POWER SUPPLY SPECIFICATION

AC/DC 2.2kW

Rev.: 1.1

Model Name: MC2200B4-3-3R1-02

2017/08/08

Prepared by	Reviewed by	Approved by
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1.0 Revision Log

Revision	Description	Approved	Date
01	Initial Release	Patrick Chang	2017/07/31
1.1	Correct typo of AC intake air flow on 4.19 Rubber Color, 8.4 Fan Speed Control and 10.1 Temperature	Patrick Chang	2017/08/08

2.0 Scope

This specification establishes the requirements for a custom "1**U**" form factor, **2200** Watts output, active power factor corrected, and wide-range power supply. Also, the approximate dimensions are **86.3mm(W) x 196mm(D) x 40mm(H)**. The power supply will be used in N+N redundant (load share) and must contain appropriate Or-ing devices on all outputs. The number of PSU would be limited to four. The vendor must be sure no violation of intellectual property.

2.1 Power Supply Overview

Application	Sever System
AC Input & DC input	100-120, 200-240VAC & 240VDC as nominal voltage range
Power Factor Correction	Active
Output Power	2200 Watts maximum continuous
EMC Classification	EN61000-4-5 2KV common mode, 1KV Differential mode FCC / CISPR Class "A"

Outputs	12V	12V Standby
Nominal Output Voltage	**12.00**	**12.00**
Voltage Regulation	**±5%**	**±5%**
Minimum Operating Current	1 A	0.1 A
Maximum Operating Current	183 A / high line 100A/ Low line	3.5 A

3.0 AC Input Requirements

3.1 Input voltage / current

AC input Parameter	Minimum	Nominal	Maximum	Unit
Low Line	90	100-120	132	VAC
High Line	180	200-240	264	VAC
Frequency	47	50/60	63	Hz
I_{in}			**15.5 / LL** **14 / HL**	A_{rms}
Turn-on		86		Vac_{rms}
Turn-off		82		Vac_{rms}
Vin_OVP	300			Vac rms

DC input Parameter	Minimum	Nominal	Maximum	Unit
HVDC	180	192-288	300	Vdc_{rms}
I_{in}			**14**	A_{rms}
Turn-on	152		162	Vdc_{rms}
Turn-off	140		149	Vdc_{rms}
Vin_OVP	310			Vdc_{rms}
Vin_UVP			149	Vdc_{rms}

Note 1: The standby output may continue to operate when input voltage below turn-off range.

Note 2: The PSU have to operate normal, input >=164VDC

Note 3: The AC voltage considering CF=1.1 & 1.6 should meet the turn on/off point as above.

Note 4: For HVDC, refer to Server AC+DC offline, HVDC_single unit test, HVDC compatibility test for qualification.

3.2 Input Fuse

A fast-blow type fuse must be placed in the single line fuse on the line/hot wire of the AC input. AC inrush does not cause the ac line fuse to blow under any condition. All protection circuits in the power supply do not cause the ac fuse to blow unless a component in the power supply has failed.
AC/DC line fuse must be acceptable for all safety agency requirements.

3.3 Harmonic Current and Power Factor Correction

The power supply shall incorporate universal power input with active power factor corrections, which shall reduce line harmonics in accordance with the EN61000-3-2 and JEIDA MITI standards.

The power factor lists as below..

Load	10%	20%	50%	100%
P.F.	>0.9	>0.96	>0.98	>0.99

Tested at 230VAC / 50Hz & 60Hz

3.4 Input Connector

The AC input receptacle shall be an IEC-320 type C20 capable of at least 16A at 250VAC rating. This connector is located at the frond side of power supply. There is a retainer to fix the line cord to avoid accident disconnection,

3.5 AC Line Isolation Requirements

The power supply shall meet all safety agency requirements for dielectric strength. Additionally, power supply vendor must provide Intel with written confirmation of dielectric withstand test which includes: voltage level, duration of test and identification detailing how each power supply is marked to indicate dielectric withstand test had been completed successfully. Transformers' isolation between primary and secondary windings must comply with the 3000Vac (4242Vdc) dielectric strength criteria. If the working voltage between primary and secondary dictates a higher dielectric strength test voltage the highest test voltage should be used. In addition the insulation system must comply with reinforced insulation per safety standard IEC 950. Separation between the primary and secondary circuits, and primary to ground circuits, must comply with the IEC 950 spacing requirements.

3.6 AC Line Dropout / Hold up time

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 output voltage regulation requirements. An AC line dropout of any duration shall not cause tripping on protection circuits.
If the AC dropout lasts longer than the hold up 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 in 3.1, over the loading condition in 4.1, capacitive loading in 4.7 & temperature specification in 10.1.1
A dropout of the AC line for any duration shall not cause damage to the power supply.

Loading during AC dropout / holdup	Holdup time / Dropout duration
0% to 100% of rated load	10msec

Note: this must be tested with a bulk capacitor having the minimum capacitance tolerance, at worst case loading and at worst case AC voltage conditions.

3.7 AC Line 12VSB Hold-up time

The 12VSB output voltage should stay in regulation under its full load (static or dynamic) during an AC dropout of **70ms min** (=12VSB holdup time) whether the power supply is in ON or OFF state (PSON asserted or de-asserted).

3.8 Inrush Current

The power supply shall provide circuitry to limit the turn-on inrush current on any initial current surge or spike of 10ms or less will not exceed **35**A peak. Any additional inrush current surges or spikes in the form of AC cycles or multiple AC cycles greater than 10ms, should be less than the ratings of its critical components (including input fuse, bulk rectifiers, surge limiting devices…etc) during input in section 3.1, the o/p loading in 4.1 & temperature in 10.1.1.

Notes:

1. The inrush current due to the EMI filter capacitors can be ignored.
2. All internal components (including the fuse, bulk rectifiers and surge limiting device) must be able to withstand the surge current without damage the power supply.
3. The inrush limiting circuitry shall be designed such that if the active bypass circuitry is not functional the remaining circuitry shall not cause any smoke/flame potential safety issue.
4. The inrush current must meet at cold/warm start.
5. During the repetitive AC on/off cycling , the PSU cannot be over stress on devices and cause the damaged.

3.9 Efficiency

The Power supply shall meet 80plus Platinum efficiency requirement at 230VAC / 240VDC & 115VAC

Load	12VSB (A)	12V (A)	Output Power (W)	Efficiency / 230VAC/240VDC
20%	0.7	35.96	440	90%
50%	1.75	89.9	1100	94%
100%	3.5	179.8	2200	91%

Load	12VSB (A)	12V (A)	Output Power (W)	Efficiency / 115VAC
20%	0.7	19.3	240	90%
50%	1.75	48.25	600	92%
100%	3.5	96.5	1200	90%

Note:

1. Fan loading is not included for efficiency measurements. Efficiency to be measured at 20-25C after supply has run for 30 minutes.
2. The power supply shall pass all efficiency measurements by 0.2% to guarantee design margins for production.

3.10 Auto Restart

Auto restart conditions are tested from –40% to –100% AC under voltage conditions for time intervals ranging from 25ms to 2S. For each time interval, all of the under voltage conditions listed will be tested.
These tests are performed at both the lowest and highest nominal operating voltages of the power supply.

Time intervals: 25ms, 40ms, 60ms, 90ms, 130ms, 200ms, 280ms, 400ms, 600ms, 900ms, 1.3S, and 2.0S
Under voltage deviation from nominal AC voltage: -40%, -50%, -60%, -70%, -80%, -90%, -100%.

Notes:

1. The power supply may power off under these conditions, it must be capable of restarting, either automatically or under program control after the disturbance.
2. The power supply should not be in a latched state such that any of the operator buttons/switches do not operate correctly after the disturbance

3.11 Line Disturbance

The following requirements for "Line Disturbances" should be over the complete load, temperature of the power supply unless specified otherwise.

Item	Sag	Input Voltage	Input Frequency	Performance Criteria
0-1/2 cycle	95%	Nominal AC voltage Ranges	50 / 60Hz	No loss of function or performance
>1 AC cycle	>30%	Nominal AC voltage Ranges	50Hz / 60Hz	Loss of function acceptable, self-recoverable.

