1 GENERAL SCOPE

This specification defines the performance characteristics of a grounded, AC input, 1600 watts, 5 output level power supply. This specification also defines worldwide safety requirements and manufactures process test requirements.

2 Power Input Specification

2.1 Input Voltage and frequency specification

The power supply shall operate within all specified limits over the following input range. Harmonic distortions of up to10% of the rated line voltage must not cause the power supply to go out of specified limits.

The power supply shall power off if the AC input is below VAC_{low_limit} and shall start (auto recover) if $VAC_{recover}$ is reached. Input of VAC below $VAC_{recover}$ shall not cause any damage to the power supply, including the input fuse. The power supply shall also operate at Vin 240Vdc.

Parameter	Minimum Input	Rated Input	Maximum Input
115Vac	90Vac	100-127Vac	140Vac
230Vac	180Vac	200-240Vac	264Vac
Frequency	47Hz	50/60Hz	63Hz

240VDC Input Rating

PARAMETER	MIN	RATED	MAX
Voltage	192VDC	240VDC	288VDC
Current	<8.5A		

2.2 Maximum Input Current

Input Voltage	Input Current	Maximum Power
90Vac	15A	1000W
100-127Vac	13~10A	1000W
140Vac	9A	1000W
180Vac	11.5A	1600W
200-240Vac	10~8.5A	1600W
264Vac	7.5A	1600W

2.3 AC Line Fuse

The power supply shall incorporate one input fuse on the line side for input over-current protection to prevent damage to the power supply and meet product safety requirements. AC inrush current shall not cause the AC line fuse to blow under any conditions. All protection circuits in the power supply shall not cause the AC fuse to blow unless a component in the power supply has failed. This includes DC output load short conditions.

2.4 AC Line Inrush

AC line inrush current shall not exceed 55A peak, for up to one-quarter of the AC cycle, after which, the input current should be no more than the specified maximum input current. The peak inrush current shall be less than the ratings of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

The power supply must meet the inrush requirements for any rated AC voltage, during turn on at any phase of AC voltage, during a single cycle AC dropout condition as well as upon recovery after AC dropout of any duration, and over the specified temperature range (Top).

2.5 AC Line Dropout / Holdup

An AC line dropout is defined to be when the AC input drops to 0VAC at any phase of the AC line for any length of time. During an AC dropout the power supply must meet dynamic voltage regulation requirements. An AC line dropout of any duration shall not cause tripping of control signals or protection circuits. If the AC dropout lasts longer than the holdup time the power supply should recover and meet all turn on requirements. The power supply shall meet the AC dropout requirement over rated AC voltages and frequencies. A dropout of the AC line for any duration shall not cause damage to the power supply.

Loading	Holdup Time
70%	10mS

2.6 Susceptibility Requirements

The power supply shall meet the following electrical immunity requirements when connected to a cage with an external EMI filter, which meets the criteria defined in the SSI document EPS Power Supply Specification.

Level	Description
A	The apparatus shall continue to operate as intended. No degradation of performance.

B	The apparatus shall continue to operate as intended. No degradation of performance beyond spec. limits.
C	Temporary loss of function is allowed provided the function is self-recoverable or can be restored by the operation of the controls.

2.6.1 Electrical Discharge Susceptibility

The power supply shall comply with the limits defined in EN 55024:2010 using the IEC 61000-4-2:2009 test standard and performance criteria B defined in Annex B of CISPR 24.

2.6.2 Fast Transient/Burst

The power supply shall comply with the limits defined in EN55024:2010 using the IEC 61000-4-4:2012 test standard and performance criteria B define in Annex B of CISPR 24.

2.6.3 Radiated Immunity

The power supply shall comply with the limits defined in EN55024:2010 using the IEC61000-4-3:2006+A1:2008+A2:2010 test standard and performance criteria A defined in Annex B of CISPR 24.

2.6.4 Surge Immunity

The power supply shall be tested with the system for immunity to AC Ring wave and AC Unidirectional wave, both up to 2kV(Differential mode 2K,Common mode 1K), per EN55024:2010, EN 61000-4-5:2014 and ANSI C63.4:2014.

The pass criteria include: No unsafe operation is allowed under any condition; all power supply output voltage levels to stay within proper spec levels; No change in operating state or loss of data during and after the test profile; No component damage under any condition.

The power supply shall comply with the limits defined in EN55024:2010 using the IEC 61000-4-5:2014 test standard and performance criteria B defined in Annex B of CISPR 24.

2.6.5 AC Line Transient Specification

AC line transient conditions shall be defined as “sag” and “surge” conditions. “Sag” conditions are also commonly referred to as “brownout”, these conditions will be defined as the AC line voltage dropping below nominal voltage conditions. “Surge” will be defined to refer to conditions when the AC line voltage rises above nominal voltage.

The power supply shall meet the requirements under the following AC line sag and surge conditions.

