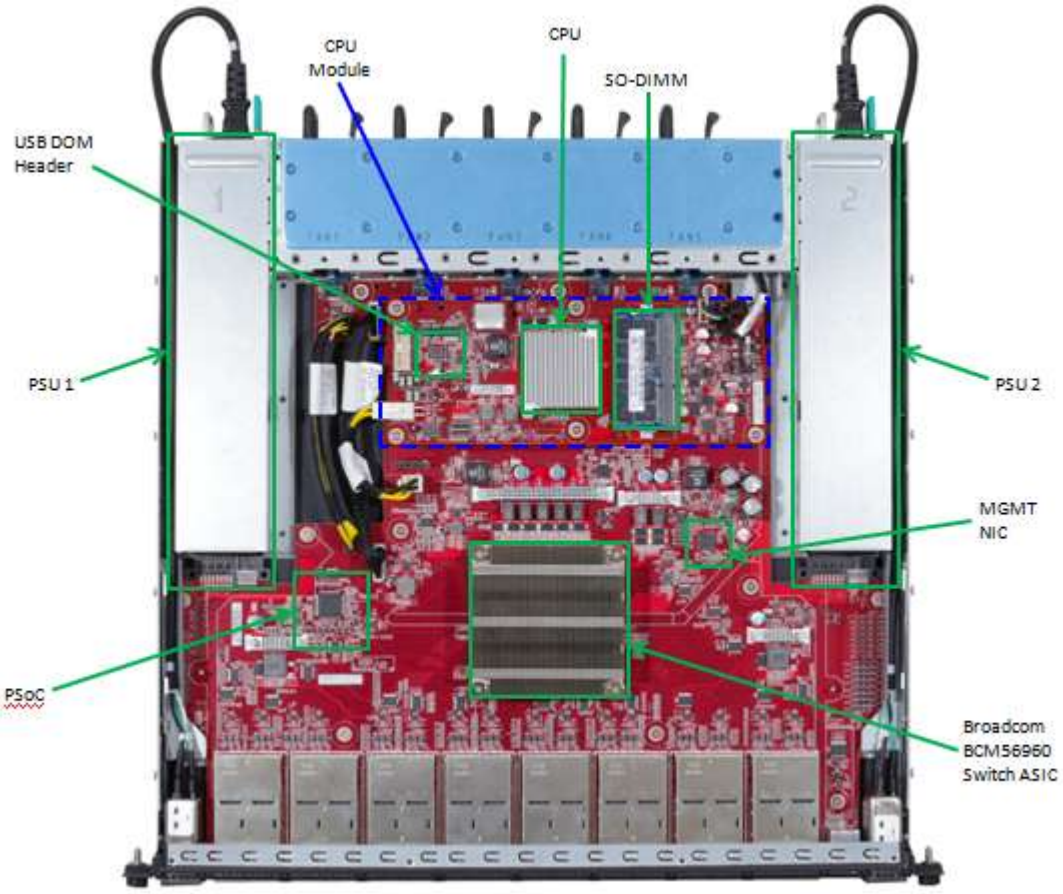


Figure 2 – Inventec DCS7032QS Top View with Key Components Identified

1.4 Front View

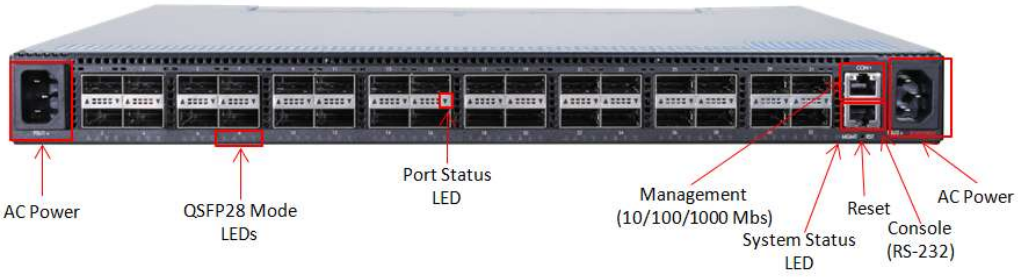


Figure 3 - Inventec DCS7032Q28 Front View

The front panel view of the Inventec DCS7032Q28 includes the following components:

- Thirty-two (32) QSFP28 Ports
- Two (2) IEC AC Power Jacks (1 Located on Each Side of Chassis)
- Port Status LEDs
- QSFP28 Mode LEDs
- RJ-45 (RS-232) Console Port
- RJ-45 10/100/1000 Ethernet Management Port
- System Status LED
- Reset Switch

1.4.1 QSFP28 Port LED Behavior

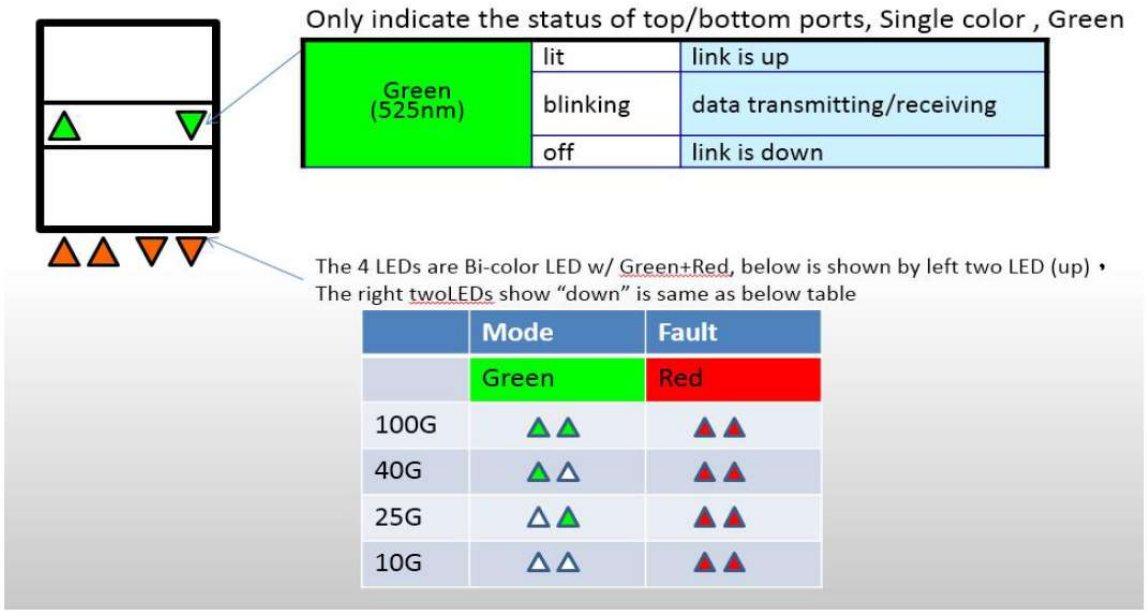


Figure 4 - Inventec DCS7032Q28 QSFP28 Port LED Behavior

1.4.2 Front Panel LED Definitions

Function	Color	Status	Description
QSFP28 mode LED (bi-color)	Green (520nm~535nm)	Solid (Both Left and Right)	100G Mode
		Solid (Left Only)	40G Mode
		Solid (Left Only)	25G Mode
		Off (Both Left and Right)	10G Mode
	Red (617.5nm~629.5nm)	Solid (Both Left and Right)	Port Fail
QSFP28 Link/Activity LED	Green (520nm~535nm)	Solid	Link Up
		Blinking	Activity – XMT/RCV
		Off	Link Down
Management port GbE Link LEDs	Green (568nm)	Solid	Link Up
		Off	Link Down
Management port GbE Activity LEDs	Green (568nm)	Blinking	Activity – XMT/RCV
		Off	No Activity

Table 3 - Inventec DCS7032Q28 Front Panel LED Definitions

1.4.3 Optics and Cable Support

40Gb QSFP+ Optical Modules	Standard 40Gb QSFP+ modules including and not limited to: 40GBASE-SR4, 40GBASE-LR4, 40GBASE-ER, AOC Cables
40Gb Direct Attach Copper (DAC)	Standard DAC cables including and not limited to: Passive cables up to 7m,QSFP-to-QSFP DAC, QSFP-to-SFP+ DAC Breakout
QSFP28 Optics	Support for all standards complaint QSFP28 Transceivers including and not limited to 100GBASE-SR4, 100GBASE-LR4
QSFP28 Direct Attach Copper (DAC)	Standard DAC cables including but not limited to: Passive cables up to 3m, QSFP28-to-QSFP28 DAC, QSFP28-to-SFP28 DAC Breakout

Table 4 - Inventec DCS7032Q28 Optics and Cable Support

1.5 Rear View

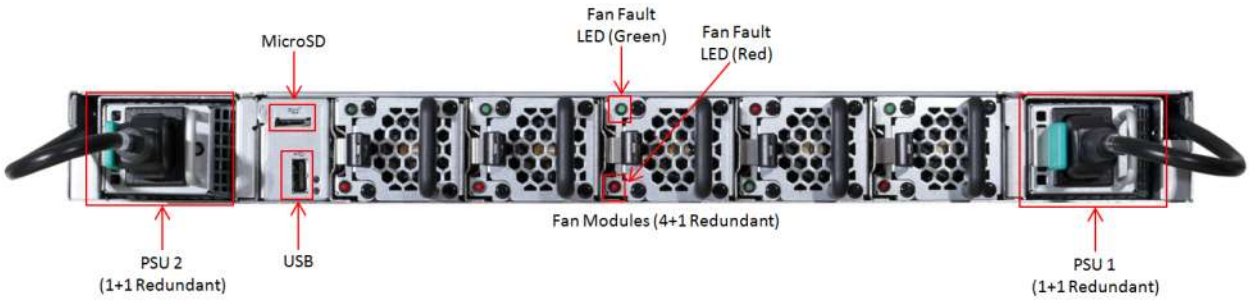


Figure 5 - Inventec DCS7032Q28 Rear View

The rear view of the Inventec DCS7032Q28 includes the following components:

- Two (1+1) Redundant, Hot Swappable, Power Supply Modules
  - Status LED (Per Power Supply)
  - Color Coding to Indicate Airflow Direction
- Five (4+1) Redundant, Hot Swappable, Fan Modules
  - 2 LEDs Per Fan Module to Indicate Status (Red, Green)

1.5.1 Field Replaceable Units

1.5.1.1 Power Supply Modules

The Inventec DCS7032Q28 supports two (1+1) redundant power supply modules as listed in the following table.

