



ACBEL POLYTECH INC.

CRPS 2U 1+1 Housing

Power Distribution Board Specification

Model Number: CRPSH1216-CAA
use R1C Module Series(1200W-1600W)

Revision: V0.0

Release Date: 2020/07/10

Released by:

Change Date:

Changed by:

REVISION LOG

DATE	SECTION	REVISION	ISSUE / DESCRIPTION

1. GENERAL SCOPE

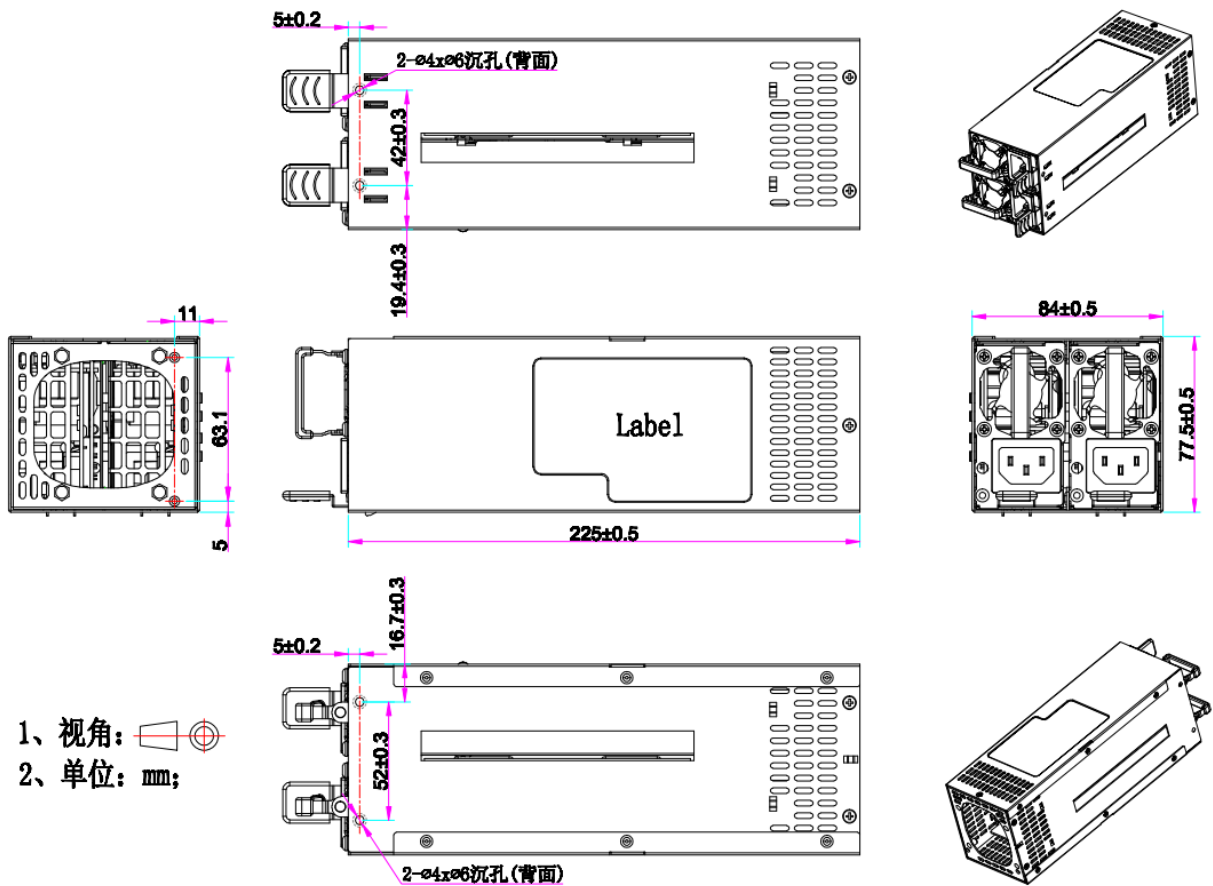
This specification describes the performance characteristic of a DC-DC switching power distribution board (PDB) with a +12V main DC input and a +12Vsb auxiliary input. The PDB will switch into +5V, +3.3V main and +5Vsb auxiliary output and distribute +12V main output. The maximum output power is 1200W/1600W, which depends on the specified power value of the system you choose. The PDB operates with a single power supply or in 1+1 parallel. Power modules shall support hot-plug and active load share for 12V Main output. Mixed operation of different input type power modules (AC-DC and DC-DC) is allowed.

