TABLE OF CONTENTS

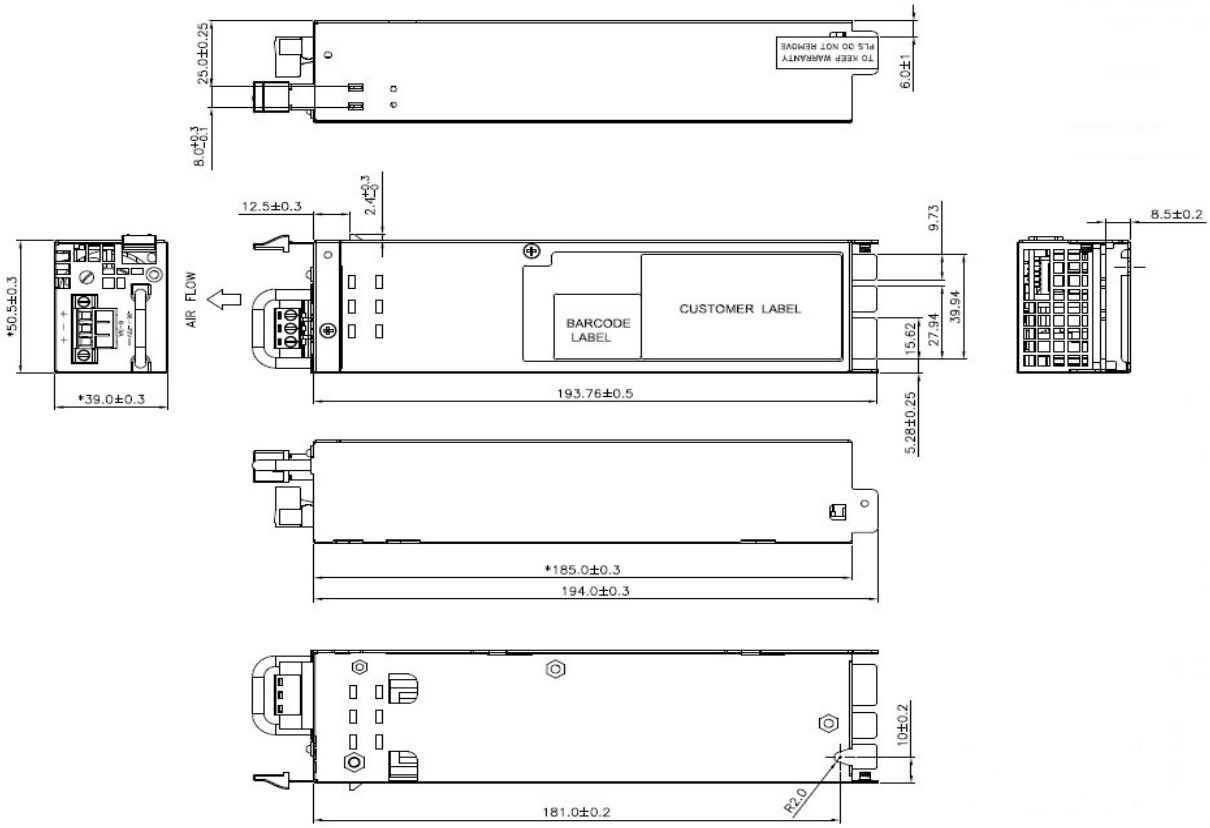
1. GENERAL SCOPE

This specification describes the performance characteristic of a 150W AC-DC switching power supply module with a +12V main DC output. The power supply shall be able to operate as a single supply, or in a N+1 parallel hot-plug able operation with active load sharing in a N+1 redundant configuration.

1.1. Mechanical Overview

The physical size of the power supply enclosure is intended to accommodate the power range of up to 150watts. The physical size is 39mm x 50.5mm x 185mm (height x width x length).
The power supply shall have a card edge for the DC outputs and signal pins, mating with Molex LPH series connector on the PDB side.
The AC plugs directly into the external face of the power supply.

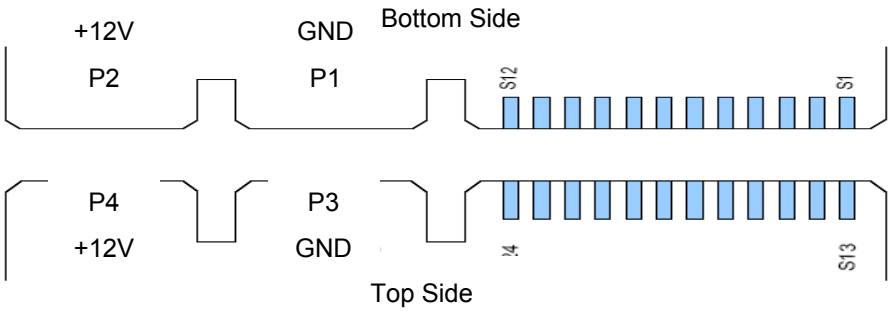
Figure 1 – Power Supply Dimension



1.1.1. DC Output Connector

The power supply shall have a card edge to mate with the Molex Low Profile Hybrid (LPH) Interconnect system. The Matting connector at system side is Molex PN 45984-4343.

Figure 2 – Card Edge Pin Out Location



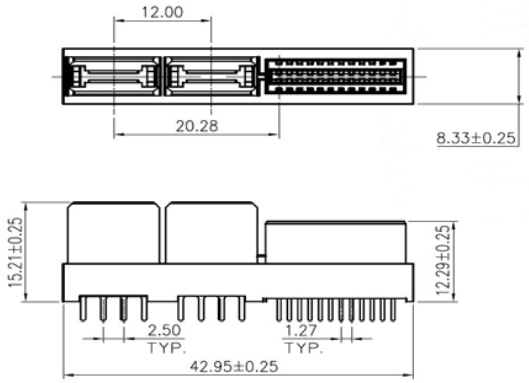
Pin Assignment :

- P1~4,: Power Circuits
- S1 ~ S24: Signal Circuits

Table 1 – Card Edge Pin Out Definition

Pin Name	Signal Name	P	Function
P1 Bottom	+12VRTN	P	+12V return
P2 Bottom	+12V	P	+12V
P3 Top	+12VRTN	P	+12V return
P4 Top	+12V	P	+12V
S1	+12VS	O	+12VS
S2	NC		NC
S3	+12VIBUS	O	+12V Main output Current share bus
S4	PS-ALERT	O	PS-ALERT
S5	SDA	I/O	I2c Data signal
S6	SCL	I/O	I2c Clock signal
S7	+ PS_Kill	O	In order to switch of the Main output (shorter)
S8	PSON	O	Power enable input
S9	PWOK	O	Pwr OK output
S10	A1	I	I2c address bit 1
S11	NC		NC
S12	NC		NC
S13	NC		NC
S14	PS-present	O	Power supply present(shorter)
S15	A0	I	I2c address bit 0
S16	NC		NC
S17	Vsso	O	Reserved for Factory use (+15Vcc)
S18	EEPROM_WP	P	EEPROM write protection
S19	NC		NC
S20	NC		NC
S21	NC		NC
S22	NC		NC
S23	NC		NC
S24	NC		NC

Figure 3 – PDB Mating Connector



1.1.2. Handle Retention

The power supply shall have a handle to assist extraction. The module shall b able to be inserted and extracted without the assistance of tools. The power supply shall have a retention mechanism, which retains the power supply into the system or enclosure during all mechanical shock (50G) and vibration testing.
The handle shall protect the operator from any burn hazard through the use of Industrial designed plastic handle or equivalent approved material.

1.2. LED Marking and Identification

The power supply shall have a single bi-colored LED for indication of the power supply status.
The LED is driven by an internal circuitry and should even illuminate in an N+1 configuration even without AC power.
The LED TYPE: YCG317GW or equal.