AC Line Sag Transient Performance (10sec interval between each sagging):

Duration	Sag	Operating AC Voltage	Line Frequency	Performance Criteria
0 to 1/2 AC cycle	95%	Nominal AC Voltage ranges	50/60Hz	No loss of function or performance
>1 AC cycle	>30%	Nominal AC Voltage ranges	50/60Hz	Loss of function acceptable, self recoverable

AC Line Surge Transient Performance

Duration	Surge	Operating AC Voltage	Line	Performance Criteria
Continuous	10%	Nominal AC Voltage ranges	50/60Hz	No loss of function or performance
0 to 1/2 AC cycle	30%	Mid-point of nominal AC Voltages	50/60Hz	No loss of function or performance

2.6.6 AC Line Fast Transient (EFT) Specification

The power supply shall meet the EN61000-4-5 directive and any additional requirements in IEC1000-4-5:1995 and the level 3 requirements for surge-withstand capability, with the following conditions and exceptions:

- These input transients must not cause any out-of-regulation conditions, such as overshoot and undershoot, nor must it cause any nuisance trips of any of the power supply protection circuits.
- The surge-withstand test must not produce damage to the power supply.
- The supply must meet surge-withstand test conditions under maximum and minimum DC-output load conditions.

2.6.7 Power Recovery

The power supply shall recover automatically (auto recover) after an AC power failure. AC power failure is defined to be any loss of AC power that exceeds the dropout criteria.

2.6.8 Voltage Brownout

Input voltage range for AC minimum startup voltage, 84 to 89VAC, and maximum turn off voltage range 76 to 83VAC

2.6.9 AC Line Leakage Current

The maximum leakage current to ground of power supply shall be 3.5 mA when tested at 264Vac/60Hz.

2.7 Power factor correction

The power supply modules shall incorporate universal power input with active power factor correction, which shall reduce the line harmonics in accordance with the EN61000-3-2 CLASS "D" standards. Power Factor: Typ. > 95% @115/230Vac, full load.

3 Power Output Specification

3.1 Grounding

The output ground of the pins of the power supply provides the output power return path. The ground output at the PCB card edge 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. This path may be used to carry DC-current.

3.2 Output Rating

GROUP	1	2	3	4	5
OUTPUT VOLTAGE	**+3.3V**	**+5V**	**+12V**	**-12V**	**+5VSB**
MAX. LOAD(100~127Vac)	20A	50A	83.3A	0.3A	4A
MAX. LOAD(200~240Vac)	20A	50A	133.3A	0.3A	4A
MIN. LOAD	0A	0A	0A	0A	0A
REGULATION	±5%	±5%	±5%	±5%	±5%
RIPPLE & NOISE (mV)	50	50	120	120	50
Capacitive Loads (uF)	12000	12000	4700	350	350

NOTE:

- The continuous maximum total output power shall not exceed 1000W@100~127Vac and 1600W@200~240Vac.
- Combined +3.3V and +5V power shall not exceed 280W.
- The power supply shall meet the voltage regulation under all operating conditions (AC line, transient loading, output loading). These limits include the peak-peak ripple/noise.

- Ripple and Noise measuring with an oscilloscope with 20 MHz bandwidth. Output should be bypassed at the connector with a 0.1uF ceramic disk capacitor and a 10uF electrolytic capacitor to simulate system load. The length of ground wire on probe should not longer than 40mm, if a Non - differential type of scope was used.

3.3 No Load Operation

The power supply shall meet all requirements except for the transient loading requirements when operated at no load on all outputs.

3.4 Dynamic Loading

The output voltages will remain within limits specified for the step loading and capacitive loading specified in the table below. The load transient repetition rate shall be tested between 50Hz and 5kHz at duty cycles ranging from 10%-90%. The load transient repetition rate is only a test specification. The Δ step load may occur anywhere within the MIN load to the MAX load conditions.

Output	Δ Step Load Size	Load Slew Rate	Test capacitive Load
+3.3V	30% of max load	0.5A/μs	1000uF
+5V	30% of max load	0.5 A/μs	1000uF
+12V	65% of max load	0.5 A/μs	2200uF
+5VSB	25% of max load	0.5 A/μs	1uF

3.5 Maximum Load Change

The power supply shall continue to operate normally when there is a step change ≤ 1A/μsec, between minimum load and maximum load.

3.6 Close loop Stability

The power supply shall be unconditionally stable under all line/load/transient load conditions including capacitive load ranges. A minimum of: 45 degrees phase margin and -10dB gain margin is required.

Closed-loop stability must be ensured at the maximum and minimum loads as applicable.

3.7 Residual Voltage Immunity in Standby mode

The power supply should be immune to any residual voltage placed on its outputs (Typically a leakage voltage through the system from standby output) up to 500mV. There shall be no additional heat generated, nor stressing of any internal components with this voltage applied to any individual

or all outputs simultaneously. It also should not trip the protection circuits during turn on.

The residual voltage at the power supply outputs for no load condition shall not exceed 100mV when AC voltage is applied and the PSON# signal is de-asserted.

3.8 Soft Starting

The Power Supply shall contain control circuit which provides monotonic soft start for its outputs without overstress of the AC line or any power supply components at any specified AC line or load conditions.

3.9 Forced Load Sharing

The +12V output will have active load sharing. The output will share within 10% at full load. The failure of a power supply should not affect the load sharing or output voltages of the other supplies still operating. The supplies must be able to load share in parallel and operate in a hot-swap / redundant 1+1 configurations.