2. MECHANICAL OVERVIEW

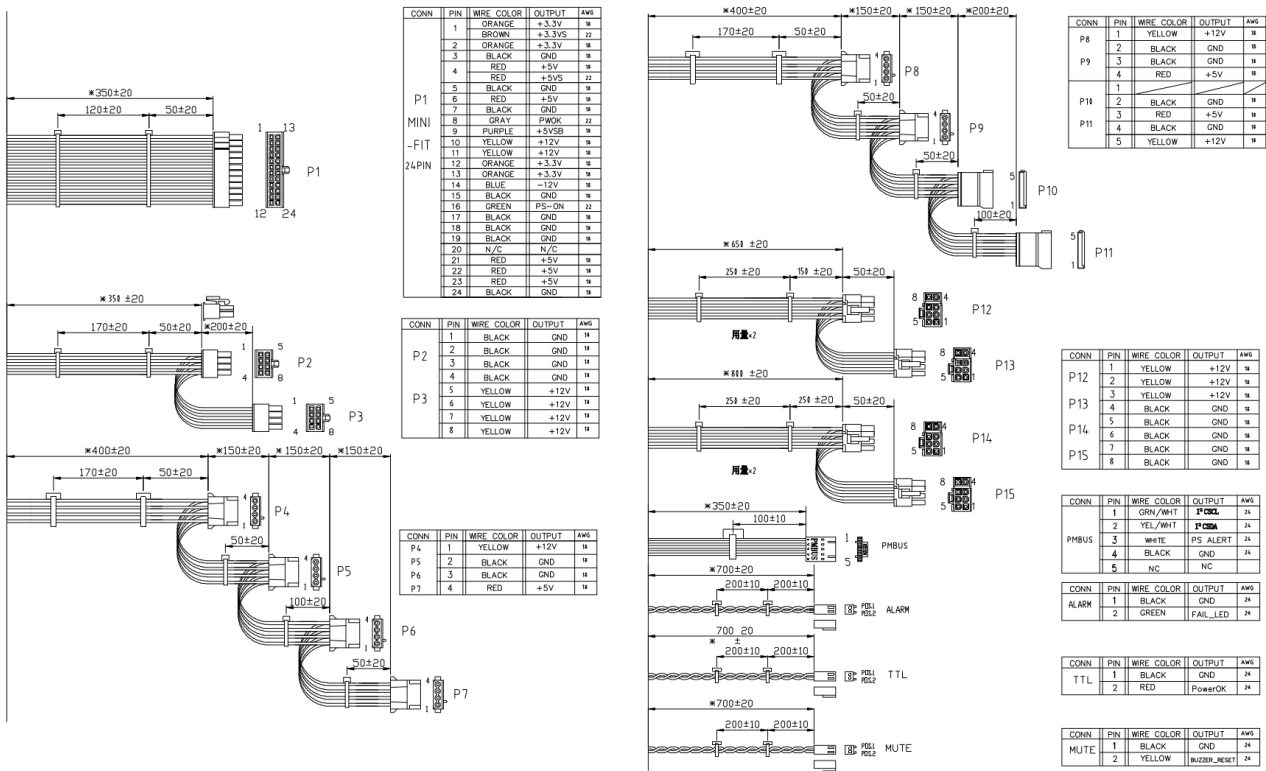
The physical size of the PDB enclosure is 225mm*77.5mm*84mm.

The following is the power supply PDB outline drawing and the style of the output wire.

The power supply PDB Outline Drawing:

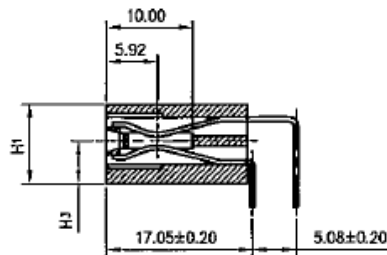
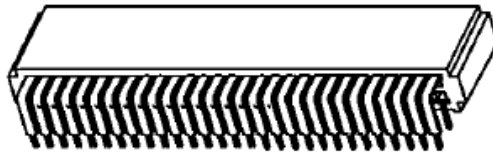
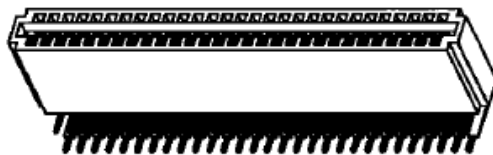


Output Line outline:(CRPSH1216-CAA)



2.1 THE PDB DC INPUT CONNECTOR

The power supply modules shall use a card edge output connection for power and signal that is compatible with a 2x25 Power Card Edge connector (equivalent to 2x25 pin configuration of the FCI power card connector 10035388102LF).