Table 2 – LED Status Information

Power supply condition	Power supply LED
No AC power to all PSU	OFF
No AC power to this PSU only	0.5Hz Flashing Red
AC present/only standby output on	1Hz Flashing Green
Power supply DC output ON and OK	Green
Power supply failure	Red
Power supply warning	0.5Hz Flashing Red*/Green*

NOTE: * Flashing frequency: 1Hz (0.5 sec Red/ 0.5sec Green)

1.3. Enviornmental Requirements

The power supply shall operate within all specified limits over specified conditions in 2.3.

The defined operation condition include temperature, humidity, altitude, shock and vibration.

1.3.1. Temperature and Humidity Requirements

The power supply shall operate within all specified limits over T_{op} temperature range and specified humidity Range. All airflow shall pass through the power supply and not over the exterior surfaces of the power supply.

The power supply shall withstand thermal storage specified in $T_{non\text{-}OP}$ without any damage.

Table 3 – Temperature Requirements

Item	Description	MIN	MAX	PEAK w. derating	Unit
T_{OP}	Operating temperature range.	-5	55	150W	°C
Δ T	Max temperature rise across power supply		15		°C
$T_{non\text{-}OP}$	Non-Operating temperature range.	-40	70	85	°C
T_{Δ_change}	Rate of temperature change.		10		°C/hrs
H_{OP}	Operating humidity range, non condensing		95		%
$H_{non\text{-}OP}$	Non-Operating humidity range, non condensing		95		%

1.3.2. Altitude Requirements

The power supply shall operate within all specified limits over A_{op} Altitude range. The change pressure condition shall not harm the power supply and the operation within specified regulations shall be assured.

The power supply shall withstand Altitude storage specified in $A_{non\text{-}OP}$ without any damage.

Table 4 – Altitude Requirements

Item	Description	MIN	MAX	Unit
A_{OP}	Operating Altitude range.	0	5000	m
$A_{non\text{-}OP}$	Non-Operating Altitude range.	0	15000	m

1.3.3. Vibration and shock Requirements

The power supply shall operate within all specified limits over G_{op} Shock Vibration range.

The power supply shall withstand Shock Vibration storage specified in $G_{non\text{-}OP}$ without any damage.

A) Operation : Freq. Range/Displacement: 5Hz~12.8Hz/0.06"

Freq. Range/Acceleration: 12.8Hz~500Hz/0.5g

Cycles: 4 cycles/axis

B) Non-Operation :

Freq. Range/Displacement: 5Hz~22.9Hz/0.06"

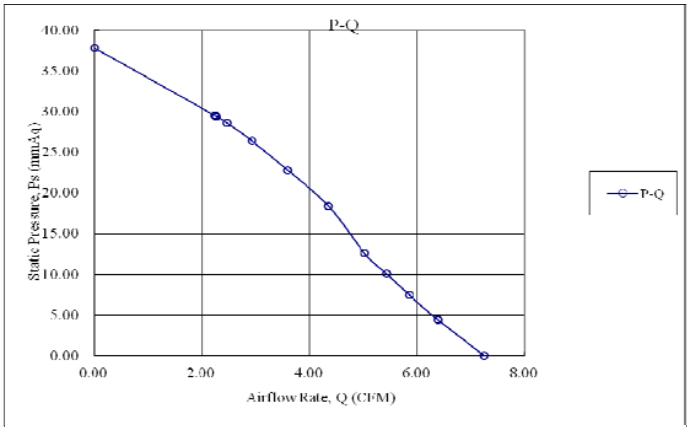
Freq. Range/Acceleration: 22.9Hz~500Hz/1.6g

Cycles: 4/axis

1.3.4. Airflow Requirements

The power supply shall incorporate36*36*28mm fan for self cooling. The airflow direction shall be from card edge connector to external handle (inside out, pulling).

The air shall exit the power supply on the AC inlet face. The power supply shall meet all requirements with the below system airflow impedance presented to the power supplies airflow path, the impedance table show in the Table.



Fan Duty(%)	10	20	30	40	50	60	70	80	90	100
Airflow CFM(Q)	0.99	1.75	2.43	3.10	3.65	4.23	5.02	5.94	6.58	7.24

1.3.5. Acoustic Requirements

The power supply internal fan shall be controllable through PWM control. The fan speed shall vary based on output loading and ambient temperature. The Fan shall also be controllable through PMBus or SMBus command. The declared sound power levels of the power supply shall meet below requirements.

Fan Duty(%)	10	20	30	40	50	60	70	80	90	100
Acoustic Noise dB(A)	25.6	36.3	46	51.2	55.2	58	61.6	66.4	71.1	74.8

2. ELECTRICAL PERFORMANCE

2.1. AC power Input Specification

2.1.1. AC Inlet connector

The power supply shall incorporate an AC input connector complying to IEC 320 C-14 power inlet connector specification. This inlet shall be rated for operation at 15A/250VAC.

2.1.2. Input voltage and frequency specification

The power supply shall operate within all specified limits over the following input range. Harmonic distortions of the rated line 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 supply the full output power in the voltage range of 90VAC to 264VAC.

Table 7 – Rated output power for each input voltage range

Parameter	Minimum input	Rated Input	Maximum input	$VAC_{recover}$	VAC_{low_limit}
115 VAC	$90V_{rms}$	$100\text{-}127V_{rms}$	$136V_{rms}$	85VAC ±5VAC	75VAC ±5VAC
230 VAC	$180V_{rms}$	$200\text{-}240V_{rms}$	$264V_{rms}$		
Frequency	47Hz	50/60Hz	63Hz		

2.1.2.1 Input voltage UVP (Brownout/Brown-in)

To consult **Table 7**

2.1.3. Input current

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

Table 8 – Maximum input current

Input voltage	Input current	Max power	Peak power
90-136VAC	3A	150W	180W
180-264VAC	1.5A	150W	180W

2.1.4. 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. Fuses should be slow blow type or equivalent to prevent nuisance trips. 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.

2.1.5. AC line inrush

The power supply must meet inrush requirements for any rated AC voltage, during turn on at any phase of AC voltage, during a single cycle AC dropout condition, during repretitive ON/OFF cycling of AC, and over the specified temperature range (T_{OP}). The peak Inrush current shall be less than the ratings of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

The maximum AC line inrush current for this power shall be 25A peak over the entire input voltage range.

Input Voltage	Initial Cold Start Inrush Current	Initial Cold Start Inrush Current	Initial Cold Start Inrush Current
90~136 VAC	50 A for 2 us	40 A for 200 us	25 A for 5 ms
180~264 VAC	100 A for 2 us	40 A for 200 us	25 A for 5 ms

Inrush current shall be measured at an ambient temperature of 25 deg C after the input voltage has been removed from the power supply for a minimum of 10 minutes.

2.1.6. Input Power Factor Correction

The input Power Factor shall be greater than 0.90/115Vac and 0.90/230Vac over all input voltages at loads greater than 50% of the power supply' s rated output, and meet Energy start 4.0 level .

Table 9 – Power Factor Correction

Input voltage	50% loading	100% loading
115VAC	>0.9	0.98
230VAC	>0.9	0.94

2.1.7. AC line dropout

An AC line dropout is a transient condition defined as the AC input to the power supply drops to 0 VAC at any phase of the AC line for any length of time. During an AC dropout the power supply must meet dynamic voltage regulations requirements. An AC line dropout of any duration shall not cause dripping of the control signals and protection circuits. If the AC dropout lasts longer than the holdup time, the power supply should recover when VAC meets $VAC_{recover}$ and meet all turn on requirements.

