6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=N (550W+550W=550W) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode.
  Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

  Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply’s exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

Technical information in this specification is subject to change without notice.
The revision of specification will be marked on the cover.

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+12V
Max. Load	30A	41A
Min. Load	2A	2A

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 550 W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V, +12V, outputs are measure at the power supply connectors references to ReturnS.

Output Voltage	+5V	+12V
Load Reg.	+/- 5%	+/- 5%
Line Reg.	+/- 1%	+/- 1%
Ripple & Noise	50mV	120mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling cycling the AC power.
The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

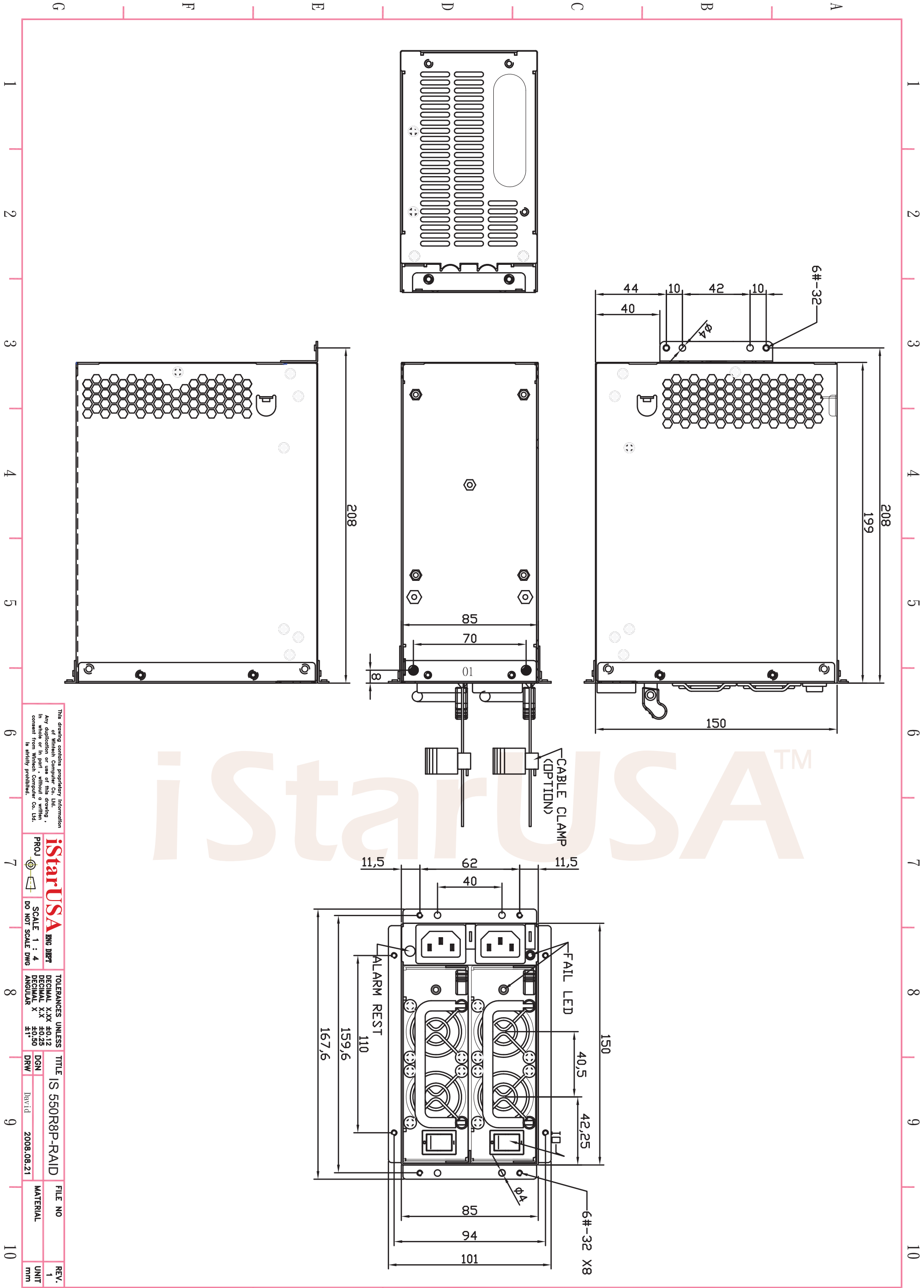
5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing



1. General

This is the specification of Model IS-550R8P-RAID; it is intended to describe the functions and performance of the subject power supply. This 550 watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 10-5A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	10A
Voltage (230V)	180Vac	200-240Vac	264 Vac	5A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class “D” standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

P2: Processor Power Connector (sectional connector 4-Pin + 4-Pin)

Connector housing: 8- Pin Molex 5557 (39-01-2080) or Equivalent
Contact: Molex 5556T (39-00-0059) or Equivalent

Pin	Signal	Color	Size	Pin	Signal	Color	Size
1	COM	Black	18 AWG	5	+12 VDC1	Yellow/Black stripe	16 AWG
2	COM	Black	18 AWG	6	+12 VDC1	Yellow/Black stripe	16 AWG
3	COM	Black	18 AWG	7	+12 VDC2	Yellow	16 AWG
4	COM	Black	18 AWG	8	+12 VDC2	Yellow	16 AWG

4-Pin HDD / CD-ROM Drive Power Connectors

Connector housing: 4- Pin AMP: 1-480424-0 or Molex 8981-04P or Equivalent
Contact: Amp 61314-1 or Equivalent

Pin	Signal	Color	Size
1	+12V4	Yellow/Green stripe	18 AWG
2	COM	Black	18 AWG
3	COM	Black	18 AWG
4	+5 VDC	Red	18 AWG

Small 4-Pin : Floppy Disk Drive Power Connectors

Connector housing: 4- Pin AMP: 171822-4 or Equivalent

Pin	Signal	Color	Size
1	+5 VDC	Red	22 AWG
2	COM	Black	22 AWG
3	COM	Black	22 AWG
4	+12 V4	Yellow/Green stripe	22 AWG

Serial ATA Power Connector

This is a required connector for systems with serial ATA devices.

Molex Housing #675820000 or Equivalent
Molex Terminal #67510000 or Equivalent

Pin	Signal	Color	Size
1	+12V4	Yellow/Green stripe	18 AWG
2	COM	Black	18 AWG
3	+5VDC	RED	18 AWG
4	COM	Black	18 AWG
5	+3.3VDC	Orange	18 AWG

Workstation Power Connector for High Power Graphics Cards

For workstation systems with high-powered graphics cards an additional power connector to the baseboard may be needed. This connector supplies additional +12V power for the higher power level graphics cards used in workstation applications.

Connector housing: 6-pin Molex 45559-0002 or equivalent
Contacts: Molex 39-00-0207 or equivalent

PCI-Express 6-Pin

Pin	Signal	Color	Size	Pin	Signal	Color	Size
1	+12 V4	Yellow/Green stripe	18 AWG	4	COM	Black	18 AWG
2	+12 V4	Yellow/Green stripe	18 AWG	5	COM	Black	18 AWG
3	+12 V4	Yellow/Green stripe	18 AWG	6	COM	Black	18 AWG

PCI-Express 8-Pin

Pin	Signal	Color	Size	Pin	Signal	Color	Size
1	+12 V4	Yellow/Green stripe	18 AWG	5	COM	Black	18 AWG
2	+12 V4	Yellow/Green stripe	18 AWG	6	COM	Black	18 AWG
3	+12 V4	Yellow/Green stripe	18 AWG	7	COM	Black	18 AWG
4	COM	Black	18 AWG	8	COM	Black	18 AWG

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V1,2,3,4	+13.3V	+14.5V	Latch Off
5VSB	5.7V	6.5V	Auto recovery

Table 15 –Over Voltage protection

4.3 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 122°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TUV, CCC
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 16 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms.
Measurement will be made at 240 VAC and 60Hz.

7. Reliability

7.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

Technical information in this specification is subject to change without notice.
The revision of specification will be marked on the cover.

8. Connections

8.1 AC Input Connector

The AC input connector shall be an *IEC 320 C-14* power inlet. This inlet is rated for 15 A/250 VAC.

8.2 DC Wire Harness and Connector Requirements

(Subject to change without notice; please see appendix: wireharness drawing)

P1: Motherboard Power Connector (sectional connector 20-Pin + 4-Pin)
Connector housing: 24- Pin Molex 5557 (No.39-01-2240) or Equivalent
Contact: Molex 5556T (No.44476-1111) or Equivalent

Pin	Signal	Color	Size	Pin	Signal	Color	Size
1	+3.3 VDC	Orange	16 AWG	13	+3.3 VDC;+3.3VRS+	Orange / Brown	16 AWG/ 22AWG
2	+3.3 VDC	Orange	16 AWG	14	-12 VDC	Blue	18 AWG
3	COM	Black	18 AWG	15	COM	Black	18 AWG
4	+5 VDC	Red	18 AWG	16	PS_ON#	Green	22 AWG
5	COM	Black	18 AWG	17	COM	Black	18 AWG
6	+5 VDC	Red	18 AWG	18	COM	Black	18 AWG
7	COM	Black	18 AWG	19	COM	Black	18 AWG
8	PW_OK	Gray	22 AWG	20	N/C	--	--
9	5VSB	Purple	18 AWG	21	+5 VDC	Red	18 AWG
10	+12V3	Yellow/Blue stripe	18 AWG	22	+5 VDC ;+5V RS+	Red; Red	18 AWG; 22AWG
11	+12V3	Yellow/Blue stripe	18 AWG	23	+5 VDC	Red	18 AWG
12	+3.3 VDC	Orange	16 AWG	24	COM	Black	18 AWG

Table 11 – Turn On/Off Timing

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS

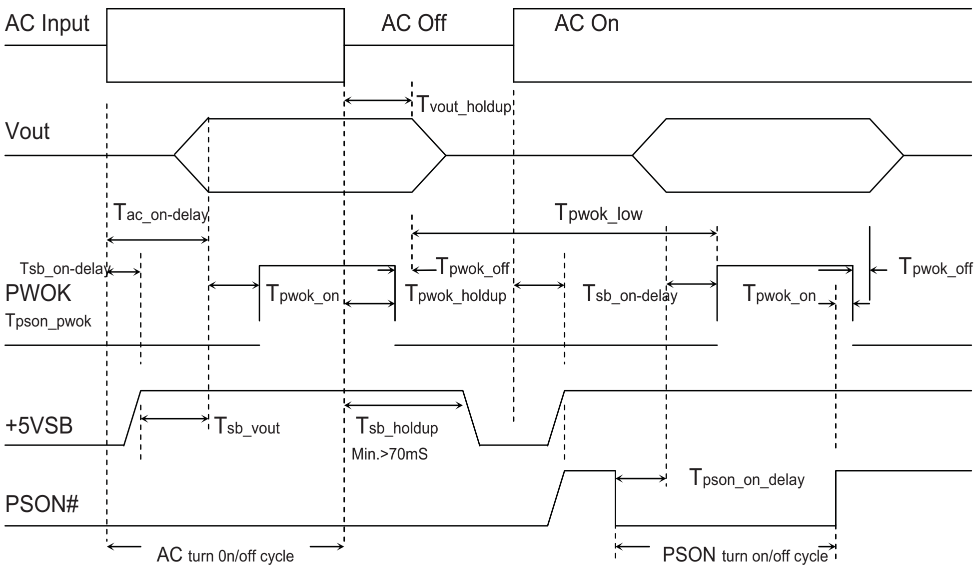


Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	Accepts an open collector/drain input from the system. Pull-up to VSB locted in power supply.
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 13 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is specified at 50% and 20% loading conditions to help reduce system power consumption at typical system loading conditions.

Loading	100% of maximum	50% of maximum	20% of maximum
Minimum	81%	83%	80%

3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 4A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Current Protection

This power supply shall have current limit to prevent the +5V, +3.3V, and +12V outputs from exceeding the values shown in table 14. The current limit shall not trip under maximum continuous load or peak loading as described in Table 5. The power supply shall latch off if the current exceeds the limit. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. The -12V and +5VSB outputs shall be shorted circuit protected so that no damage can occur to the power supply.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 14 –Over Current protection

4.2 Over Voltage Protection

The power supply shall shut down in a latch off mode when the output voltage exceeds the over voltage limit shown in Table 15.

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Single rail for +12V

Output Voltage	+5V	+3.3V	+12V (Single Rail)	-12V	+5VSB
Max. Load	30A	28A	80 A	0.5A	4A
Min. Load	1.0A	0A	3A	0A	0.1A
Max. Combined	**180W**		**80A**		
Total Output	**980W**			**6W**	**20W**

Multiple rails for +12V

Output Voltage	+5V	+3.3V	+12V1	+12V2	+12V3	+12V4	-12V	+5VSB
Max. Load	30A	28A	18A	18A	18A	18A	0.5A	4A
Min. Load	1.0A	0A	0.8A	0.8A	0.8A	0.8A	0A	0.1A
Max. Combined	**180W**		**80A**					
Total Output	**980W**						**6W**	**20W**

Table 5 – Output Loads

Note 1: Maximum continuous total DC output power should not exceed 1000W.
Note 2: Single / Multiple rail(s) for +12V is adjustable by a switch.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V1	+12V2	+12V3	+12V4	-12V	+5VSB
Load Reg.	+/-3%	+/-3%	+/-3%	+/-3%	+/-3%	+/-3%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	120mV	120mV	120mV	120mV	50mV

Table 7 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be □0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
T_{vout_rise}	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
T_{vout_on}	All main output must be within regulation of each other within this time.		50	mS
T_{vout_off}	All main output must leave regulation within this time		400	mS

Table 10 – Output Voltage Timing

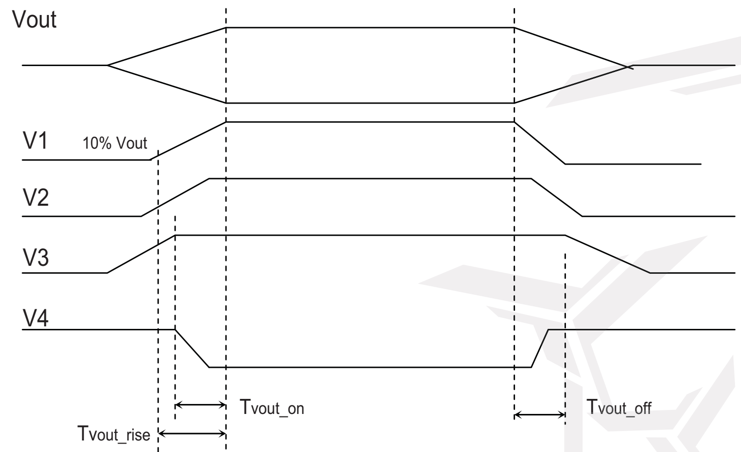
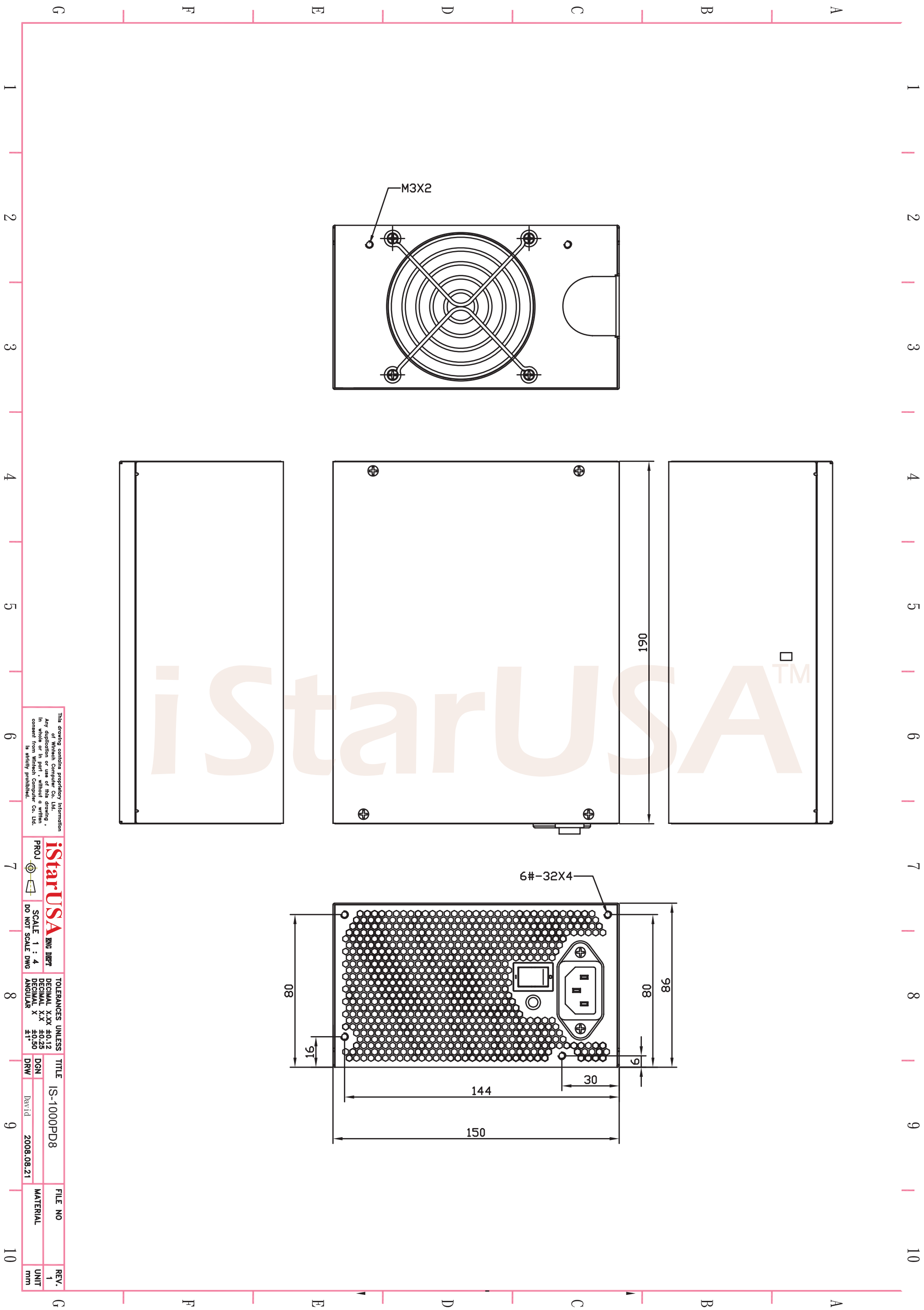


Figure 1 : Output Voltage Timing



1. General

This is the specification of Model IS-1000PD8; it is intendedo describe the functions and the subject power supply. This PS/2 1000 watts switching powesupply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 14-7.5A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	14A
Voltage (230V)	180Vac	200-240Vac	264 Vac	7.5A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.99 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class "D" standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

P2: Processor Power Connector (sectional connector 4-Pin + 4-Pin)

Connector housing: 8- Pin Molex 5557 (39-01-2080) or Equivalent
Contact: Molex 5556T (39-00-0059) or Equivalent

Pin	Signal	Color	Size	Pin	Signal	Color	Size
1	COM	Black	18 AWG	5	+12 VDC1	Yellow/Black stripe	16 AWG
2	COM	Black	18 AWG	6	+12 VDC1	Yellow/Black stripe	16 AWG
3	COM	Black	18 AWG	7	+12 VDC2	Yellow	16 AWG
4	COM	Black	18 AWG	8	+12 VDC2	Yellow	16 AWG

4-Pin HDD / CD-ROM Drive Power Connectors

Connector housing: 4- Pin AMP: 1-480424-0 or Molex 8981-04P or Equivalent
Contact: Amp 61314-1 or Equivalent

Pin	Signal	Color	Size
1	+12V4	Yellow/Green stripe	18 AWG
2	COM	Black	18 AWG
3	COM	Black	18 AWG
4	+5 VDC	Red	18 AWG

Small 4-Pin : Floppy Disk Drive Power Connectors

Connector housing: 4- Pin AMP: 171822-4 or Equivalent

Pin	Signal	Color	Size
1	+5 VDC	Red	22 AWG
2	COM	Black	22 AWG
3	COM	Black	22 AWG
4	+12 V4	Yellow/Green stripe	22 AWG

Serial ATA Power Connector

This is a required connector for systems with serial ATA devices.