Make-Liteon 550 Watt PSU: AC Input Range: 115-230 VAC / xx-yyHz • PS-2551-1L-LF Front-to-Rear Airflow		
	Inches	**Millimeters**
Length	9.45	240.00
Width	2.02	51.30
Height	1.52	38.5

Table 5 - PSU Options and Dimensions

1.5.1.1.1 Power Supply Modules: Mechanical Drawing

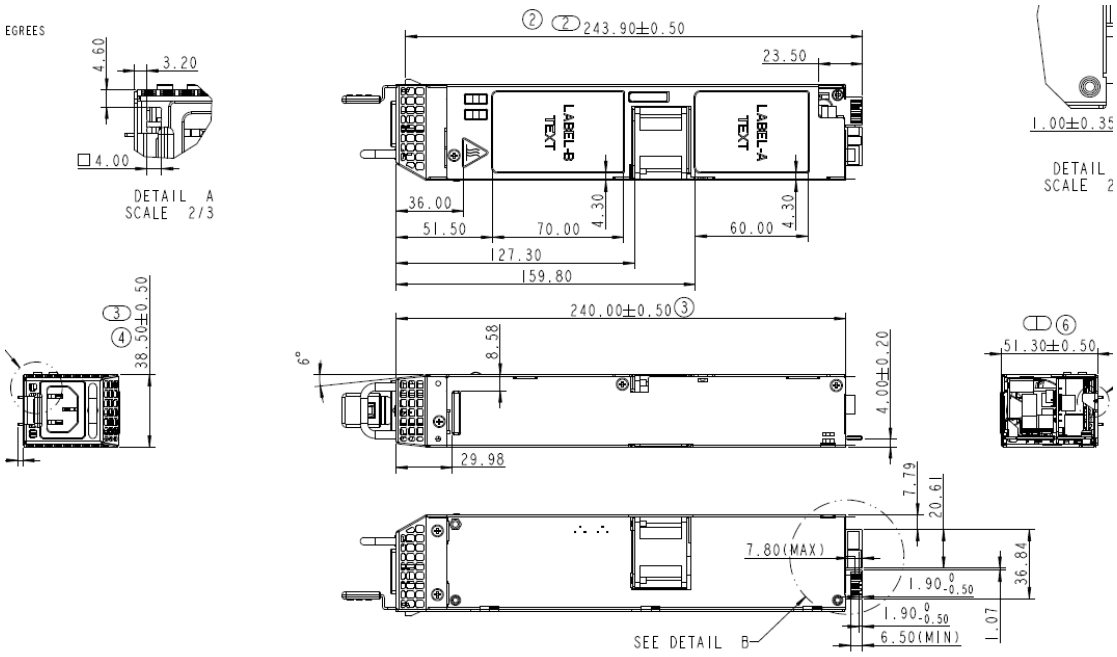


Figure 6 - Inventec DCS7032Q28 PSU Module Drawing

1.5.1.1.2 PSU Pin-Out

OUTPUT PIN DESCRIPTION

Pin #	Function	Card-Edge rating	Application Rating	function
53-64	+12VDC	5.5A/pin	131A/24 pins=5.46A	+12VDC output
41-52	RTN	5.5A/pin	131A/24 pins=5.46A	+12VDC and +12Vsb return, GND
40	RS+	5.5A/pin	<100mA	+12VDC remove sense+
39	+12VSB	5.5A/pin	2.5A	+12Vsb output
38	PS_A0	5.5A/pin	<100mA	PSU address Setting
37	POK	5.5A/pin	<100mA	+12VDC Output OK.
36	Return	5.5A/pin	<100mA	PMBUS return or Signal return
35	SCL	5.5A/pin	<100mA	PMBUS clock
34	-PS_PRESENT	5.5A/pin	<100mA	Power Supply unit Present Indicator
33	SDA	5.5A/pin	<100mA	PMBUS data
1-12	+12VDC	5.5A/pin	131A/24 pins=5.46A	+12VDC output
13-24	RTN	5.5A/pin	131A/24 pins=5.46A	+12VDC and +12Vsb return, GND
25	CR	5.5A/pin	<100mA	Cold Redundant Bus
26	RS-	5.5A/pin	<100mA	+12VDC remote sense-
27	VIN_GOOD	5.5A/pin	<100mA	Vin status indicator
28	LSB	5.5A/pin	<100mA	Load Sharing Bus
29	-PS_ON	5.5A/pin	<100mA	Power Supply unit on/off control signal
30	PS_KILL	5.5A/pin	<100mA	Enable/Disable +12VDC
31	Reset	5.5A/pin	<100mA	PMBUS Reset
32	-Alert	5.5A/pin	<100mA	PSU fail warning

Table 6 - Inventec DCS7032Q28 Golden Fingers Pinout Defintions

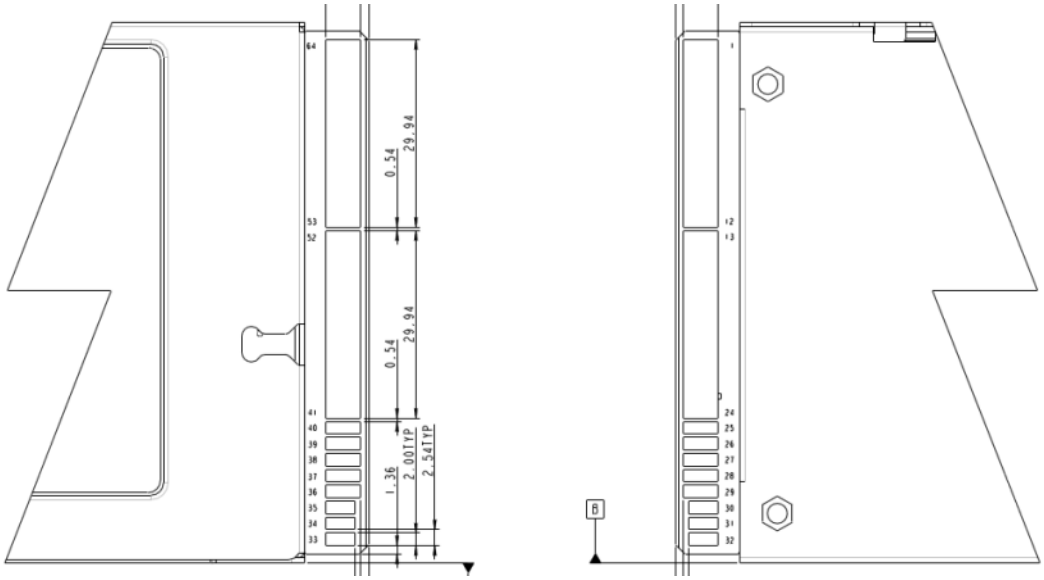
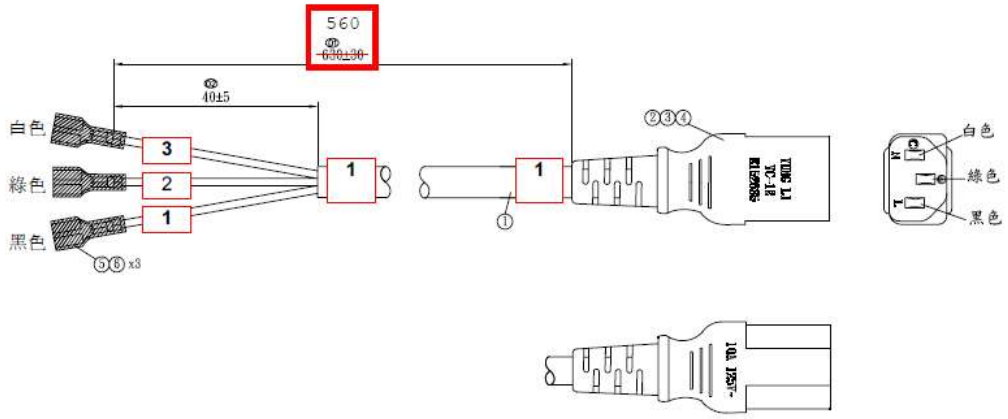