A Input dropout of any length shall not cause any damage to the power supply.

Table 10 – Holdup time until Power output goes out of regulations FOR FAN DUTY 100%

Loading	Main output for FAN DUTY 100%	Main output(min) For FAN DUTY100%	Standby output(min)
30W	134ms	129ms	
40W	110ms	105ms	
50W	95ms	90ms	
60W	85mS	80mS	
75W	75ms	70ms	
80W	65mS	60mS	
90W	58ms	55ms	
100W	51ms	46ms	
110W	46ms	41ms	
120W	41ms	36ms	
130W	38ms	33ms	
140W	35ms	31ms	
150W	31mS	28mS	70mS

2.1.8. Efficiency

The Efficiency should meet at least Climate Saver 2 / 80Plus Silver rating, specified in below table.

This power module shall have a version with Saver 2 efficiency.The efficiency should be measured at 230VAC and with external fan power according to Climate Saver / 80Plus efficiency measurement specifications (CSCI-09-10).

Table 11 – Efficiency requirements

Efficiency Std.	20% load	50% load	100% load
Silver/without fan	85%	89%	85%

FAN POWER LOSS

FAN DUTY	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
230VAC FAN (PIN LOSS)	0.12W	0.9W	1.2W	1.7W	2.4W	3.4W	4.7W	6.3W	8.2W	10.5W

2.1.9. Suspeceptibility 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.

Table 12 – Performance criteria

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.

2.1.9.1. Electrical Discharge Susceptibility

The power supply shall comply with the limits defined in EN 55024:1998 using the IEC 61000-4-2:1995 test standard and performance criteria A defined in Annex B of CISPR 24.

2.1.9.2. Fast Transient/Burst

The power supply shall comply with the limits defined in EN55024:1998 using the IEC 61000-4-4:1995 test standard and performance criteria B define in Annex B of CISPR 24.

2.1.9.3. Radiated Immunity

The power supply shall comply with the limits defined in EN55024:1998 using the IEC61000-4-3:1995 test standard and performance criteria A defined in Annex B of CISPR 24.

2.1.9.4. Surge Immunity

The power supply shall be tested with the system for immunity to AC Ringwave and AC Unidirectional wave, both up to 2kV, per EN55024:1998, EN 61000-4-5:1995 and ANSI C62.45:1992.

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 EN55024:1998 using the IEC 61000-4-5:1995 test standard and performance criteria B defined in Annex B f CISPR 24.

2.1.9.5. 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.

Table 13 – AC Line SAG transient performance.

AC Line Sag (10sec interval between each sagging)				
Duration	**Sag**	**Operating AC voltage**	**Line frequency**	**Performance criteria**
Continuous	10%	Nominal AC voltage	50/60Hz	No loss of function or performance
0 to AC cycle	100%	Nominal AC voltage	50/60Hz	Loss of function or performance is acceptable, self recoverable
>1 AC cycles	>10%	Nominal AC voltage	50/60Hz	Loss of function acceptable, self recoverable
0 to 1/2 AC cycle	30%	Mid-point of nominal AC voltage	50/60Hz	No loss of function or performance

Table 14 – AC Line SURGE transient performance.

AC Line Surge				
Duration	**Surge**	**Operating ac voltage**	**Line frequency**	**Performance criteria**
Continuous	10%	Nominal AC voltage	50/60Hz	No loss of function or performance
0 to 1/2 AC cycle	30%	mid-point of nominal AC voltage	50/60Hz	No loss of function or performance

2.1.9.6. 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.

2.1.10. 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.

2.1.11. AC Line Leakage Current

The maximum leakage current to ground for each power supply shall be 1.5mA when tested at 240VAC.

2.2. DC output voltages

2.2.1. 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(for chassis GND=signal GND). Resistance of the ground returns to chassis shall not exceed 1.0mΩ. This path may be used to carry DC-current.

2.2.2. Output rating

The following table defines the power and current rating of the 150W power supply. The combined output power of all outputs shall not exceed the rated output power. The power supply must meet both static and dynamic voltage regulation requirements.

Table 15 – Output Power and Current Ratings

Output Wattage		+12V		
Max.	Peak	Minimum	Maximum	Peak
150W	180W	0A	12.5A	15A
Total output power			150W	180W

Total combine max :150W, Total combine peak power:180W.

2.2.3. No load operation

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

2.2.4. Peak load operation

The power supply shall be capable to hold the peak loading requirements for 15mS Max. without going out of regulation or shutting down.

2.2.5. Voltage Regulation

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.

The regulation of Table 16(AC line, output loading) shall be measured at the output connector of the power supply, subject to the dynamic loading conditions, transient loading (in paragraph 3.2.7.)

Table 16 – Output Voltage regulation

	Output loading Output voltage limits(V_{dc})			
Output	Minimum	Nominal	Maximum	REG
+12V	11.76V	12V	12.24V	+/-2%

2.2.6. Ripple and Noise Regulation

Ripple and Noise is defined in table 17. Ripple and Noise shall be measured over a Bandwidth of 0Hz to 20MHz at the power supply output connector. A 0.1μ F ceramic capacitor and 10μ F of tantalum capacitor shall be placed at each point of measurement. The measurement points shall be as close as possible to the point of load.

The ripple and noise specification shall be met over all load ranges and AC line voltages with 1+N power supplies in parallel operation.

Table 17– Ripple and Noise Regulation

Output	+12V
Maximum ripple/noise	120mVp-p

2.2.7. Dynamic loading

The power supply shall operate within specified limits and meet regulation requirements for step loading and capacitive loading specified below.

The load transient repetition rate shall be tested between 50Hz to 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 and the MAX load.

This shall be tested with no additional bulk capacitance added to the load.

Table 18 – Transient Load Requirements

Output	Δ Step size	Slew Rate	Capacitive Load
+12V	60% OF MAX.	0.25A/μ sec	2200μ F

Note: For dynamic conditions +12V min. loading is 0.5A.

	Output voltage limits(V_{dc})			
Output	Minimum	Nominal	Maximum	REG
+12V	11.40V	12V	12.60V	+/-5%

2.2.8. Capacitive load

The power supply shall operate within specifications over the capacitive loading ranges defined below in table 19.

Table 19 – Capacitive Loading Conditions

Output	Min	Max
+12V	10μ F	11000μ F

2.2.9. Maximum load change

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

2.2.10. 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 -12dB-gain margin is required.
Closed-loop stability must be ensured at the maximum and minimum loads as applicable.

2.2.11. Common Mode Noise

2.2.11.1 The Common Mode noise on any output shall not exceed 350mV pk-pk over the frequency band of 10Hz to 200MHz. Measurement shall be made across a 100Ω resistor across the DC outputs, including ground at the DC output connector and chassis ground for PSU.

2.2.11.2 The Common Mode noise on any output shall not exceed 50mV pk-pk over the frequency band of 10Hz to 200MHz. Measurement shall be made across a 100Ω resistor across the DC outputs, including ground at the DC output connector and chassis ground for system.

2.2.12. 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 condition.

2.2.13. 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.

2.2.14. Load sharing control

The +12 V output shall have active load sharing. When operating at 50% of full load, the output current of any 1+1 power supplies shall be within (+/-6.5%). For example, if power supply #1 is operating at 12.5A, then all other power supplies within the system shall be operating between 11.75A to 13.25A (+/- 6% of 12.5A).

All current sharing functions shall be implemented internal to the power supply by making use of the 12VLS signal. The power distribution board (Housing Back Plane, for example YH-Part), must connect the 12VLS signals between the power supplies together. The power supply shall be able to share with up to 1+N supply in parallel.