Ishare Voltage	
% of max. current capacity	Voltage level (+/- 10%)
50%	4V
100%	8V

3.10 Overshoot at Turn-on/Turn-off

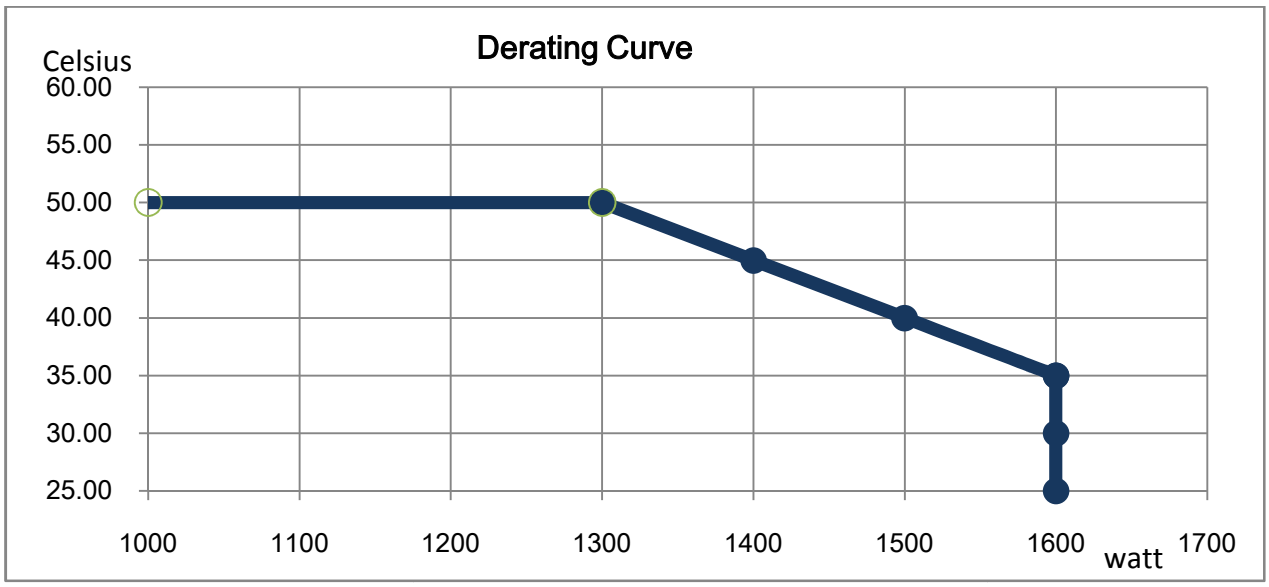
Any output overshoot at turn on shall be less than 10% of the nominal output value. Any overshoot shall recover to be within regulation requirements in less than 10ms.

3.11 Undershoot at Turn-on/Turn-off

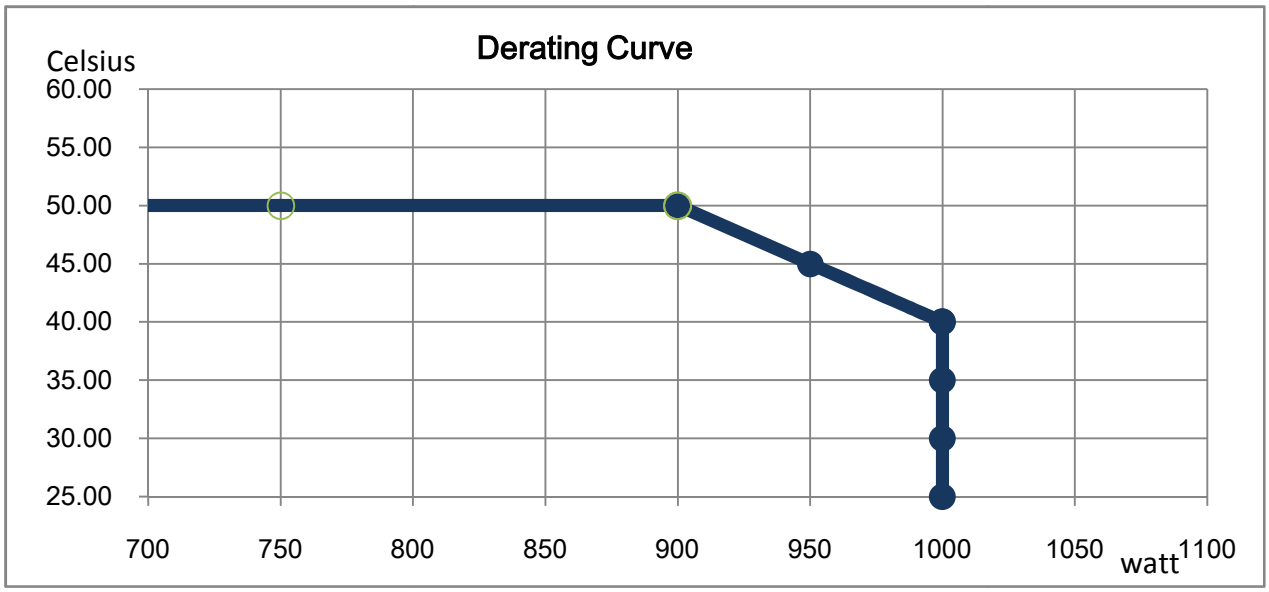
Any output shall not undershoot at turn on or off cycle under any circumstances.