Gold finger pin assignment/OUTPUT PIN ASSIGNMENT

PIN	SIGNAL_NAME	PIN	SIGNAL_NAME
A1-A9	GND	B1-B9	GND
A10-18	+12V	B10-18	+12V
A19	PMBus SDA	B19	A0 (SMBus address)
A20	PMBus SCL	B20	A1 (SMBus address)
A21	PSON	B21	12VSB
A22	SMBAlert#	B22	SMART_ON
A23	Return Sense	B23	12V load share Bus
A24	+12V Remote Sense	B24	Present
A25	PWOK	B25	Vin-good or PS-KILL

The output pin definition of CRPS module should conform to the above table, with +12VDC as the main input and +12Vsb DC as the auxiliary input.

The PDB output Terminals:

Signal	Definition	Wire color
GND	The outputs' voltage return	Black wire
+12V	The main output voltage	Yellow wire
+5V	+5V output voltage	Red wire
+3.3V	+3.3V output voltage	Orange wire
-12V	-12V output voltage	Blue wire
+5Vsb	The auxiliary output voltage	Purple wire
PSON	Power enable input: When PSON signal is low, the power supply will turn on , and turn off when it's high	Green wire
PWOK	PSU OK output signal.	Gray wire
+12V Sense	+12V output voltage remote sense	Yellow wire
+5V Sense	+5V output voltage remote sense	Red wire
+3.3V Sense	+3.3V output voltage remote sense	Orange wire
SMB Alert	Power supply warning signal	White wire
Reset button	Reset the buzzer warning signal	Yellow + Black wire
Status LED	Lighting warning for the power supply's status	optional

3. DC/DC INPUT VOLTAGE SPECIFICATION

The maximum input current defines the maximum possible input current to ensure the proper function of the PDB to meet all defined specifications.

CRPS power supply modules, Card edge for DC output		
power supply modules	PDB Input	
	+12VDC	12VSBDC
1200W	100A maximum	2.1A
1600W	132A maximum	2.1A

4. DISTRIBUTION OF OUTPUT LOAD VALUE

These are provided at different load levels; 100%, 50%, and 20% output load.

Load value 1-Suitable for 1200W

load	+12V	+5V	+3.3V	-12V	+5VSB
100%	87.527A	15.818A	15.818A	0.438A	2.626A
50%	43.764A	7.909A	7.909A	0.219A	1.313A
20%	17.505A	3.164A	3.164A	0.088A	0.525A

Load value 2-Suitable for 1600W

load	+12V	+5V	+3.3V	-12V	+5VSB
100%	120.459A	16.328A	16.328A	0.452A	2.710A
50%	60.229A	8.164A	8.164A	0.226A	1.355A
20%	24.092A	3.266A	3.266A	0.090A	0.542A

5. DC OUTPUT SPECIFICATION

5.1 OUTPUT CURRENTS

The following tables define the power and current ratings.

1200W	Output voltage	Minimum current	Maximum current
	+12V	0.5A	100A
	+5V	0.1A	25A
	+3.3V	0.1A	25A
	-12V	0A	0.5A
	+5VSB	0.1A	3A

Notes:

- 1) The total max continuous output power is 1200W;
- 2) +3.3V&+5V max combined output power is 150W.

	Output voltage	Minimum current	Maximum current
1600W	+12V	0.5A	132A
	+5V	0.1A	25A
	+3.3V	0.1A	25A
	-12V	0A	0.5A
	+5VSB	0.1A	3A

Notes:

- 3) The total max continuous output power is 1600W;
- 4) +3.3V&+5V max combined output power is 150W.

5.2 VOLTAGE REGULATION

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. These limits include the peak-peak ripple/noise. +3.3V&+5V output voltages are measured at the remote sense point, all others voltages shall be measured at the output connectors.

Voltage Regulation Limits

PARAMETER	TOLERANCE	MIN	NOM	MAX	UNITS
+3.3V	- 5% / +5%	+3.135	+3.3	+3.465	Vrms
+5V	- 5% / +5%	+4.75	+5	+5.25	Vrms
+12V	- 5% / +5%	+11.4	+12	+12.6	Vrms
-12V	- 10% / +10%	-13.2	-12	-10.8	Vrms
+5VSB	- 5% / +5%	+4.75	+5	+5.25	Vrms

5.3 DYNAMIC LOADING

The output voltages shall remain within limits specified for the step loading and capacitive loading specified in the tables below. The load transient repetition rate shall be tested between 50Hz and 10kHz at duty cycles ranging from 10%-90%. The load transient repetition rate is only a test specification. The Δstep load may occur anywhere within the MIN load to the MAX load conditions.

Transient load requirements

Output	ΔStep Load Size (See note)	Load Slew Rate	Test capacitive Load
+12V	50% of max load	0.5 A/μs	2200μF
+5V	30% of max load	0.5 A/μs	1000μF
+3.3V	30% of max load	0.5 A/μs	1000μF
+5VSB	1A	0.5 A/μs	100μF

Note: For dynamic condition +12V min loading is 1A;+3.3V/0.3A;+5V/0.3A.