The failure of a power supply shall not affect the load sharing or output voltages of the other supplies still operating. The power supplies must be able to load share with 100mV of drop between different power supply' s output.

If the load sharing is disabled by shorting the load share bus to ground, the power supply shall continue to operate within regulation limits for loads less than or equal to the rating of one power supply.

Table 20 - Load share bus output characteristics

Item	Description	Min	Nominal	Max	Units
V_{share}; I_{out}=Max.	Voltage of load share bus at specified max output current		6		V
$\triangle V_{share}/\triangle I_{out}$	Slope of load share bus voltage with changing load		$6/I_{outmax}$		V/A
I_{share}SINK	Amount of current the load share bus output from each power supply is allowed to sink		1.5		mA
I_{share}SOURCE	Amount of current the load share bus output from each power supply needs to source		1.5		mA
T_{share}; I_{out}=Max.	Delay from output voltages in regulation to load sharing active with maximum load of one power supply and two power supplies in parallel. (remote on/off only)			100	msec

2.3. Timing Requirements

These are the timing requirements for the power supply operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 1 to 70ms. 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.

2.3.1. Output Voltage Timing

The timing of signals and outputs are specified in below Table 13 and illustrated in Figure 1.

Table 21 - Turn on/off timing

Turn on	Description	Min	Max	Units
$T_{vout\ rise}$	Output voltage rise time for all main output	1*	70*	msec
$T_{ac\_on\_delay}$	Delay from AC being applied to all output voltage being within regulation		2500	msec
T_{vout_holdup}	Time all main output 12VI voltages stay within regulation after loss of AC.	28		msec
T_{pwok_holdup}	Delay from loss of AC to de-assertion of PWOK	27		msec
$T_{pson\_on\_delay}$	Delay from PSON# active to output voltages within regulation limits	5	400	msec
T_{pson_pwok}	Delay from PSON# deactivate to PWOK being de-asserted.		50	msec
T_{pwok_on}	Delay from output voltage(12V) within regulation limits to PWOK asserted at turn on	100	500	msec
T_{pwok_off}	Delay from PWOK de-asserted to output voltages dropping out of regulation limits.	1		msec
T_{pwok_low}	Duration of PWOK being in the de-asserted state during an off/on cycle using AC or the PSON signal	100		msec

Figure 5 – Output Voltage timing

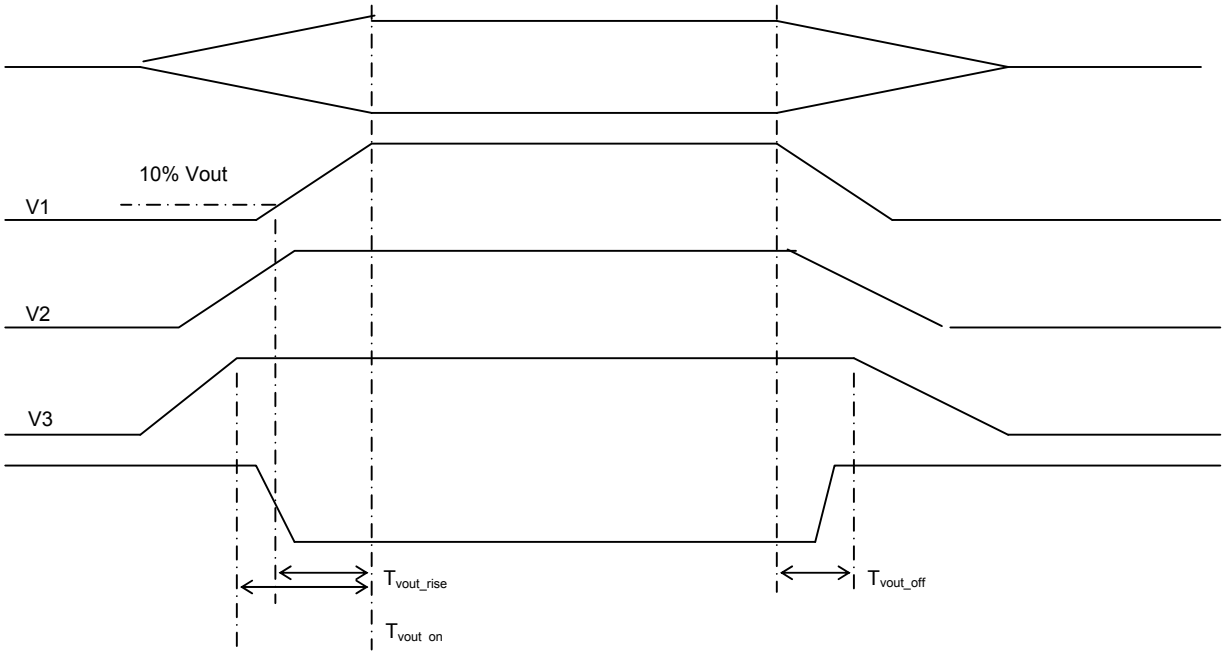
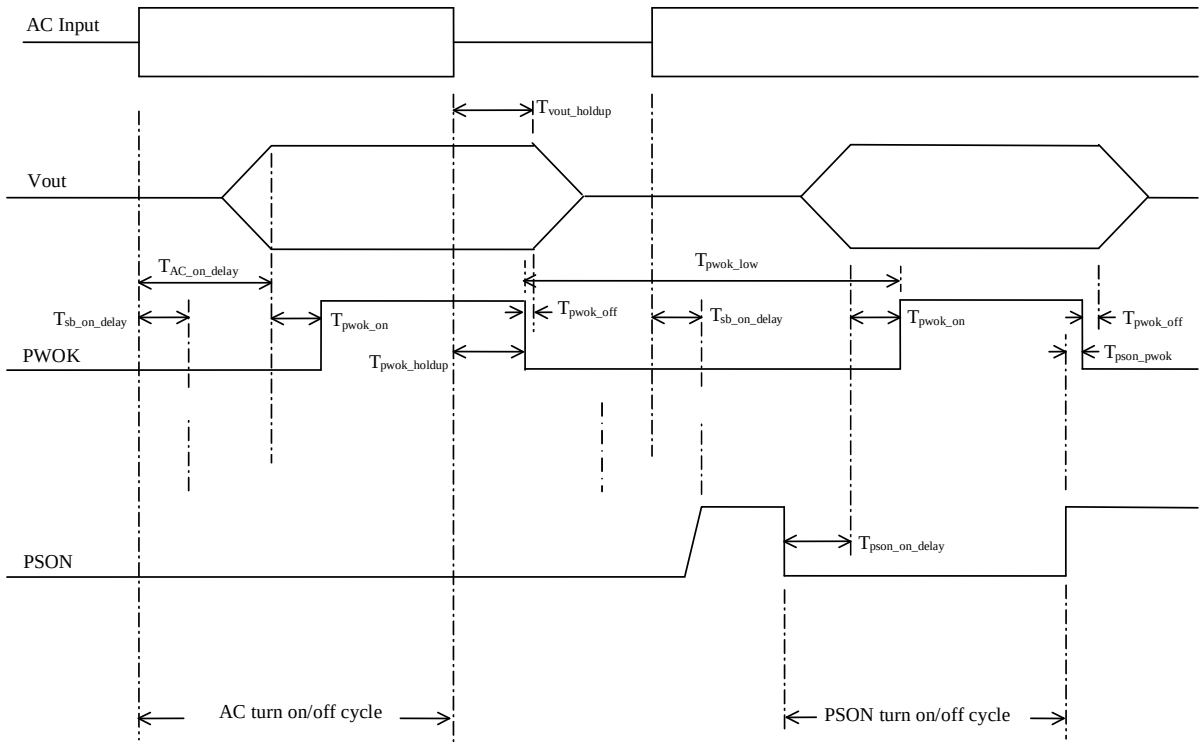


Figure 6 – Turn On/Off Timing (Power Supply Signals)



2.3.2. Overshoot

Any output overshoot at turn on shall be less than 3% of the nominal output value. Any overshoot shall recover to within the specified regulation in less than 0.5mS

2.3.3. Undershoot

Any output shall not undershoot at turn on or off shall be less than 3% of the nominal output value.