3.12 Output de-rating curve

At high line 200-240VAC



At low line 100-127VAC



4 Timing

The output voltages rise from 10% to within regulation limits (Tvout_rise) within 5 to 70ms. For 5VSB, it rises from 1 to 25ms. All outputs rise monotonically. Each output voltage shall reach regulation within 50mS (Tvout_on) of each other during turn on of the power supply system. Each output voltage shall fall out of regulation within 400mS (Tvout_off) of each other during turn off.

Item	Description	MIN	MAX	Units
Tvout_rise	Output voltage rise time for all main output	5	70	ms
	Output voltage rise time for the 5VSB output	1	25	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

Output Voltage Timing

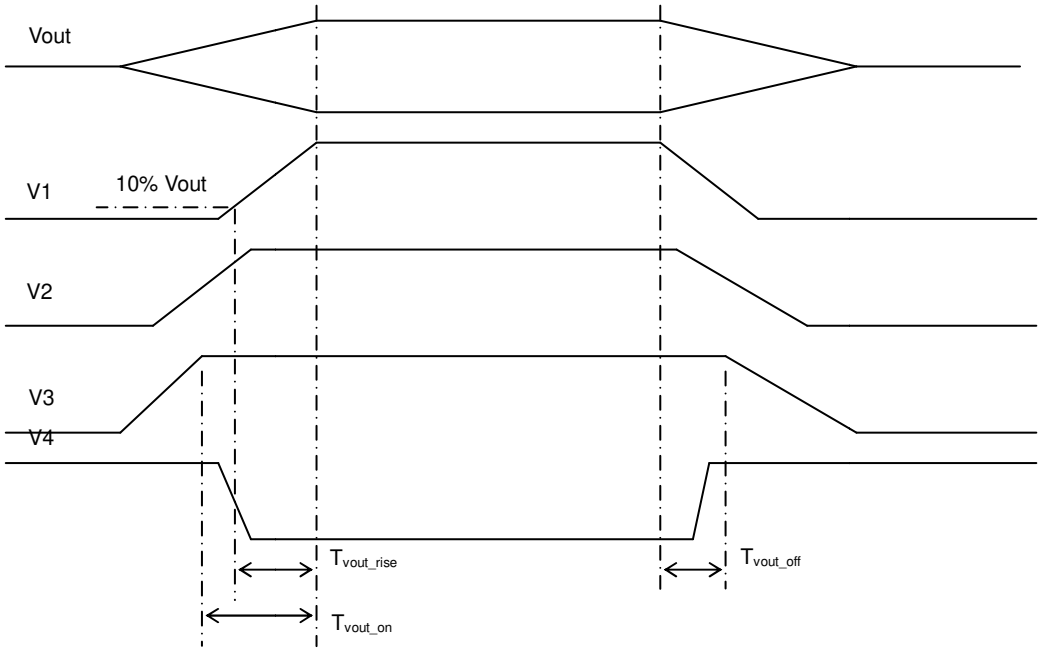
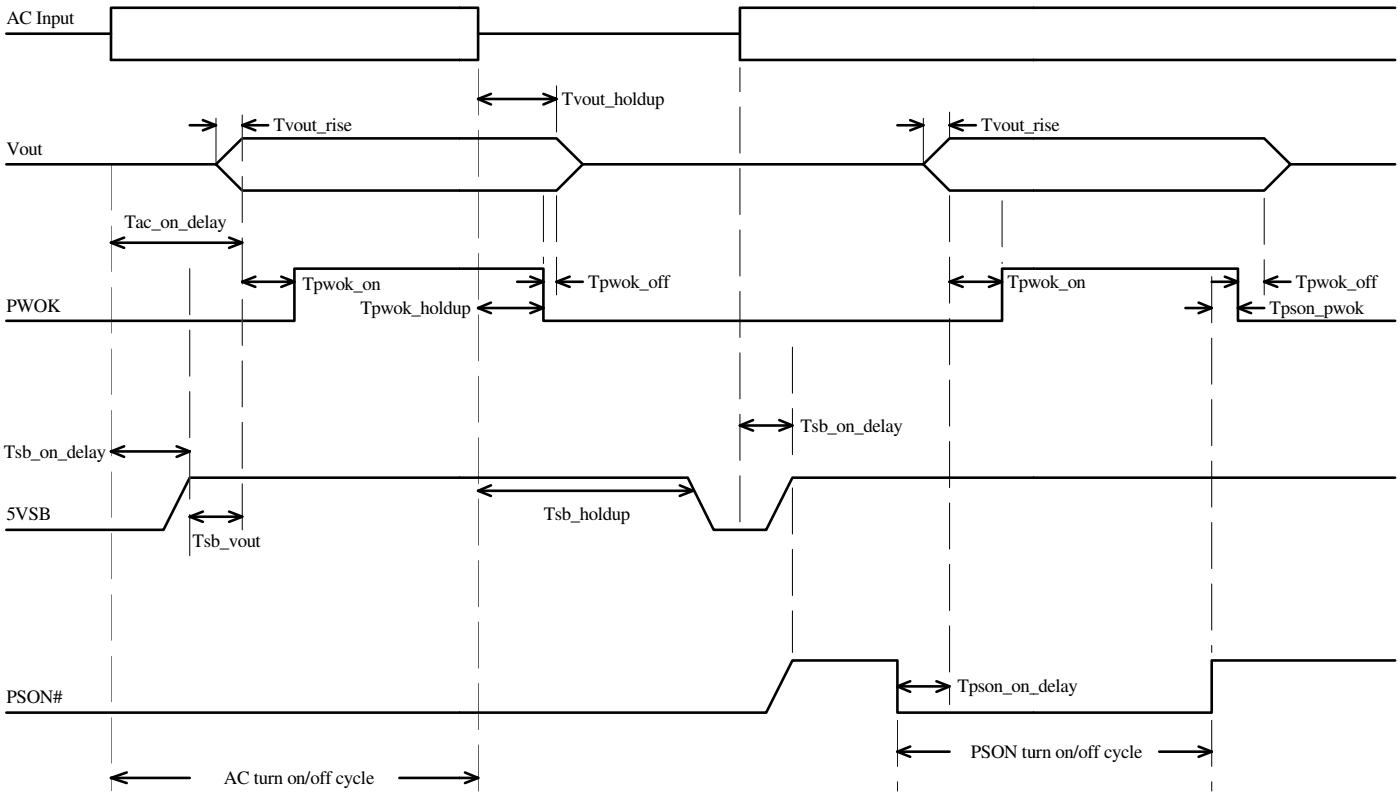