Molex Housing #675820000 or Equivalent
Molex Terminal #67510000 or Equivalent

Pin	Signal	Color	Size
1	+12V4	Yellow/Green stripe	18 AWG
2	COM	Black	18 AWG
3	+5VDC	RED	18 AWG
4	COM	Black	18 AWG
5	+3.3VDC	Orange	18 AWG

Workstation Power Connector for High Power Graphics Cards

For workstation systems with high-powered graphics cards an additional power connector to the baseboard may be needed. This connector supplies additional +12V power for the higher power level graphics cards used in workstation applications.

Connector housing: 6-pin Molex 45559-0002 or equivalent
Contacts: Molex 39-00-0207 or equivalent

PCI-Express 6-Pin

Pin	Signal	Color	Size	Pin	Signal	Color	Size
1	+12 V4	Yellow/Green stripe	18 AWG	4	COM	Black	18 AWG
2	+12 V4	Yellow/Green stripe	18 AWG	5	COM	Black	18 AWG
3	+12 V4	Yellow/Green stripe	18 AWG	6	COM	Black	18 AWG

PCI-Express 8-Pin

Pin	Signal	Color	Size	Pin	Signal	Color	Size
1	+12 V4	Yellow/Green stripe	18 AWG	5	COM	Black	18 AWG
2	+12 V4	Yellow/Green stripe	18 AWG	6	COM	Black	18 AWG
3	+12 V4	Yellow/Green stripe	18 AWG	7	COM	Black	18 AWG
4	COM	Black	18 AWG	8	COM	Black	18 AWG

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V1,2,3,4	+13.3V	+14.5V	Latch Off
5VSB	5.7V	6.5V	Auto recovery

Table 15 –Over Voltage protection

4.3 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 122°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TUV, CCC
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 16 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms.
Measurement will be made at 240 VAC and 60Hz.

7. Reliability

7.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

Technical information in this specification is subject to change without notice.
The revision of specification will be marked on the cover.

8. Connections

8.1 AC Input Connector

The AC input connector shall be an *IEC 320 C-14* power inlet. This inlet is rated for 15 A/250 VAC.

8.2 DC Wire Harness and Connector Requirements

(Subject to change without notice; please see appendix: wireharness drawing)

P1: Motherboard Power Connector (sectional connector 20-Pin + 4-Pin)
Connector housing: 24- Pin Molex 5557 (No.39-01-2240) or Equivalent
Contact: Molex 5556T (No.44476-1111) or Equivalent

Pin	Signal	Color	Size	Pin	Signal	Color	Size
1	+3.3 VDC	Orange	16 AWG	13	+3.3 VDC;+3.3VRS+	Orange / Brown	16 AWG/ 22AWG
2	+3.3 VDC	Orange	16 AWG	14	-12 VDC	Blue	18 AWG
3	COM	Black	18 AWG	15	COM	Black	18 AWG
4	+5 VDC	Red	18 AWG	16	PS_ON#	Green	22 AWG
5	COM	Black	18 AWG	17	COM	Black	18 AWG
6	+5 VDC	Red	18 AWG	18	COM	Black	18 AWG
7	COM	Black	18 AWG	19	COM	Black	18 AWG
8	PW_OK	Gray	22 AWG	20	N/C	--	--
9	5VSB	Purple	18 AWG	21	+5 VDC	Red	18 AWG
10	+12V3	Yellow/Blue stripe	18 AWG	22	+5 VDC ;+5V RS+	Red; Red	18 AWG; 22AWG
11	+12V3	Yellow/Blue stripe	18 AWG	23	+5 VDC	Red	18 AWG
12	+3.3 VDC	Orange	16 AWG	24	COM	Black	18 AWG

Table 11 – Turn On/Off Timing

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS

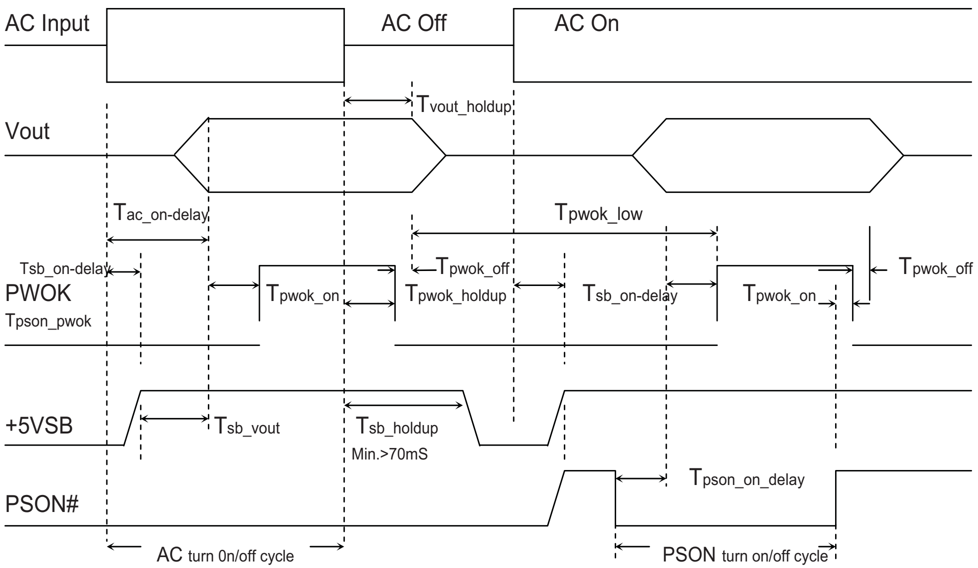


Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	Accepts an open collector/drain input from the system. Pull-up to VSB locted in power supply.
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 13 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is specified at 50% and 20% loading conditions to help reduce system power consumption at typical system loading conditions.

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Loading	100% of maximum	50% of maximum	20% of maximum
Minimum	80%	84%	82%

3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 4A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Current Protection

This power supply shall have current limit to prevent the +5V, +3.3V, and +12V outputs from exceeding the values shown in table 14. The current limit shall not trip under maximum continuous load or peak loading as described in Table 5. The power supply shall latch off if the current exceeds the limit. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. The -12V and +5VSB outputs shall be shorted circuit protected so that no damage can occur to the power supply.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 14 –Over Current protection

4.2 Over Voltage Protection

The power supply shall shut down in a latch off mode when the output voltage exceeds the over voltage limit shown in Table 15.

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Single rail for +12V

Output Voltage	+5V	+3.3V	+12V (Single Rail)	-12V	+5VSB
Max. Load	30A	28A	72 A	0.5A	4A
Min. Load	1.0A	0A	3A	0A	0.1A
Max. Combined	180W		72A		
Total Output	860W			6W	20W

Multiple rails for +12V

Output Voltage	+5V	+3.3V	+12V1	+12V2	+12V3	+12V4	-12V	+5VSB
Max. Load	30A	28A	18A	18A	18A	18A	0.5A	4A
Min. Load	1.0A	0A	0.8A	0.8A	0.8A	0.8A	0A	0.1A
Max. Combined	180W		72A					
Total Output	860W						6W	20W

Table 5 – Output Loads

Note 1: Maximum continuous total DC output power should not exceed 680 W.

Note 2: Single / Multiple rail(s) for +12V is adjustable by a switch.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V1	+12V2	+12V3	+12V4	-12V	+5VSB
Load Reg.	+/-3%	+/-3%	+/-3%	+/-3%	+/-3%	+/-3%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	120mV	120mV	120mV	120mV	50mV

Table 7 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be □0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
T_{vout_rise}	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
T_{vout_on}	All main output must be within regulation of each other within this time.		50	mS
T_{vout_off}	All main output must leave regulation within this time		400	mS

Table 10 – Output Voltage Timing

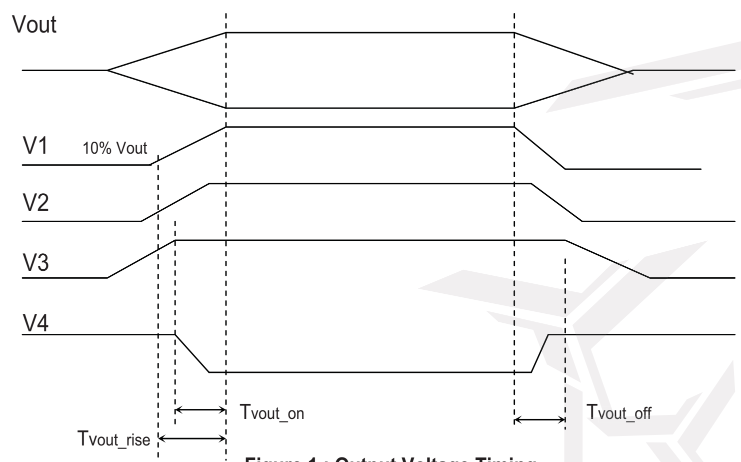
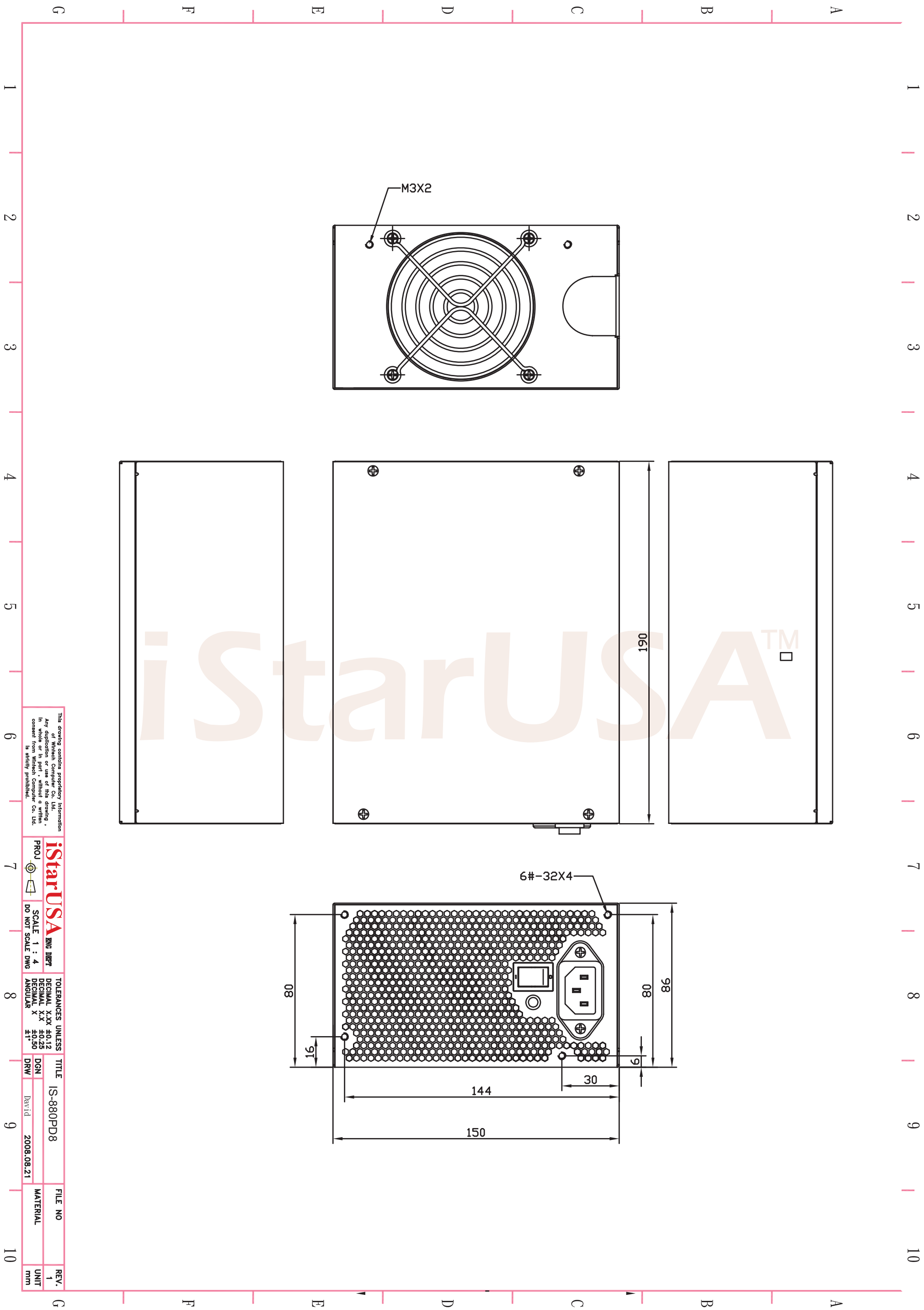


Figure 1 : Output Voltage Timing



1. General

This is the specification of Model IS-880PD8; it is intended to describe the functions and the subject power supply. This PS/2 880 watts switching power supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 14-7A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	14A
Voltage (230V)	180Vac	200-240Vac	264 Vac	7A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.99 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class “D” standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

P2: Processor Power Connector (sectional connector 4-Pin + 4-Pin)

Connector housing: 8- Pin Molex 5557 (39-01-2080) or Equivalent
Contact: Molex 5556T (39-00-0059) or Equivalent

Pin	Signal	Color	Size	Pin	Signal	Color	Size
1	COM	Black	18 AWG	5	+12 VDC1	Yellow/Black stripe	16 AWG
2	COM	Black	18 AWG	6	+12 VDC1	Yellow/Black stripe	16 AWG
3	COM	Black	18 AWG	7	+12 VDC2	Yellow	16 AWG
4	COM	Black	18 AWG	8	+12 VDC2	Yellow	16 AWG

4-Pin HDD / CD-ROM Drive Power Connectors

Connector housing: 4- Pin AMP: 1-480424-0 or Molex 8981-04P or Equivalent
Contact: Amp 61314-1 or Equivalent

Pin	Signal	Color	Size
1	+12V4	Yellow/Green stripe	18 AWG
2	COM	Black	18 AWG
3	COM	Black	18 AWG
4	+5 VDC	Red	18 AWG

Small 4-Pin : Floppy Disk Drive Power Connectors

Connector housing: 4- Pin AMP: 171822-4 or Equivalent

Pin	Signal	Color	Size
1	+5 VDC	Red	22 AWG
2	COM	Black	22 AWG
3	COM	Black	22 AWG
4	+12 V4	Yellow/Green stripe	22 AWG

Serial ATA Power Connector

This is a required connector for systems with serial ATA devices.

Molex Housing #675820000 or Equivalent
Molex Terminal #67510000 or Equivalent

Pin	Signal	Color	Size
1	+12V4	Yellow/Green stripe	18 AWG
2	COM	Black	18 AWG
3	+5VDC	RED	18 AWG
4	COM	Black	18 AWG
5	+3.3VDC	Orange	18 AWG

Workstation Power Connector for High Power Graphics Cards

For workstation systems with high-powered graphics cards an additional power connector to the baseboard may be needed. This connector supplies additional +12V power for the higher power level graphics cards used in workstation applications.