2.3.4. Temperature coefficient

After operating for 30 minutes or longer at 25° C ambient, the output voltages shall not change by more than ± 0.05 % per degree C for any given line and load conditions.

2.4. Control and Indicator functions

The following section define the input and output signals from the power supply. Signals that can be defined as low true use the following convention:
Signal$^{\#}$ = low true.

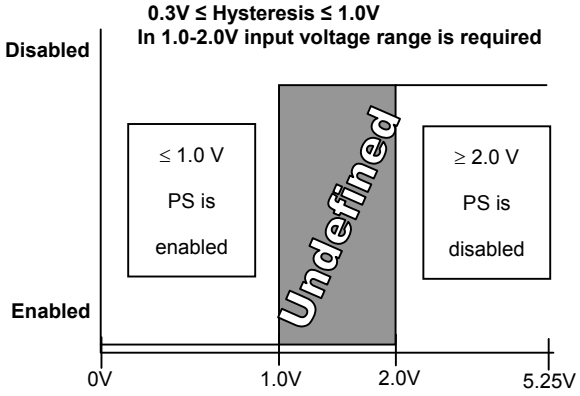
2.4.1. PSON Input Signal (Power supply enable)

The PSON signal is required to remotely turn on/off the main output of the power supply.
PSON is and 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.
PSON is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Table 22 – PS ON signal characteristics

Signal Type	Accepts an open collector/drain input from the system. Pul-up to Vsb located in the power supply.	
PSON= Low	ON	
PSON = High or Open	OFF	
PSON = Low, PSKILL = Open	OFF	
	MIN	MAX
Logic level low (power supply ON)	0V	0.7V
Logic level high (power supply OFF)	2.0V	3.46V
Source current, V_{pson} = low		4mA
Power up delay: $T_{pson\_on\_delay}$	5ms	400ms
PWOK delay: T_{pson_pwok}		50ms

Figure 7 – PSON# Signal Characteristic



2.4.2. PSKILL Input Signal

The purpose of the PSKILL pin is to allow for hot swapping of the power supply. The PSKILL pin on the power supply is shorter than the other signal pins. When a power supply is operating in parallel with other power supplies and then extracted from the system, the PSKill pin will quickly turn off the main output to prevent arcing of the DC output contacts. T_{PSKill} is the minimum time delay from the PSKill pin un-mating to when the power pins un-mate. The power supply must discharge its output inductor within this time from the un-mating of PSKill pin. When the PSKill signal pin is not pulled down or left open (power supply is extracting from the system or had not been inserted to the system), the power supply should shut down regardless of the condition of the PSON# signal.

The mating pin of this signal in the system shall be tied to ground. Internal to the power supply, the PSKILL pin shall be connected to a standby voltage through a pull-

up resistor. Upon receiving a LOW state signal at the PSKILL pin, a PSON# signal shall enable the power supply to turn on.
See Table 23.

Table 23 – PSKILL signal characteristics

Signal Type (Input Signal to Supply)	Accepts a ground input from the system. Pull- up to Vsb located in the power supply.	
PSKILL = Low, PSON = Low	ON	
PSKILL = Low or Open, PSON = Open	OFF	
PSKILL = Open , PSON = Low	OFF	
	MIN	MAX
Logic level low (power supply ON)	0V	0.7V
Logic level high (power supply OFF)	2.0V	3.46V
Source current, V_{pskill} = low		4mA
Delay from PSKILL=High to power supply turned off (T_{PSKill})		100μ sec

2.4.3. Power OK (PG or PWOK) Output Signal

PWOK is a power good signal and shall be pulled HIGH by the power supply to indicate that all outputs are within regulation limits. When any output voltage falls below regulation limits, a internal failure 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.
See Table 24.

Table 24 – PWOK signal characteristics

Signal Type	Open collector/drain output from power supply. Pull-up to Vsb located in power supply.	
PWOK=High	Power Good	
PWOK=Low	Power Not Good	
	MIN	MAX
Logic level low voltage, I_{sink}=4mA	0V	0.7V
Logic level high voltage, I_{source} = 200μ A	2.0V	3.46V
Sink current, PWOK=low		4mA
Source current, PWOK=high		2mA
PWOK delay: T_{pwok_on}	100ms	500ms
PWOK rise and fall time		100μ sec
Power down delay: T_{pwok_off}	1ms	200ms

2.4.4. SMBAlert (PSAlert) Output Signal Pin

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.

2.4.4.1. Smart Ride-Through (SmaRT)

SMBAlert will also be asserted in case of a input power lost.
This function is part of the Smart ride-through (SmaRT) function in order to throttle the system and start up all put in greenRedundancy™ held power supplies.
The SMBAlert needs to be asserted up on input power lost according to below table.

2.4.4.2. Thermal CLST

SMBAlert# shall also be utilized for warning of critical thermal component temperatures. The Thermal CLST shall assert when the component temperature, which shall be reported by a dedicated thermal probe, is reaching below specified Δ T to critical shut down. The power supply shall report the temperature in addition to Thermal CLST through PMBus to the system, in order to increase fan speed to cool down environmental temperature.
This signal is to be asserted in parallel with LED turning solid red or blinking red/ Green.
See Table 25.

Table 25 – PSAlert signal characteristics

Signal Type	Open collector/drain output from power supply. Pull-up to 3.3V located in power supply.	
Alert=High	Power OK	
Alert=Low	Power Alert to system	
	MIN	MAX
Logic level low voltage, I_{sink}=4mA	0V	0.7V
Logic level high voltage, I_{sink} = 50μ A	2.0V	3.46V
Sink current, Alert#=low		4mA
Sink current, Alert#=high		50μ A
50μ A rise and fall time		100μ sec
SmaRT input power fail assertion		2msec
Thermal CLST Δ T to critical thermal	10°C	

3. Protection circuits

Protection circuits inside the power supply shall cause only the main output to shutdown. If the power supply latches off due to a protection circuit assert, an Input Power cycle OFF for 15sec or PSU delay for 4sec auto recover the power supply.

3.1. Over Voltage Protection (OVP_{main})

All Over Voltage Condition shall be measured internal to the power supply on all outputs (Main $Output_{AR}$) at the card edge output. The power supply shall shutdown (auto recover)after an Over Voltage condition occurs on main outputs, The voltages never shall exceed the maximum levels specified in below table when measured during any fail.

The power supply shall alert the system of the OCP/SCP condition via SMBAlert# and fail LED indicator.

PSU the main output will auto recover.

Table 29 - Over Voltage Protection requirements

Output	Min	Max	Units
Main (+12V)	13.3	15.6	VOLTS

3.2. Over Current and Short Circuit Protection (OCP/SCP_{main})

The Over Current Condition shall be measured internal to the power supply on all outputs (Main), and preventing outputs to exceed current limits specified in below table. The power supply shall shutdown(auto recover) after an Over Current

condition on main outputs, PSU shut down the main output will auto recover.

The power supply shall alert the system of the OCP/SCP condition via SMBAlert and fail LED indicator.
The power supply shall not be damaged from repeated power cycling in this condition.