Item	Surge	Input Voltage	Input Frequency	Performance Criteria
Continuous	10%	Nominal AC voltage Ranges	50 / 60Hz	No loss of function or performance
0-1/2 cycle	30%	Mid-point of Nominal AC voltage	50Hz / 60Hz	No loss of function or performance

Notes: During those testing as above, the load should be set to maximum and minimum.

3.12 iTHD

This test shall be measured at 230VAC

Load	10%	20%	50%	100%
iTHD	<20%	<10%	<8%	<5%

3.13 Leakage Current

Maximum input leakage current at 264VAC, 50Hz, shall not exceed 0.8mA

3.14 AC Line Transient, Compliable with EMC Standard

Power supply shall operate within specifications under the followings conditions:

a) Transients as defined in IEC61000-4-4, Electrical Fast Transients standard, up to 1KV at AC line. Apply to six combinations of input AC/DC PSU (L1, L1-L2, L1-PE, L2-L2-PE, L2, L2-PE).
b) Transients as defined in IEC61000-4-5, Electrical Surge standard. Up to and including 10% margin limits, phase degrees, 45, 90, 135, 180, 225, 270 degree.
Common mode 2.0KV
Differential mode 1.0KV

c) Power supply shall comply with IEC61000-4-2, Electrostatic Discharge standard, up to 8KV with contact, 15KV with air discharge.
d) Power supply shall meet all the transient requirements for the CE mark designation.

3.15 EMI

The power supply shall comply with FCC Part 15 and EN55022:2006 (CISPR22:2005) Class A for conducted emissions. It must comply at 200-240VAC/50Hz with 6dB margin as minimum.

3.16 Voltage Interruptions

The power supply shall comply with the limits defined in EN55024: 1998/A1: 2001/A2: 2003 using the IEC 61000-4-11: Second Edition: 2004-03 test standard and performance criteria C defined in Annex B of CISPR 24.

Performance criteria C, Temporary loss of function is allowed provided the function is self-recoverable or can be restored by the operation of the controls.

3.17 Power Recovery

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

4.0 DC Output Requirements

4.1 Output Load And Status Regulation

The following table provides a summary of specifications for each individual output. The Output voltage must meet the following table under section 3.1, section 10.1.1.

Outputs	12V	12V Standby
Nominal Output Voltage	12.00	12.00
Voltage Regulation	±5%	±5%
Minimum Operating Current[1]	1 A	0.1 A
Maximum Output Current[1] Continuous	183 A / 100	3.5 A
Peak Load 1 >20S	219 A / 120 A	4 A
Peak Load 2 >15mS	256 A / 140 A	4.5 A
Peak Load 3 >100uS	274 A / 150A	NA

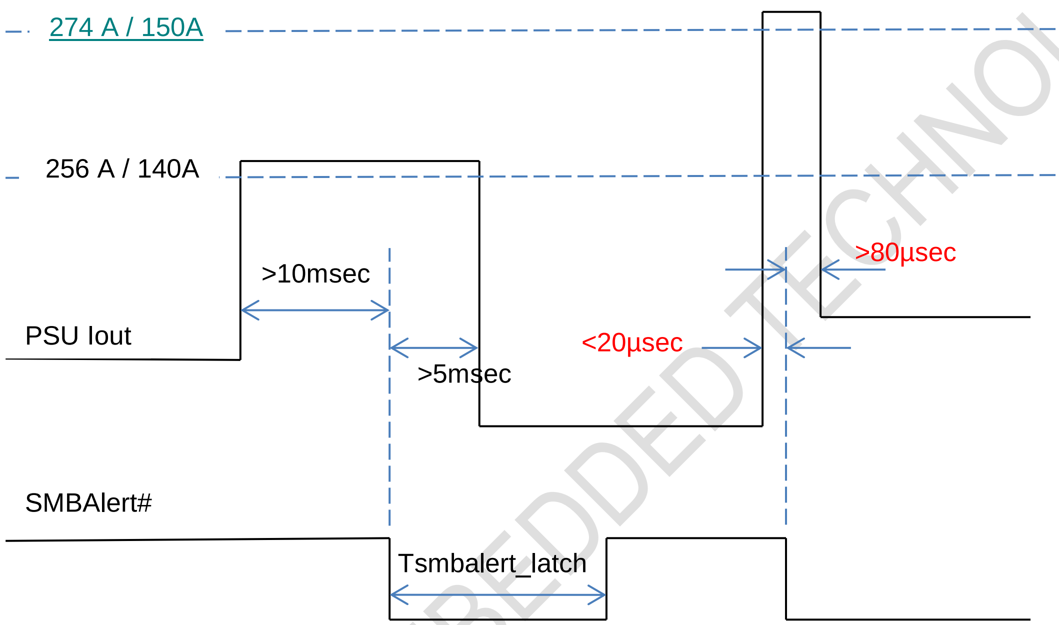
Notes:

1. During load changes from minimum to maximum or maximum to minimum, the unit must not shut down.
2. Length of time the 20sec peak power can be supported is based on thermal sensor and assertion of the SMBAlert# signal. Minimum peak power duration shall be 20 seconds without asserting the SMBAlert# signal at maximum operating temperature.
3. Duty cycle of the 15msec peak power shall be 5%; 15msec at Peak / 300msec at continuous rated power.
4. The length of time the 15msec peak power cycles can be supported. This peak power must be support for no less than 5msec after the SMBAlert# signal is asserted.
5. 2200W & 1200W is the maximum power rating for high/low line range.
6. 12V regulation setup: 12.05V ± 0.05V at 91.5A output
7. 12Vsb regulation setup: 12.00V ± 0.05V at 1.75A output

4.2 Peak load with added system buffer capacitance

The power supply shall be able to support peak power levels higher than 97.5A (1170W) with added system buffer capacitance for up to 100µsec.

Peak Power	Peak current	System capacitance	Peak load duration	Voltage regulation
3288W (High Line)	274 A	TBD	100µsec	5%
1800W (Low line)	150A	TBD	100µsec	5%

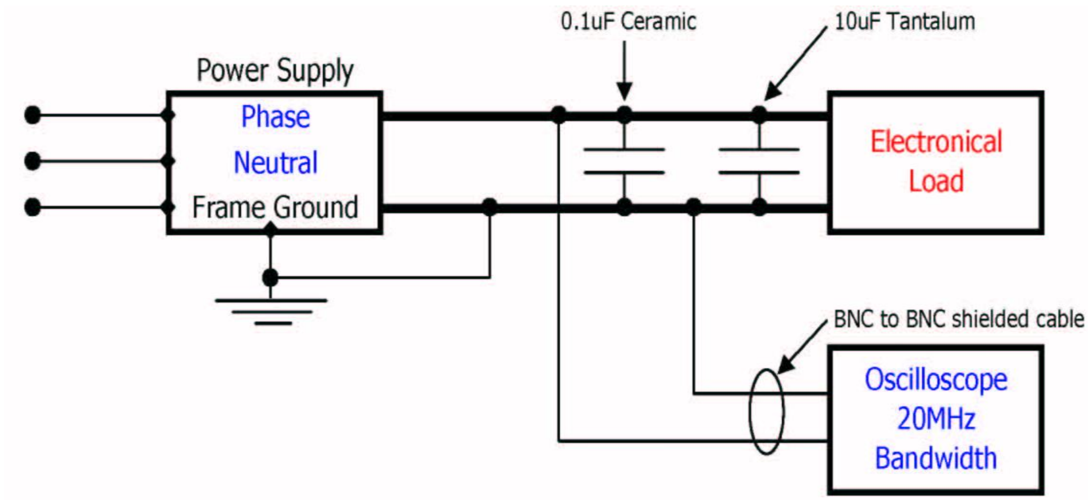


Note 1: Tsmbalert_latch = 100m sec (+ /- 50m sec)

4.3 Ripple /Noise

The following output ripple/noise requirements will be met throughout the load ranges specified in section 4.1 and under all input voltage conditions specified in section 3.1 and temperature condition specified in section 10.1.1.

Outputs[1,2,3,4]	Maximum	Capacitive loading
12V Standby	120 mV	Min. capacitive load
+12V	120 mV	



Notes:

1. Output ripple & noise should be measured at the pins of the mating output connector.
2. Connect the probe with the input tip and ground as short as possible.
3. Output ripple & noise measured with only PS capacitance plus 10uF of low ESR ceramic and 0.1uF Ceramic capacitors.
4. Ripple & noise are defined as periodic or random signals over the frequency band of 10Hz to 20MHz.