Connector housing: 6-pin Molex 45559-0002 or equivalent
Contacts: Molex 39-00-0207 or equivalent

PCI-Express 6-Pin

Pin	Signal	Color	Size	Pin	Signal	Color	Size
1	+12 V4	Yellow/Green stripe	18 AWG	4	COM	Black	18 AWG
2	+12 V4	Yellow/Green stripe	18 AWG	5	COM	Black	18 AWG
3	+12 V4	Yellow/Green stripe	18 AWG	6	COM	Black	18 AWG

PCI-Express 8-Pin

Pin	Signal	Color	Size	Pin	Signal	Color	Size
1	+12 V4	Yellow/Green stripe	18 AWG	5	COM	Black	18 AWG
2	+12 V4	Yellow/Green stripe	18 AWG	6	COM	Black	18 AWG
3	+12 V4	Yellow/Green stripe	18 AWG	7	COM	Black	18 AWG
4	COM	Black	18 AWG	8	COM	Black	18 AWG

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V1,2,3,4	+13.3V	+14.5V	Latch Off
5VSB	5.7V	6.5V	Auto recovery

Table 15 –Over Voltage protection

4.3 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 122°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TUV, CCC
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 16 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms.
Measurement will be made at 240 VAC and 60Hz.

7. Reliability

7.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

Technical information in this specification is subject to change without notice.
The revision of specification will be marked on the cover.

8. Connections

8.1 AC Input Connector

The AC input connector shall be an *IEC 320 C-14* power inlet. This inlet is rated for 15 A/250 VAC.

8.2 DC Wire Harness and Connector Requirements

(Subject to change without notice; please see appendix: wireharness drawing)

P1: Motherboard Power Connector (sectional connector 20-Pin + 4-Pin)
Connector housing: 24- Pin Molex 5557 (No.39-01-2240) or Equivalent
Contact: Molex 5556T (No.44476-1111) or Equivalent

Pin	Signal	Color	Size	Pin	Signal	Color	Size
1	+3.3 VDC	Orange	16 AWG	13	+3.3 VDC;+3.3VRS+	Orange / Brown	16 AWG/ 22AWG
2	+3.3 VDC	Orange	16 AWG	14	-12 VDC	Blue	18 AWG
3	COM	Black	18 AWG	15	COM	Black	18 AWG
4	+5 VDC	Red	18 AWG	16	PS_ON#	Green	22 AWG
5	COM	Black	18 AWG	17	COM	Black	18 AWG
6	+5 VDC	Red	18 AWG	18	COM	Black	18 AWG
7	COM	Black	18 AWG	19	COM	Black	18 AWG
8	PW_OK	Gray	22 AWG	20	N/C	--	--
9	5VSB	Purple	18 AWG	21	+5 VDC	Red	18 AWG
10	+12V3	Yellow/Blue stripe	18 AWG	22	+5 VDC ;+5V RS+	Red; Red	18 AWG; 22AWG
11	+12V3	Yellow/Blue stripe	18 AWG	23	+5 VDC	Red	18 AWG
12	+3.3 VDC	Orange	16 AWG	24	COM	Black	18 AWG

Table 11 – Turn On/Off Timing

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS

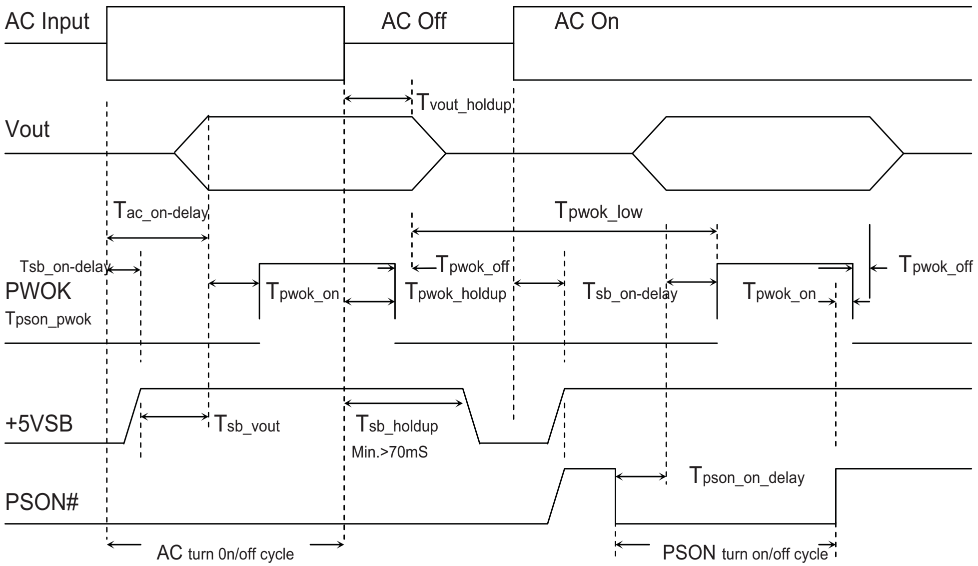


Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	Accepts an open collector/drain input from the system. Pull-up to VSB locted in power supply.
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 13 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is specified at 50% and 20% loading conditions to help reduce system power consumption at typical system loading conditions.

Loading	100% of maximum	50% of maximum	20% of maximum
Minimum	80%	83%	81%

3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 4A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Current Protection

This power supply shall have current limit to prevent the +5V, +3.3V, and +12V outputs from exceeding the values shown in table 14. The current limit shall not trip under maximum continuous load or peak loading as described in Table 5. The power supply shall latch off if the current exceeds the limit. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. The -12V and +5VSB outputs shall be shorted circuit protected so that no damage can occur to the power supply.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 14 –Over Current protection

4.2 Over Voltage Protection

The power supply shall shut down in a latch off mode when the output voltage exceeds the over voltage limit shown in Table 15.

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Single rail for +12V

Output Voltage	+5V	+3.3V	+12V (Single Rail)	-12V	+5VSB
Max. Load	30A	28A	62 A	0.5A	4A
Min. Load	1.0A	0A	3A	0A	0.1A
Max. Combined	180W		62A		
Total Output	760W			6W	20W

Multiple rails for +12V

Output Voltage	+5V	+3.3V	+12V1	+12V2	+12V3	+12V4	-12V	+5VSB
Max. Load	30A	28A	18A	18A	18A	18A	0.5A	4A
Min. Load	1.0A	0A	0.8A	0.8A	0.8A	0.8A	0A	0.1A
Max. Combined	180W		62A					
Total Output	760W						6W	20W

Table 5 – Output Loads

Note 1: Maximum continuous total DC output power should not exceed 780 W.

Note 2: Single / Multiple rail(s) for +12V is adjustable by a switch.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V1	+12V2	+12V3	+12V4	-12V	+5VSB
Load Reg.	+/-3%	+/-3%	+/-3%	+/-3%	+/-3%	+/-3%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	120mV	120mV	120mV	120mV	50mV

Table 7 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be □ 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
T_{vout_rise}	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
T_{vout_on}	All main output must be within regulation of each other within this time.		50	mS
T_{vout_off}	All main output must leave regulation within this time		400	mS

Table 10 – Output Voltage Timing

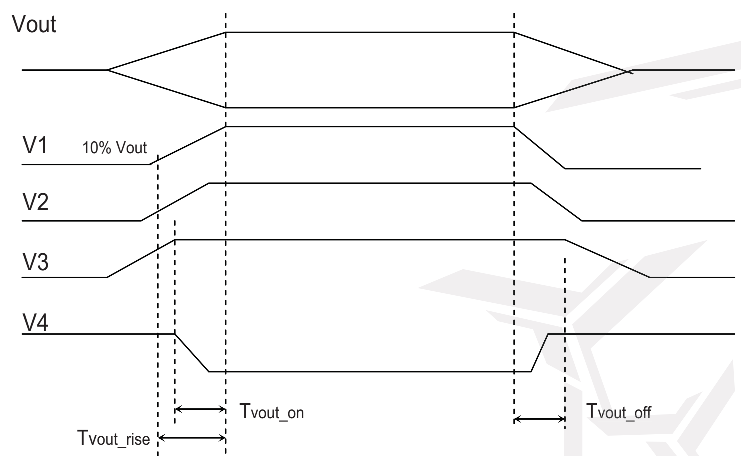
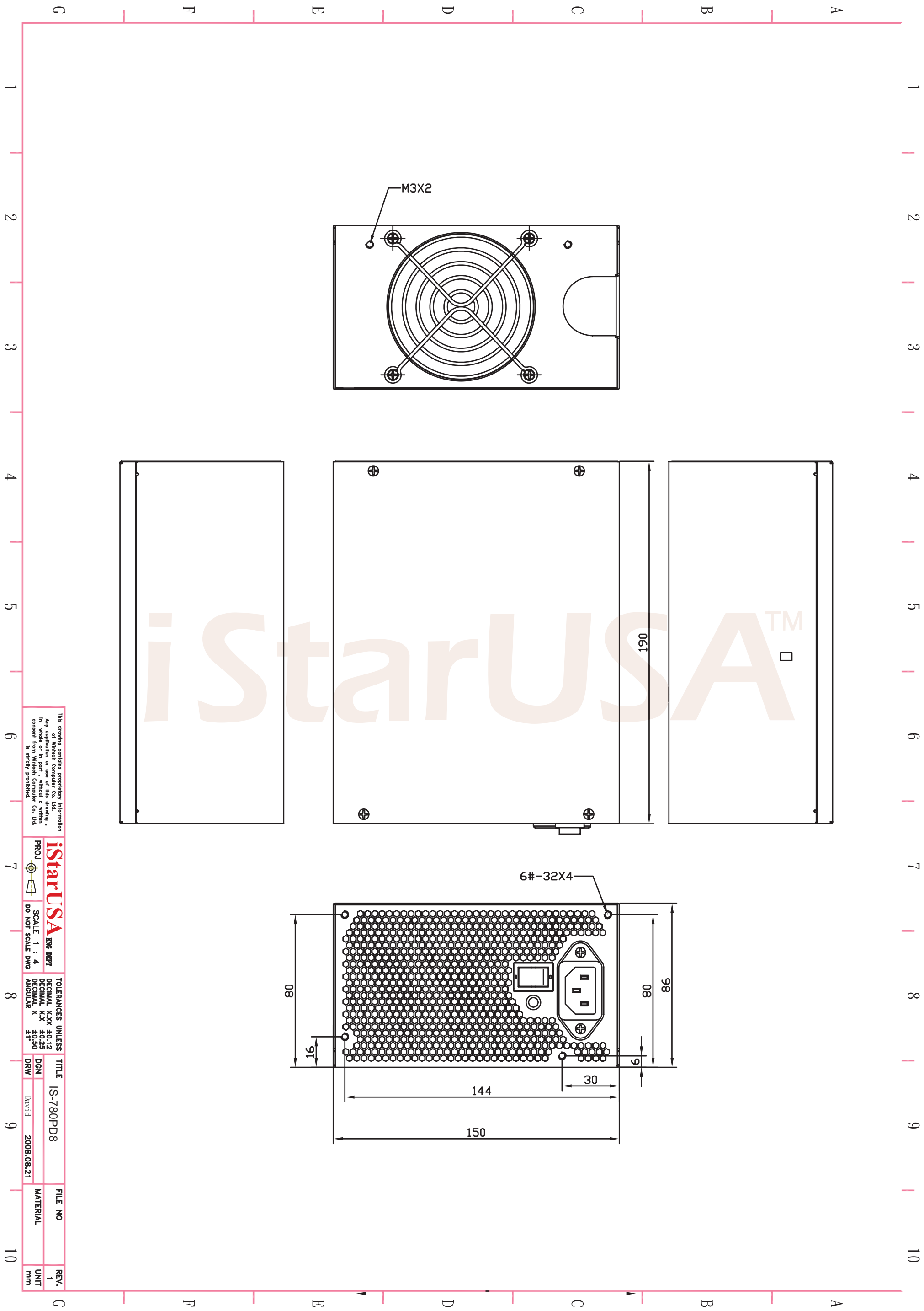


Figure 1 : Output Voltage Timing



1. General

This is the specification of Model IS-780PD8; it is intended to describe the functions and the subject power supply. This PS/2 780 watts switching power supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 12-6A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	12A
Voltage (230V)	180Vac	200-240Vac	264 Vac	6A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.99 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class "D" standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

P2: Processor Power Connector (sectional connector 4-Pin + 4-Pin)

Connector housing: 8- Pin Molex 5557 (39-01-2080) or Equivalent
Contact: Molex 5556T (39-00-0059) or Equivalent

Pin	Signal	Color	Size	Pin	Signal	Color	Size
1	COM	Black	18 AWG	5	+12 VDC1	Yellow/Black stripe	16 AWG
2	COM	Black	18 AWG	6	+12 VDC1	Yellow/Black stripe	16 AWG
3	COM	Black	18 AWG	7	+12 VDC2	Yellow	16 AWG
4	COM	Black	18 AWG	8	+12 VDC2	Yellow	16 AWG

4-Pin HDD / CD-ROM Drive Power Connectors

Connector housing: 4- Pin AMP: 1-480424-0 or Molex 8981-04P or Equivalent
Contact: Amp 61314-1 or Equivalent

Pin	Signal	Color	Size
1	+12V4	Yellow/Green stripe	18 AWG
2	COM	Black	18 AWG
3	COM	Black	18 AWG
4	+5 VDC	Red	18 AWG

Small 4-Pin : Floppy Disk Drive Power Connectors

Connector housing: 4- Pin AMP: 171822-4 or Equivalent

Pin	Signal	Color	Size
1	+5 VDC	Red	22 AWG
2	COM	Black	22 AWG
3	COM	Black	22 AWG
4	+12 V4	Yellow/Green stripe	22 AWG

Serial ATA Power Connector

This is a required connector for systems with serial ATA devices.

Molex Housing #675820000 or Equivalent
Molex Terminal #67510000 or Equivalent

Pin	Signal	Color	Size
1	+12V4	Yellow/Green stripe	18 AWG
2	COM	Black	18 AWG
3	+5VDC	RED	18 AWG
4	COM	Black	18 AWG
5	+3.3VDC	Orange	18 AWG

Workstation Power Connector for High Power Graphics Cards

For workstation systems with high-powered graphics cards an additional power connector to the baseboard may be needed. This connector supplies additional +12V power for the higher power level graphics cards used in workstation applications.

Connector housing: 6-pin Molex 45559-0002 or equivalent
Contacts: Molex 39-00-0207 or equivalent

PCI-Express 6-Pin

Pin	Signal	Color	Size	Pin	Signal	Color	Size
1	+12 V4	Yellow/Green stripe	18 AWG	4	COM	Black	18 AWG
2	+12 V4	Yellow/Green stripe	18 AWG	5	COM	Black	18 AWG
3	+12 V4	Yellow/Green stripe	18 AWG	6	COM	Black	18 AWG

PCI-Express 8-Pin

Pin	Signal	Color	Size	Pin	Signal	Color	Size
1	+12 V4	Yellow/Green stripe	18 AWG	5	COM	Black	18 AWG
2	+12 V4	Yellow/Green stripe	18 AWG	6	COM	Black	18 AWG
3	+12 V4	Yellow/Green stripe	18 AWG	7	COM	Black	18 AWG
4	COM	Black	18 AWG	8	COM	Black	18 AWG

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V1,2,3,4	+13.3V	+14.5V	Latch Off
5VSB	5.7V	6.5V	Auto recovery

Table 15 –Over Voltage protection

4.3 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 122°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TUV, CCC
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 16 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms.
Measurement will be made at 240 VAC and 60Hz.

7. Reliability

7.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

Technical information in this specification is subject to change without notice.
The revision of specification will be marked on the cover.

8. Connections

8.1 AC Input Connector

The AC input connector shall be an *IEC 320 C-14* power inlet. This inlet is rated for 15 A/250 VAC.

8.2 DC Wire Harness and Connector Requirements

(Subject to change without notice; please see appendix: wireharness drawing)

P1: Motherboard Power Connector (sectional connector 20-Pin + 4-Pin)
Connector housing: 24- Pin Molex 5557 (No.39-01-2240) or Equivalent
Contact: Molex 5556T (No.44476-1111) or Equivalent

Pin	Signal	Color	Size	Pin	Signal	Color	Size
1	+3.3 VDC	Orange	16 AWG	13	+3.3 VDC;+3.3VRS+	Orange / Brown	16 AWG/ 22AWG
2	+3.3 VDC	Orange	16 AWG	14	-12 VDC	Blue	18 AWG
3	COM	Black	18 AWG	15	COM	Black	18 AWG
4	+5 VDC	Red	18 AWG	16	PS_ON#	Green	22 AWG
5	COM	Black	18 AWG	17	COM	Black	18 AWG
6	+5 VDC	Red	18 AWG	18	COM	Black	18 AWG
7	COM	Black	18 AWG	19	COM	Black	18 AWG
8	PW_OK	Gray	22 AWG	20	N/C	--	--
9	5VSB	Purple	18 AWG	21	+5 VDC	Red	18 AWG
10	+12V3	Yellow/Blue stripe	18 AWG	22	+5 VDC ;+5V RS+	Red; Red	18 AWG; 22AWG
11	+12V3	Yellow/Blue stripe	18 AWG	23	+5 VDC	Red	18 AWG
12	+3.3 VDC	Orange	16 AWG	24	COM	Black	18 AWG

Table 11 – Turn On/Off Timing

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS

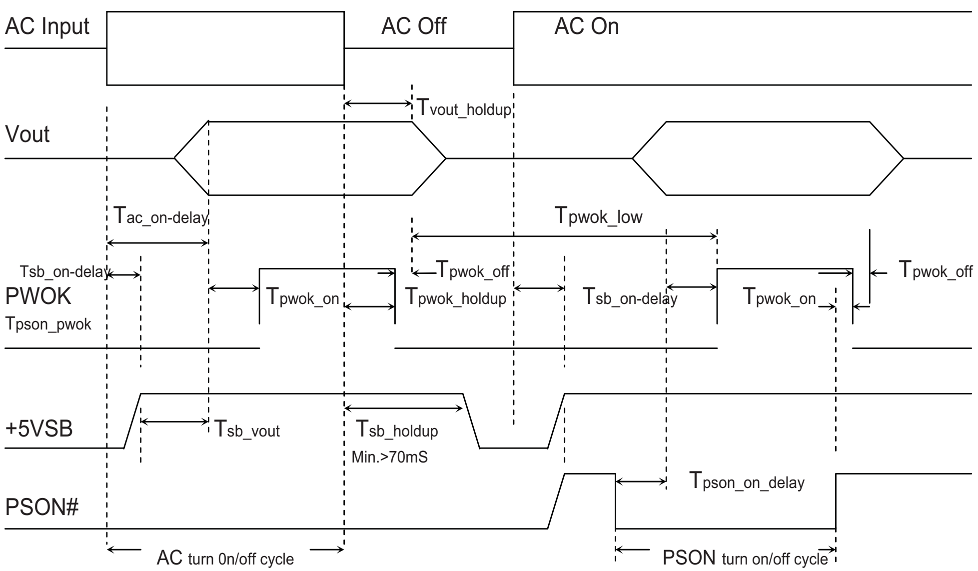


Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	**Accepts an open collector/drain input from the system. Pull-up to VSB locted in power supply.**
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 13 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is specified at 50% and 20% loading conditions to help reduce system power consumption at typical system loading conditions.