Figure 7 - Inventec DCS7032Q28 Golden Fingers Mechanical Drawing

1.5.1.1.3 Power Supply Modules: Filter cable (Mechanical Drawing, Dimensions, and Specifications)

ISSUE	QTY	ECN NO.	REVISED DESCRIPTION	DATE	APPROVED
0					



序號	名　　稱	用量	備　　注
1	SVT 18/3C 105°C 黑色 四字	1PC	
2	YP-12 黑35P膠料	18g/PC	
3	U型端子:97740BS-0	3PCS	
4	品字內模　白色	1PC	
5	"250"端子: 99764不是	3PCS	
6	熱縮套管:□8x23mm	3PCS	

DRAWER		GOLDEN BRIDGE ELECTECH INC. UTE	
ENGINEER			
CHECKED			
APPROVED			
SAMPLE NO.	AS51-14060028	ORG:	
CUSTOMER:	及樂達	SPEC: YC-12/TERMINAL	
P/N:			

SYMBOL	QTY	DESCRIPTION
☒	0	CRITICAL DIMENSION
□	0	MAJOR DIMENSION
DRAWING NO.		AS51-14060028
REVISION		
UNIT		mm
SCALE		NONE
PAGE NO.		1 OF 1
DATE		2014.07.08
FILES:		R:\SP\SP14\AS51-14060028I.DWG

1. ELECTRICAL CHARACTERISTICS:

1-1. VOLTAGE RATING 115/250VAC

1-2. CURRENT RATING

A. AT 115VAC ..... 8 A RMS Max.
B. AT 250VAC ..... 6 A RMS Max.

1-3. OPERATING FREQUENCY..... 50/60 Hz

1-4. LEAKAGE CURRENT: EACH LINE TO GROUND

A. @115VAC 60Hz ..... 0.20 mA Max.
B. @250VAC 50Hz ..... 0.40 mA Max.

1-5. HIPOT RATING (FOR ONE MINUTE)

A. LINE TO GROUND 2250VDC
B. LINE TO LINE 1450VDC

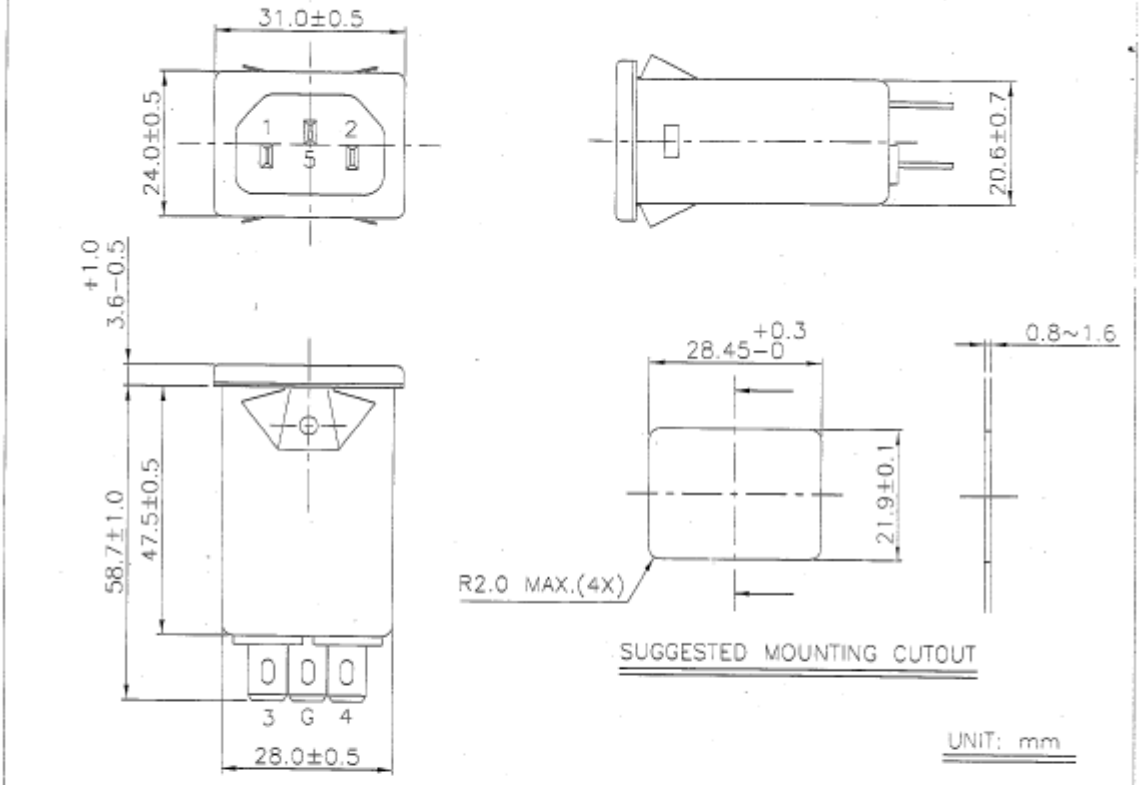
1-6. TEMPERATURE RANGE: -25 ~ +100°C (DERATING ABOVE 40°C)

1-7. MINIMUM INSERTION LOSS IN dB: (AT 50 OHM SYSTEM)

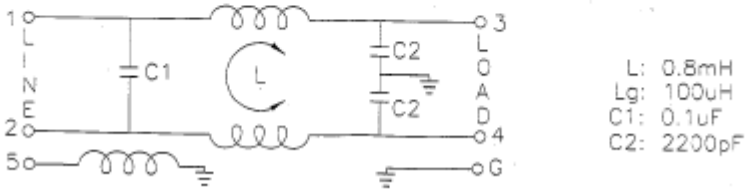
FREQ. MHz	.01	.05	.10	.15	.50	1.0	5.0	10	30
COM. MODE dB	/	5	8	10	15	20	35	40	50
DIF. MODE dB	/	1	4	5	10	15	45	40	50