4.4 Dynamic Regulation

The output voltages shall meet regulation in section 4.1, under all input voltage conditions specified in section 3.1 and temperature condition specified in section 10.1.1.

Outputs[1]	Step Load Size	Slew Rate	Test Capacitor load
12V	50%	1.0A/uS	2200uF
Standby power	50%	2.5 A/uS	100 uF

Notes:

1. Frequency of the dynamic load will be 50Hz to 10KHz with a duty cycle of 10 to 90%. Frequency and duty cycle will be adjusted to produce the maximum amount of voltage transient on the output.
2. Dynamic Regulation of main power is 12V+-6%.

4.5 Audible Noise

No abnormal audible noise is allowed to be generated by the power supply.

4.6 Immune Voltage

The PSU 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.

4.7 Capacitive Loading

The PSU will be able to power up and operate normally with the capacitive load on the DC outputs (defined by capacitance and ESR), the power supply shall be stable and meet all requirements with the following capacitive loadings.

Outputs[1]	Min (For Smart-redundant & off line mode)	MAX	Units
12V Standby	100	3,100	uF
12V	2200	50,000	uF

4.8 Turn on/off Overshoot & Undershoot

During the turn-on or turn-off stage, the output voltage including the standby output, under any of the conditions specified in section 4.1 and temperature section 10.1.1, capacitive loading section 4.7 will less than 10% above the nominal voltage and will settle into the regulation band within 20ms.
The output voltage undershoot during turn-off of any of the output, including the Standby output, under any of the condition specified in section 4.1 and temperature section 10.1.1, capacitive loading section 4.7

There must be a smooth and continuous ramp of each output voltage from 10% to 95% of its final set point within the regulation band. No voltage of opposite direction will be present on any output during turn-on or turn-off stage.

4.9 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.

4.10 No Load Condition

This condition shall not trip any failure circuitry shutdown or cause any permanently damaged to the power supply. Also, the power supply shall normal operate when the power supply is turn on or when the power supply is already on at no load condition.

When the power supply is subsequently loaded, it must begin to regulate and source current without fault.

4.11 Close Loop Stability

The power supply shall be unconditionally stable under all line/load/transient load condition section 4.1 including capacitive load section 4.7, temperature 10.1.1. A minimum of 45 degrees phase margin and -10dB gain margin is required.
The power supply manufacturer shall provide proof of the unit's closed-loop stability with local sensing through the submission of Bode plots.
Bode Plot documentation will have Phase and Gain margin data, line and load conditions, as well as the oscillator injection level. For verification purposes the plots will have the method of test and injection points clearly documented on a current schematic. Stability plots need to be provided at both the upper and lower operating temperature limits.

4.12 Remote Sense

Differential (Single ended) remote sense is to be provided for the designated remote sense outputs. The remote sense must be able to compensate for the defined system output voltage drop over the system output resistance (after the output connector).

The remote sense lines must be protected such that if only the remote sense is connected to the load, or there is a short across the remote sense, the power supply is not damaged.

Notes: Make sure the drop compensation is included in determining your OV limits.

4.13 Common Mode Noise

The Common Mode noise on any output shall not exceed **350mV pk-pk** over the frequency band of 10Hz to 20MHz. The measurement shall be made across a 100Ω resistor between each of DC outputs, including ground at the DC power connector and chassis ground (power subsystem enclosure).
The test set-up shall use a FET probe such as Tektronix model P6046 or equivalent.

4.14 Hot Swap Requirement

Hot swapping a power supply is the process of inserting and extracting a power supply from an operating system. During this process, the output voltage shall remain within the regulation limits specified in section 4.1 with capacitive load specified in section 4.7, temperature in section 10.1.1.

The hot swap test must be conducted when the system is operating under static, dynamic condition and zero loading condition.
The power supply should use a latching mechanism to prevent insertion and extraction of the power supply when AC power cord is inserted into the power supply.

4.15 Output Isolation

All outputs have an isolating device to isolate the power supply from the system power during a power supply failure or during a hot swap operation. This device is located in power supply. This device is an or'ing diode or functional equivalent.

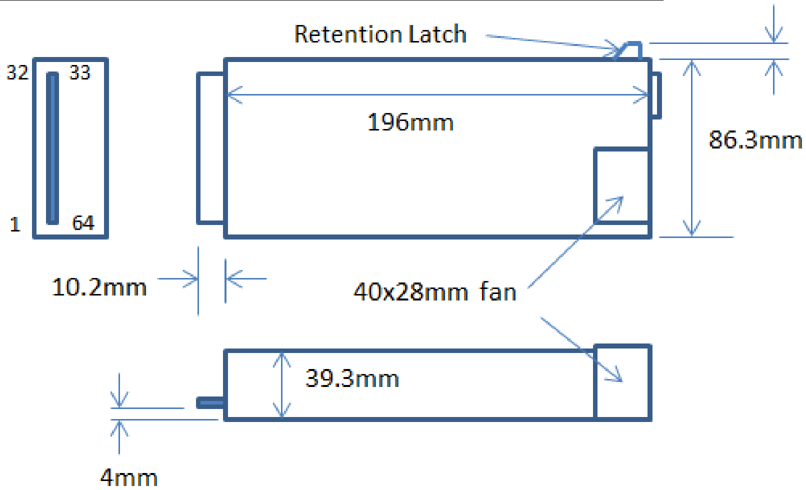
4.16 Soft Starting

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.

4.17 DC Connector and Pin Assignment

Pin No.	Pin Name	Pin type	Pin Length	Description
13-24 41-52	PWR Return	12V main & 12VSB GND	Standard	12V main & 12VSB Return
1-12 53-64	12V Output	12V main output	Standard	12V main output
25	Smart redundant Bus	I/O	Standard	Smart share for good efficiency performance (Connect together at system board)
26	Return Sense	Analog Input	Standard	12V main output Remote Sense -
27	VIN_GOOD	Output	Standard	Indicate AC voltage is existence and with operating range.
28	12V load share bus	Analog Output	Standard	12V main output load current sharing
29	PSON	Input	Standard	Active low; 12V main output on/off control
30	PSKILL	Input	Short	To turn on/off PSU, last fit and first out from pin contact.
31	N.C			
32	SMBAlert	Output	Short	Active low; I^2C alert signal (interrupt)
33	SDA	I/O	Short	SMBus/PMBus Data
34	Present	Output	Short	Power Supply Present
35	SCL	I/O	Short	SMBus/:PMBus Clock
36	Signal Return	Signal GND	Long	Signal GND
37	PWOK	Output	Standard	Active high; indicate 12V main is valid
38	A0	Input	Standard	PMBus address 0
39	12V standby	Aux power	Standard	Standby voltage
40	+12V remote sense	Analog Input	Standard	12V main output remote sense + To compensate the voltage drops on paths.

Output Pin-Out Drawing: Refer to 2D drwaing in detail.



4.18 Handle Retention

The power supply shall have a handle to assist extraction. The module shall be able to be inserted and extracted without the assistance of tools. The power supply shall have a latch which retains the power supply into the system and prevents the power supply from being inserted or extracted from the system when the AC power cord is pulled into the power supply.

The handle shall protect the operator from any burn hazard and be designed plastic handle.

4.19 Rubber Color

The rubber color at latch mechanism shows the airflow direction of PSU

Server / Storage PSU
Green: Airflow direction is intake from ac connector side and exhausted from dc connector the of power supply.

4.20 LED Identification and Indicators

The power supply shall use a bi-color LED; Amber & Green. Refer to the LED luminance test for more details.

LED luminance is 300~1100 cd/m^2.

Power Supply Condition	**LED State**
Output ON and OK	GREEN
No AC power to all power supplies	OFF
AC present / Only 12VSB on (PS off)	0.5 Hz Blink GREEN
Sleep PS in Smart redundant state / Off line mode	2Hz Blink GREEN
Standby power failed, OCP, SC, SC, OVP/UVP, OTP, fan lock. Auto-recover while the abnormal was removed.	OFF
12V Fault causing a shutdown; failure(OCP,SC, OVP/UVP, OTP), Fan Fail, Input OVP	AMBER

5.0 Protection Requirements

5.1 Primary Protection

The supply must have internal primary over current protection. A normal blow (fast blow), high-breaking-capacity fuse must be placed in the line side of the input circuit. This fuse is not to be considered replaceable for purposes of determining power supply reliability and life as specified in Section 8.
If any component on the line side of the fuse is shorted or opened, it shall not cause a fire or any other safety risk.