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Loading	100% of maximum	50% of maximum	20% of maximum
Minimum	81%	83%	80%

3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 4A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Current Protection

This power supply shall have current limit to prevent the +5V, +3.3V, and +12V outputs from exceeding the values shown in table 14. The current limit shall not trip under maximum continuous load or peak loading as described in Table 5. The power supply shall latch off if the current exceeds the limit. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. The -12V and +5VSB outputs shall be shorted circuit protected so that no damage can occur to the power supply.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 14 –Over Current protection

4.2 Over Voltage Protection

The power supply shall shut down in a latch off mode when the output voltage exceeds the over voltage limit shown in Table 15.

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Single rail for +12V

Output Voltage	+5V	+3.3V	+12V (Single Rail)	-12V	+5VSB
Max. Load	30A	28A	56A	0.5A	4A
Min. Load	1.0A	0A	3A	0A	0.1A
Max. Combined	180W		56A		
Total Output	660W			6W	20W

Multiple rails for +12V

Output Voltage	+5V	+3.3V	+12V1	+12V2	+12V3	+12V4	-12V	+5VSB
Max. Load	30A	28A	18A	18A	18A	18A	0.5A	4A
Min. Load	1.0A	0A	0.8A	0.8A	0.8A	0.8A	0A	0.1A
Max. Combined	180W		56A					
Total Output	660W						6W	20W

Table 5 – Output Loads

Note 1: Maximum continuous total DC output power should not exceed 680 W.
Note 2: Single / Multiple rail(s) for +12V is adjustable by a switch.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V1	+12V2	+12V3	+12V4	-12V	+5VSB
Load Reg.	+/-3%	+/-3%	+/-3%	+/-3%	+/-3%	+/-3%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	120mV	120mV	120mV	120mV	50mV

Table 7 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be □ 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
T_{vout_rise}	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
T_{vout_on}	All main output must be within regulation of each other within this time.		50	mS
T_{vout_off}	All main output must leave regulation within this time		400	mS

Table 10 – Output Voltage Timing

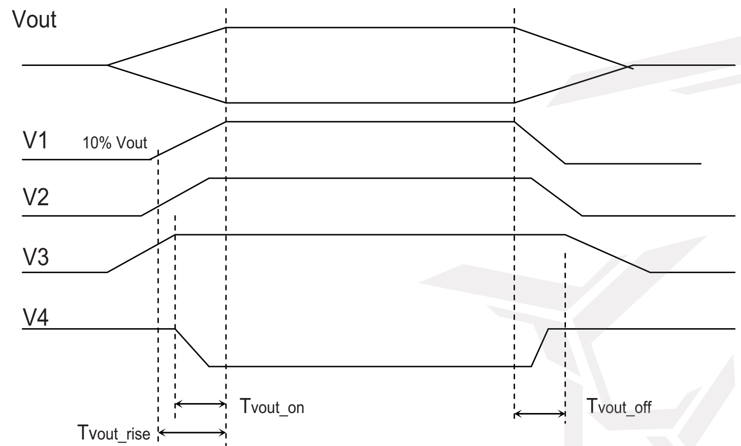
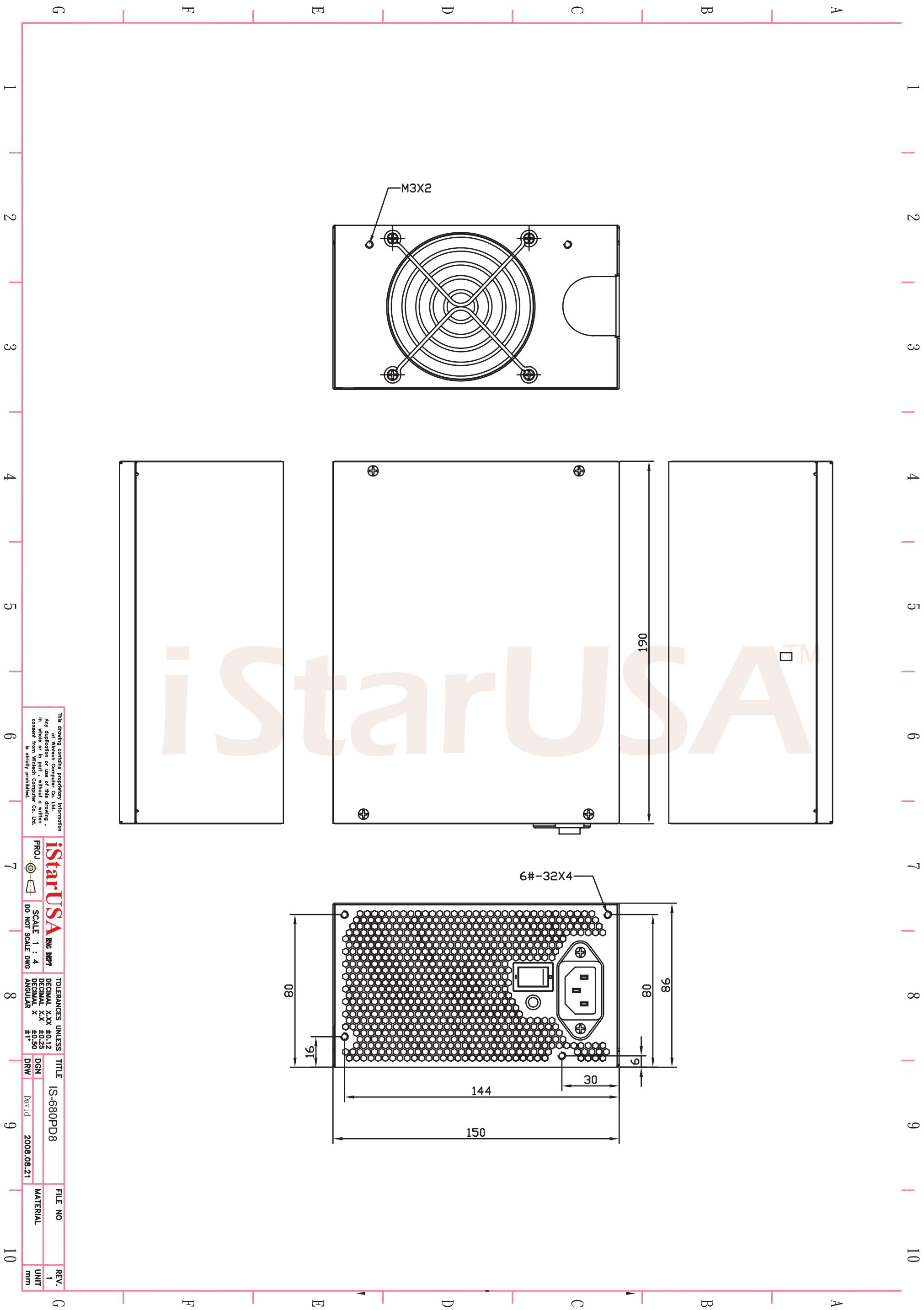


Figure 1 : Output Voltage Timing



1. General

This is the specification of Model IS-680PD8; it is intended to describe the functions and the subject power supply. This PS/2 680 watts switching power supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 10-5A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	10A
Voltage (230V)	180Vac	200-240Vac	264 Vac	5A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.99 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class "D" standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=800W (400W N+1) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.
- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply's exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

Technical information in this specification is subject to change without notice.
The revision of specification will be marked on the cover.

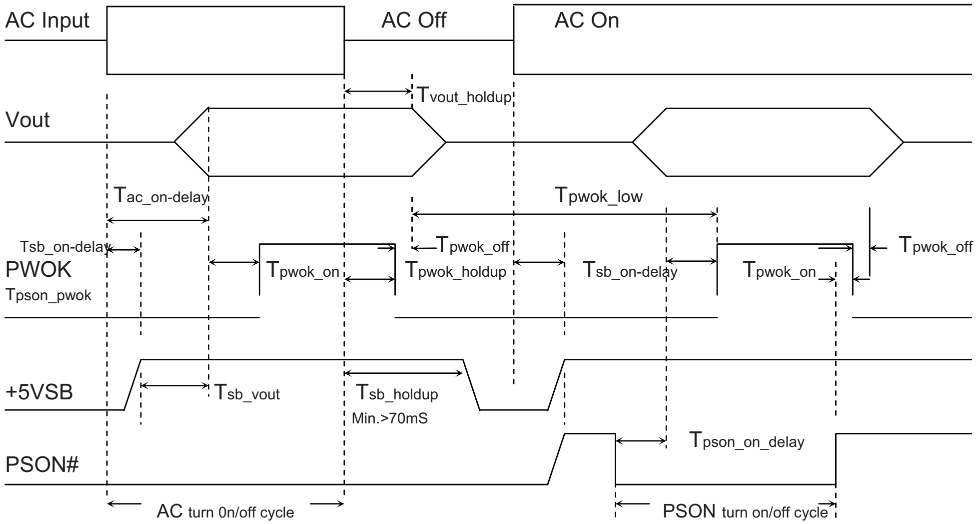


Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	**Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.**
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

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3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	40A	32A	65A	0.5A	0.8A	2A
Min. Load	1A	1A	2A	0A	0A	0.1A
Max. Combined	220W					
Total Output	778W			2.5W	9.6W	10W

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 800W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
T_{vout_rise}	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
T_{vout_on}	All main output must be within regulation of each other within this time.		50	mS
T_{vout_off}	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

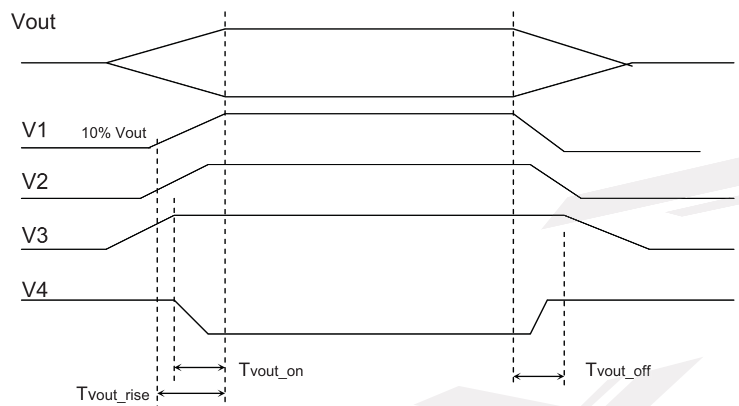
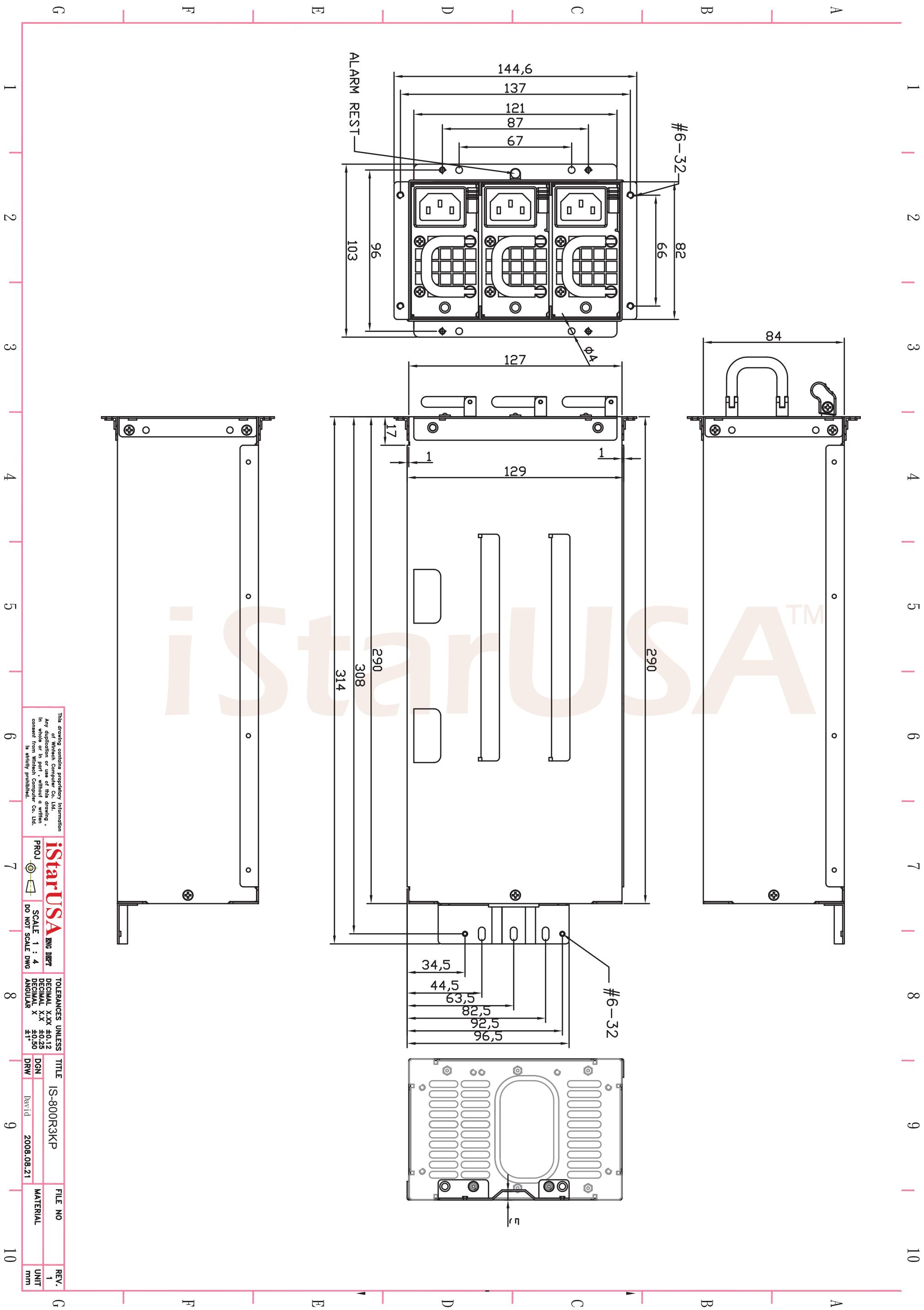


Figure 1 : Output Voltage Timing

Table 5 – Turn On/Off Timing



1. General

This is the specification of Model IS-800R3KP; it is intended to describe the functions and performance of the subject power supply. This 800watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 13-6A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	13A
Voltage (230V)	180Vac	200-240Vac	264 Vac	6A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class “D” standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=700W (350W N+1) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply's exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

Technical information in this specification is subject to change without notice.
The revision of specification will be marked on the cover.