1-8. SAFETY

2. PHYSICAL DIMENSIONS:



3. SCHEMATIC:

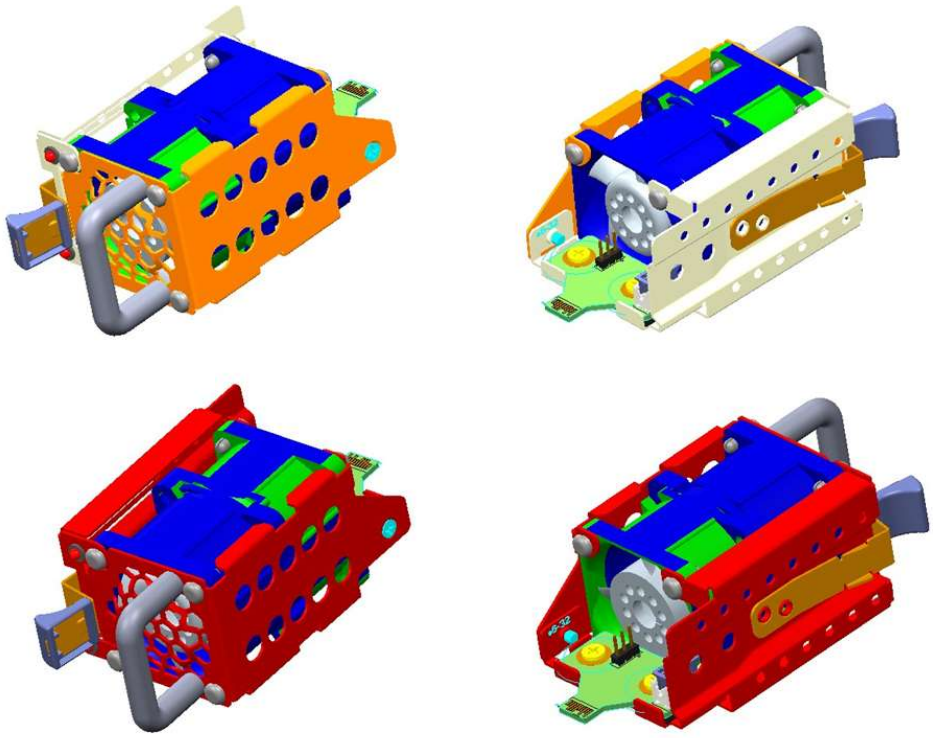


1.5.1.1.4 Fan Modules

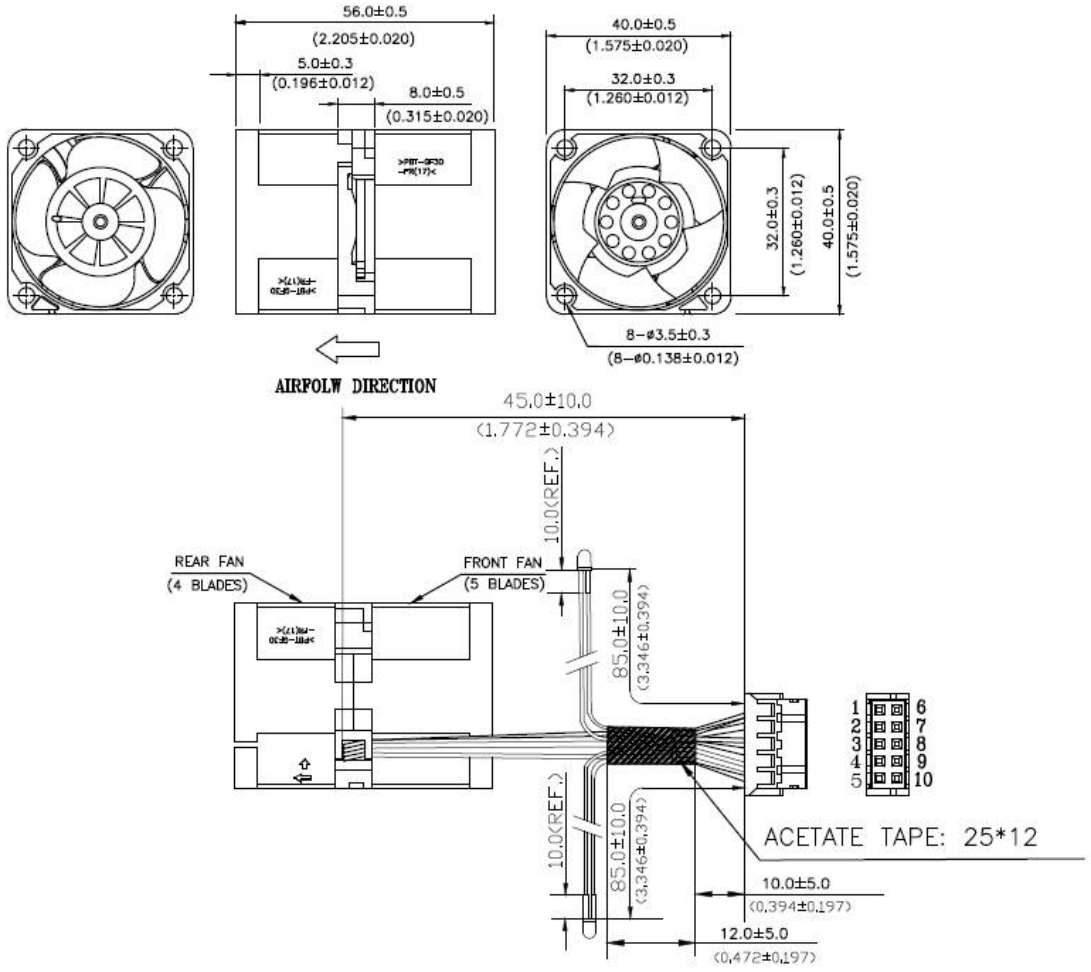
The Inventec DCS7032Q28 supports five individual fan modules. Each fan module supports two 40 mmx40 mmx56 mm fans.

Description	Manufacturer	Part Number
Fan (Front-to-Rear Airflow)	Delta	GFB0412EHS-AA04
Fan (Rear-to-Front Airflow)	Delta	GFB0412EHS-AA04

Table 7 - Fan Modules



1.5.1.1.1 Fan Connector Pinout



1.6 Inventec DCS7032Q28 System Description

The Inventec DCS7032Q28 consists of a 1U chassis, with the dimension of 17" L x 19" W x 1.75" H. The whole system consists of one chassis, one CPU board with 1 DDR3 SO-DIMM, one Switch board, one FAN board and one daughter board, five fans, and two PSUs.

The connection between CPU board and daughter board is through a cable. The hot-swappable PSUs are connected directly to the Switch board via a straddle mounted connectors, this is to provide power for the whole system. Each PSU can deliver up to 550W power. Every fan module includes 2 fans and one fan board and is connected to Fan board via gold fingers. It is also hot-swappable. The Inventec DCS7032Q28 has a total of thirty-two 100G QSFP28 ports on the front panel.

1.6.1 PCB Board Assemblies

The Inventec DCS7032Q28 is comprised of the following four (4) PCB assemblies:

Description	Dimensions	Layers
Switch PCB	12.29in x 16.98in x 0.12in (309.214mm x 431.292mm x 3.048mm)	20 Layers
CPU Module PCB	3.38in x 8.72in x 0.085in (85.85mm x 221.5mm x 2.16mm)	10 Layers
Micro-SD PCB	0.91in x 2.50in x 0.093in (23.12mm x 63.5mm x 2.36mm)	6 Layers
Fan tray module PCB	1.52in x 1.18in x 0.062in (38.5mm x 30mm x 1.58mm)	4 Layers
Fan PCB	1.44in x 9.61in x 0.062in (36.58mm x 244.10mm x 1.57mm)	4 Layers

1.6.1.1 Switch PCB

The Switch PCB is a multi-layer board supporting the Broadcom Tomahawk switching silicon, front panel networking and management ports, LEDs, and the connections to other PCB boards in the system.

1.6.1.2 Switch PCB Top View

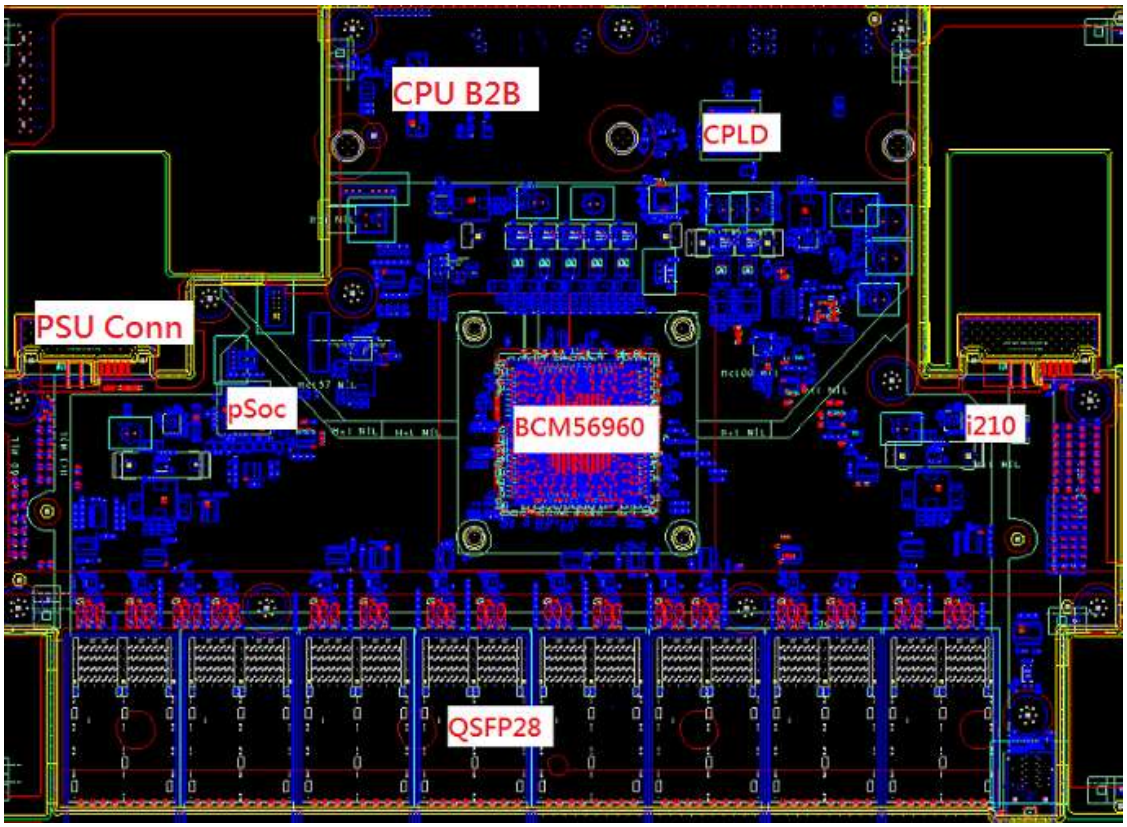


Figure 8 - Inventec DCS7032Q28 Switch PCB Top View With Major Components Highlighted