Table below shows the timing for the power supply being turned on and off via the AC input, with PSON held low and the PSON signal, with the AC input applied.

Item	Description	MIN	MAX	Units
Tsb_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.		3000	ms
Tvout_holdup	Time all output voltage stay within regulation after loss of AC @70% load.	11		ms

Tpwok_holdup	Delay from loss of AC to de-assertion of PWOK @70% load.	10		ms
Tpson_on_delay	Delay from PSON# active to output voltages within regulation limits.	5	400	ms
T pson_pwok	Delay from PSON# deactivate to PWOK being de-asserted.		50	ms
Tpwok_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 output voltages(3.3V, 5V, 12V, -12V) dropping out of regulation limits.	1		ms
Tpwok_low	Duration of PWOK being in the de-asserted state during an off/on cycle using AC or the PSON# signal.	100		ms
Tsb_vout	Delay from 5VSBbeing in regulation to O/Ps being in regulation at AC turn on.	50	1000	ms
Tsb_holdup	Time 5VSB output voltage stays within regulation after loss of AC	70		ms
Tvout_rise	Output voltage rise time from each main output		20	ms

Turn on/off Timing



5 Control And Indicator Functions

5.1 PSON# Input Signal

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

Signal Type	Accepts an open collector/drain input from the system. Pull-up to VSB 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, Vpson = low		4mA
Power up delay: Tpson_on_delay	5ms	400ms

PWOK delay: T pson_pwok		50ms

5.2 PWOK (Power OK) Output Signal

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. The start of the PWOK delay time shall inhibited as long as any power supply output is in current limit.

Signal Type	Open collector/drain output from power supply. Pull-up to VSB located in the power supply.	
PWOK = High	Power OK	
PWOK = Low	Power Not OK	
	MIN	MAX
Logic level low voltage, Isink=400uA	0V	0.4V
Logic level high voltage, Isource=200μA	2.4V	3.46V
Sink current, PWOK = low		400μA
Source current, PWOK = high		2mA
PWOK delay: Tpwok_on	100ms	500ms
PWOK rise and fall time		100μs
Power down delay: Tpwok_off	1ms	200ms

5.3 SMBAlert# SIGNAL (Optional)

This signal 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.

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=4mA	0V	1.0V
Logic level high voltage, Isink=50μA	2V	3.46V
Sink current, Alert# = low		4mA
Sink current, Alert# = high		50μA
Alert# rise and fall time		100μs

5.3.1 A0

PSU Module Address Line 0. This signal line is provided for determining the address for the specific PSU FRU and SMBus address. The pull-up resister should be located in the system and the pull-up voltage should be limited to 3.3V.

The address line should be pull low with equal to or less than 100 ohm in the motherboard design.

5.3.2 A1

PSU Module Address Line 1. This signal line is provided for determining the address for the specific PSU FRU and SMBus address. The pull-up resister should be located in the system and the pull-up voltage should be limited to 3.3V.

The address line should be pull low with equal to or less than 100 ohm in the motherboard design.

5.4 SDA and SCL

One pin is the serial clock (SCL), and the other pin is used for serial data (SDA). The SCL and SDA signals are pulled up by system, both pins are bi-directional, open drain signals, and are used to form a serial bus.

6 Output Protection

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.

6.1 Over Current Protection: (OCP)

This power supply has current limit to prevent the outputs from exceeding the values shown in table below. If the current limits are exceeded the power supply will shut down and latch off. The latch will be cleared by toggling the PSON# signal or by an AC power interruption. This power supply will not be damaged from repeated power cycling in this condition. 5VSB will be auto-recovered after removing OCP limit.