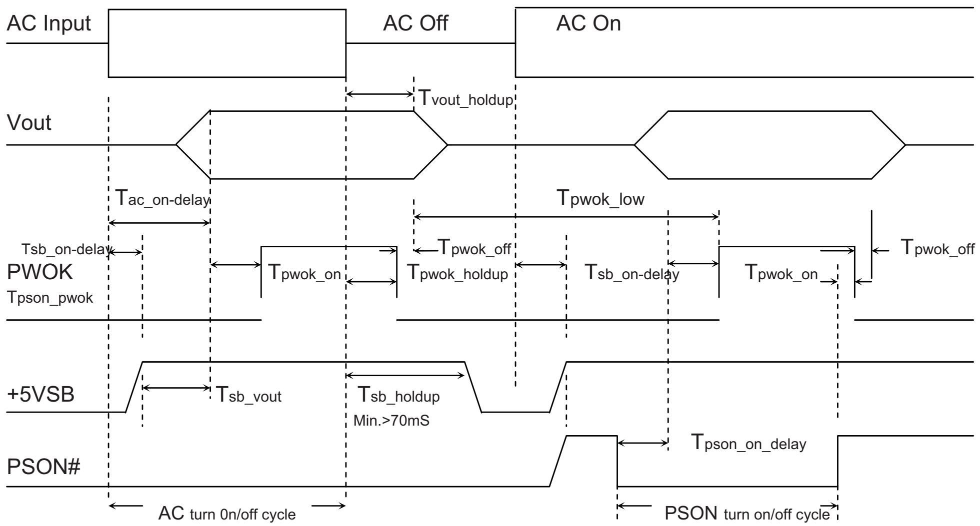


Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	**Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.**
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

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3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	40A	32A	56A	0.5A	0.8A	2A
Min. Load	1A	1A	2A	0A	0A	0.1A
Max. Combined	220W					
Total Output	678W			2.5W	9.6W	10W

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 700W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
Tvout_rise	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
Tvout_on	All main output must be within regulation of each other within this time.		50	mS
Tvout_off	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

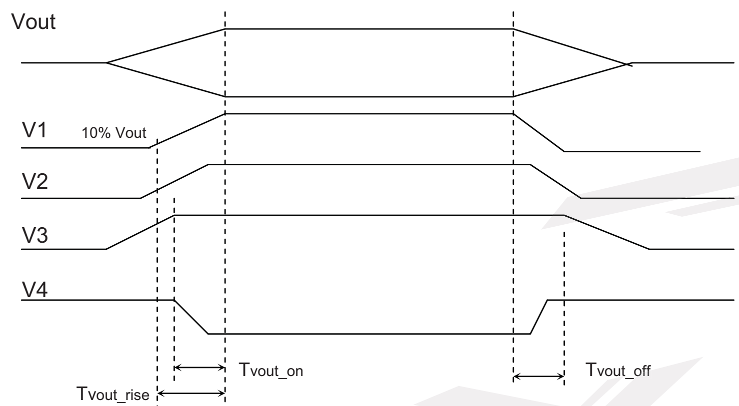
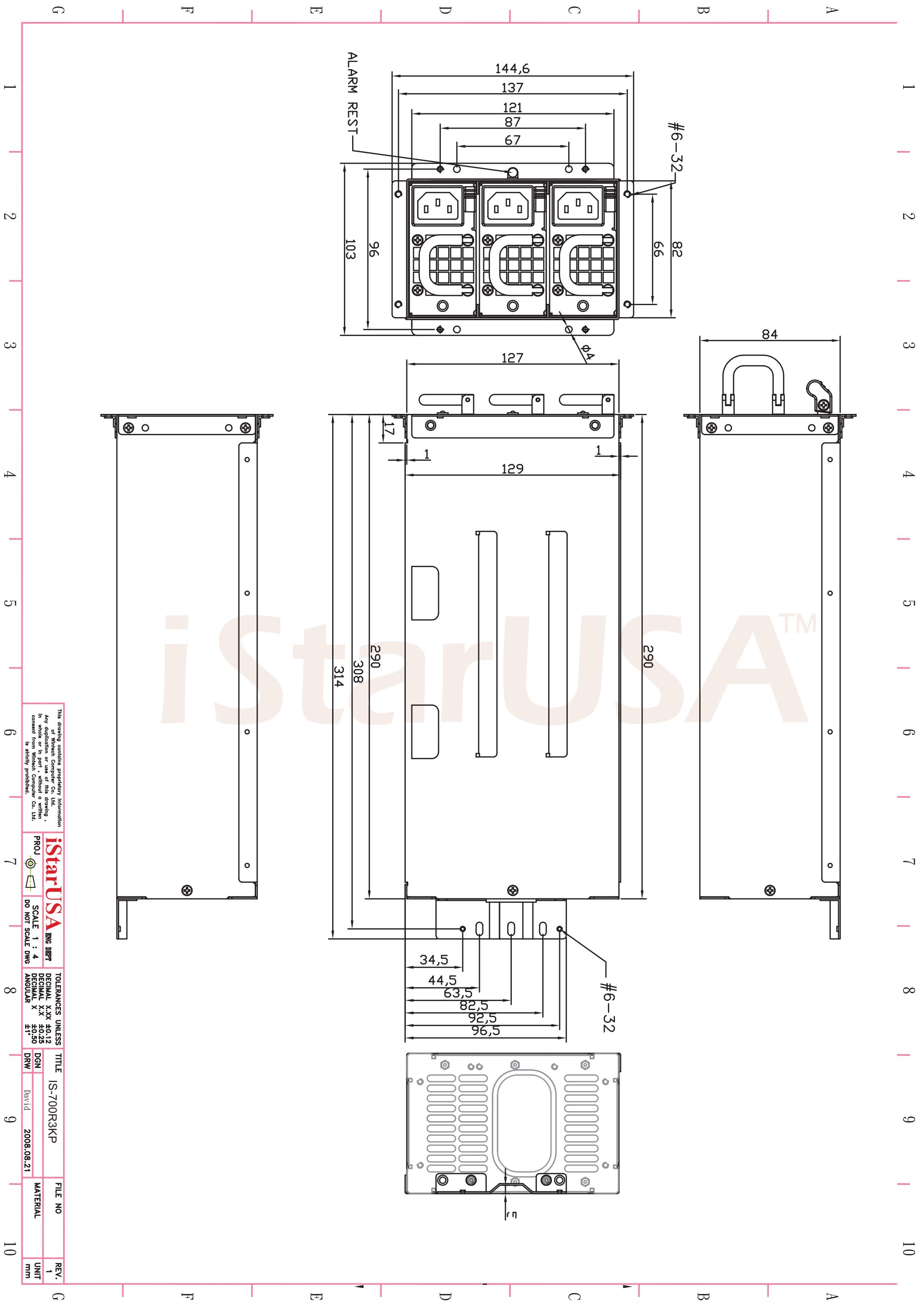


Figure 1 : Output Voltage Timing

Table 5 – Turn On/Off Timing



1. General

This is the specification of Model IS-700R3KP; it is intended to describe the functions and performance of the subject power supply. This 700watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 12-6A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	12A
Voltage (230V)	180Vac	200-240Vac	264 Vac	6A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class "D" standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=N (700W+700W=700W) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply's exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

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The revision of specification will be marked on the cover.

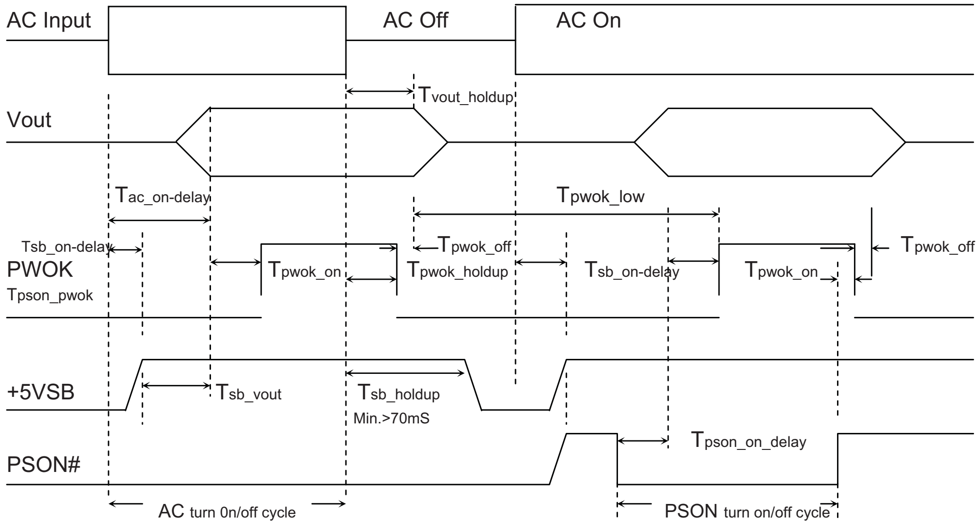


Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	**Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.**
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	24A	24A	56A	0.5A	0.8A	3A
Min. Load	1A	1A	2A	0A	0A	0.1A
Max. Combined	180W					
Total Output	672W			2.5W	9.6W	15W

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 700W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
Tvout_rise	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
Tvout_on	All main output must be within regulation of each other within this time.		50	mS
Tvout_off	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

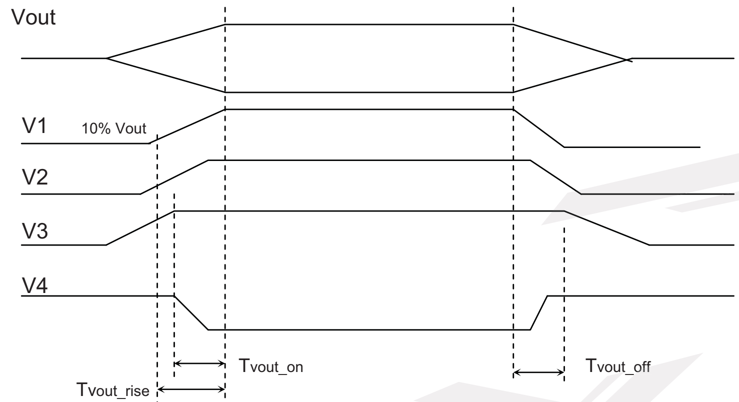
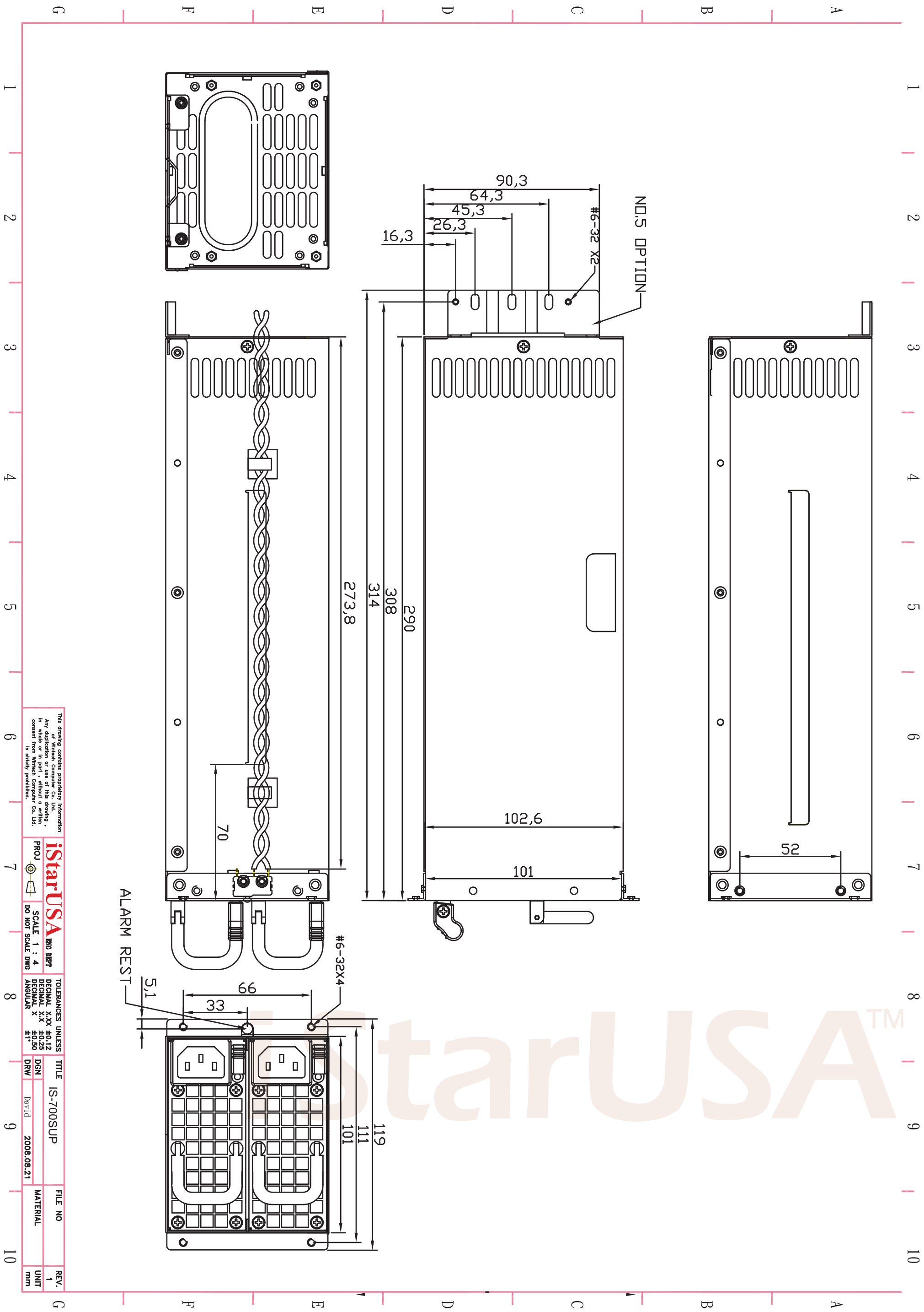


Figure 1 : Output Voltage Timing

Table 5 – Turn On/Off Timing



1. General

This is the specification of Model IS-700S2UP; it is intended to describe the functions and performance of the subject power supply. This 700watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 12-6A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	12A
Voltage (230V)	180Vac	200-240Vac	264 Vac	6A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class “D” standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=N (600W+600W=600W) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply's exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

Technical information in this specification is subject to change without notice.
The revision of specification will be marked on the cover.

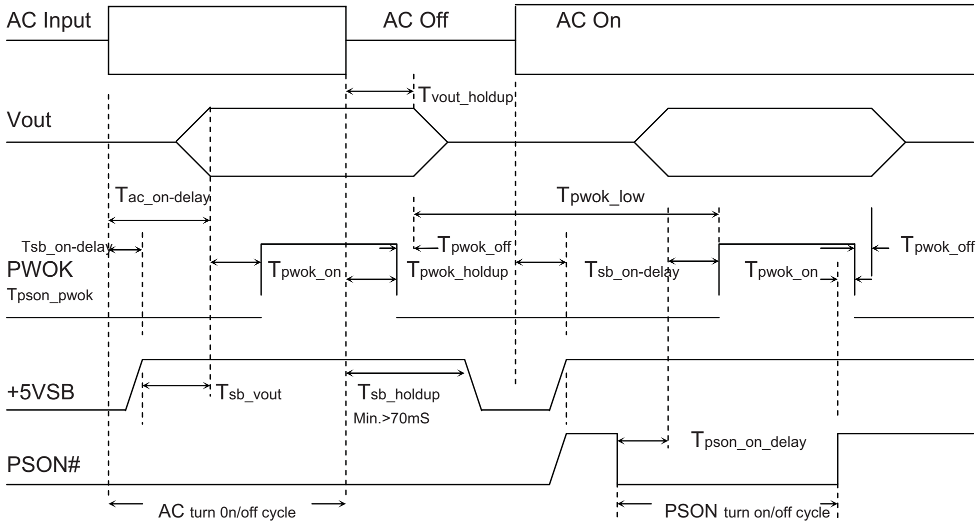


Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	**Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.**
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

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3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	24A	24A	48A	0.5A	0.8A	3A
Min. Load	1A	1A	2A	0A	0A	0.1A
Max. Combined	180W					
Total Output	576W			2.5W	9.6W	15W

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 600W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
Tvout_rise	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
Tvout_on	All main output must be within regulation of each other within this time.		50	mS
Tvout_off	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

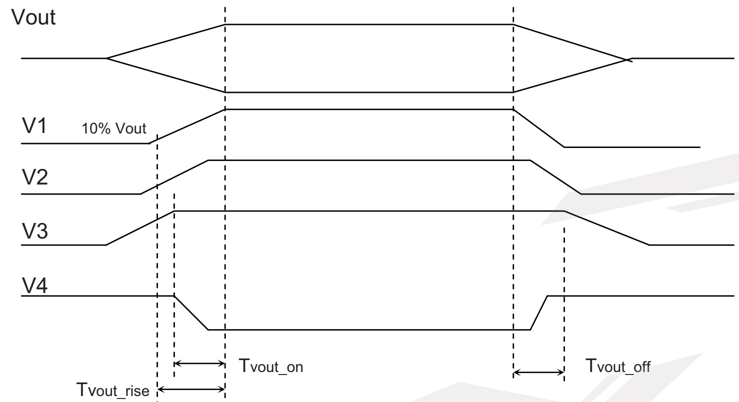
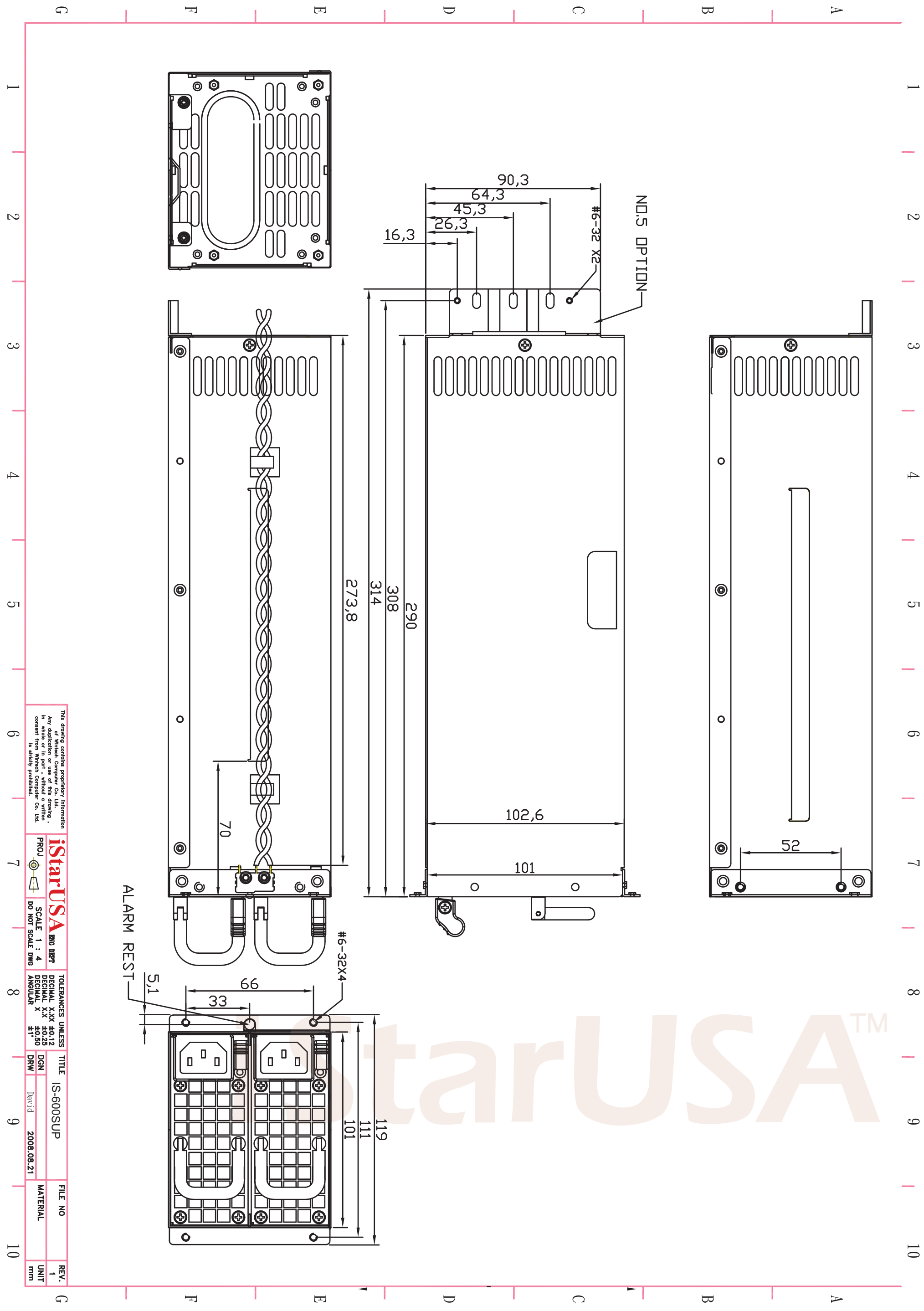


Figure 1 : Output Voltage Timing

Table 5 – Turn On/Off Timing



1. General

This is the specification of Model IS-600S2UP; it is intended to describe the functions and performance of the subject power supply. This 600watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 10-5A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	10A
Voltage (230V)	180Vac	200-240Vac	264 Vac	5A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class “D” standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=N (500W+500W=500W) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply's exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

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The revision of specification will be marked on the cover.