1.6.1.3 Switch PCB Bottom View

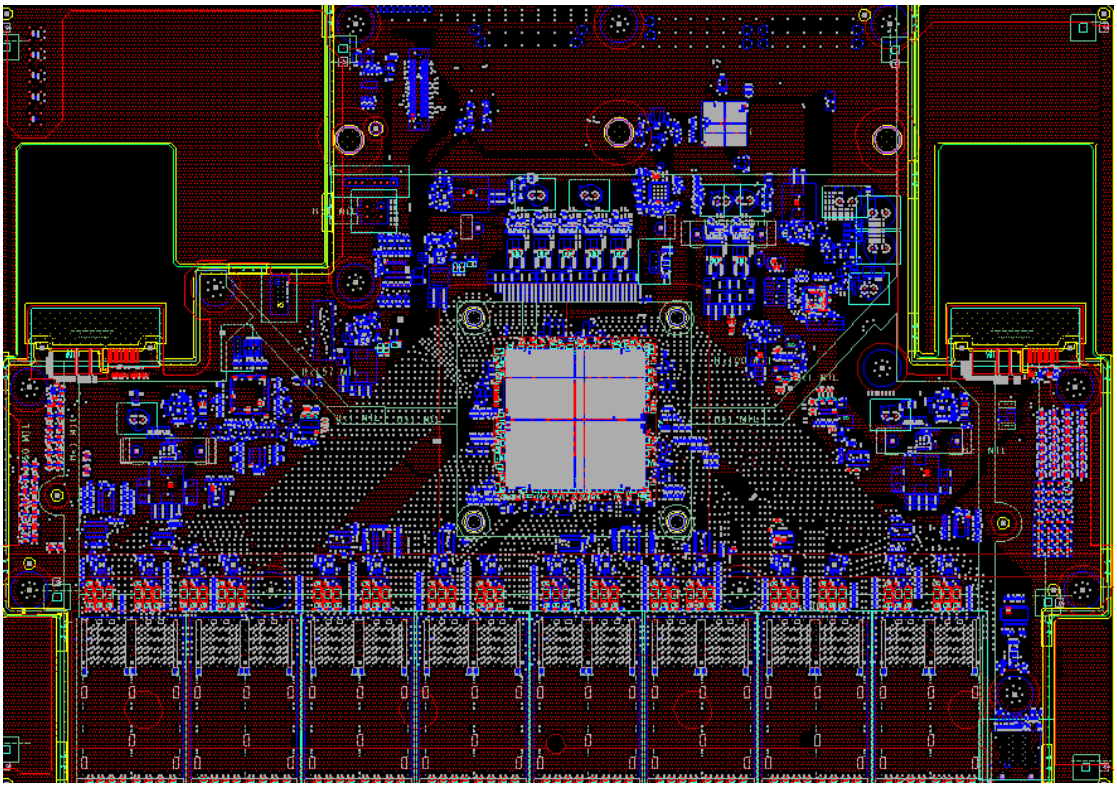


Figure 9 - Inventec DCS7032Q28 Switch PCB Bottom View

1.6.1.3.1 Switch PCB Major Components

Description	Manufacturer	Part Number
Switching Silicon	Broadcom	BCM56960
Management NIC	Intel	WGI210AT S LJXQ
CPLD	Lattice	LCMXO2-2000HC-4FTG256C
pSoc	Cypress	CY8C3246LTI-149
QSFP28	Molex	172564-2001
CPU B2B	Molex	52885-0774
PSU Conn	FCI	10126933-0808205BLF

1.6.1.3.2 Switch PCB Block Diagram

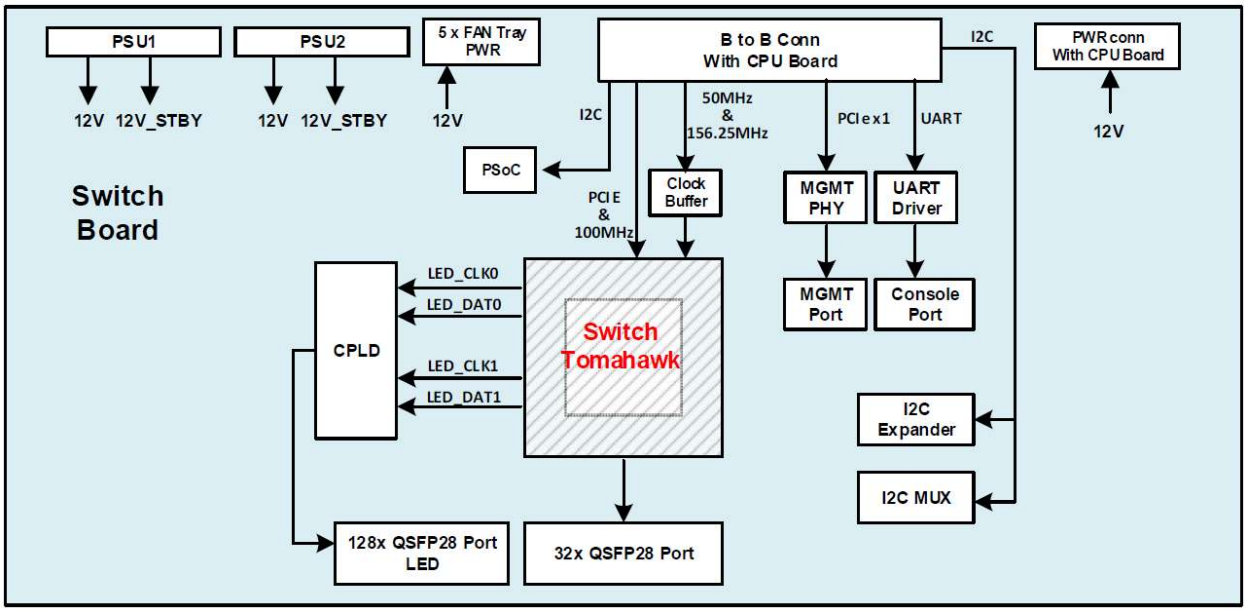
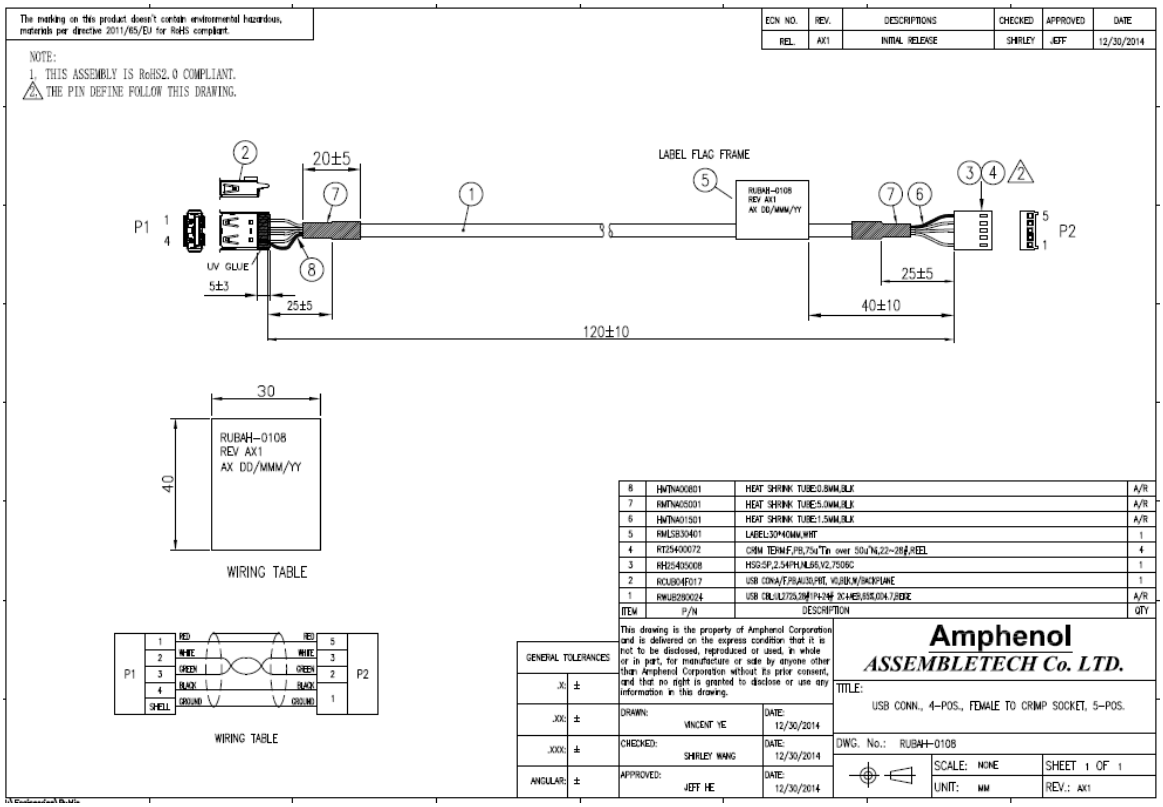