5.4 CAPACITIVE LOADING

The power supply shall be stable and meet all requirements with the following capacitive loading ranges.

Capacitive loading conditions

OUTPUT	MIN	MAX	Units
+12V	2200	21000	μF
+5V	1000	10000	μF
+3.3V	1000	10000	μF
-12V	10	330	μF
+5VSB	100	3100	μF

5.5 GROUNDING

The output ground of the pins of the power supply provides the output power return path. The output connector ground pins shall be connected to the safety ground (power supply enclosure). This grounding should be well designed to ensure passing the max allowed Common Mode Noise levels.

The power supply shall be provided with a reliable protective earth ground. All secondary circuits shall be connected to protective earth ground. Resistance of the ground returns to chassis shall not exceed 1.0mΩ. This path may be used to carry DC current.

5.6 HOT SWAP REQUIREMENTS

Hot swapping a power supply is the process of inserting and extracting a power supply from an operating power system. During this process the output voltages shall remain within the limits with the capacitive load specified. The hot swap test must be conducted when the system is operating under static, dynamic, and zero loading conditions. The power supply shall use a latching mechanism to prevent insertion and extraction of the power supply when the AC power cord is inserted into the power supply.

5.7 RIPPLE / NOISE

The maximum allowed ripple/noise output of the power supply measured over a bandwidth

of 10Hz to 20MHz at the power supply output connectors. A 10µF tantalum capacitor in parallel with a 0.1µF ceramic capacitor is placed at the point of measurement. To help reduce switching ripple further, an additional 2,200uF low ESR electrolytic capacitor may be placed in parallel (or add minimum capacitive loading of each output also).

Ripples and Noise

+12V	+5V	+3.3V	-12V	+5VSB
120mVp-p	60mVp-p	50mVp-p	120mVp-p	50mVp-p

The test set-up shall be as shown below.

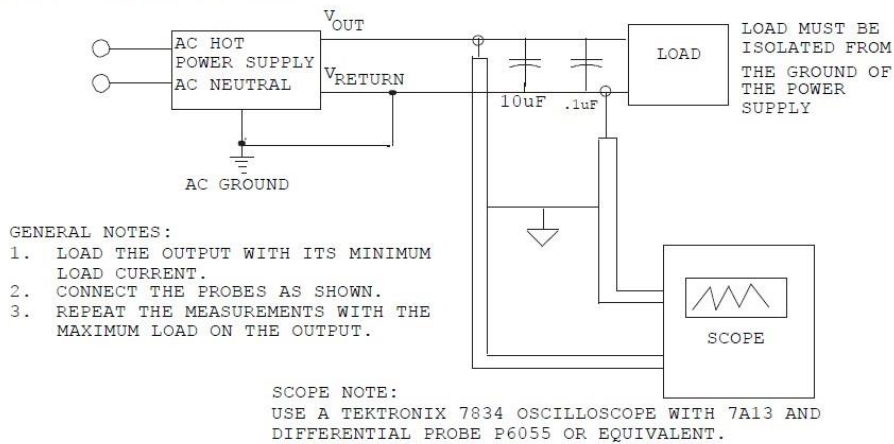


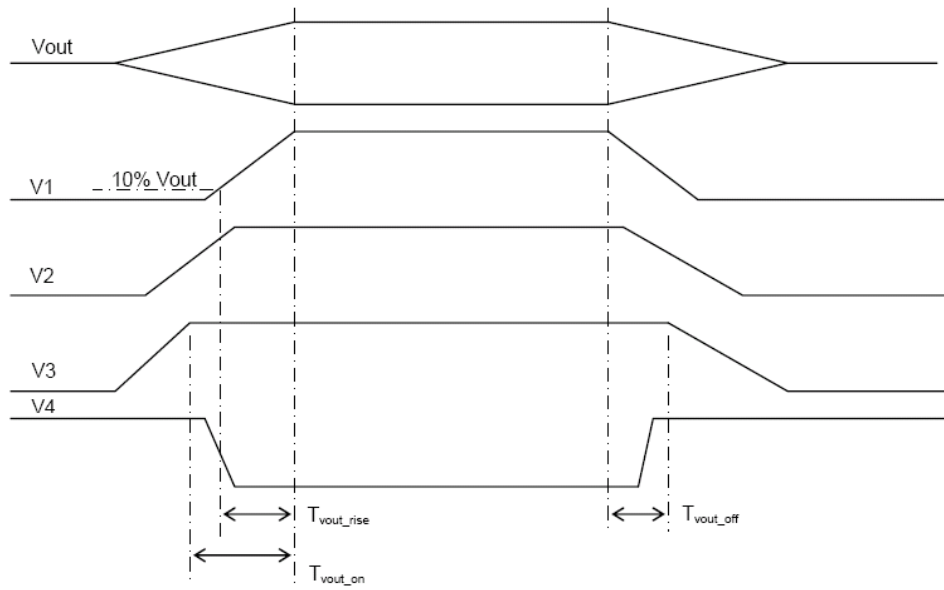
Figure: Differential Noise test setup

Note: When performing this test, the probe clips and capacitors should be located close to the load.