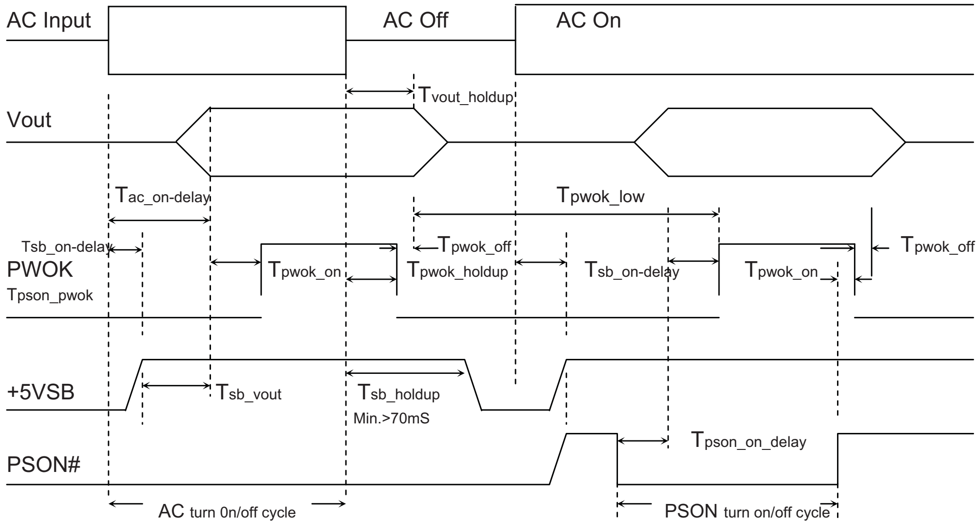

Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	**Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.**
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

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3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	24A	24A	40A	0.5A	0.8A	3A
Min. Load	1A	1A	2A	0A	0A	0.1A
Max. Combined	180W					
Total Output	480W			2.5W	9.6W	15W

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 500W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
T_{vout_rise}	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
T_{vout_on}	All main output must be within regulation of each other within this time.		50	mS
T_{vout_off}	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

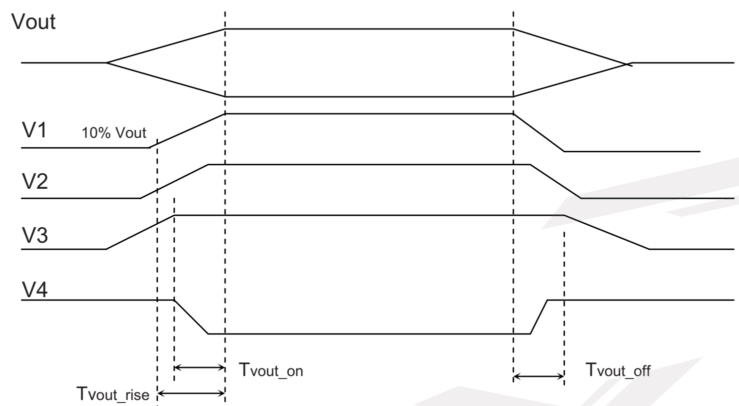
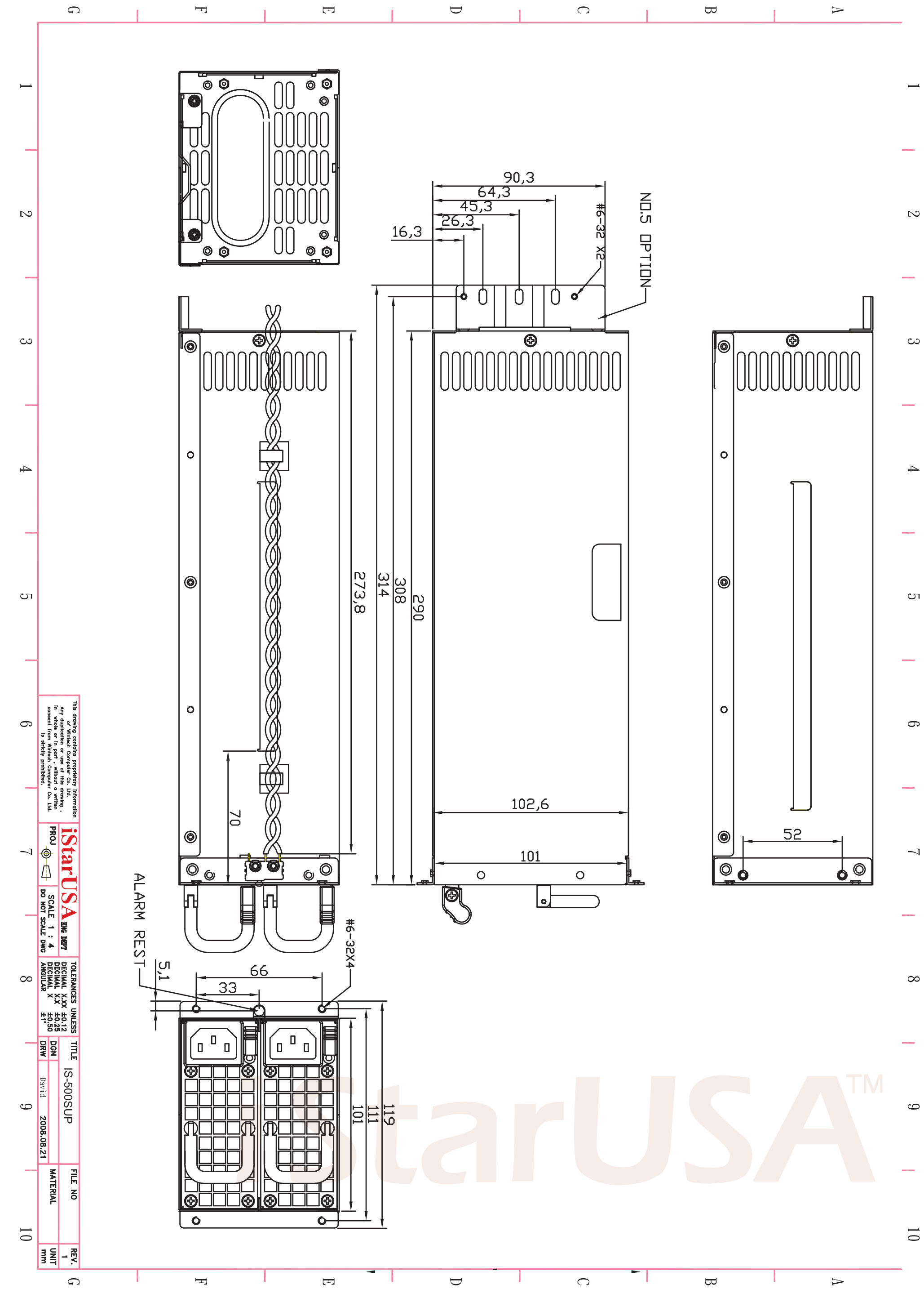


Figure 1 : Output Voltage Timing

Table 5 – Turn On/Off Timing



1. General

This is the specification of Model IS-500S2UP; it is intended to describe the functions and performance of the subject power supply. This 500watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 8-4A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	8A
Voltage (230V)	180Vac	200-240Vac	264 Vac	4A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class "D" standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=N (460W+460W=460W) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply's exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

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The revision of specification will be marked on the cover.

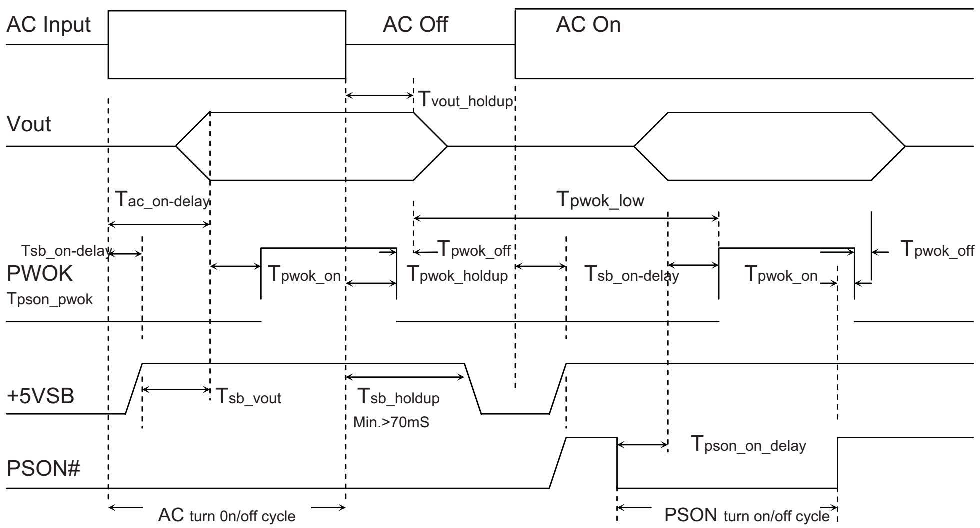

Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	**Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.**
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

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3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	25A	20A	35A	0.5A	1A	2A
Min. Load	1A	1A	2A	0A	0A	0.1A
Max. Combined	180W					
Total Output	435W			2.5W	12W	10W

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 460W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
Tvout_rise	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
Tvout_on	All main output must be within regulation of each other within this time.		50	mS
Tvout_off	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

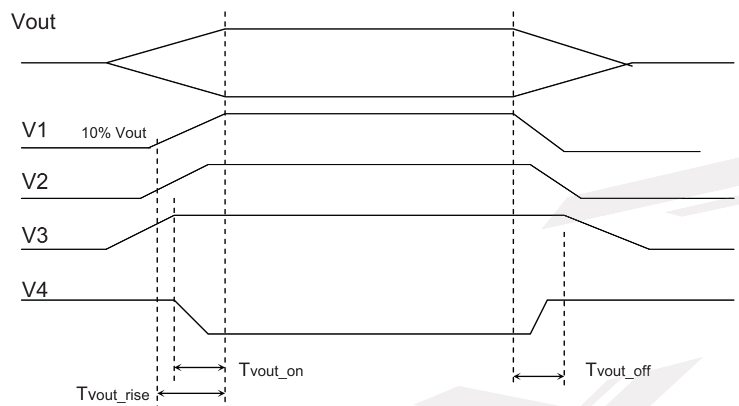
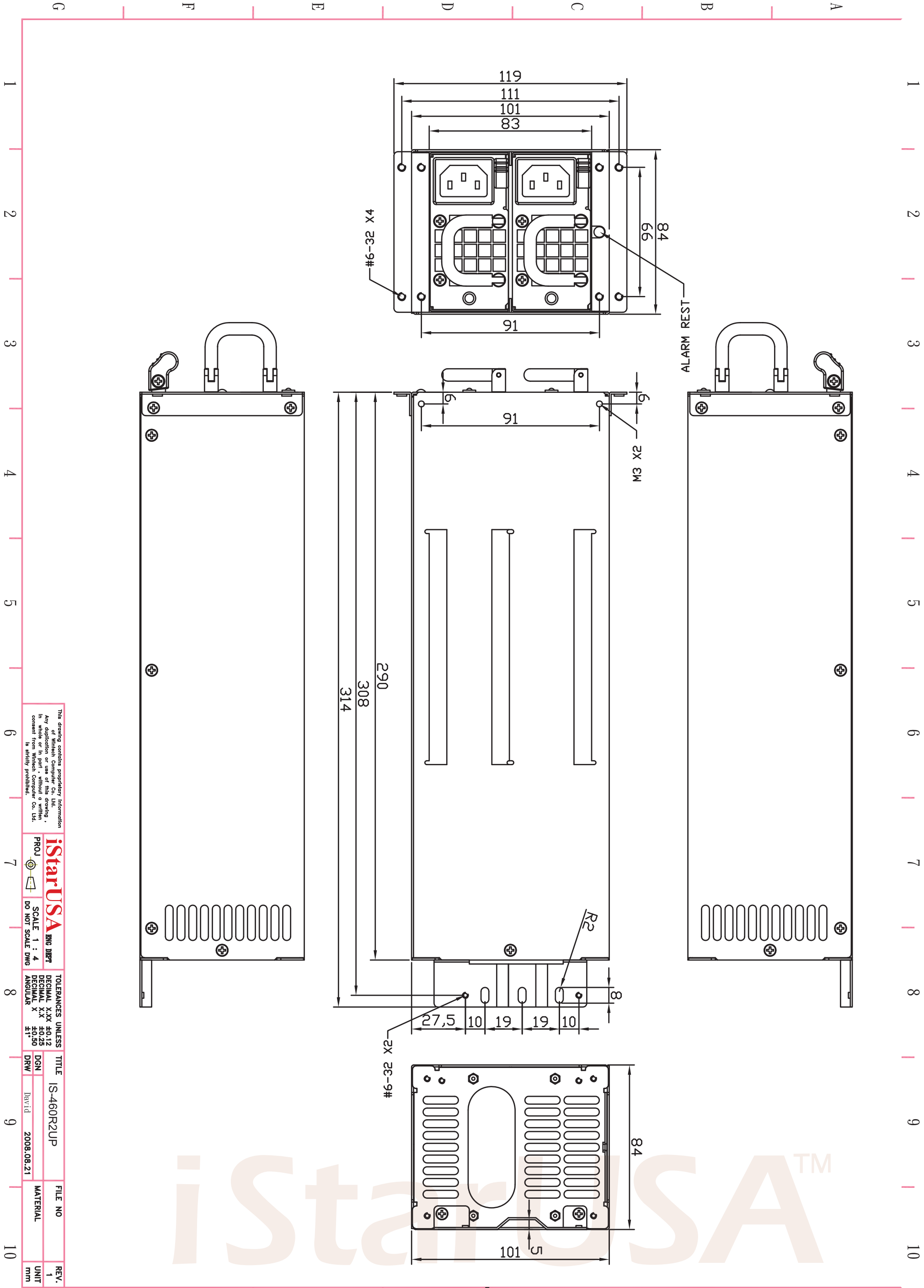


Figure 1 : Output Voltage Timing

Table 5 – Turn On/Off Timing



1. General

This is the specification of Model IS-460R2UP; it is intended to describe the functions and performance of the subject power supply. This 460watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 7-3.5A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	7A
Voltage (230V)	180Vac	200-240Vac	264 Vac	3.5A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class "D" standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=N (400W+400W=400W) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply's exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

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The revision of specification will be marked on the cover.