Figure 10 - Inventec DCS7032Q28 Main PCB Block Diagram

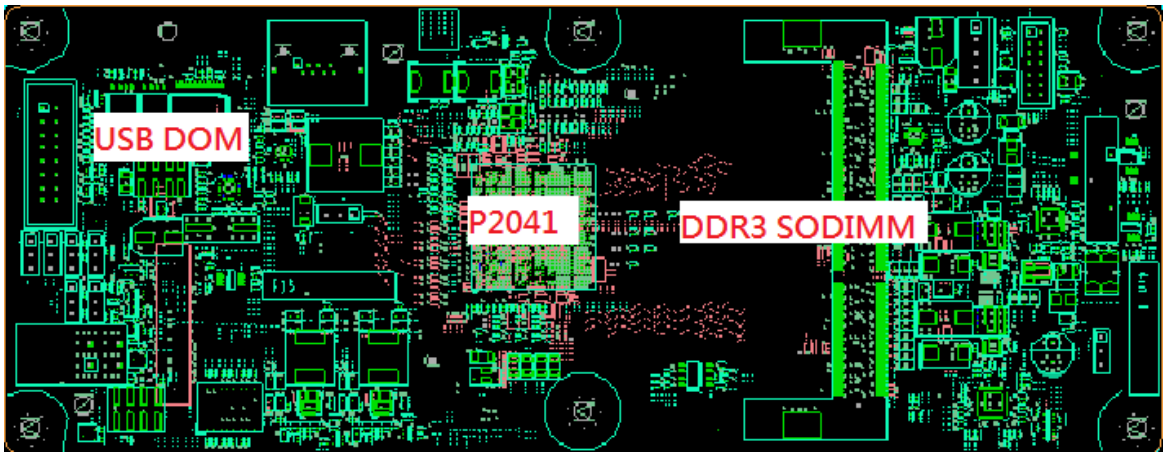
1.6.1.3.3 Switch PCB USB cable



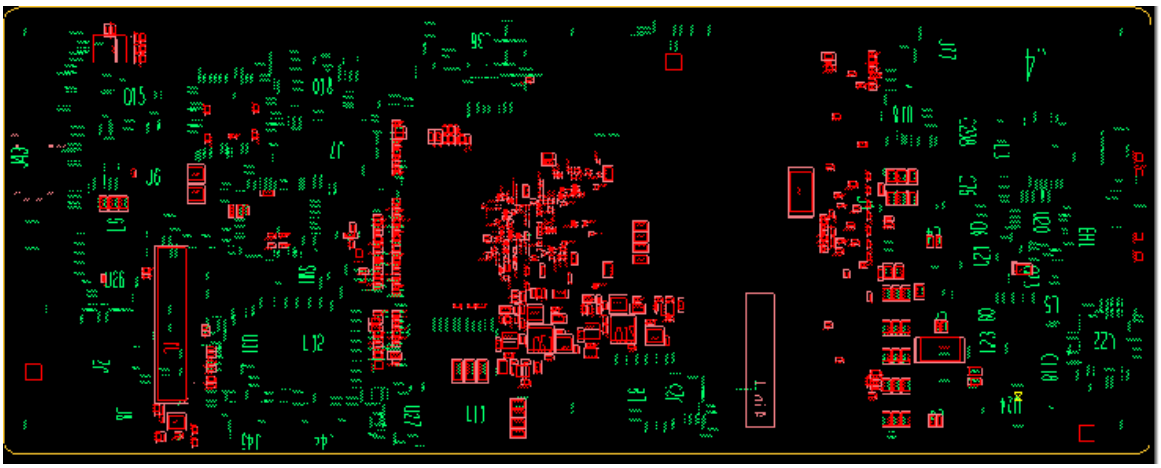
1.6.1.4 Freescale P2041 CPU Module Description

The P2041 CPU module is a multi-layer PCB which accommodates the communication processor and the associated components for the CPU subsystem. The processor residing on this CPU module is Freescale P2041 QorIQ integrated communication processor which provides four Power Architecture® processor cores with high performance data path acceleration logic and peripheral bus interfaces required for Networking and Telecommunication.

1.6.1.4.1 Freescale P2041 CPU Module Top View



1.6.1.4.2 Freescale P2041 CPU Module Bottom View



1.6.1.4.3 Freescale P2041CPU Module Major Components

Description	Manufacturer	Part Number
P2041 CPU	Freescale	P2041NSN7PNC 1.5GHz 1.0V FCPBGA780 FREESCALE
DDR3 8GB SO-DIMM w/ECC	Hynix	HMT41GA7BFR8A-PB
4GB USB DOM	ADATA	IUM01-004GFHS

1.6.1.4.4 Freescale P2041 CPU Module Block Diagram

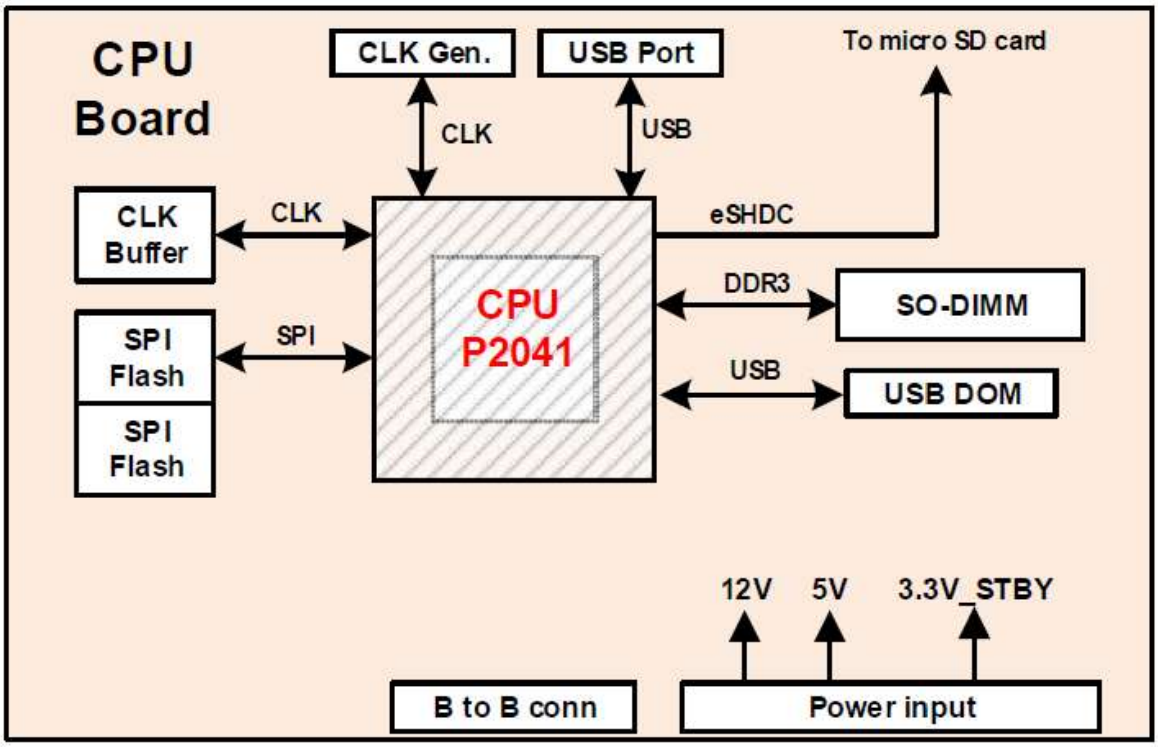


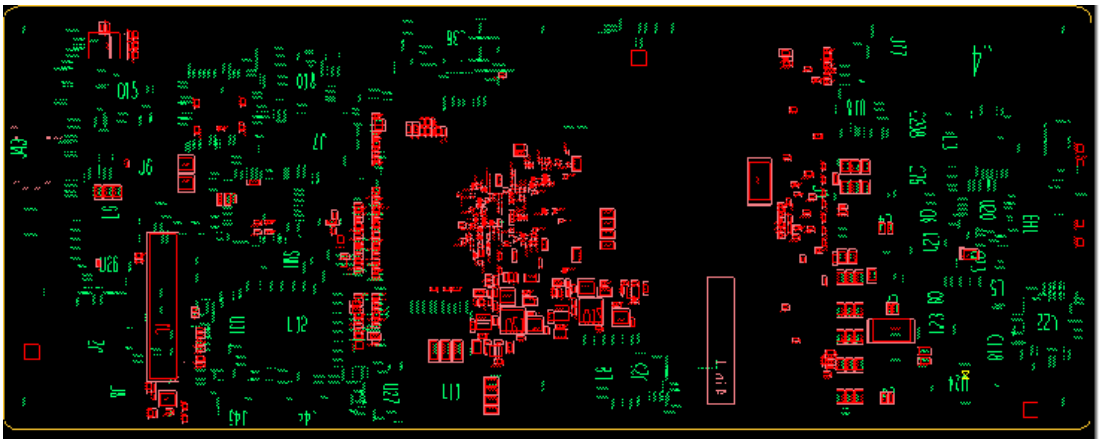
Figure 11 - Freescale P2041 CPU Module

1.6.1.5 Intel Intel C2538 CPU Module

The x86 CPU module is a multi-layer PCB which accommodates the communication processor and the associated components for the CPU subsystem. The communication processor residing on this CPU module is Intel Atom C2538. Intel C2538 processor has four cores with the thermal design power (TDP) around 15W, the integrated HW acceleration, and the Intel Xeon Instruction Set Architecture compatibility.