5.8 TIMING REQUIREMENTS

These are the timing requirements for the power supply operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70ms. For 5Vsb, it is allowed to rise from 1 to 25ms. All main outputs shall rise positive monotonically and have a slope value between 0 V/mS to 0.1V/mS. For 5Vsb output any 5ms segment of the 10% to 90% rise time waveform, a straight line draw between the end points of the waveform segment must have a slope $\geq [V_{out, nominal} / 20]V/mS$. Each output voltage shall reach regulation within 5mS (T_{vout_on}) of each other during turn on of the power supply system. Each output voltage shall fall out of regulation within 400mS (T_{vout_off}) of each other during turn off. Table below shows the timing requirements for the power supply being turned on and off via the input power, with PSON held low and the PSON signal, with the input power applied.

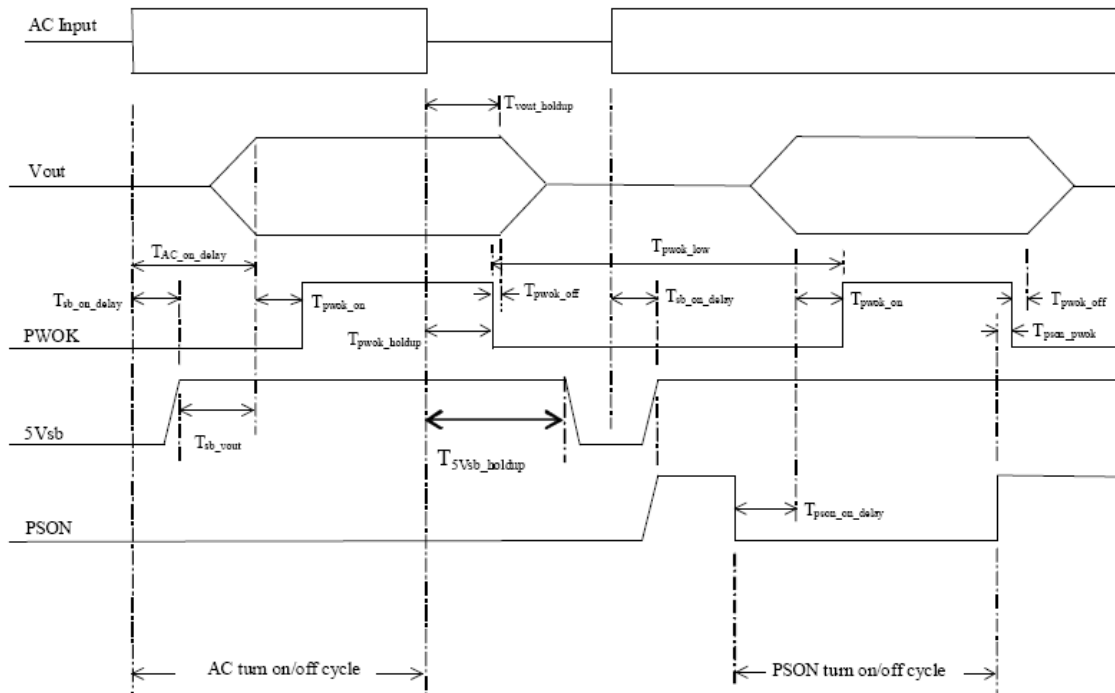
Signal Timing Sequence 1: Output Voltage Timing



Timing value :

Item	Description	MIN	MAX	Units
Tvout rise	Output voltage rise time from each main output.(except -12V)	1	70	ms
T5vsb rise	Output voltage rise time for the +5VSB output.	1	50	ms
Tvout_on	All main outputs must be within regulation of each other within this time.		50	ms
Tvout off	All main outputs must leave regulation within this time.		400	ms

Signal Timing Sequence 2: Turn On/Off Timing



Timing value :