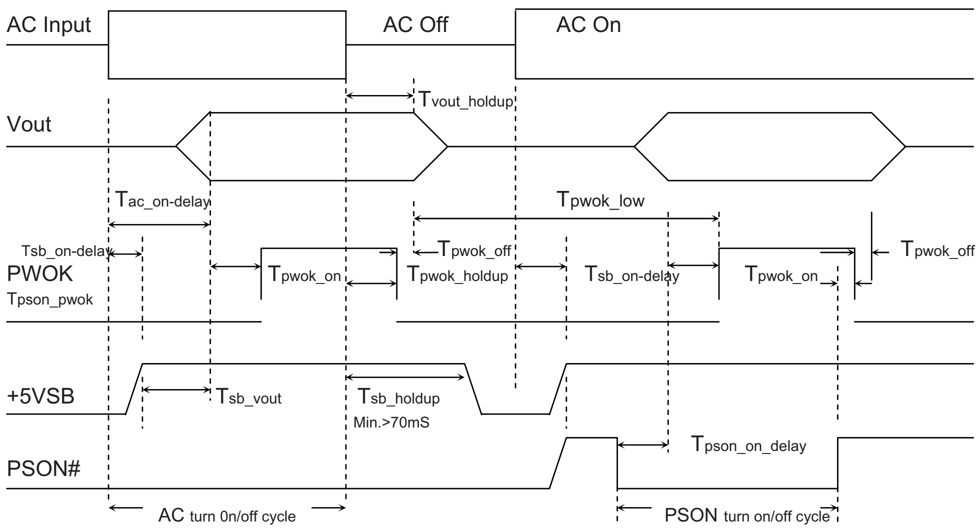


Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	**Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.**
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	25A	20A	28A	0.5A	1A	2A
Min. Load	1A	1A	2A	0A	0A	0.1A
Max. Combined	**180W**					
Total Output	**375W**			**2.5W**	**12W**	**10W**

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 400W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
Tvout_rise	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
Tvout_on	All main output must be within regulation of each other within this time.		50	mS
Tvout_off	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

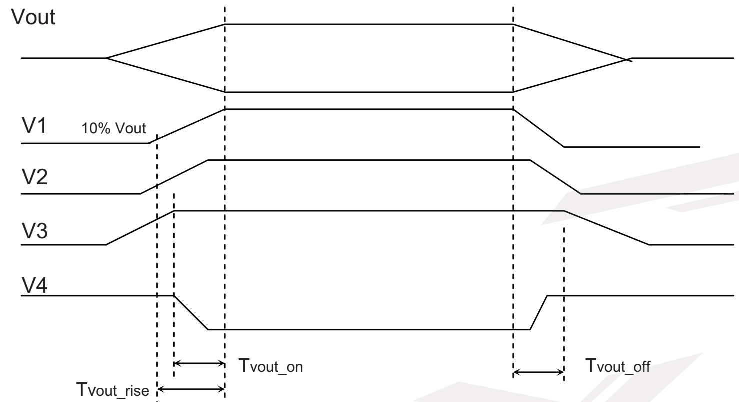
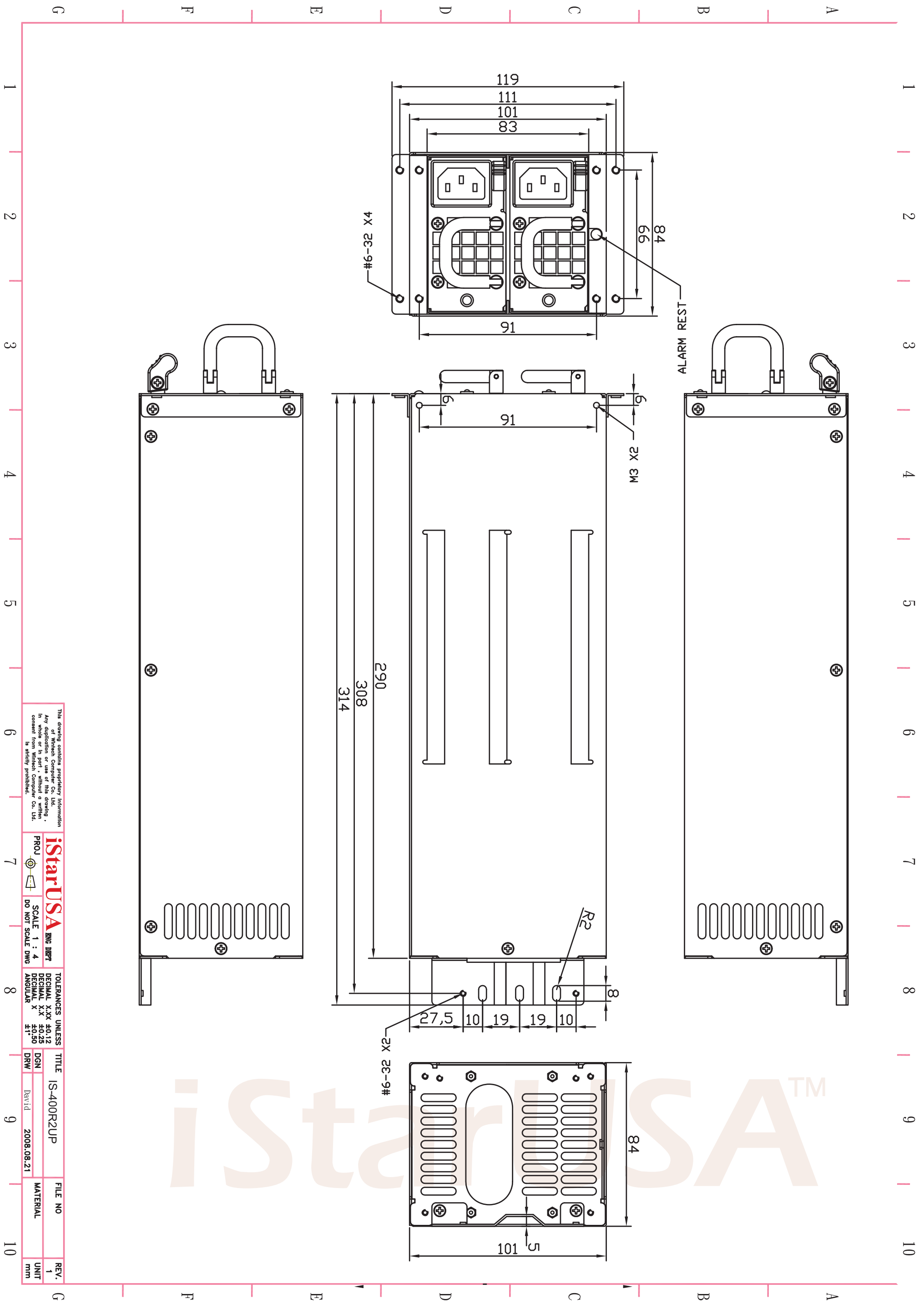


Figure 1 : Output Voltage Timing

Table 5 – Turn On/Off Timing



1. General

This is the specification of Model IS-460R2UP; it is intended to describe the functions and performance of the subject power supply. This 400watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 6-3A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	6A
Voltage (230V)	180Vac	200-240Vac	264 Vac	3A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class "D" standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=N (350W+350W=350W) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply’s exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

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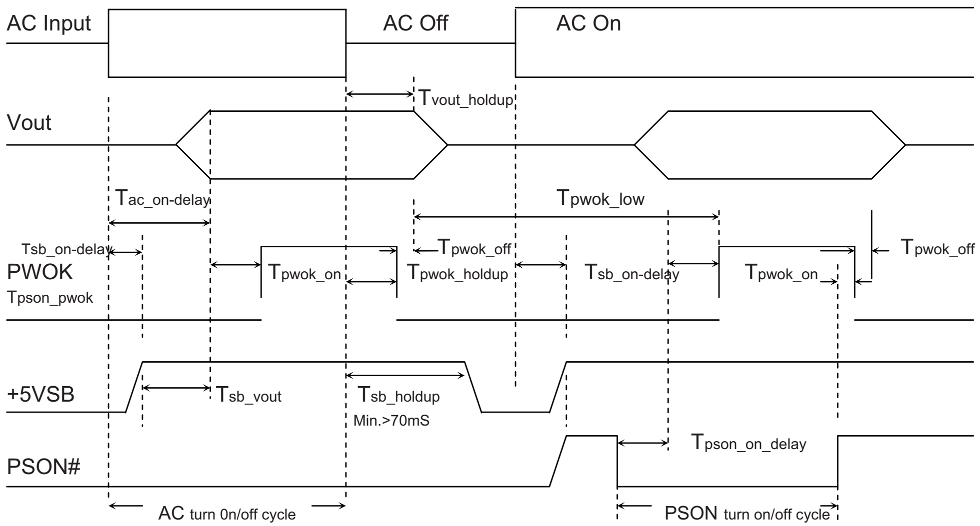

Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

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3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	25A	20A	24A	0.5A	1A	2A
Min. Load	1A	1A	2A	0A	0A	0.1A
Max. Combined	180W					
Total Output	325W			2.5W	12W	10W

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 350W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
Tvout_rise	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
Tvout_on	All main output must be within regulation of each other within this time.		50	mS
Tvout_off	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

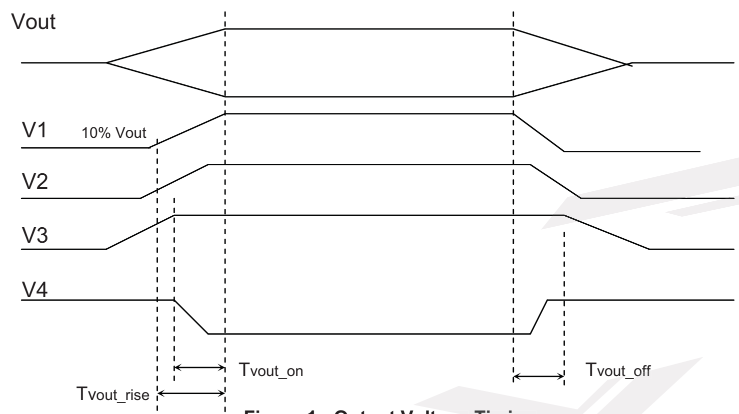
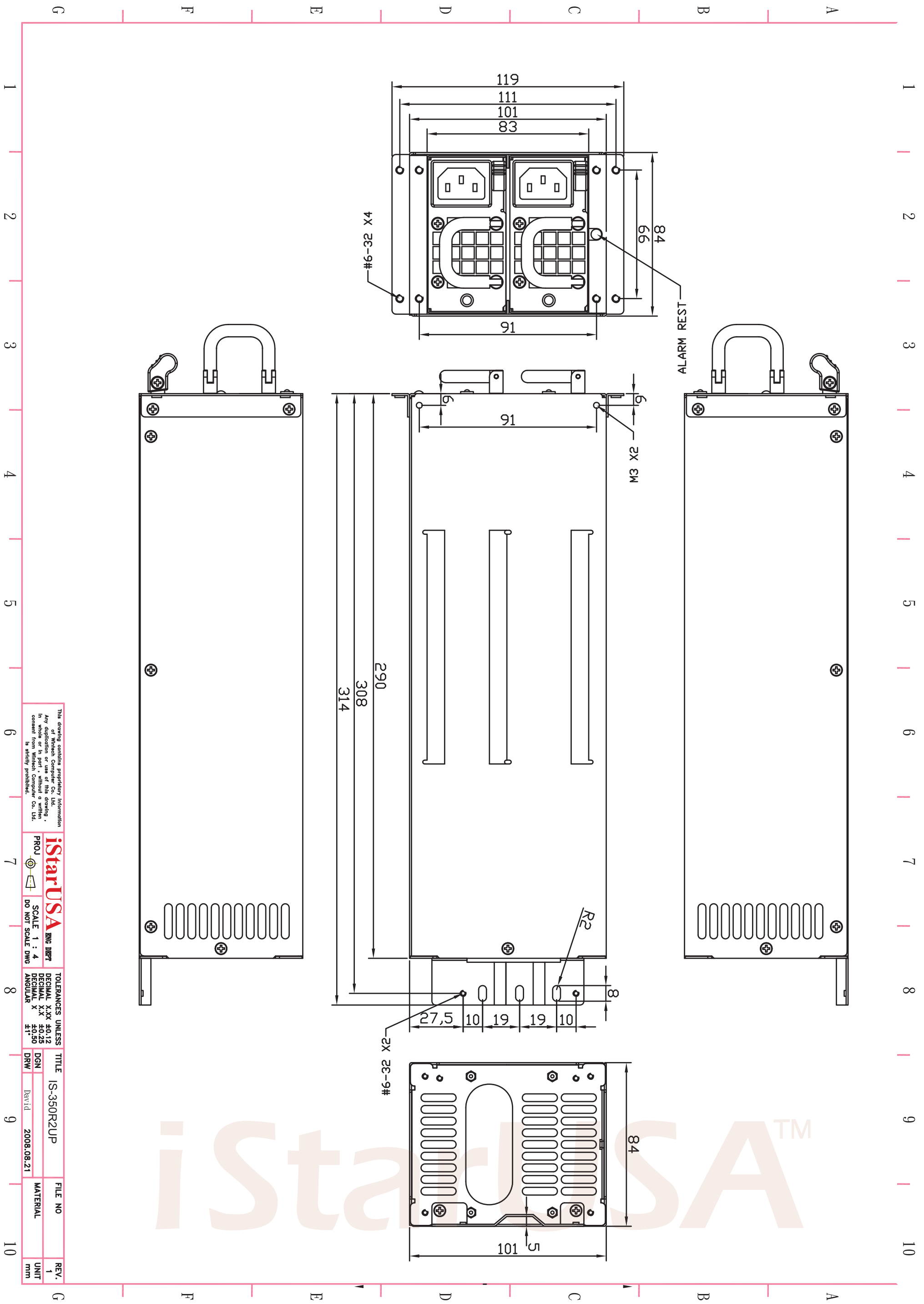


Figure 1 : Output Voltage Timing
Table 5 – Turn On/Off Timing



1. General

This is the specification of Model IS-350R2UP; it is intended to describe the functions and performance of the subject power supply. This 350watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 10-5A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	6A
Voltage (230V)	180Vac	200-240Vac	264 Vac	3A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class "D" standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=2000W (700W N+1) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply’s exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

Technical information in this specification is subject to change without notice.
The revision of specification will be marked on the cover.

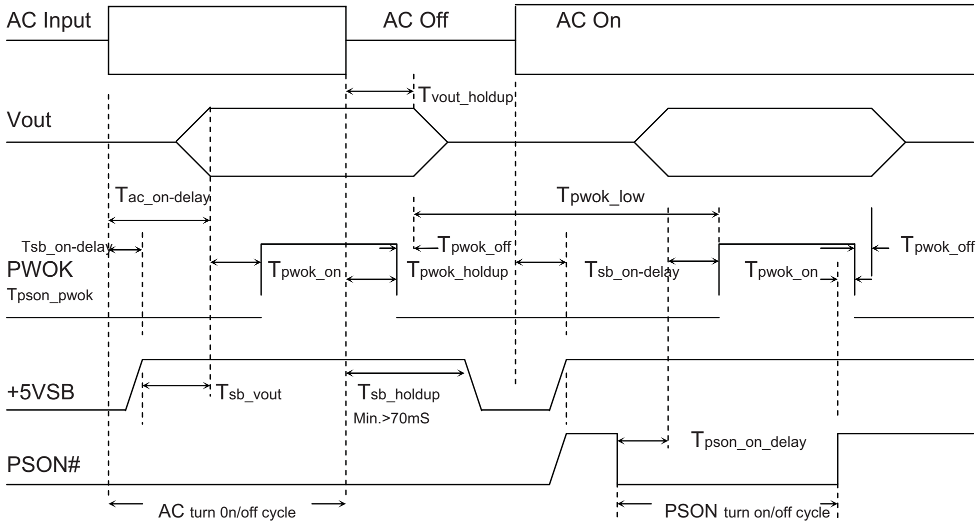


Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	**Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.**
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.
The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	60A	60A	158A	0.5A	0.8A	3A
Min. Load	1A	1A	2A	0A	0A	0.1A
Max. Combined	440W					
Total Output	1975W			2.5W	9.6W	15W

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 2000W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
Tvout_rise	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
Tvout_on	All main output must be within regulation of each other within this time.		50	mS
Tvout_off	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

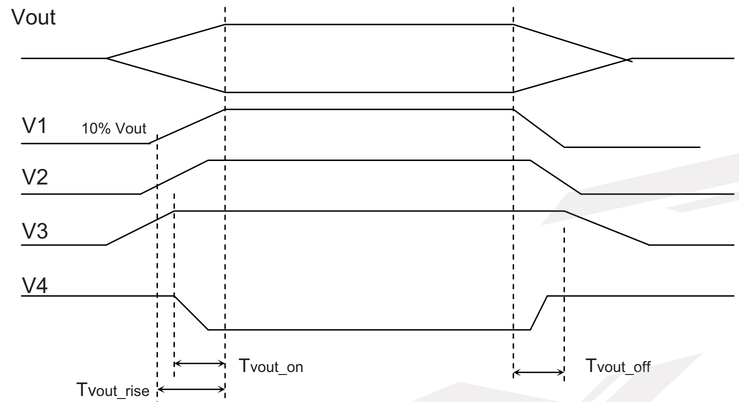
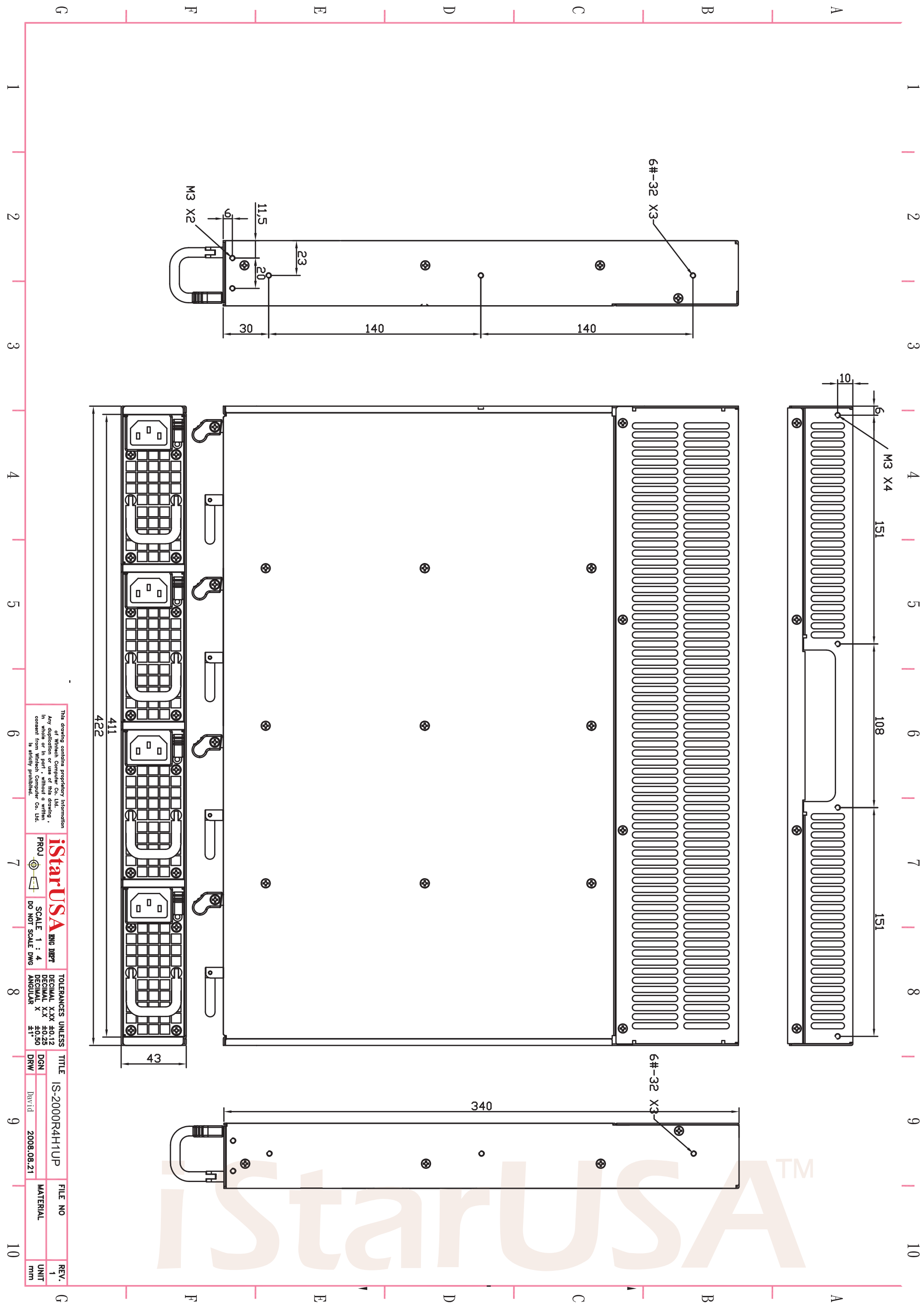