Table 30 – Over Current/Short Circuit Protection

Output	Over Current limit
Main (+12V)	120% MIN.; MAX. (18.75A)

3.3. Over Temperature Protection (OTP_{AR})

The power supply shall have minimum of two thermal sensors to measure the environmental (T_{env}) and critical component (T_{comp}) temperature. The thermal sensors shall be part of a protection circuit to protected against over temperature conditions caused by loss of fan cooling or excessive ambient temperature. In an critical Over temperature condition, specified in below table, the PSU shall be shutdown with the exception of the **auxiliary output.**

The Thermal CLST shall be part of the **OVP_{AR}**.

The power supply shall alert the system of the **OTP_{AR}** condition via SMBAlert and fail LED indicator. The power supply will auto recover from this condition, when the temperature is dropping within specification again.

Table 31 – Over Temperature Protection$_{AR}$

Condition	Warning in °C	Critical in°C	Recover °C	Timing for SMBAlert#/LED	TEMP ISSUE
T_{env}	65 (+/-5 °C)	>75	<58	1sec	Before OTP 75DEG For 70w laod US200,US200 part temp over spec issue Before OTP 75DEG For 150w laod US200,US200 ,Relay part temp over spec issue
T_{comp}	90(+/-5 °C)	100(+/-5 °C)	<68	1sec	*
Thermal CLST	90			100µ sec	*

3.4. Fan Failure Protection$_{AR}$

The power supply shall have a circuit internal to monitor the power supply internal fan. The fan failure protection shall monitor the fan speed and should assert SMBAlert and fail LED signal in case the fan Rotation Per Minute (RPM) drop lower threshold or set PWM Δ as defined in below table.

The protection circuit shall shutoff the main outputs only and let them latch off .The latch on the main output can be cleared by asserting the PSON# signal or by an Input Power interruption.

Table 32 – Fan Failure Protection$_{AR}$

Condition	FAN RPM	Timing for SMBAlert/LED
Warning	2000	3sec
Critical	1000	3sec

3.5. Under Voltage Protection

All under Voltage Condition shall be measured internal to the power supply on all outputs (Main $Output_{AR}$) at the card edge output. The power supply shall shutdown (auto recover)an under Voltage condition occurs on main outputs, The voltages never shall exceed the maximum levels specified in below table when measured during any fail.
The power supply shall alert the system of the OCP/SCP condition via $SMBAlert^{\#}$ and fail LED indicator.
PSU shut down the main output will auto recover.

Table 29 - Under Voltage Protection requirements

Output	SPEC	Units
Main (+12V)	<10.8V	VOLTS

4. Power Supply Management

4.1. Hardware Layer

The serial bus communication devices for Power Supply Management Controller (PSMC) and Field Replacement Unit (FRU) in the power supply shall be compatible with both SMBus 2.0 "high power" and I2C Vdd based power and drive specification.

This bus shall operate at 3.3V but be tolerant to 5V pull-ups. The power supply should not have any internal pull-ups on the SMBus, pull-ups shall be located on system side.

Two pins are allocated on the power supply. One pin is the serial clock (SCL). The second pin is used for serial data (SDA). Both pins are bi-directional and are used to form a serial bus. The device(s) in the power supply shall be located at an address(s) determined by addressing pins A0 and A1 on the power supply module. The circuits inside the power supply shall derive their 3.3V power from the 5V bus through a buffer. Device(s) shall be powered from the system side of the +5V device. No pull-

up resistors shall be on SCL or SDA inside the power supply. The pull-up resistors should be located external to the power supply on system/application side.

4.1.1. Capancitance for SMBus

The recommended Capacitance per pin on SDA and SCL shall be 10pF, and is not allowed to exceed 40pF per pin. In an N+1 configuration of up to eight (8) power module with additional PDB, the total Capacitance of each Bus pin shall not exceed 400pF.

4.1.2. I2c Bus noise requirement

The power supplies i2c bus' SDA and SCL line shall be clean from noise, which might affect the proper function when utilized with other devices.

The maximum allowed line noise on SDA or SCL is 300mV.

4.1.3. Pull Ups

The main pull-ups are provided by the system and may be connected to 5V or 3.3V. For the system design, the main pull-ups shall be located external to the power supply and derive their power from the standby rail. In case the power supply require pull-ups internal, the pull up resistance shall be very week on SDA or SCL.

4.2. Power Supply Management Controller (PSMC)

The PSMC device in the power supply shall derive its power of the 5V output on the system side of the 5V device and shall be grounded to return. It shall be compatible with SMBus specification 2.0 and PMBus^{TM} Power System Management Protocol Specification Part I and Part II in Revision 1.2 or later

It shall be located at the address set by the A0, A1 and A2 pins.

Refer to the specification posted on www.ssiforum.org and www.pmbus.org website for details on the power supply monitoring interface requirements and refer to followed section of supported features. The below table reflect the power module addresses complying with the position in the housing.

Table 33 – PSMC Addressing

PDB position and PSMC address	PM1 B0h	PM2 B2h	PM3 B4h	PM4 B6h
Pin A1/A0	0/0	0/1	1/0	1/1

4.2.1. General Call Address

The PSMC shall respond to the General Call Address (00h) as well to its own physical address.

4.2.2. Write Protection (WP)

The Power Supply shall have a hardware Pin for WP the memory of the PSMC for firmware updates and towards accidental EEPROM writes.

The WP is a active high signal and prevents any write to any memory. The WP needs to be pulled low in order to update the PSMC firmware or write to the EEPROM.

4.3. Power Supply Field Replacement Unit (FRU)

The power supply shall support electronic access of FRU information over an I^2C bus. Five pins at the power supply connector are allocated for this. They are named SCL, SDA, A1, A0 and Write protect. SCL is serial clock. SDA is serial data. These two bidirectional signals from the basic communication lines over the I^2C bus. A0and A1 are input address lines to the power supply. The backplane defines the state of these lines such that the address to the power supply is unique within the system. The resulting I^2C address shall be per table below. The Write protection pin is to ensure that data will not accidentally overwritten.

The device used for this shall be powered from a 3.3V bias voltage derived from the 3.3V output . No pull-up resistors shall be on SCL or SDA inside the power supply.

Table 33 - EEPROM Addressing

PDB position and FRU address	PM1 /A0h	PM2/A2h	PM3/A4h	PM4/A6h
Pin A1/A0	0/0	0/1	1/0	1/1

4.3.1. FRU Data

The FRU Data format shall be compliant with the IPMI ver. 1.0 (per rev. 1.1 from Sep.25th , 1999) specification. The current version of these specification is available at http://developer.intel.com/design/servers/ipmi/specs.htm. The following is the exact listeng of the EEPROM content. During testing this should be followed and verified.

4.3.2. FRU Device protocol

The FRU device will implement the same protocols as the commonly used ATC24C02 device, including Byte Read, Sequential Read, Byte Write, and Page Read protocols.

4.3.3. FRU Data Format

The information to be contained in the FRU device is shown in the following table.

Table 35 - EEPROM Addressing

Area Type	Description
Common Header	As defined by the FRU document
Internal Use Area	Not required, do not reserve
Chassis Info Area	Not applicable, do not reserve
Board Info Area	Not applicable, do not reserve
Product Info Area	As defined by the IPMI FRU document. Product information shall be defined as follows:
Field Name	**Field Description**
Manufacturer Name	3Y Power
Product Name	YM-1151DBR
Product part/model number	Customer part number
Product Version	Customer current revision
Product Serial Number	{Defined at time of manufacture}
Asset Tag	{Not used, code is zero length byte}
FRU File ID	URM1A151AMP20000AXX
PAD Bytes	{Added as necessary to allow for 8-byte offset to next area}
Multi-Record Area	As defined by the IPMI FRU document. The following record types shall be used on this power supply: - Power Supply Information (Record Type 0x00) - DC Output (Record Type 0x01) No other record types are required for the power supply. Multi-Record information shall be defined as follows:
Field Name (PS Info)	**Field Information Definition**

Overall Capacity (watts)	150
Peak VA	
Inrush current (A)	0
Inrush interval (msec)	0
Low end input voltage range 1	90
High end input voltage range 1	264
Low end input voltage range 2	
High end input voltage range 2	
A/C dropout total. (msec)	20
Binary flags	Set for: Hot Swap support, Auto switch, and PFC
Peak Wattage	Set for: 150 Watts
Combined wattage	None
Predictive fail tach support	Supported
Field Name (Output)	Field Description: Four outputs are to be defined from #1 to #4, as follows: +12V.
Output Information	Set for: No Standby on all others.
All other output fields	Format per IPMI specification, using parameters in this specification.