Item	Description	MIN	MAX	UNITS
T _{sb_on delay}	Delay from AC being applied to 5VSB being within regulation.		1500	ms
T _{ac_on_delay}	Delay from AC being applied to all output voltages being within regulation.		2500	ms
T _{vout holdup}	Time 12V output voltage dropping to regulation after loss of AC at 100% load condition	13		ms
T _{pwok holdup}	Delay from loss of AC to desertion of PWOK at 100% load condition.	12		ms
T _{pson_on_delay}	Delay from PSON#active to output voltages within regulation limits.	5	400	ms
T _{psonpwok}	Delay from PSON# deactivate to PWOK being deserted.		50	ms
T _{pwok_on}	Delay from output voltages within regulation limits to PWOK asserted at turn on.	100	500	ms
T _{pwok off}	Delay from PWOK de-asserted to +12V dropping out of regulation limits.	1		ms
T _{pwok_low}	Duration of PWOK being in the deserted state during an off/on cycle using AC or the PSON# signal.	100		ms
T _{sb_vout}	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	2000	ms

5.9 MAXIMUM CONTINUOUS OUTPUT POWER

Maximum continuous output power is not exceed to 1200W/1600W.This will depend on the CRPS power supply you choose.

6. PROTECTION CIRCUITS

Protection circuits inside the power supply shall cause only the power supply’s main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, an AC cycle

OFF for 15sec and a PSON# cycle HIGH for 1sec shall be able to reset the power supply. The auxiliary output shall not be affected by any protection circuit, unless the auxiliary output itself is affected.

6.1 CURRENT LIMIT (OCP)

The power supply shall have current limit to prevent the outputs from exceeding the values shown in table below. If the current limits are exceeded the power supply shall shutdown and latch off. The latch will be cleared by toggling the PSON# signal or by an AC power interruption. The power supply shall not be damaged from repeated power cycling in this condition. +5VSB will be auto-recovered after removing OCP limit. The test method should under 1+0 status.

1200W OCP Requirements

OUTPUT	MIN	MAX
+5V	27.5A	40A
+3.3V	27.5A	40A
SLOW +12V OCP(Single AC Power Supply Test)	Rating + 10A	Rating + 18A
-12V	Protected under over current or shorted condition(1.1A-2.5A)	
+5VSB	5.5A	12.5A

1600W OCP Requirements

OUTPUT	MIN	MAX
+5V	27.5A	40A
+3.3V	27.5A	40A
SLOW +12V OCP(Single AC Power Supply Test)	Rating + 10A	Rating + 18A
-12V	Protected under over current or shorted condition(1.1A-2.5A)	
+5VSB	5.5A	12.5A

6.2 OVER VOLTAGE PROTECTION (OVP)

The power supply over voltage protection shall be locally sensed. The power supply shall shutdown and latch off after an over voltage condition occurs. This latch shall be cleared by toggling the PSON# signal or by an AC power interruption. The values are measured at the output of the power supply’s connectors. The voltage shall never exceed the maximum levels when measured at the power connectors of the power supply connector during any single point of fail. The voltage shall never trip any lower than the minimum levels when measured at the power connector.

Over Voltage Limits

Output	Action voltage			Units
	Min	Nom	Max	
+3.3	3.7	4.2	4.7	V
+5V	5.7	6.3	7.5	V
+12V	13.3	15	15.6	V

6.3 OVER TEMPERATURE PROTECTION (OTP)

The power supply will be protected against over temperature conditions caused by loss of fan cooling or excessive ambient temperature. In an OTP condition the PSU will shutdown. When the power supply temperature drops to within specified limits, the power supply shall restore power automatically, while the 12VSB remains always on. The OTP circuit must have built in margin such that the power supply will not oscillate on and off due to temperature recovering condition. The OTP trip level shall have a minimum of 5°C of ambient temperature margin.

6.4 SHORT CIRCUIT PROTECTION (SCP)

The power supply shall shut down and latch off for shorting the main outputs. +5VSB must be capable of being shorted indefinitely. The latch will be cleared by toggling the PSON# signal or by an AC power interruption. The power supply shall not be damaged from repeated power cycling in this condition. +5VSB will be auto-recovered after removing SCP limit.

6.5 WARNING

	State	Power LED	PDB LED	Buzzle	TTL(optional)
1+0(only one power)	Normal	Green	Green	quietly	Low
	Only +5Vsb(PS-OFF)	Green Blink	Green Blink	quietly	Low
	+12V OCP;AC Power output OVP,OTP,Fan Fail	Orange	Green Blink	quietly	Low
	AC power input UVP input OVP	Orange	Nothing	quietly	Low
	+5V,+3.3V,-12V OCP;+5V,+3.3V OVP;PDB OTP	Green Blink	Green Blink	quietly	Low
1+1	Normal	Green	Green	quietly	High
	Only +5Vsb(PS-OFF)	Green Blink	Green Blink	quietly	Low
	AC power input UVP, input OVP	Orange	nothing	quietly	Low
	One unit input AC fail	Orange	Green Blink	Alarm	Low
	AC Power output OVP ,OTP;Fan Fail	Orange	Green Blink	Alarm	Low
	+12,+5V,+3.3V,5VSB,-12V OCP;+5V,+3.3V OVP;PDB OTP	Green Blink	Green Blink	quietly	Low

7. CONTROL AND INDICATOR FUNCTIONS

The following sections define the input and output signals from the power supply. Signals that can be defined as low true use the following convention: Signal# = low true.