5.2 Secondary Protection

5.2.1 Over Current Protection

Over current is a fault condition defined as a 10A/S current ramp starting from full load applied to the output under test. Also, the other outputs may be set to any condition defined in section 4.1. A fault on any output will cause the rest of the outputs to latch off but that shall not cause any damage to the power supply.

OC condition	Minimum (high line/ low line)	SMBAlert Delay	PSU Fault Delay
12V - OCW	201A / 110A	20 sec	None
12V - OCP1	219A / 120A	20 sec	>20Sec +100mS
12V - OCP2	256A / 140A	10-15mSec	>20mSec
12V - OCP3	274A / 150A	<20uSec	>100uSec
12V – SCP	>160% load	<20uSec	immediately
12VSB – OCP1	4A	None	>20 sec
12VSB – OCP2	4.5A	None	>15mS

Notes:

1. The above current limits will be satisfied throughout AC input in section 3.1 and the entire operating temperature range in section 10.1.1.
2. Dynamic loading must not cause a false trigger over current.
3. A fault on any output other than Standby will not cause the Standby to turn off.
4. The Standby output shall not latch off. It must return to normal operation once the fault is removed. Also, that fault on Standby will cause the other outputs to turn off but not latch off.
5. OCW event is 110% of Imax where the power supply continues to operate.
6. The OCP point should consider the design tolerance and cannot fault trigger at peak power condition running, refer to section 4.1.
7. OCP3 & SCP have to make SMBAlert assertion while situation occurred.

5.2.2 Fast Output Current Sensing

The power supply shall have a circuit to quickly assert the SMBAlert signal when the output current exceeds the $I_{throttle}$ threshold. A current sense resistor on the output side of the PSUs output capacitors shall be used to quickly sense current exceeding the Ithrottle threshold. The SMBAlert# signal shall assert within Tfast_smbalert time. The PSU shall hold the SMBAlert# signal asserted for Tsmbalert_latch duration then release it.

Key characteristics of the fast output current sensing requirements

- Ithrottle < minimum OPP level (SMBAlert must assert before current/power hits the OPP threshold)
- Tfast_smbalert < 20µsec
- Tsmbalert_latch = 100msec (+/-50msec)

5.2.3 Over and Under Voltage Protection

Outputs[1,2,3]	Under Voltage		Over Voltage		Unit
	Minimum	Maximum	Minimum	Maximum	
12V Standby	10	11	13.5	15	V
12V	10	11	13.5	15	V

Notes:

1. The above OV/UV test will be satisfied throughout AC input in section 3.1 and the entire operating temperature range in section 10.1.1
2. Standby output shall not latch off due to an under/over voltage condition.
3. A fault on any output other than Standby will not cause the Standby to turn off. Also, that fault on Standby will cause the other outputs to turn off but not latch off.
4. The power supply will provide latch mode except for Standby output.

5.2.4 Short Circuit Protection

A short circuit is considered to be resistance of 0.1 ohms or less, applied to any output during start-up or while running will not cause any damage to the power supply (connectors, components, PCB traces, etc.).The power supply shuts down and latches off for short on main outputs but recovers upon PS_ON assertion or AC toggle

When the Standby output is shorted the output may go into “hiccup mode”, and all outputs shuts down upon a short circuit of the 12VSB. When the short is removed on 12VSB, the power supply shall recover automatically.

5.2.5 Over Power Protection

The power supply shall support over power protection (OPP) level low enough as protection and cannot saturation on magnetic devices. The power supply shall be stable operating at any load point from rated power up to the OPP point.

OPP threshold: 160% of full power W +/-50W

SMBAlert shall always assert ahead of the OPP threshold being exceeded

5.2.6 Reset after Shutdown

If the power supply latches into a shutdown state due to a fault condition on any output, the power supply will return to normal operation only after the fault has been removed and the power supply has been power-cycled. Both methods of resetting the power supply shall be designed into the supply so that the user may choose which method to use.

Reset can be accomplished in one of two ways as below:

i. Removing AC input power, waiting for Standby output to drop below 1.0V, then reapplying AC power. The time it takes for Standby output to drop below 1.0V shall not exceed 10 seconds.

ii. Cycling the state of PS_ON from on to off to on. The minimum cycle time will be 100mS.

5.2.7 Over Temperature Protection

The power supply shall incorporate a thermal shutdown feature that turns off all outputs (except standby output) when an over temperature condition occurs, such as loss of fan cooling or excessive ambient temperature. The power supply will not be damaged and will return to normal operation after the over temperature condition no longer exists and the power supply has been reset per section 5.2.6. The OTP trip level shall have a minimum of 4 degree.C of hysteresis shall be employed to prevent a frequent toggling on and off of the outputs.

There are thermal sensors located in the power supply to monitor the inlet temperature, hot spots devices, used for corresponding action when the temperature over its limitation. The thermal sensor reading accuracy should be kept within +/-3°C to ensure the sensor reading can reflect to correct threshold.

3 level temperature protection mechanisms are designed to protect power supply against over temperature conditions. The power supply shall assert the over temperature warning (OTW) SMBAlert signal when the inlet operating temperature/internal component reach a warning threshold.

Power supply will be protected by OTP shutdown if the operating inlet temperature or internal component continue to increase and reach OTP threshold.

Note: Internal fan speed control algorithm shall ramp up the fan speed to the maximum prior to the SMBAlert insertion.

6.0 Control Signals

This requirement shall be met throughout the load regulation condition specified in section 4.1, under all input voltage condition specified in section 3.1 and temperature condition specified in section 10.1.1.

Signal Name	I/O	Open collector	Connect to inner 3.3V	Pull-high resistor in PSU
-PS_ON	I	No	Yes	10k
-PS_PRESENT	O	No	No	100 ohm / 1206 to GND
POK	O	No	Yes	1k
SDA	I/O	No	Yes	5.9k
SCL	I/O	No	Yes	5.9k
-Alert	O	No	Yes	10k
PS_A0	I	No	Yes	10k
PSKILL	I	No	Yes	10k
Vin_GOOD	O	No	Yes	1k

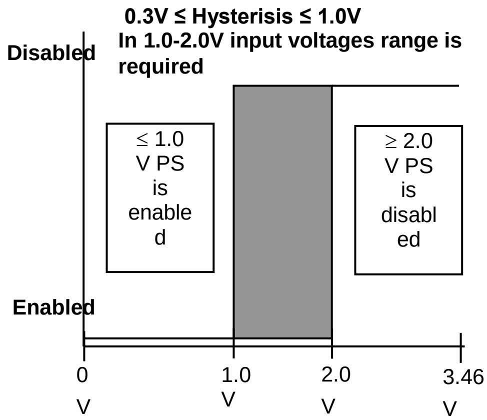
6.1 –PS_ON

The PS_ON signal is required to remotely turn on/off the power supply. PSON is an active low signal that turn on the main power rails. When this signal is not pulled low by the system, or left open, the outputs turn off.

The power supply shall provide an internal pull-up to TTL high. The power supply shall also provide de-bounce circuitry on PS_On to prevent it from oscillating On/Off at startup when activated by mechanical switch.

Provisions for de-bouncing will be included in the –PS_ON circuitry to prevent the power supply from oscillating on/off at startup.

Signal type	Accepts an open collector/drain input from the system Pull-up to internal VSB located in power supply	
PS_On =Low	PSU On	
PS_On =Open or High	PSU Off	
	MIN	MAX
Logic level low (PSU ON)	0 V	1.0 V
Logic level high (PSU OFF)	2.0V	3.46V
Source current, Vpson= low		4mA
Power up delay: Tpson_on_delay	5 ms	400 ms
Power off delay: Tpson_off_pwok		5ms



6.2 Power Good (POK or P_GOOD)

This signal should be asserted high by the power supply to indicate that all outputs are within the regulation thresholds listed in section 4.1. Conversely, this signal should be de-asserted to a low state when any of the DC outputs voltage falls below its under voltage threshold, or when mains power has been removed for a time sufficiently long so that power supply operation can't be guaranteed.