1.6.1.5.1 Intel C2538 CPU Module Top View

1.6.1.5.2 Intel C2538 CPU Module Bottom View



1.6.1.5.3 Intel C2538 CPU Module Major Components

Description	Manufacturer	Part Number
CPU	Intel	C2538 FH8065501516762S R1S9
8GB DDR3 SODIMM	Hynixx	HMT41GA7BFR8A-PB
SATA DOM 8GB	ADATA	ISMS312-008GWH

1.6.1.5.4 Intel C2538 CPU Module Block Diagram

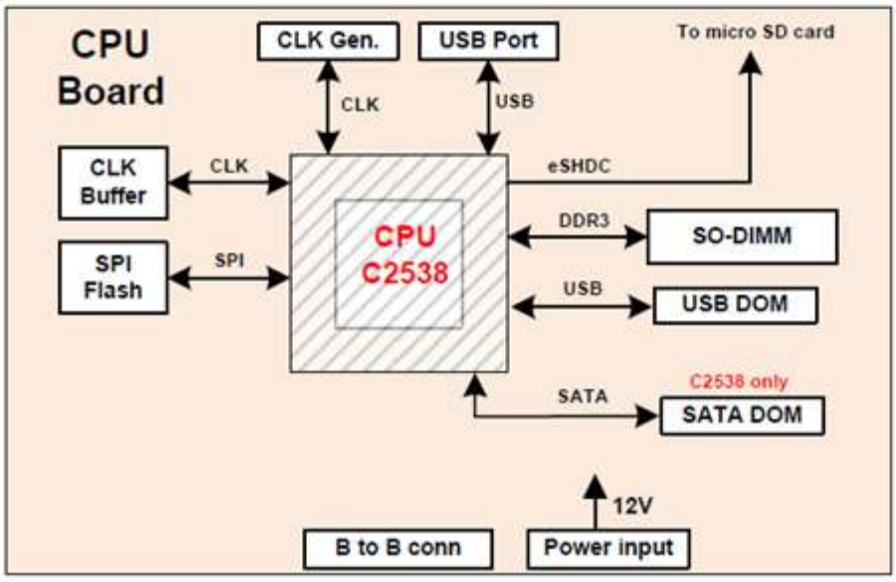
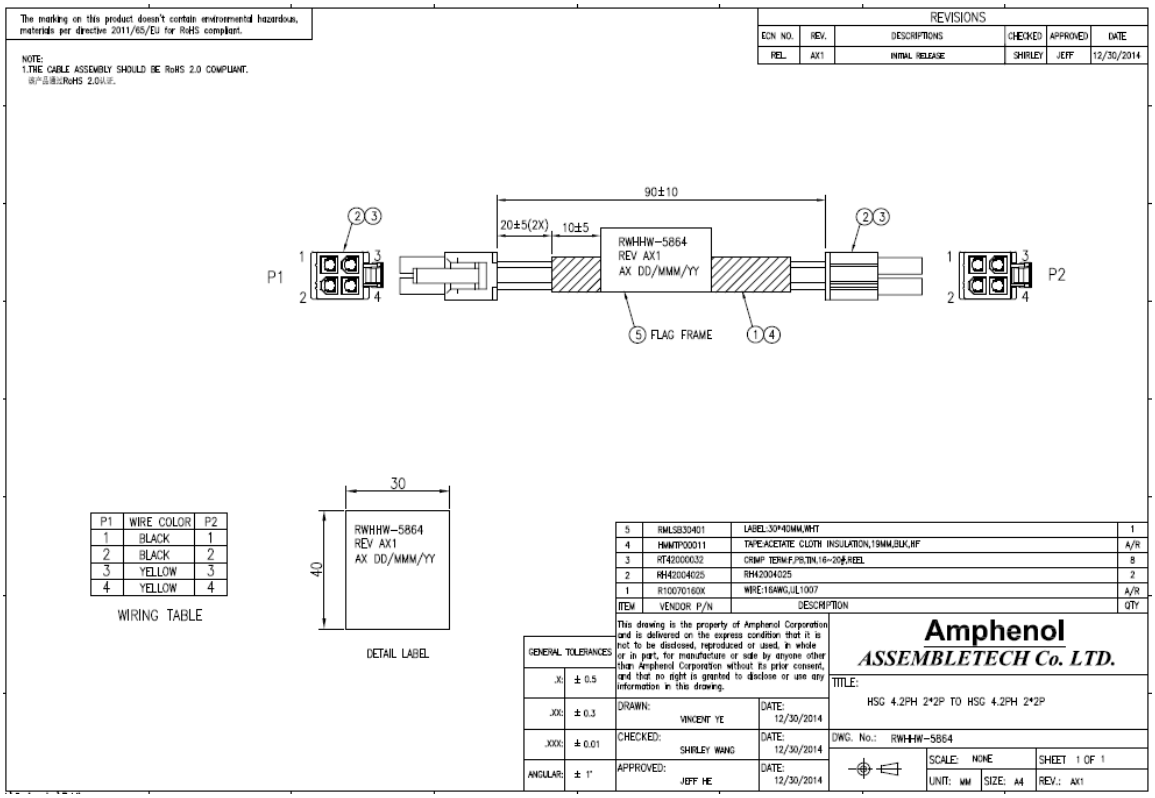


Figure 12 - Intel C2538 CPU Module

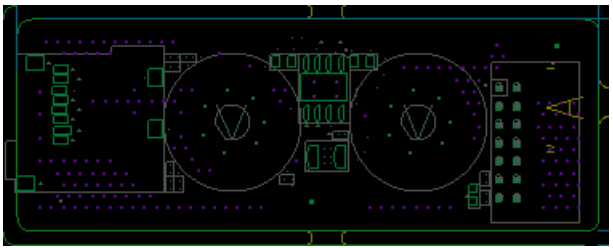
1.6.1.5.5 CPU Module cable



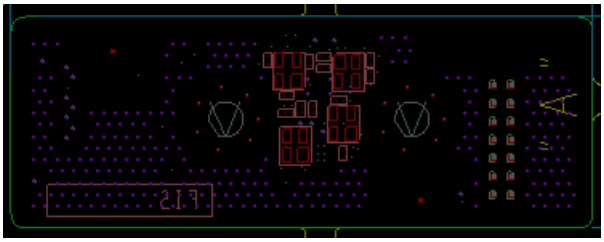
1.6.1.6 Micro-SD PCB Description

Micro-SD PCB includes micro-SD socket and connected to the main board by the cable.

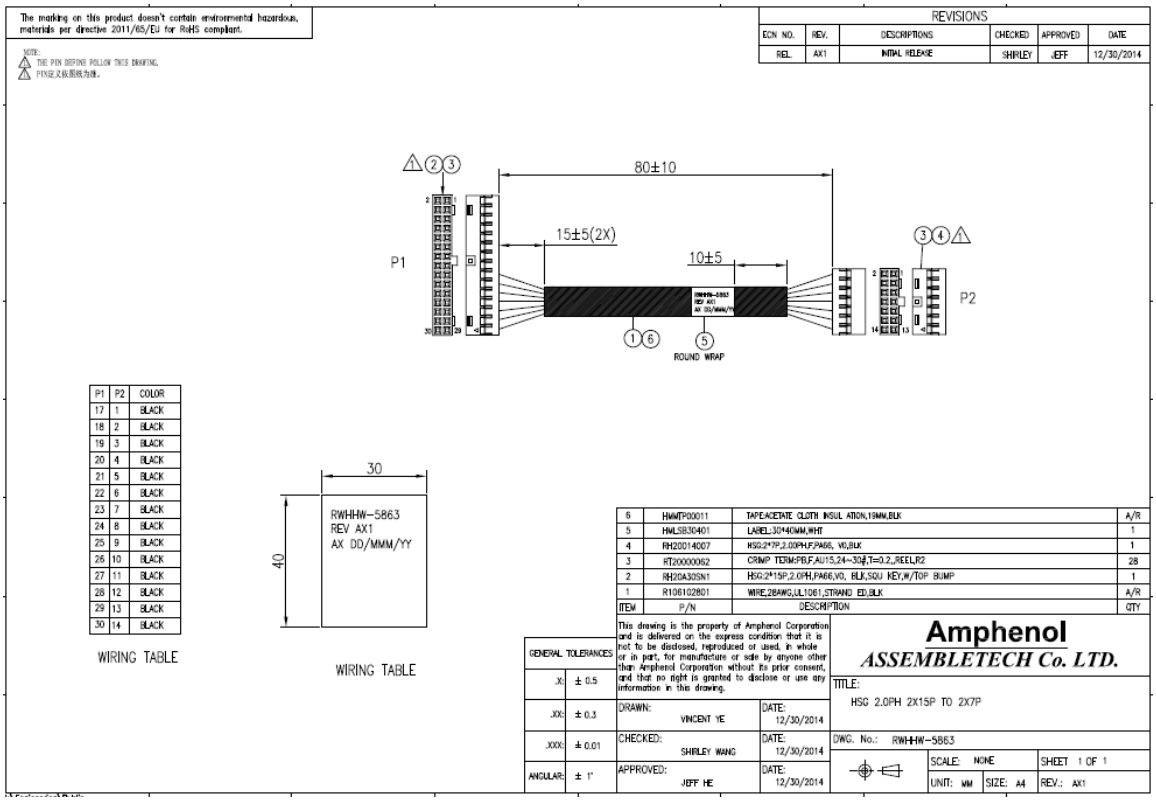
1.6.1.6.1 Micro-SD PCB Top View



1.6.1.6.2 Micro-SD PCB Bottom View



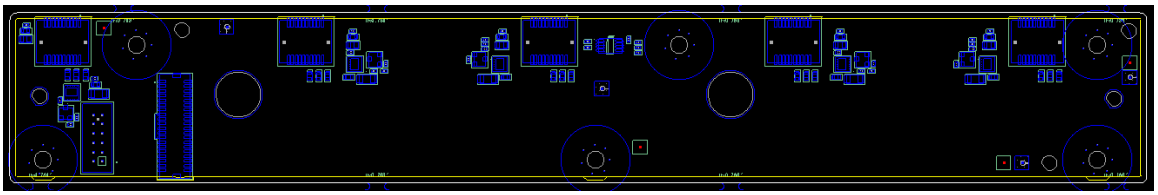
1.6.1.6.3 Micro-SD Signal cable



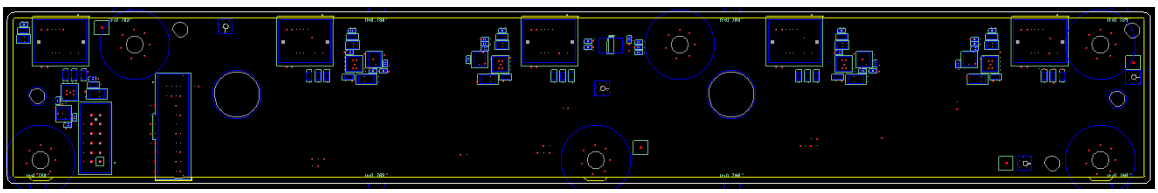
1.6.1.7 Fan PCB Description

The Fan board is 4 layers PCB and provides power, management and connectivity for 4 system Fan module. The Fan PCB connects to main switch board with small cable for power and monitor system Fan.