7.1 I2C BUS(SCL; SDA)

Each module shall provide SCL/SDA bus for EEPROM read/write of system. It's pull up from +3.3Vdd device by a 10K ohm resistor. System should be has 1k~2k ohm pull high resistor on the SCL/SDA bus. SCL/SDA pin should be link together and closer. The SCL/SDA bus total capacitance must lower 100pF from system and PDB. The max I2C bus speed is 100KHz and the MCU of PSU is slave device in I2C bus .The time interval of I2C command is 1ms.

7.2 SMBAlert# INDICATE(SMBAlert#)

This is an active low signal and indicates that the power supply is experiencing a problem that the user should investigate.This shall be asserted due to Critical events or Warning events. The signal shall activate in the case of critical component temperature reached a warning threshold, general failure, over-current, over-voltage, under-voltage, failed fan.This signal may also indicate the power supply is reaching its end of life or is operating in an environment exceeding the specified limits.

This signal is to be asserted in parallel with LED turning solid Amber or blink Amber.

SMBAlert# Signal Characteristics

Signal Type(Active Low)	Open collector/ drain output from power supply.Pull-up to VSB located in system.	
Alert#=High	OK	
Alert#=Low	Power Alert to system	
	MIN	MAX
Logic level low voltage,Isink=4 mA	0V	0.4V
Logic level high voltage,Isink=50uA		3.46V
Sink current,Alert#= low		4 mA
Sink current,Alert#= high		50uA

7.3 PS-ON INPUT SIGNAL (PS-ON POWER SUPPLY ENABLE)

The PS-ON signal is required to remotely turn on/off the main output of the power supply. PSON# is an active low signal that turns on the +12V power rail. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

PS-ON Signal Characteristic

Signal Type	Accepts an open collector/drain input from the system. Pull-up to 3.3V _{SB} Located in power supply.	
PSON#= Low	ON	
PSON#=High or Open	OFF	
	MIN	MAX
Logic level low(power supply ON)	0V	1.0V
Logic level high(power supply OFF)	2.0V	3.46V
Source current,V _{pson} =low		4mA
Power off delay: T _{pson_off_delay}		5msec
Power up delay:T _{pson_on_delay}	5msec	400msec
PWOK delay:T _{pson_pwok}		5msec

7.4 PWOK OUTPUT SIGNAL (PWOK)

PWOK is a power OK signal and will be pulled HIGH by the power supply to indicate that all the outputs are within the regulation limits of the power supply. When any output voltage falls below regulation limits or when AC power has been removed for a time sufficiently long so that power supply operation is no longer guaranteed, PWOK will be de-asserted to a LOW state. See Table: for a representation of the timing characteristics of PWOK. The start of the PWOK delay time shall be inhibited as long as any power supply output is in current limit.

PWOK / PG Signal Characteristics

Signal Type	Open collector/drain output from power supply. Pull-up to V _{SB} located in the power supply.	
PWOK =High	Power OK	
PWOK =Low	Power Not OK	
	MIN	MAX
Logic level low voltage,I _{sink} =400uA	0V	0.4V
Logic level high voltage,I _{source} =200uA	2.4V	3.46V
Sink current,PWOK =low		400uA
Source current,PWOK= high		2mA
PWOK delay:T _{pwok_on}	100ms	500ms
PWOK rise and fall time		100usec

8. ENVIRONMENTAL REQUIREMENTS

8.1 TEMPERATURE REQUIREMENTS

The power supply shall operate within all specified limits over the Top temperature range. The

average air temperature difference (ΔT_{ps}) from the inlet to the outlet of the power supply shall not exceed the values shown below Table. All airflow shall pass through the power supply and not over the exterior surfaces of the power supply.

Environmental Requirements

Description	Min	Max
Operating temperature range	0°C	45°C
Non-operating temperature range	-40°C	70°C

8.2 HUMIDITY

Operating: 5% to 85% relative humidity (non-condensing)

Non-Operating: 5% to 95% relative humidity (non-condensing)

8.3 ALTITUDE

Operating: 15250 feet above sea level with a 45°C maximum ambient air temperature;
Non-operating: 50000 feet above sea level

8.4 MECHANICAL SHOCK

Non-operating: 50 G Trapezoidal Wave, Velocity change = 170 in. / sec.