This signal must be driven low at least 1ms before any of the outputs go out of regulation. Also, that will be defined and selected for inclusion from any variation of the following three items:

A.) AC Power Loss ; B.) Fan Failure ; C) Over Temperature

This signal will have an internal pull-up resistor to internal 3.3V sources

Signal type	Pull-up to 3.3V must be located in the PSU	
POK or P_Good =High	DC Outputs O.K.	
POK or P_Good =Low	DC Outputs N.G.	
	Minimum	Maximum
Logical Level Low, Isink =400uA	0 V	0.4V
Logical Level High, Isource =200uA	2.4V	3.46V
Sink current, PWOK=low		4mA
Source current, PWOK=high		50uA
PWOK delay: Tpwok_on	100 ms	500 ms
Power down delay: Tpwok_off	1 ms	
POK or P_Good Rise & Fall Time		100us

6.3 PRESENT

This pin will be tied to Standby return through a 100 ohms resistor. The resistor should not be damaged if connected directly to 3.3V standby.

6.4 PSKILL

The DC main outputs, but not standby, will be disable when the input is driven high than 2.64V or open circuit.
The main outputs will be powered on or off based on PS_ON.
In the low state the input wil not source more than 1mA of current.
Provisions for de-bounding will be included in the PS_KILL circuitry to prevent the power supply from oscillating on/off at startup.

6.5 Load Share Bus

6.5.1 Load Share Signal Characteristics

The load share signal is only for the load function. The load share signal characteristics can be defined by vendor. The delay from output voltages in regulation to load share active with maximum load of one power supply and four power supplies in parallel is 100mS maximum.

Item	Description	Min	Nominal	Max
Vshare; Iou=Max	Voltage of load share bus at specified maximum output current	7.76V	8.0V	8.24V
△Vshare / △Iout; Iout>1A	Slope of load share bus voltage with changing load		8.00/Imax V/A	
Ishare sink; Vshare=4.00V	Amount of current the load share bus output from each power supply sources.			0.5mA
Ishare source Vshare=4.00V	Amount of current the load share bus output from each power supply sinks.	4mA		
Tshare: Iout=maximum	Delay from output voltages in regulation to load sharing active with maximum load of one power supply and up to four power supplies in parallel.			100ms

6.5.2 Load Share bus definition

This input /output will allow two or more power supplies to share output current between them,
If one of the supplies fails the remaining supplies must pick up the entire load without any of the outputs dropping out of regulation. A defective supply that is connected to the output voltage bus will not have adverse effect on the operation of the remaining function supplies.

Total Load	Number of supplies	Load share bus(V) Minimum	Load share bus(V) Nominal	Load share bus (V) Maximum
100%	2	3.8	4	4.2
50%	2	1.8	2	2.2
20%	2	0.64	0.8	0.96
100%	1	7.8	8	8.2
50%	1	3.8	4	4.2
20%	1	1.4	1.6	1.8
0%	1	0	0	0.3

6.5.3 Load Share Accuracy

The 12V main will have active load sharing. The failure of a power supply should not affect the load sharing or output voltages of the other supplies, and does not cause these outputs to go out of regulation in the system. The power supplies must be able to load share with up to 4 power supplies in parallel and operate in a hot-swap/redundant N+1 or N+N configurations.

The 12V standby output can be passive sharing, 7A can be provided in parallel mode without any failure after 12V standbys are in steady state. The 12VSB of power supplies are connected together in the system, so that a failure or hot swap of a redundant power supply does not cause these outputs to go output of regulation in the system.

Load	Sharing Accuracy
50-100%	±5%
20-50%	±10%

Note 1: Sharing accuracy is not measured under transient conditions, but under transient conditions a false over current fault must not occur.
Note 2: Current sharing is not required power on of the outputs until the P.G. signal is asserted (all outputs are valid.)
Note 3: Accuracy is PS1 or PSU2 / average (PSU1 current + PSU2 current).

6.6 SMBAlert

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, AC lost, 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 with PSU Fault occurred.

It also complies with Reference the latest **PMBus command list, REV: xx**

Signal type	Open collector / drain output from power supply. Pull-up to 3.3VSB located in system	
SMBAlert=High	OK	
SMBAlert=low	Power Alert to system	
	Minimum	Maximum
Logical Level Low, Isink=4mA	0 V	0.4V
Logical Level High, I sink=50uA	2.4V	3.46V
Sink current, Alert#=low		4mA
Source current, Alert# = high		50uA
Alert# rise and fall time		100us

6.7 Address_A0

This signal is defined by end user system for PMBus communication, to allocate address of power supply unit in particular slot location

Signal type	Input pin 10k ohms Pull-up resistor to internal 3.3V located in power supply	
SMB Adress_A0/A1 =low	Address 0	
	Minimum	Maximum
Logical Level Low	0 V	0.4V
Logical Level High	2.4V	3.57V

6.8 PMBus CLOCK_SCL & DATA_SDA

SCL is the SMBus clock input to the supply,
SDA is the bi-directional SMBus data path to /from the supply.

Both have a 5.9k ohms pull-up resistor to 3.3V internal located in power supply. The pull-up must be diode isolated to prevent an unpowered/ faulted supply from loading the signal. It must be designed to not glitch bus during hot plug and unplugging.

The PMBus operation frequency is 100kHz.
It shall conform to SMBus V2.0 signaling protocol standards. And this specification is based on the PMBus specification parts I and II, revision 1.2.

Note: All I2C devices will be powered from the outside of the standby Oring-device. This will allow the status to be read from a supply that is not powered on, or has some other fault.
Some types of protection must be provided so a fault within the supply does not take down the bus.

6.9 REMOTE SENSE + / REMOTE SENSE -

These signals are analog In/Output 12V Main Voltage Sense. Both are analog input/output voltage sense lines to compensate for power path voltage drop. These low level analog signals should be isolated from digital circuit noise. When one or more remote sense lines are opened, regulation measured at the power supply output connector must be maintained within regulation defined, plus or minus an additional 200mV.

If the REMOTE SENSE+ is shorted to DC_RETURN, the main 12V output shall go over-voltage and the power supply will shut down.

6.10 Smart Redundant Bus

This signal should be connected together at system board for smart redundant function.
Please refer to the PMBus specification for detail.

6.11 VIN_GOOD

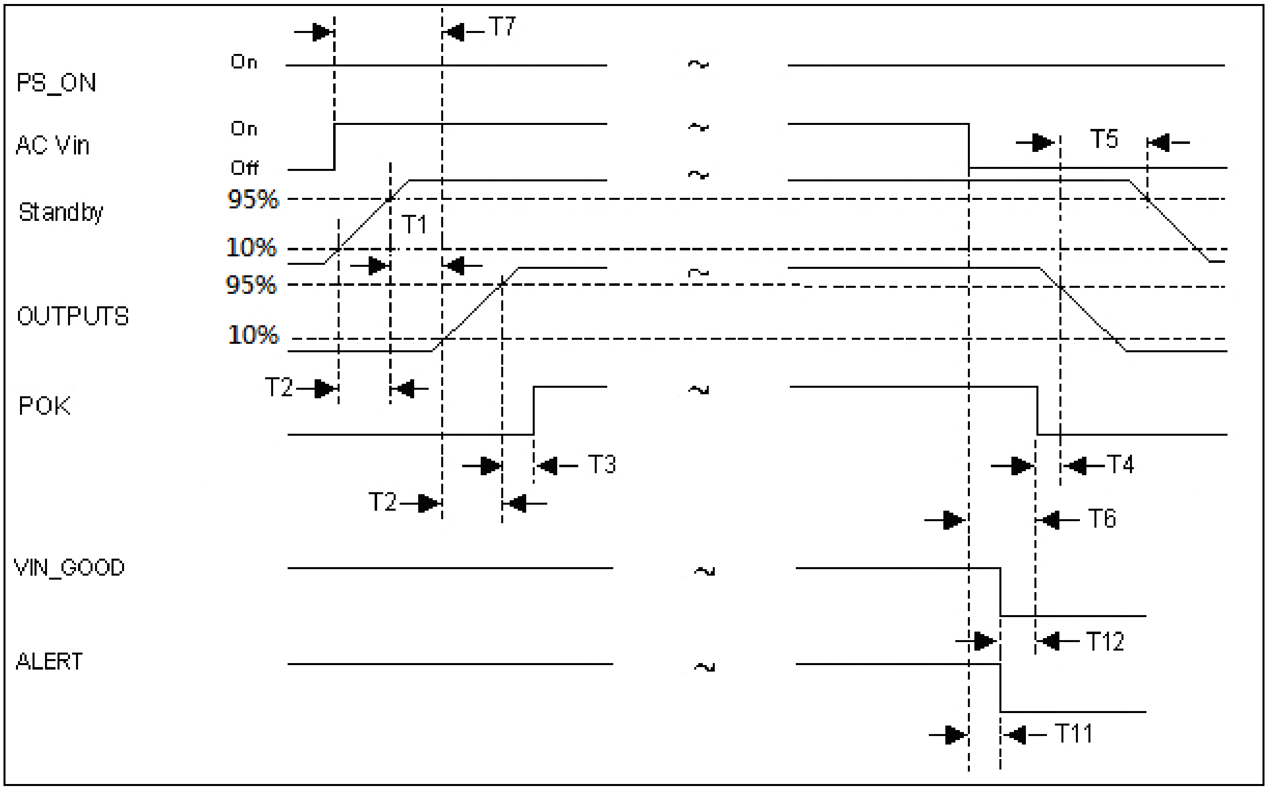
This signal is an output to indicate AC power is existence and is within operation range. It should act from high to low level within 2mS only for Vin power dropout event.