		+12V	+5V	+3.3V	+5VSB
High Line Vin 180VAC	Single Mode	110% minimum, 150% maximum	110% minimum, 150% maximum	110% minimum, 150% maximum	110% minimum, 150% maximum
	Parallel Mode				
Low Line Vin 90VAC	Single Mode	110% minimum, 150% maximum	110% minimum, 150% maximum	110% minimum, 150% maximum	110% minimum, 150% maximum
	Parallel Mode	130% minimum			

6.2 Over Voltage Protection: (OVP)

This power supply over voltage protection will be locally sensed. This power supply will shut down and latch off after an over voltage condition occurs. This latch will 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 will never exceed the maximum levels when measured at the power connectors of the power supply connector during any single point of fail. The voltage will never trip any lower than the minimum levels when measured at the power connector. 5VSB will be auto-recovered after removing OVP limit.

Output Voltage	MAX (V)
+3.3V	4.5
+5V	6.5
+12V	14.5
-12V	-15
+5VSB	6.5

6.3 Over Temperature Protection: (OTP)

This 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, this power supply will restore power automatically, while the 5VSB remains always on. The OTP circuit has built in margin such that the power supply will not oscillate on and off due to temperature recovering condition.

6.4 Short Circuit Protection: (SCP)

A short circuit placed on any DC output to DC return shall cause no damage. The power supply shall be latched in case any short circuit is taken place at +5V, +3.3V, +12V, -12Voutput. The power supply shall be auto-recovered in case any short circuit is taken place at +5VSB.

7 Environment

7.1 Temperature and Humidity

Item	Description	MIN	MAX	Unit
T_{OP}	Operating temperature range	0	50	°C
$T_{non\text{-}OP}$	Non-Operating temperature range	-40	70	°C
T_{Δ_change}	Rate of temperature change		20	°C/hrs
H_{OP}	Operating humidity range, non condensing	20	85	%
$H_{non\text{-}OP}$	Non-Operating humidity range, non condensing	10	95	%

7.2 Altitude

Item	Description	MIN	MAX	Unit
A_{OP}	Operating Altitude range	0	5,000	m
$A_{non\text{-}OP}$	Non-Operating Altitude range	0	15,200	m

7.3 Random Vibration

Non-operating

Sine sweep

5Hz to 500Hz @ 0.5gRMS at 0.5 octave/min; dwell 15 min at each of 3 resonant points;

Random profile

5Hz @ 0.01g²/Hz to 20Hz @ 0.02g²/Hz (slope up); 20Hz to 500Hz @ 0.02g²/Hz (flat);

Input acceleration = 3.13gRMS; 10 min. per axis for 3 axis on all samples

7.4 Mechanical Shock

Operating: 5G, no malfunction

Non-operating: 50G, no damage. Trapezoidal Wave, Velocity change = 4.3m/sec. Three drops in each of six directions are applied to each of the samples

8. Firmware Requirements

8.1 PMBus

8.1.1 Addressing

The PSU PMBus device address locations are shown below.

PSU PMBus Device Address Locations

Addresses used:		
System addressing A1/ A0 [3]	0/0	0/1
PMBus device read / write addresses [2]	B0h/B1h[1]	B2h/B3h
PSU PDB Device	BEh/BFh	

[1] Non-redundant power supplies will use the 0/0 address location

[2] The addressing method uses the 7 MSB bits to set the address and the LSB to define whether a device is reading or writing. The addresses defined above use 8 bits including the read/write bit.

[3] The '0' and '1' correspond to '1' = signal is not grounded; '0' = signal is grounded

8.1.2 PMBus Commands (Module)

The following PMBus commands shall be supported for the purpose of monitoring currents, voltages, and power. All sensors shall continue providing real time data as long as the PMBus device is powered. This means in standby mode the main output(s) of the power supply shall be zero amps and zero volts.

Command Code	Command Name	SMBusb Transaction Type	Number Of Data Bytes	Data Format	Remark
00h	PAGE	Read/Send Byte	1		
03h	CLEAR_FAULT	Send Byte	0		
05h	PAGE_PLUS_WRITE	Block Write			Used with STATUS_INPUT, STATUS_TEMPERATURE, STATUS_IOUT
06h	PAGE_PLUS_READ	Block Write-Block Read Process Call			Used with STATUS_INPUT, STATUS_TEMPERATURE, STATUS_IOUT, STATUS_WORD
19h	CAPABILITY	Read Byte	1		
1Ah	QUERY	Block Write-Block Read Process Call	1		
1Bh	SMBALERT_MASK	Write Word /Block Write-Block Read Process Call	2		

20h	VOUT_MODE	Read Byte	1		
30h	COEFFICIENTS	Block Write-Block Read Process Cal	5		
3Ah	FAN_CONFIG_1_2	Read Byte	1		
3Bh	FAN_COMMAND_1	Read/Write Word	2		
78h	STATUS_BYTE	Read Byte	1		
79h	STATUS_WORD	Read Word	2		
7Ah	STATUS_VOUT	Read/Write Byte	1		
7Bh	STATUS_IOUT	Read/Write Byte	1		
7Dh	STATUS_TEMPERATURE	Read/Write Byte	1		
7Eh	STATUS_CML	Read/Write Byte	1		
7Fh	STATUS_OTHER	Read/Write Byte	1		
81h	STATUS_FAN_1_2	Read/Write Byte	1		
86h	READ_EIN	Block Read	10		
87h	READ_EOUT	Block Read	10		
88h	READ_VIN	Read Word	2	Linear Data Format	
89h	READ_IIN	Read Word	2	Linear Data Format	
8Bh	READ_VOUT	Read Word	2	Linear Data Format	
8Ch	READ_IOUT	Read Word	2	Linear Data Format	
8Dh	READ_TEMPERATURE_1	Read Word	2	Linear Data Format	
8Eh	READ_TEMPERATURE_2	Read Word	2	Linear Data Format	
8Fh	READ_TEMPERATURE_3	Read Word	2	Linear Data Format	
90h	READ_FAN_SPEED_1	Read Word	2	Linear Data Format	
96h	READ_POUT	Read Word	2	Linear Data Format	