Three drops in each of six directions are applied to each of the samples.

8.5 RANDOM VIBRATION

Non-Operating Test

Sinusoidal: Input Acceleration: 1.5G, peak to peak

Frequency Band: 10Hz-500Hz-10Hz

Sweep Rate: 0.5 Octaves/minute

Sweep Time: Two sweeps per axis

Orientation: Three mutually perpendicular axes

Random: Break Point: 2Grms, 10Hz-500Hz frequency content

Dwell Time: 60 minutes per axis

Orientation: Three mutually perpendicular axes

8.6 THERMAL SHOCK (SHIPPING)

Non-operating: -40°C to +70°C, 50 cycles, 30°C/min. \geq transition time \geq 15°C/min. duration of exposure to temperature extremes for each half cycle shall be 30 minutes.

9. PMBUS

Refer to the PMBUS application profile for systems for requirements. Note. PMBUS signal

should be pull up to 3.3V only inside PSU.

9.1 ACCURACY

For the following PMBUS commands a minimum preciseness/accuracy for voltage, current and power readings and settings must be follow below table: Power PMBUS Accuracy: (For the AC input voltage:100~127V;200V~240V;DC input:220Vdc-260Vdc).

The maximum deviation for the ambient temperature is +4°C.

READ_VIN READ_IIN READ_VOUT READ_IOUT READ_POUT READ_PIN

Table : Power PMBUS Accuracy

	Pin<100W	Pin>100W	
Pin	±10W	±5%	
	lin: 0.25~1.6A	lin: >1.6A	
Iin	±0.2A or±5%	±5%	
	10%~20% of Max. Load	20%~50% of Max. Load	50%~100% of Max. Load
Iout	±10% or ±2A	±5% or ±2A	±5% or ±2A
Pout	±5% or ±10W	±5% or ± 10W	±5% or ± 10W
	0%~20% of Max. Load	20%~50% of Max. Load	50%~100% of Max. Load
Vout	±5%	±5%	±5%
Vin	±5%	±5%	±5%

10.RELIABILITY / WARRANTY / SERVICE

10.1 COMPONENT DE-RATING

The following component de-rating guidelines shall be followed. Any exceptions are subject

to final approval. Semiconductor junction temperatures shall not exceed 120°C. Transformer temperature shall not exceed 110°C & not violate safety’s requirement.

Inductor case temperature shall not exceed 85% of rated temperature in°C.

Capacitor case temperature shall not exceed 85% of rated temperature in °C.

Resistor wattage de-rating shall be > 30%.

Component voltage and current de-rating shall be > 15%.

During abnormal conditions (such as a short circuit and the like) no de-rating is required as long as the max rating is not exceeded.

Note: Bulk Cap is an exception to be able to work at maximum rated voltage.

10.2 INVESTIGATIVE LIFE REQUIREMENT

The power supply shall support 5 year calculated life with a 90% confidence under the

following conditions:

- 100-240VAC input
- 45°C inlet temperature
- 80% of output max-load

10.3 MEAN TIME BETWEEN FAILURES (MTBF)

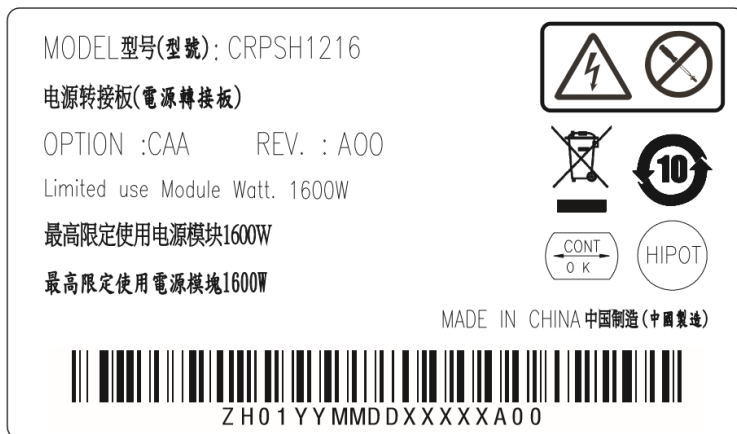
The power supply shall have a minimum MTBF at continuous operation of 160,000 hours at 100% load and 25°C, as calculated by Bell core Telcordia SR-332- Issue 2.2-250,000 hours demonstrated at 75% load and 40°C.

10.4 WARRANTY PERIOD

Three (3) years.

11. THE PDB LABEL

PDB label: Example:



2:1