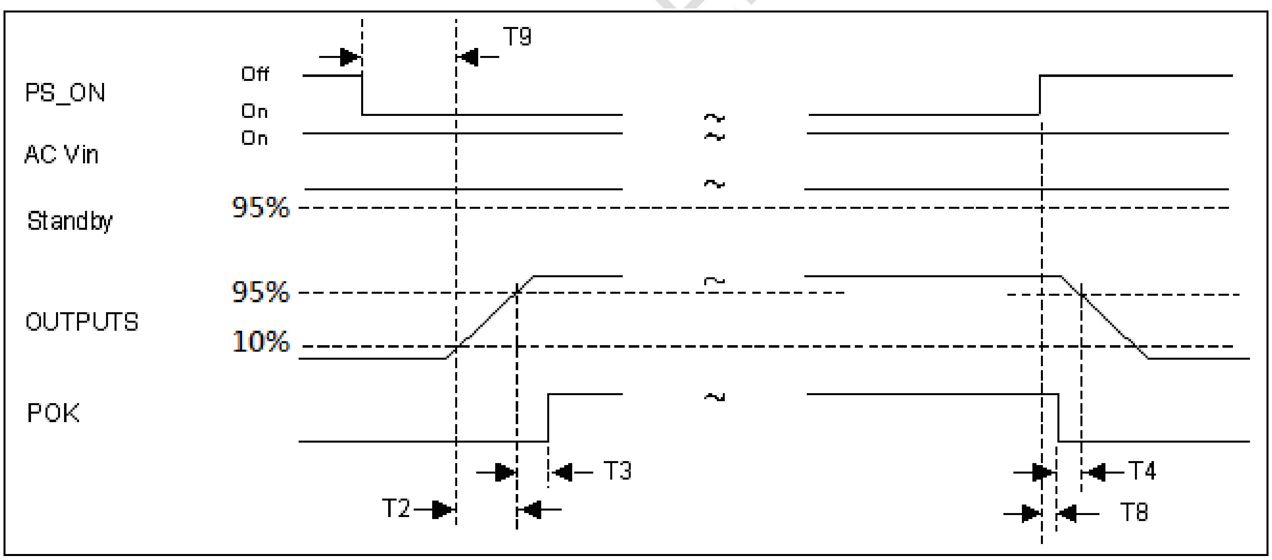
Signal type	1k ohms Pull-up to 3.3V must be located in the PSU	
VIN_GOOD =High	Input Voltage is in operating range	
VIN_GOOD =Low	Input Voltage is no in operating range	
	Minimum	Maximum
Logical Level Low, Isink =4mA	0 V	0.4V
Logical Level High, Isource =50uA	2.4V	3.46V
Sink current, VIN_GOOD=low		4mA
Source current, VIN_GOOD=high		50uA
VIN_GOOD delay: Tvin-good_off		2mS
VIN_GOOD Rise & Fall Time		100us

7.0 Timing

These are the timing requirements for the power supply operation. **All outputs must rise monotonically**. Table below shows the timing requirements 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
T1	Delay from 12VSB regulation to DC outputs turn on.	5	500	ms
T2	12VDC / 12VSB rise time	2	20	ms
T3	Delay from output voltages within regulation to POK asserted at turn on	100	500	ms
T4	Delay from POK desertion to 12V dropping out of regulation	1		ms
T5	Delay from 12V out of regulation to 12VSB turned off.	5		ms
T6	Delay from AC loss to PWOK desertion 16ms is for 1600W of output power	10 16		ms
T7	Delay from AC on to 12V on		2000	ms
T8	PS_Off# (PSU off) to PWOK		2	ms
T9	PS_ON# (PSU on) to outputs		350	ms
T11	Delay from Vin drop out to VIN_GOOD# & SMBAlert#		2	ms
T12	Delay from VIN_GOOD# to PWOK	1		ms


T7
PS_ON
On
AC Vin
On
Off
T5
Standby
95%
T1
10%
95%
OUTPUTS
10%
T2
POK
T3
T4
T2
T6
VIN_GOOD
ALERT
T12
T11


T9
Off
PS_ON
On
On
AC Vin
Standby
95%
95%
OUTPUTS
10%
POK
T3
T4
T2
T8

8.0 Additional Requirements

8.1 OTP

The power supply shall incorporate a thermal shutdown feature that turns off all outputs (except Standby output) When an over temperature condition occurs, the power supply will not be damaged and will automatically restart when the over temp condition no longer exists. Hysteresis > 4 °C shall be employed to prevent a frequent toggling on and off of the outputs.

The location of the OTP sensor should be on the component(s) most likely to overheat in the event of an abnormal ambient temperature or a blockage of airflow.

In normal operation the OTP cannot activate when the power supply is operated in any of the specified operating conditions of sections 3.1, 4.1, and 10.1.1.

The OTP must be driven low before or at the same time that POK is driven low. POK must be low for at least 1mS before the main outputs go out of regulation.

8.2 FAN FAIL

The fan is running at normal operation. If there is a fan fault per section 6.12, the PSU is off and the POK must be low for at least 1mS before the main outputs go out of regulation.
If the fan fault at standby mode, the standby can be off due to thermal concern.

Fan_Fault will be latched and is reset per section 5.2.6.

8.3 Standby turn-off

Following removal of AC power, the Standby output will remain at its steady state value until such time as it begins to decrease in voltage. The decrease will be monotonic in nature dropping to 0.5 volts or less. There will be no other perturbations of this voltage at, or following, removal of AC power.

8.4 Fan Speed Control

The power supply shall provide forced air-cooling by means of a DC fan intaking through the circular grill. The **40** mm dia. X **28** mm thick cooling fan should be mounted, to be exhausted through the DC output of the PSU case.

The power supply shall utilize a thermal fan speed controller utilizing a thermistor located on the supply's main heat sink as close as possible to the major heat source.

This fault should be inhibited for 15 +/- 5 seconds when the power supply outputs are first turned-on. This will allow sufficient time for the fan to come up to speed and the fan detect circuitry to stabilize.

A fan fault is when the fan RPM falls below **TBD** +/- 200 RPM (minimum fan speed) after 15 +/- 5 delay during normal operation.

Notes:

1. The controller shall drive the fan speed to vary linearly (not in steps) to a maximum rpm when the supply is close to maximum rated loading.
2. PSU shall employ PWM Control technique to vary fan speed to maintaining hot spot components with safe operating specification.
3. When the power supply is off, but AC power applied (in standby mode), one 12V fan may be operated at a significantly reduced RPM to maintain the component in safe specification.
4. The PSU's fan speed can be booted via FAN_COMMAND_1 / 3Bh of system BMC

9.0 PMBus

9.1 PMBus requirement

Refer to specification PMBus command list rev. xx for details on PMBus requirement.