97h	READ_PIN	Read Word	2	Linear Data Format	
98h	PMBUS_REVISION	Read Byte	1		
99h	MFR_ID	Block Read	Variable(up to 32 bytes)	ASCII	only Block Read for users
9Ah	MFR_MODEL	Block Read	Variable(up to 32 bytes)	ASCII	only Block Read for users
9Bh	MFR_REVISION	Block Read	Variable(up to 32 bytes)	ASCII	only Block Read for users
9Ch	MFR_LOCATION	Block Read	Variable(up to 32 bytes)	ASCII	only Block Read for users
9Dh	MFR_DATE	Block Read	Variable(up to 32 bytes)	ASCII	only Block Read for users
9Eh	MFR_SERIAL	Block Read	Variable(up to 32 bytes)	ASCII	only Block Read for users
A0h	MFR_VIN_MIN	Read Word	2	Linear Data Format	
A1h	MFR_VIN_MAX	Read Word	2	Linear Data Format	
A2h	MFR_IIN_MAX	Read Word	2	Linear Data Format	
A3h	MFR_PIN_MAX	Read Word	2	Linear Data Format	
A4h	MFR_VOUT_MIN	Read Word	2	Linear Data Format	
A5h	MFR_VOUT_MAX	Read Word	2	Linear Data Format	
A6h	MFR_IOUT_MAX	Read Word	2	Linear Data Format	
A7h	MFR_POUT_MAX	Read Word	2	Linear Data Format	
A8h	MFR_TAMBIENT_MAX	Read Word	2	Linear Data Format	
A9h	MFR_TAMBIENT_MIN	Read Word	2	Linear Data	

				Format	
ABh	MFR_EFFICIENCY_HL	Block Read	14		
D0h	MFR_REDUNDANCY_SETTING	Read/Write Byte	1		
DCh	MFR_BLACK_BOX	Block Read	230		
DDh	MFR_REAL_TIME_BLACK_BOX	Block Write / Block Read	4		
DEh	MFR_SYSTEM_BLACK_BOX	Block Write / Block Read	40		
DFh	MFR_BLACK_BOX_CONFIG	Read/Write Byte	1		
E0h	MFR_CLEAR_BLACK_BOX	Send Byte	0		
FBh	MFR_PFC_FIRMWARE_VERSION	Read Word	2	Mfr	
FCh	MFR_SND_FIRMWARE_VERSION	Read Word	2	Mfr	

8.1.3 PMBus Commands (PDB)

Command Code	Pages	Command Name	SMBus Transaction Type	Number Of Data Bytes
00h		PAGE	Read/Send Byte	
79h		STATUS_WORD	Read Word	2
7Ah	00h~02h	STATUS_VOUT	Read/Write Byte	1
7Bh	00h~02h	STATUS_IOUT	Read/Write Byte	1
8Bh	00h~02h	READ_VOUT	Read Word	2
8Ch	00h~02h	READ_IOUT	Read Word	2
8Dh		READ_TEMPERATURE_1	Read Word	2
8Eh		READ_TEMPERATURE_2	Read Word	2
96h	00h~02h	READ_POUT	Read Word	2

8.2 Page Define

00h: 12V output

01h: 5V output

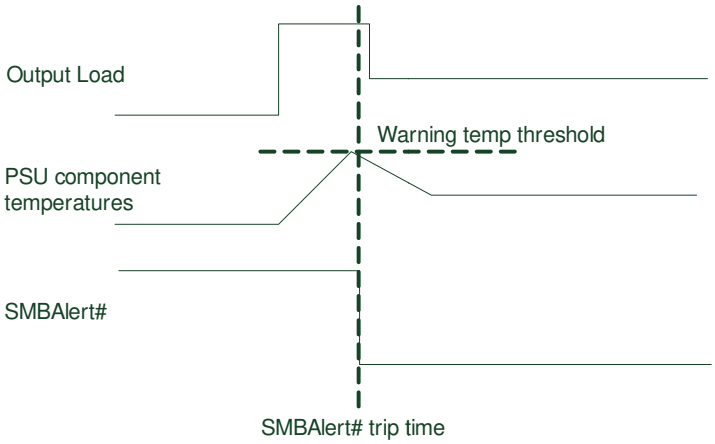
02h: 3.3V output

8.3 Sensors Accuracy

Sensor Functions	Accuracy 0-100% load	Accuracy 40-200W load	Accuracy 200W-Full load
READ_VIN	+/- 3%		
READ_IIN			+/- 5%
READ_PIN		+/- 10W	+/- 5%
READ_VOUT	+/- 3%		
READ_IOUT		+/- 1A	+/- 5%
READ_POUT		+/- 10W	+/- 5%
READ_TEMPERATURE	+/- 3 °C		
READ_FAN_SPEED	+/- 5 %		

8.4 Closed Loop System Throttling (CLST)

The power supply shall always assert the SMBAlert signal whenever any component in the power supply reaches a warning threshold. Upon reduction of the load within 2msec after the SMBlert# signal is asserted if the load is reduced to less than the power supply rating; the power supply shall continue to operate and not shutdown.