5. ENVIRONMENTAL

The power supply shall operate normally, and sustain no damage as a result of the environmental conditions listed in this chapter.

5.1. Temperature

Operating Ambient, normal mode (inlet Air): -5°C min/+55°C max at 5000m above sea level.
(At full load, with a maximum rate of change of 5°C/10 minutes, but no more than 10°C/hr)
Operating Ambient, stand-by mode (inlet Air): -5°C min/+55°C max at 5000m above sea level.
Non-operating ambient: -40°C to +70°C (Maximum rate of change shall be 20°C/hr)

5.2. Humidity

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

Non-operating: up to 95% relative humidity (non-condensing)

Note: 95% relative humidity is achieved with a dry bulb temperature of 55°C and a wet bulb temperature of 54°C.

5.3. Altitude

A) Operation : sea level to 5000m

B) Non-Operation : sea level to 15,200m

5.4. Vibration

C) Operation : Freq. Range/Displacement: 5Hz~12.8Hz/0.06"

Freq. Range/Acceleration: 12.8Hz~500Hz/0.5g

Cycles: 4 cycles/axis

D) Non-Operation :

Freq. Range/Displacement: 5Hz~22.9Hz/0.06"

Freq. Range/Acceleration: 22.9Hz~500Hz/1.6g

Cycles: 4/axis

5.5. Mechanical Shock

A) Operation: 10G, no malfunction

B) Non operating: 50G Trapezoidal Wave, Velocity change = 4.3m/sec. Three drops in each of six directions are applied to each of the samples.

5.6. Thermal shock (Shipping)

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

5.7. Catastrophic Failure

The power supply shall be designed to fail without startling noise or excessive smoke.

5.8. EMI

The power supply shall comply with FCC part 15, CRISP 22 and EN55-22; Class B . Test shall be conducted using a shielded DC output calbe to a shielded load. The load shall be adjusted to 100% load. Test will be performed at 100VAC @ 50Hz, 120VAC @ 60Hz, and 230VAC @ 50Hz power.

The power supply shall comply with EN55024.

The power supply when installed in the system must meet the following all the immunity requirements when integrated into the end system.

5.9. Magnetic Leakage Fields

The PFC choke magnetic leakage field shall not cause any interference with a high resolution computer monitor placed next to or on top of the chassis.

5.10. Voltage Fluctuations and Flicker

The power supply shall meet the specified limits of EN61000-3-3, for voltage fluctuations and flicker for equipment ≤ 16 amps connected to low voltage distribution systems.

6. REGULATORY Requirements

Intended Application – This product was evaluated as Information Technology Equipment (ITE), which may be installed in offices, schools, computer rooms, and similar commercial type locations. The suitability of this product for other product categories and environments (such as: medical, industrial, telecommunications, residential, alarm systems, test equipment, etc.) other than ITE application, may require further evaluation.

6.1. Product Safety Compliance

A) UL 60950-1/CSA 60950-1 (USA/Canada)

B) EN60950-1

C) IEC60950-1

D) CE – Low Voltage Directive 2006/95/EC (Europe)

E) BSMI (Taiwan)

F) CCC (China)

6.2. Product EMC Compliance – Class B Compliance

Note: The product is required to comply with Class B emission, as the system it is build into might be configured with the intend for commercial environment or home use. The Power supply is to have a minimum Class B Limits to support 3Y' s Standard margin requirements.

A) FCC / ICES-003 Emission (USA/Canada)

B) CRISP 22 – Emission (International)

C) EN55022 – Emission (Europe)

D) EN55024 – Immunity (Europe)

- EN61000-4-2 Electrostatic Discharge
- EN61000-4-3 Radiated RFI Immunity
- EN61000-4-4 Electrical Fast Transients (2.0KV)CRITICAL B LEVEL
- EN61000-4-5 Electrical Surge Level 3
- EN61000-4-6 RF Conducted
- EN61000-4-8 Power Frequency Magnetic Fields
- EN61000-4-11 Voltage Dips and Interruptions

E) EN61000-3-2 – Harmonics (Europe)

F) EN61000-3-3 – Voltage Flicker (Europe)

G) CE – EMC Directive 2004/108/EC (Europe)

6.3. Maximum AC Leakage current to ground

1.5mA max for each power supply at 240Vac.

6.3.1. Hi-pot

6.3.1.1 Input to earth ground 1500Vac or 2250Vdc for 1 minute, less than 10mA leakage.

6.3.1.2 Primary to secondary 3000Vac or 4240Vdc for 1 minute, less than 30mA leakage.

6.3.1.3Primary to secondary 500Vdc for 1 minute, isolation resistance shall not be less than 2M ohm.

6.4. Electrostatic Discharge (ESD)

In addition to IEC 801-2/ IEC1000-4-2, the following ESD tests shall be conducted. Each surface area of the system under test shall be subjected to twenty (20) successive static discharges, at each of the following voltages: 2kV , 3kV , 4kV , 5kV , 6kV , 7kV , 8kV , 10kV , 15kV.

Performance criteria:

a) All power system output shall continue to operate within the limits of this specification, without glitches or interruption, while the supply is operated as defined and subjected to 2kV through 15kV ESD pulses. The direct ESD event shall not cause any out of regulation condition. The power system shall withstand these tests without nuisance trips.

b) The power system, while operating as defined, shall not have a component failure when subjected to any discharge voltages up to and including 15kV. Component failure is defined as any malfunction of the power supply caused by component degradation or failure requiring component replacement to correct the problem.

6.5. Certifications / Registrations/ Declerations

A) UL Certification

B) cUL Certification

C) CB Certification & Report

D) FCC/ICES-003 Class B Attestation

E) TÜV Rheinland

F) CE Declaration of Conformity

G) BSMI (Taiwan)

H) CCC Certification (China)

6.6. Comonent Regulation Requirements

1. All Fans shall have the minimum certifications: UL and TÜV or VDE
2. All current limiting devices shall have UL and TÜV or VDE certifications and shall be suitable rated for the application where the device In its application complies with IEC60950.
3. All printed wiring boards shall be rated UL94V-0 and be sourced from a UL approved printing wiring board manufacturer.
4. All connectors shall be UL recognized and have a UL flame rating of UL94V-0
5. All wiring harnesses shall be sourced from a UL approved wiring harness manufacturer.

   SELV cable to be rated minimum 80V @ 120°C
6. Product safety label must be printed on UL approved label stock and printer ribbon.

   Alternatively labels can be purchased from a UL approved label manufacturer.
7. The product must be marked with the correct regulatory markings to support

the certifications that are specified in this document.

6.6.1. Product Ecology Requirement

All materials, parts and subassemblies must not contain restricted materials as defined in directive 2011/65/EU, Restriction of Hazardous Substances (RoHS) 6/6.

All cords and cables shall contain <100ppm of cadmium.

All packing materials must be marked with applicable recycling logos for Europe (green dot) and Japan (Eco-marks), if sold as a retail product. All packing materials shall be recyclable.