9.1.1 Accuracy for Vin, Iin, Pin, Vout, Iout, Pout

Output Loading	10% - 20%	> 20% - 100%
V / I / Power	< 5%	< 2%
READ_FAN	< 500 rpm	
READ_Temperature	< 3 degree.C	

Note: The Accuracy must meet the table under section 3.1, section 4.1 & section 10.1.1.

9.1.2 Smart Redundancy

Redundant power supplies in a system shall power ON or OFF depending upon loading state. Power supply that or OFF (in the Smart Standby state) shall power on quickly to maintain full redundancy in the system.

9.1.3 Black Box

The power supply shall save the latest PMBus data and other pertinent data into nonvolatile memory when a critical event shuts down the power supply. This data shall be accessible via the SMBus interface with an external source providing power to the 12Vstby output.

9.1.4 System on-Line Bootloader

The power supply shall have the capability to update its firmware via the PMBus interface while it is in standby mode. This FW can be updated when in the system and in standby mode and outside the system with power applied to the 12Vstby pins. Refer to PSU FW update document, V x.x.

9.1.5 Off Line mode

Off line mode PSU / slave PSU in system should keep the low consumption < W, over section 3.1 in AC input, section 4.1 in DC output load, section 10,1,1 in temperature
Off line mode PSU / slave PSU would be waked up to take the system loading immediately and keep system operating normally while the master PSU enters AC lost or malfunction condition.

10.0 Environmental Requirements

10.1 Temperature

10.1.1 Normal Operating Ambient (At Sea Level)

+0℃ minimum.

+50℃ maximum. (AC intake airflow, Air flow is from AC to DC side),

Maximum rate of change is 10℃ / hr.

10.1.2 Non-Operating Ambient (At Sea Level)

-40℃ minimum to +70℃ maximum.

Maximum rate of change is 20℃/hr.

10.2 Humidity

10.2.1 Operating

5 to 85% relative humidity. (Non-Condensing)

10.2.2 Non-Operating

Up to 95% relative humidity. (Non-Condensing)

10.3 Altitude

10.3.1 Operating

-50 to 10,000 feet (3,048 meters), 5,000 meter is preferred.

10.3.2 Non-Operating

-50 to 50,000 feet (15,240 meters)

10.4 Mechanical Shock & Vibration

Refer to Mechanical Shock & Vibration Specification

10.5 Thermal shock (none-operating)

-40℃ minimum to +70℃ maximum, transition time not to exceed 5 minutes. Duration of exposure to temperature extremes will be 20 minutes.

10.6 Acoustic

10.6.1 Acoustical Limits to Noise for Power Supply

Subject to the measurement setup and the measurement conditions in the previous sections, the acoustical measurement sample of the power supply is required to meet the following upper limit specification. All data must be rounded to the nearest tenth dBA.

	Stand-by	**30% load (Idle)**	**70% load (Stress)**	**100% load (Max.)**	**Units and Reference**
Declared A-weighted Sound Power Level per ISO9296, LwAd (X.X BA)					B-A, re: 1 pW
Operator A-weighted Sound Pressure Level per ISO7779, LpAm-Op (XX.X dBA)					dBA, re: 20 µPa (X_{AVG}+1.65*σ)
Operator Loudness (X.X sones)					Sones (X_{AVG}+1.65*σ)
Prominent Tones in Range 0.4-10.0 kHz (X.X dB)					Presence According to **ECMA-74**[1]
Modulation (XX %)					Degree in percentage (X_{AVG}+1.65*σ)
Tonality (0.XX tu)					Tu[2] (X_{AVG}+1.65*σ)

11.0 Reliability & Qualification Requirements

11.1 Reliability

Unless otherwise specified, all section 9.0 analyses will be conducted in accordance with the parametrics listed below:

Application Conditions For Typical

The reliability requirements are based on the following product usage/application conditions.

☑AC Input Voltage Range	Refer to Section 3.1
☑DC Output Load	100% Maximum of rate output load
☑Temperature Range	Refer to Section 10.1.1, maximum load
☑Relative Humidity	44% ±10% Non-condensing
☑Altitude	Sea Level
☑MTBF	200K Hours
☑Minimum Operating Life	5 Years

11.2 De-Rating Guideline

Refer to Component De-rating Specification.

11.3 Inspection and Test Flow Plan

An inspection and test flow plan shall be created showing all inspection and test points in the build process. This plan may be in the form of a flow chart, production flow traveler, or any other document that satisfies the requirement stated above. The plan shall reference all specific inspection and test documents used during the build process, include inspection/test sample sizes at each point/operation, and describe the inspection/test methodology used, including equipment.

The document should contain ICT test, functional test, burn-in, and any other additional tests. The document should clearly list what the expected test coverage percentage is and what items are potential escapes. It should also state that if there is a test escape upstream, such as ICT, is there a later test, such as functional, that would catch the defect before arriving at customer side.

11.4 Defective Product

Customer shall inform supplier of any units or lots that fail in QSMC's manufacturing process and provide supplier with yield percentages. Defective units or lots will be shipped to supplier's facility as instructed by supplier. Supplier shall test and verify all units returned by QSMC and provide root cause, failure analysis information to Customer.

11.5 Failure Analysis

Failure analysis shall be performed on all failed product returned by Customer Computer. Unless specified, failure analysis results and recommended corrective action shall be send to Customer Computer within 48 hours from the time the product is returned. Corrective action shall be completed within 1 week and implementation within 14 days maximum.

The supplier shall analyze all failed supplies and report to Customer Computer data indicating “understanding of cause” for such failures as well as corrective action, both during development and throughout the life of the product. A failed PSU is one, which is determined by Customer Computer to no longer meet the specifications contained herein.

The above analysis of all hard and soft failures of the PSU will be expected even if the PSU is tested in excess of its specifications.

11.6 Burn In

100% of all engineer stage units (development units) will be burned-in for 24 hours before shipment to Customer on.

The Burn-In profile will be:

- ☑ Ambient temperature will be 45℃ ±5℃.
- ☑ All units subjected to burn-in will be at 100% of rated load(s). If loading the individual outputs at 90% exceeds the power supply’s output rating the loads can be decreased until the power rating of the supply is not exceeded.
- ☑ All units subjected to burn-in will be exposed to ½ hour power on and off.
- ☑ 50% of the units subjected to burn-in will have an AC input of 100-127Vac; 50% of the units will have an AC input of 200-240Vac.

Note:

1. If the power supply designated for 200-240Vac operation only then all units can be burned-in at 200-240Vac.
2. All burn-in failures will be documented with the failing components and root cause corrective action(s).

11.7 Components Source List

The manufacturer must submit a list showing all components used, mechanical and electrical, along with the AVL’s (Approved vendor List) for each of the components. During the design and development of the power supply the manufacturer must submit samples that are representative of the different sources. In particular all possible sources for connectors, fans, and MOSFET’s must be built into samples during development stage.

Customer approved equivalent means the part or design was approved during the Customer qualification process of the original design. The part or design must be included in the original bill of materials released into production.

Once a PSU has been released by Customer, any changes to the design, components, BOM’s, or AVL’s cannot be made unless approved in writing by Customer Inc. on a Customer/supplier ECR form.

11.8 Test Data and Report

All engineer (development) stage power supplies must come with individual test data. The test data must be presented by serial number and can be obtained by bench measurement or ATS (Automated Test System). At a minimum the test data must show the power supply was tested to verify the power supply meets the requirements of sections as below list:

- 3.0 AC Input Requirements
- 4.0 DC Output Requirements
- 5.0 Protection Requirements
- 6.0 Signal Requirements

Plus verification of the critical dimensions called out on the mechanical drawings on at least one sample per lot. The data may be submitted by FTP site, or e-mail.

12.0 Production EMC and Safety Requirements

12.1 Isolation between Primary-Secondary

Reinforced insulation must be used between primary and secondary circuits

12.2 Creepage & Clearance Requirement

Creepage and Clearance distances must comply with those specified by safety standards
Creepage distances require meeting 5000M attitude to comply with China GB4943.1-2011

12.3 Max Surface Temperatures

The temperature of the power supply chassis shall not exceed 70 C under all circumstances. Otherwise, a UL international HOT SURFACE label is required. If this HOT SURFACE label is required, it shall be placed in such a manner that when the power supply is extracted from the system, the label shall be visible before the operator has a chance to touch the hot surface of the power supply.