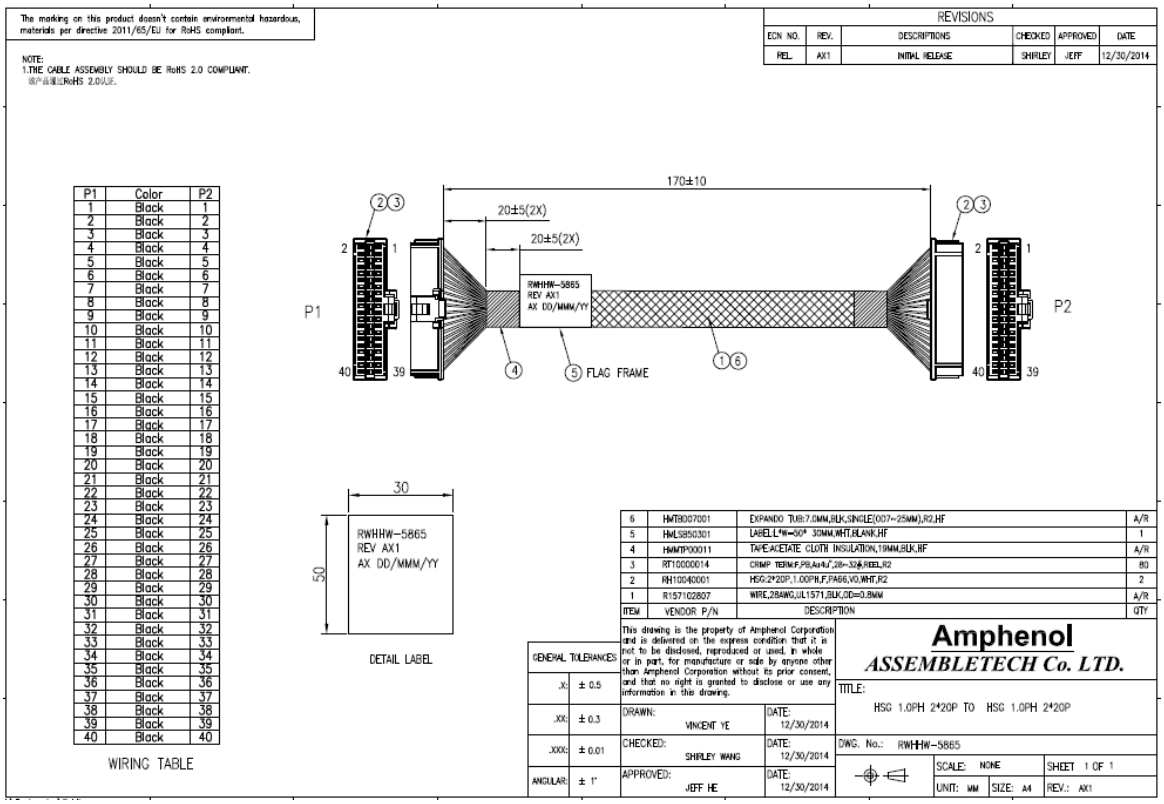
1.6.1.7.1 Fan PCB Top View



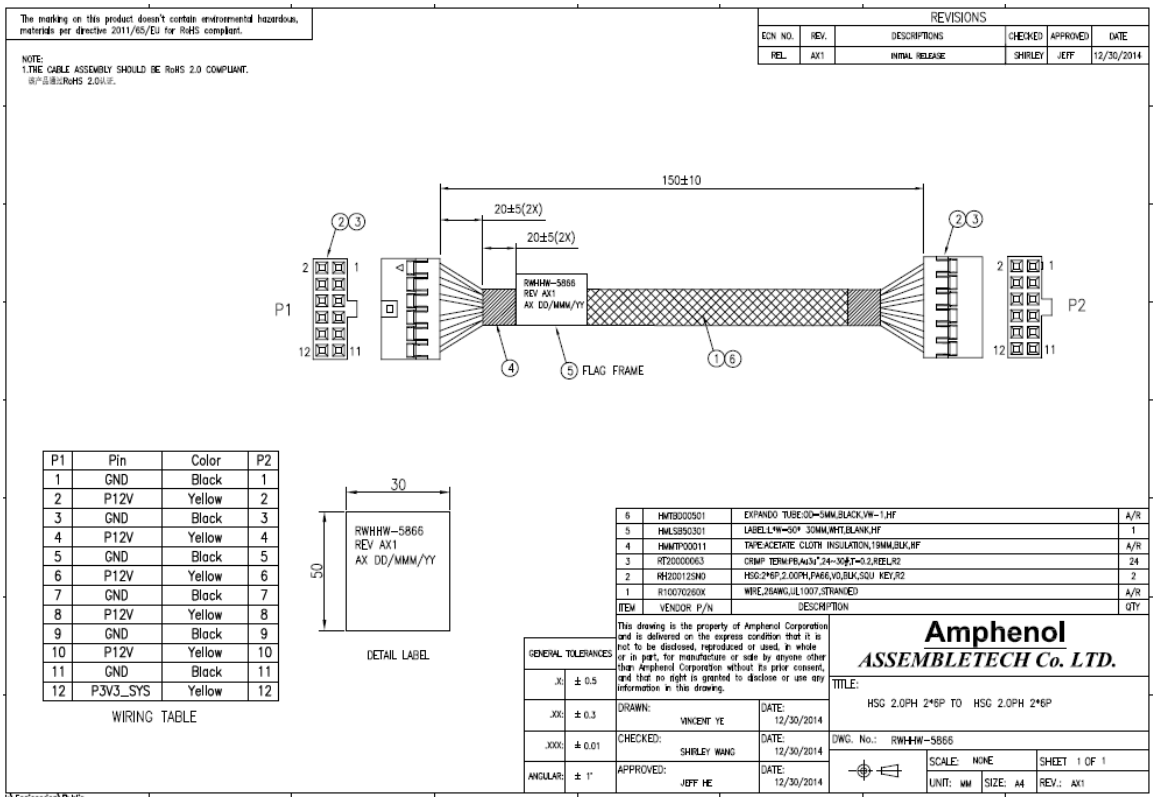
1.6.1.7.2 Fan PCB Bottom View



1.6.1.7.3 Fan Signal Cable



1.6.1.7.4 Fan Power Cable



1.7 Software Support

1.7.1 BIOS

A BIOS provided by AMI with our customization will be used. Diagnostics will be run at the UEFI shell.

1.7.2 ONIE

ONIE is supported.

1.7.3 Open Network Linux (ONL)

ONL is supported.

1.8 Environmental Requirements

- 0 to 45 Degrees C standard operating range
- -40 to 70 Degrees C storage
- Humidity 10% to 90% non-condensing
- Vibration – IEC 68-2-36, IEC 68-2-6
- Shock – IEC 68-2-29
- Acoustic Noise Level – Under 60dB in 40 degree C

1.9 Regulatory Compliance

The system meets the regulatory compliances and safety requirements of North America, EU, China, Japan, Taiwan, Singapore, India, and South Korea.

- FCC part 15 and CISPR 22 Class A
- EN 61000-3-2 Harmonics
- EN 61000-3-3 Voltage Flicker
- EN 55024 Immunity
- EN 61000-4-2 Electrostatic Discharge, 8kV Contact, 15 kV Air,
- EN 61000-4-3 Radiated Immunity 3V/m, Criteria A
- EN 61000-4-4 Transient Burst, 1 kV, Criteria B
- EN 61000-4-5 Surge, 2 kV L-L, 2 kV L-G, Level 3, Criteria B
- EN 61000-4-6 Conducted Immunity, 0.15-80 MHz, 3V
- EN 61000-4-11 Power Dips & Interruptions, >30%, 25 periods

1.10 ROHS

Restriction of Hazardous Substances (6/6)

Compliance with Environmental procedure 020499-00 primarily focused on Restriction of Hazardous Substances (ROHS Directive 2002/95/EC) and Waste and Electrical and Electronic Equipment (WEEE Directive 2002/96/EC)