7. Reliability / Waranty / Service

7.1. Component De-rating

The following component de-rating guidelines shall be followed:

1. Semiconductor junction temperature shall not exceed 115°C with an ambient of 40°C. Any exceptions are subject to final approval.
2. Transformer temperature shall not exceed 115°C with an ambient of 40°C. Any exceptions are subject to final approval.
3. Inductor case temperature shall not exceed 85% of rated temperature in °C.
4. Capacitor case temperature shall not exceed 85% of rated temperature in °C.
5. Resistor wattage de-rating shall be >30%.
6. Component voltage and current de-rating shall For 3Y standard spec at operating temperature. During abnormal conditions (such as a short circuit and the like) no de-rating is allowed as long as each component max rating is not exceeded. Any exception are subject to final approval.

7.2. Component Life requirement

All components life expectancy requirements in min. 3 years, calculated for 100% of max continues load @ 55°C ambient temperature and @ 100VAC line voltage.

7.3. Mean Time between Failures (MTBF)

The power supply shall have a minimum MTBF at continuous operation of 200,000 hours calculated at 100%, according to BELL CORE TR-322 at 25°C excluding the Fan MTBF, and at least 100,000 hours including the fan MTBF.

7.4. Warranty

The Warranty for the power supply is 36 months (three years) from production date code.

7.5. Serviceability

No troubleshooting by maintenance personnel is to be performed. Units shall be returned to 3Y Power for any troubleshooting, unless agreed by both parties.

The power supply will lose warranty if opened other than 3Y service personal or agreed by both parties.

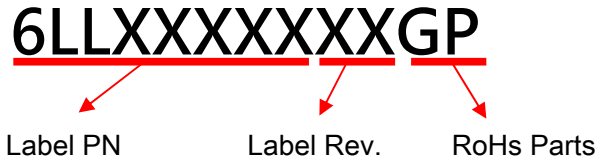
8. MISCELLANEOUS

8.1. Marking

The Power Supply shall carry labels defined in this section.

8.1.1. Model label

Please refer to PLM system and check the label part number as below:

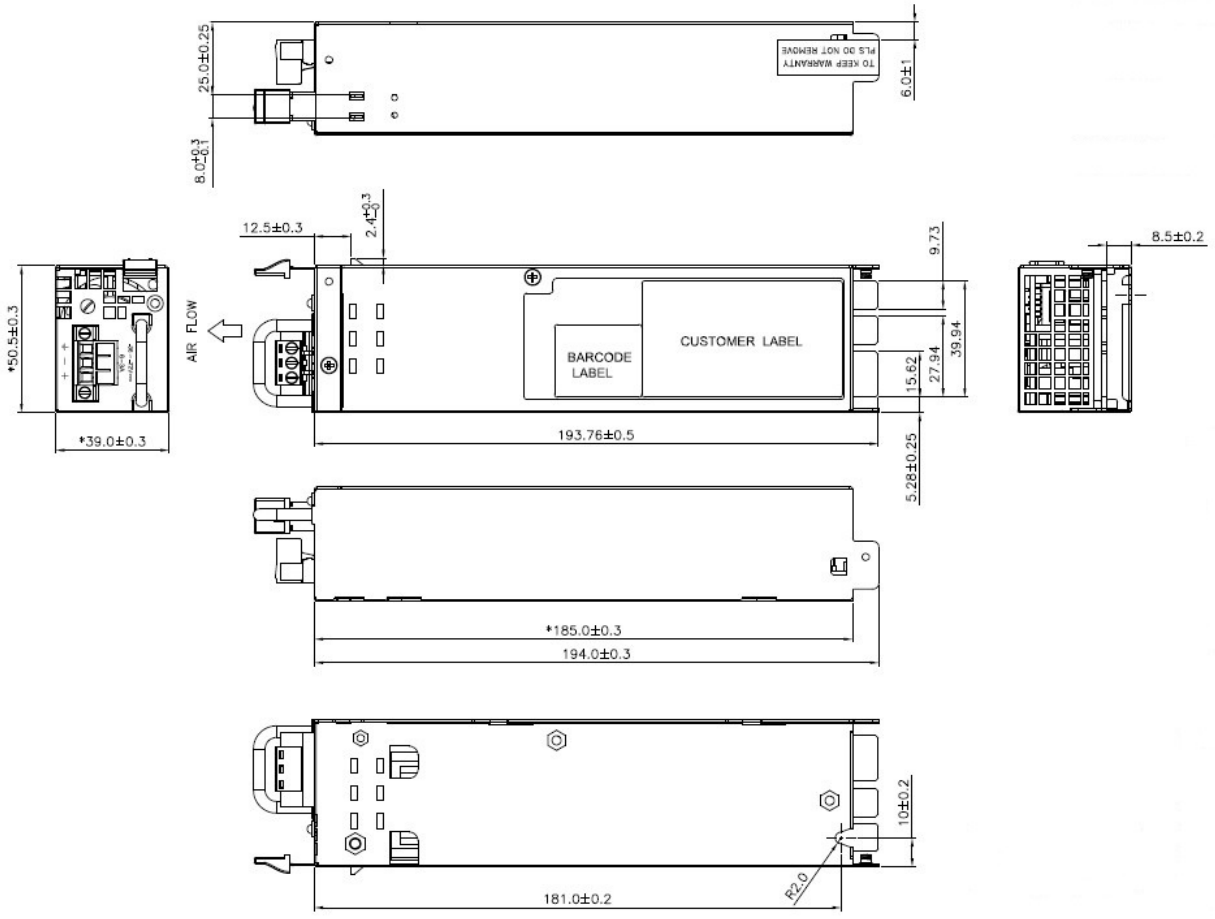


8.2. Outline Dimensions

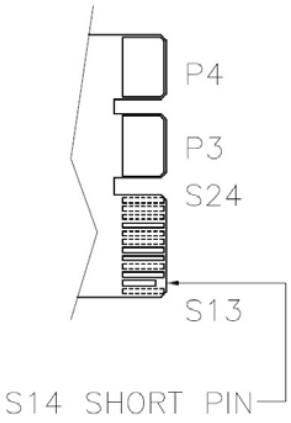
The Power Supply shall have the dimension 50.5mm x 39mm x 185mm (WxHxL) without the card edge.

Please see below Figure for details.

Figure 16 – Outline Drawing



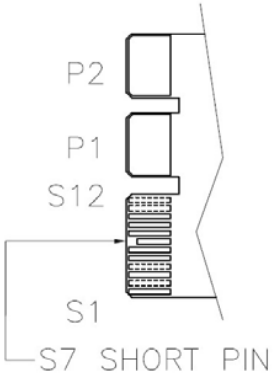
TOP VIEW



PIN NO.	CONDITION
P4	+12V
P3	+12VRTN

PIN NO.	CONDITION
S24	N.C. (without gold finger)
S23	N.C. (without gold finger)
S22	N.C. (without gold finger)
S21	N.C. (without gold finger)
S20	N.C. (without gold finger)
S19	N.C. (without gold finger)
S18	EEPROM-WP
S17	VSS0
S16	N.C. (without gold finger)
S15	A0
S14	PS-PRESENT
S13	N.C. (without gold finger)

BOTTOM VIEW



PIN NO.	CONDITION
P2	+12V
P1	+12VRTN

PIN NO.	CONDITION
S12	N.C. (without gold finger)
S11	N.C. (without gold finger)
S10	A1
S9	PWOK
S8	PS-ON
S7	PS-KILL
S6	SCL
S5	SDA
S4	PS-ALERT
S3	+12VIBUS
S2	N.C. (without gold finger)
S1	+12VS