12.4 Date Coded Serial Numbers

Power supply shall be marked with a date-coded number for traceability purposes and to comply with CSA 950 marking requirements

12.5 Power Input Electrical Ratings

Power supply shall be tested to allow Nominal AC input operating voltages (100-127VAC and 200-240 VAC), DC input operating voltages (240VDC) and current rating.
The earth safety conductor shall be color-coded green/yellow and suitable sized for the max current of the power supply.

12.6 Maximum Allowable Temperatures on Inlet Receptacles

The inlet receptacle shall be suitably rated for the maximum operating temperature to the power supply, when installed in a rack environment.

12.7 Maximum Allowable Temperature on Power Cords

The exhaust air of the power supply shall not impose temperatures that will exceed the maximum allowable temperature of the power cord.

12.8 Agency Approvals

The following agency approvals are required before shipping production level power supplies:

1. cUL
2. TUV
3. CB
4. BSMI
5. CE
6. CCC or CQC
7. BIS

Note: All agency mark must be displayed on the power supply label for production.(except CB)

12.9 Required Documents

Copies of the following items shall be submitted to Customer:

1. All agency approval certificates
2. UL Descriptive and Nemko CB Test Reports
3. Schematics
4. BOM (Bill of Material)
5. Temperature ratings of all components and printed circuit boards
6. 80plus logo

Note:

1. Schematics and BOM revision numbers must correlate, and the model designation must be specified on each page of the schematics and BOM.
2. All "Conditions of Acceptability" must be reviewed and approved by Customer Power Team prior to release from development and installation in Customer products.
3. The CB report must include input current, leakage and heating test data.
4. The CB report must include abnormal testing of the voltage selector switch (if present). If the power supply is rated 100-120V / 200-240V but does not have a voltage selector switch (auto range circuit instead), then a statement must be present in the abnormal tests that the auto range circuit did not constitute a hazard.

12.10 Dielectric Strength

All production unit must pass a 2121Vdc Hi-Pot test between primary to chassis ground or follow safety agency requirement. The voltage must be ramped up to 2121Vdc within 0.8S and it must be maintained at that level for a minimum of 1 min. without failure or It must comply with safety requirement.

Each unit must be marked to indicate it passed the test.

12.11 Ground Continuity

All production units must pass a ground continuity test with less than 0.1 ohm from the safety ground (third wire) input pin to the power supply chassis.

Each unit must be marked to indicate it passed the test.

12.12 Metal Oxide Varistor

Any Metal Oxide Varistors (MOVs) used from Line to Line must be UL recognized and IEC 61051-1,-2 or CECC42200 approved components. MOV's must be properly placed or shielded to prevent a compromise of safety insulation in the event of a failure. MOVs cannot be used in any application where either lead is connected to ground.

12.13 Gas Discharge Tubes

Gas discharge tubes cannot be used in any application where either lead is connected to ground.

12.14 Fire Enclosure

The power supply must provide its own fire enclosure to comply with UL 60950-1.

12.15 Label Markings

Label markings must be permanent, legible and comply with all agency requirements.

Labels must be affixed to the power supply showing the following:

- ☑ Appropriate regulatory certification labels.
- ☑ Vendor name/Logo in large black print.
- ☑ Model name, Serial number, Date code and Revision level.
- ☑ Nominal AC input voltages and frequencies. Maximum AC input currents.
- ☑ Nominal output voltages and maximum continuous output currents.
- ☑ Maximum continuous output power compatible with safety regulations.
- ☑ Hi-Pot/Ground Continuity/Burn-In marking to be applied on the PSU after the manufacturing Hi-Pot/Ground Continuity/Burn-In tests have been successfully completed.
- ☑ International “Hazardous Voltage” & “Caution” on top.
- ☑ Connectors marked conform to the mechanical drawing.
- ☑ Manufacturing Location.

Note: For internal power supplies, the label(s) must not cover vents or fan grills/guards. The label should be visible after installation.

13.0 Mechanical Drawing

Refer to mechanical drawing.

14.0 Quality Assurance

14.1 Vendor Responsibility

When the power supply vendor takes orders for units to this specification, this vendor then assumes the responsibility of maintaining a standard of quality that meets or exceeds that of units originally qualified in the Design Verification Test.

14.1.1 General

The power supply manufacturer shall establish and maintain an effective quality program, to be submitted and approved by Customer, which will assure adequate quality in all phases of design, procurement, fabrication and test of power supplies procured in accordance with this specification. The manufacturer shall provide Customer with all quality program data upon request.

14.1.2 Scope

The power supply manufacturer's quality program shall control all aspects of the acquisition, inspection, storage, and handling of all materials, and the process of fabrication, assembly, test and inspection, packaging, and shipment of power supply assemblies. The program should include, but not be limited to the following elements:

1. Change control of drawings and specifications.
2. Review and control of procurement of parts, materials and services.
3. Control of vendor/supplier quality.

4. Inspection and test of received parts and materials.
5. Control of non-conforming materials.
6. Material review.
7. Calibration control of tools, gauges, and test equipment.
8. In-process control of test and manufacturing processes.
9. Failure/non-conformance detection, analysis and correction.
10. Inspection/Test planning.
11. Final inspection/test.
12. Control of packaging and packing.
13. Corrective action program.

The vendor documentation will be evaluated by Customer to ensure that the documentation is complete and accurate. The power supply will not be fully qualified until Customer approves the documentation. The vendor may be provisionally qualified pending Customer's documentation approval. The vendor must provide updated information that accurately reflects any changes or modifications to the power supply.

14.2 Inspection

14.2.1 Responsibility for Inspection/Test

The power supply manufacturer is responsible for performing all inspections and tests required to verify conformance of the power supply to the requirements of this specification. Customer Computer reserves the right to witness or separately perform any or all verification inspections or tests.

14.2.2 Inspection and Test Procedure

The power supply manufacturer shall prepare final inspection /tests procedures which specify the detailed inspections or tests which are required to verify that the performance of the power supply assembly complies with the performance requirements of this specification. Customer Computer must approve these procedures prior to incorporating the procedures for production power supply inspection or test. Approval of procedures will include approval of any special test equipment used to verify conformance to the requirements of the specification.

14.2.3 Qualification Inspection /Test Procedures

When qualification is required, the power supply manufacturer will prepare a detailed procedure for the qualification of the power supply to be produced in conformance with this specification. The procedure will specify the test routines, test conditions, number of test units, and duration of tests, test data to be recorded, and the criteria for establishing qualification of the power supply. Qualification procedures are subject to approval by Customer Computer prior to beginning the qualification program. Customer Computer reserves the right to witness all tests or perform the qualification program whether in lieu of or in addition to the manufacturer's performance of this test.

14.2.4 Acceptance Inspection/Test

The power supply manufacturer shall prepare a detailed procedure specifying the inspection and test routines that will verify that each production power supply conforms to the performance requirements of this specification. The acceptance procedure is subject to approval by Customer Computer. Customer Computer reserves the right to 100% screening or testing for lot acceptance/rejection based upon sampling per MIL-STD-105K, LEVEL II, per parameters specified in paragraphs 3 through 9 of this specification.

14.3 Final Test Data

The vendor shall ship final test data with each supply until full product qualification.

14.4 Rejection and Retest

Failure of a power supply during acceptance testing to comply with the requirements of this specification shall be cause for rejection. Rejected items will be returned to the vendor for full credit. Rejected items may be reworked and retested for acceptance.

14.5 Corrective Action Program

The power supply manufacturer shall prepare and maintain a corrective action program to be approved by Customer, for the correction of incoming inspection, in process, and field problems when failures are in excess of 0.2%.

14.6 Failure Analysis

The power supply vendor shall provide failure analysis data on all units returned. All units returned to the vendor, shall be at full credit.

14.7 Preparation for Delivery

Each power supply shall be packaged to enable damage-free shipping and handling by commercial carriers to assure safe delivery to Customer facilities worldwide.

End of document.