8.5 Smart Ride-Through (SmaRT)

The power supply shall assert the SMBAlert signal < 2msec after AC input voltage is lost to 0VAC.

9. MTBF

The power supply shall have a minimum MTBF at continuous operation of 100,000 hours calculated at 100% load, according to MIL-HDBK-217F at 25°C excluding the Fan MTBF.

10.EMI

The power supply shall comply with FCC part 15, CRISP 22 and EN55032; Class A for both conducted and radiated emissions. Test shall be conducted using a shielded DC output cable to a shielded load. The load shall be adjusted to 100% load. Tests will be performed full load on each output power at 120VAC, 60Hz, and 230VAC, 50Hz.

11. Safety Compliance

- UL+cUL, UL 60950-1/CSA 60950-1 Edition 2 (USA/Canada)
- TUV, EN60950-1 Edition 2 (Europe)
- CB Certificate & Report, IEC60950-1 Edition 2
- CE, EN55032+EN55024
- CCC(CQC China), GB4943-2012 Certification (China)

12.Mechanical

Physical dimension: 265mm (D) x 76.9mm (W) x 84mm (H)

13. Redundant Function

13.1 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 can be hot swapped by the following method:

Extraction: The power supply may be removed from the system while operating with PSON# asserted, while in standby mode with PSON# de-asserted or with no AC applied. No connector damage should occur during un-mating of the power supply from the power distribution board (PDB).

Insertion: The power supply may be inserted into the system with PSON# asserted, with PSON# de-asserted or with no AC power present for that supply. No connector damage should occur due to the mating of the output and input connector.

In general a failed (of by internal latch or external control) supply may be removed, then replaced with a good power supply, however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply will get turned on into standby or Power On mode once inserted.

13.2 LED Indicators

The power supply uses a bi-color LED; Amber & Green. Below are table showing the LED states for power supply operating state.

Power Supply Condition	**LED State**
Output ON and OK	GREEN
No AC power to all power supplies	OFF
PSU standby state AC present / Only Standby on	1Hz Blink GREEN
AC cord unplugged or AC power lost; with a second power supply in parallel still with AC input power.	AMBER
Power supply critical event causing a shutdown; failure, over current, short circuit, over voltage, fan failure, over temperature	AMBER
Power supply warning events where the power supply continues to operate; high temp, high power, high current, slow fan.	1Hz Blink Amber

13.3 TTL Indicators

There shall be an open-collect TTL to indicate power supply status. The TTL shall pull high to 5.0V indicate that all the power outputs are available or one module is dummy. The TTL shall pull low(under 1.0V) indicate that one module has failed or shutdown due to protection. The standard backplane provides a single TTL outputs signal. There could have maximum 3 channels to external TTL output signal, TTL, TTL1 (reserved) and TTL2 (reserved).

Channel name		**TTL**	**TTL1**	**TTL2**
Status		Total power good status	Module 1 status (Top module)	Module 2 status (Bottom module)
Support/Do not support		Support	Do not support	Do not support
Output cable		TTL cable	Reserved	Reserved
Action conditions				
NO.	Description			
1	Without anyone module input.	Low	Low	Low
2	Module 1 with AC or DC input, but without PS-ON, anyone module 2 without AC or DC	Low	Low	Low

	input at housing.			
3	Module 2 with AC or DC input, but without PS-ON, anyone module 1 without AC or DC input at housing.	Low	Low	Low
4	Module 1 and 2 with AC or DC input at PS-ON on stage.	High	High	High
5	Module 1 with AC or DC input, and PS-ON, module 2 in the housing but without AC or DC input.	Low	High	Low
6	Module 2 with AC or DC input, and PS-ON, module 1 in the housing but without AC or DC input.	Low	Low	High
7	Module 1 with AC or DC input at PS-ON on stage, but without module 2.	Low	High	Low
8	Module 2 with AC or DC input at PS-ON on stage, but without module 1.	Low	Low	High
9	Module 1 happen OVP, OCP, OTP, and Fan fail… failure conditions, but module 2 working is normal.	Low	Low	High
10	Module 2 happen OVP, OCP, OTP, and Fan fail… failure conditions, but module 1 working is normal.	Low	High	Low

13.4 Buzzer

The backplane has an audio buzzer to indicate that one module has failed or shutdown due to protection. The warning buzzer will sound continuously. It can reset warning buzzer by pressing the buzzer reset switch or by shorted (pull low) the buzzer reset connector.

Power system condition	Backplane Buzzer
No input AC or DC power to all PSU	OFF
No input AC or DC power to one PSU only	Steady buzzing
Input AC or DC present/only standby output on	OFF
Power supply DC output ON and OK	OFF
One power module failure or shutdown	Steady buzzing