Figure 1 : Output Voltage Timing

Table 5 – Turn On/Off Timing



1. General

This is the specification of Model IS-2000R4H1UP; it is intended to describe the functions and performance of the subject power supply. This 2000watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 15-10A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	15A
Voltage (230V)	180Vac	200-240Vac	264 Vac	10A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class "D" standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1= 1800W (600W N+1) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply’s exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

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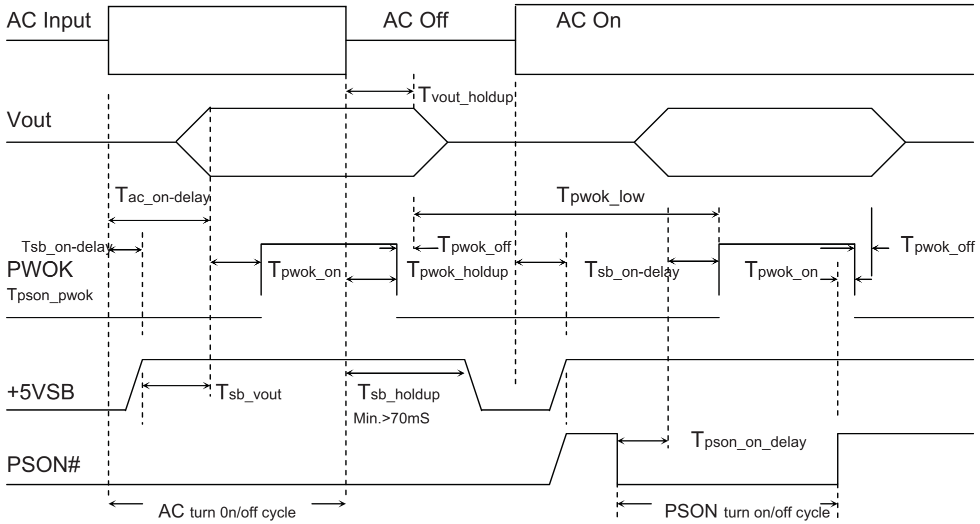

Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

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3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	60A	60A	140A	0.5A	0.8A	3A
Min. Load	1A	1A	2A	0A	0A	0.1A
Max. Combined	440W					
Total Output	1775W			2.5W	9.6W	15W

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 1800W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
T_{vout_rise}	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
T_{vout_on}	All main output must be within regulation of each other within this time.		50	mS
T_{vout_off}	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

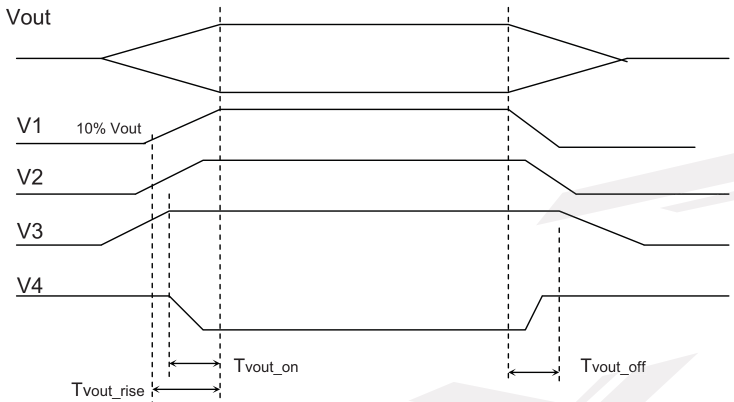
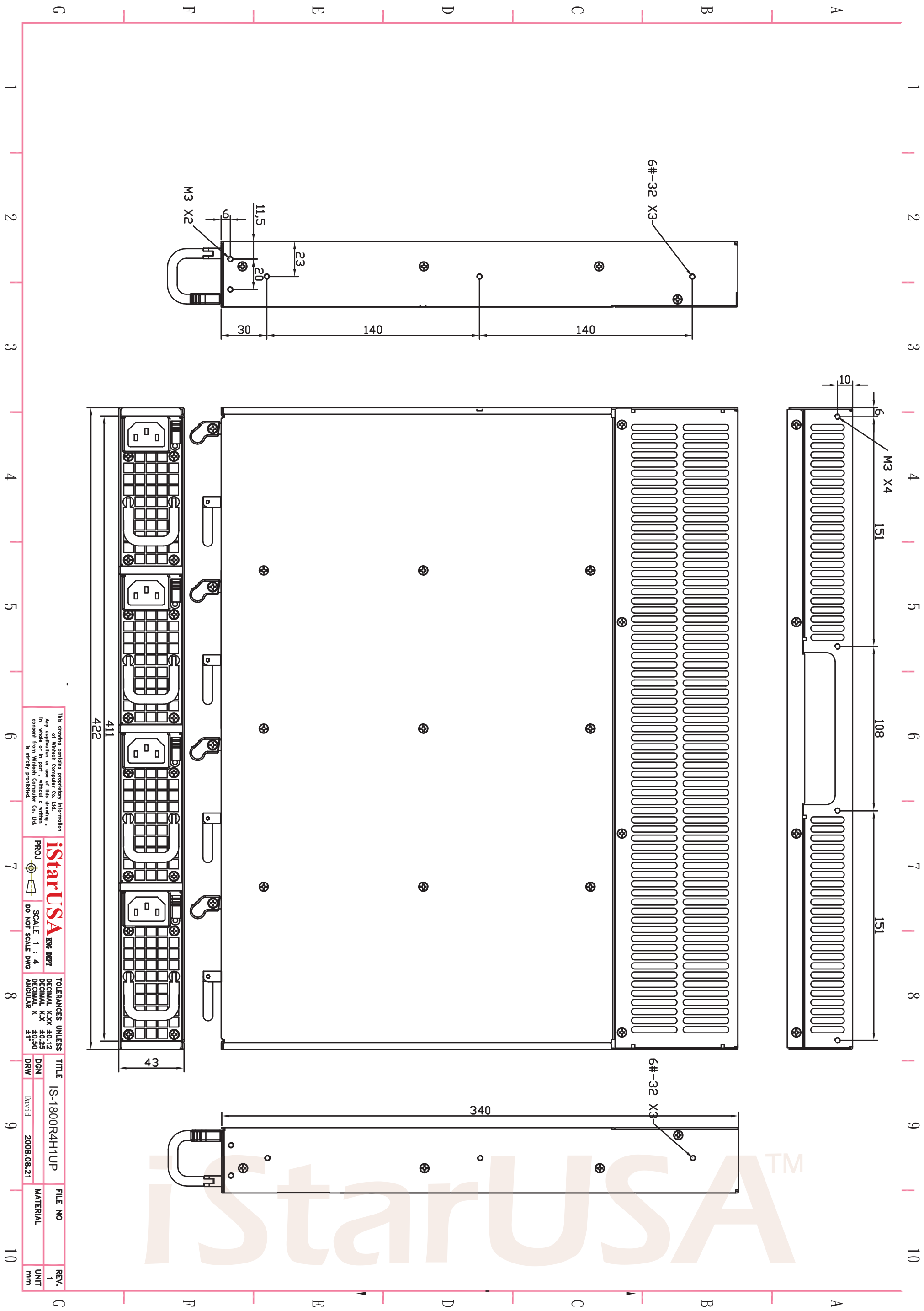


Figure 1 : Output Voltage Timing

Table 5 – Turn On/Off Timing



1. General

This is the specification of Model IS-1800R4H1UP; it is intended to describe the functions and performance of the subject power supply. This 1800watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 15-10A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	15A
Voltage (230V)	180Vac	200-240Vac	264 Vac	10A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class “D” standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=1500W(500W N+1) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply's exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

Technical information in this specification is subject to change without notice.
The revision of specification will be marked on the cover.

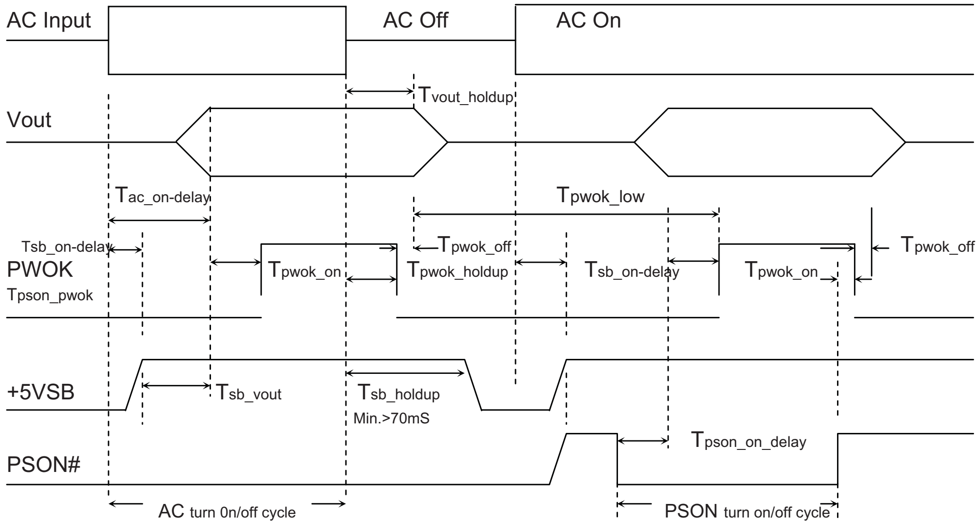


Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	**Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.**
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 75% at full loading condition to help reduce system power consumption at typical system loading conditions.

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3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	60A	60A	122A	0.5A	0.8A	3A
Min. Load	1A	1A	2A	0A	0A	0.1A
Max. Combined	440W					
Total Output	1475W			2.5W	9.6W	15W

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 1500W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
Tvout_rise	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
Tvout_on	All main output must be within regulation of each other within this time.		50	mS
Tvout_off	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

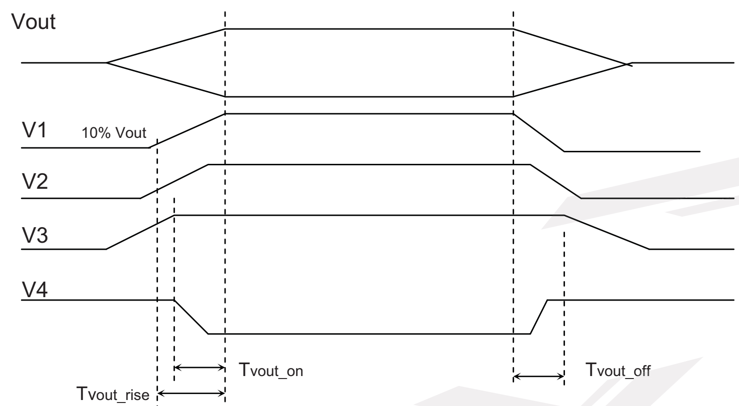
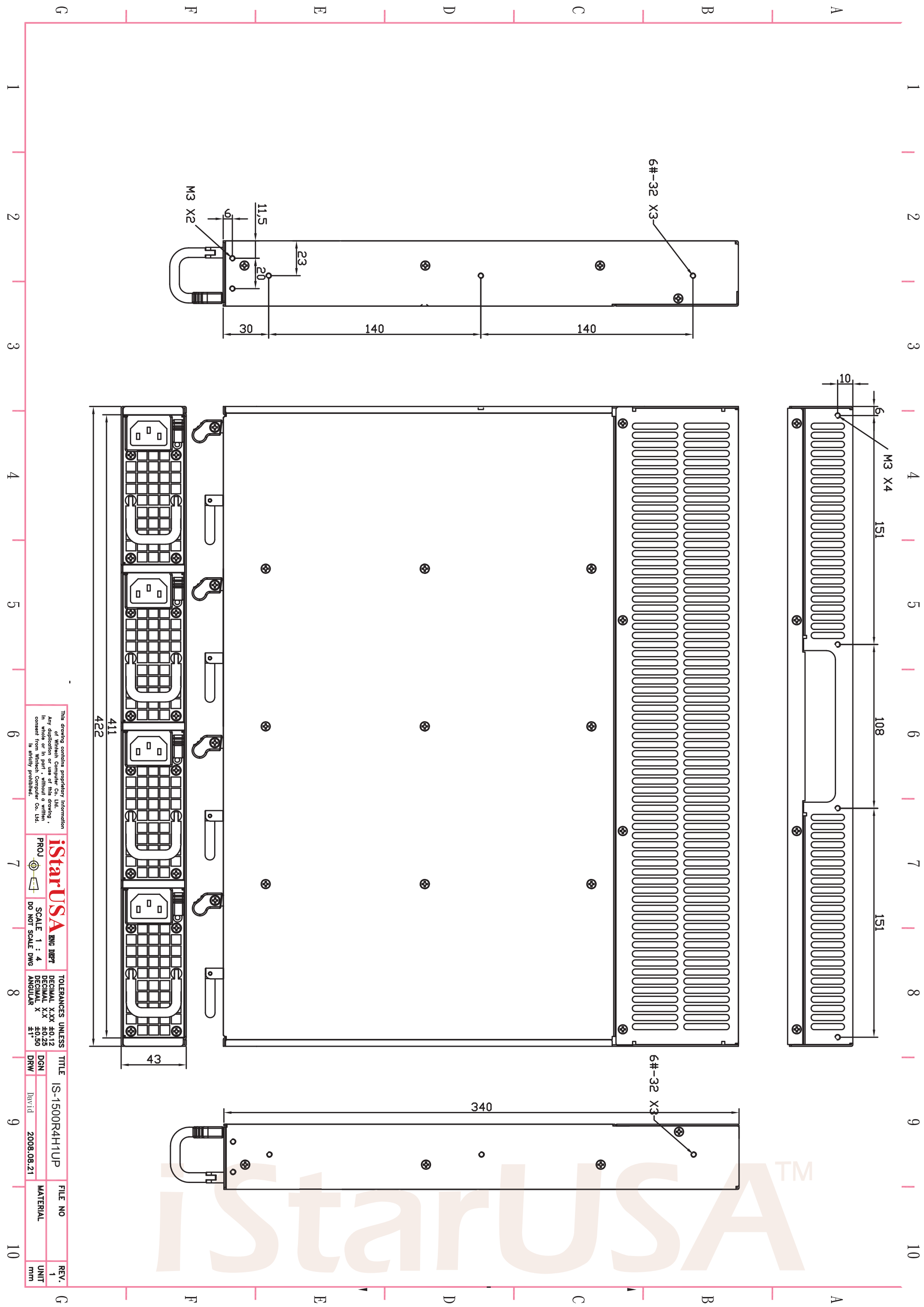


Figure 1 : Output Voltage Timing

Table 5 – Turn On/Off Timing



1. General

This is the specification of Model IS-1500R4H1UP; it is intended to describe the functions and performance of the subject power supply. This 1500watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 10-5A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	12A
Voltage (230V)	180Vac	200-240Vac	264 Vac	6A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class “D” standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=N (550W+550W=550W) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply’s exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

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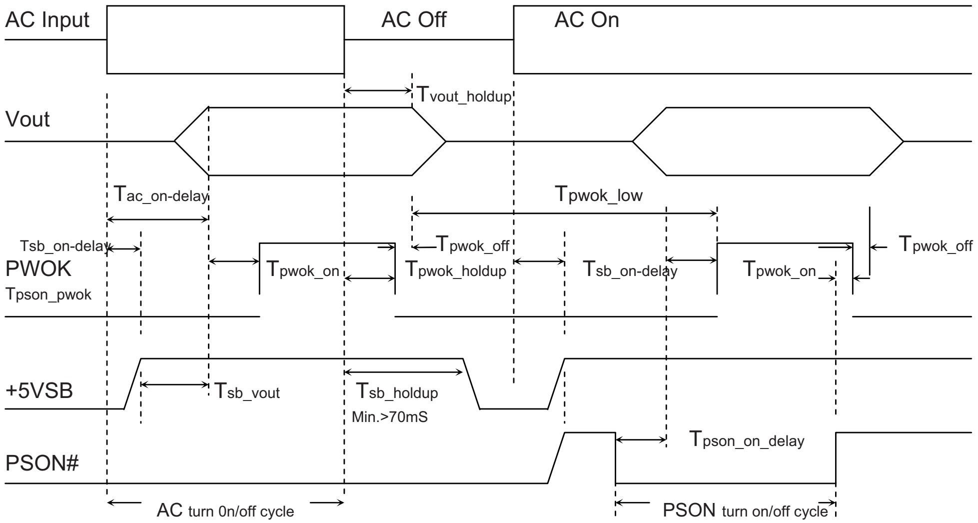

Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	**Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.**
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

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3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.
The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	30A	24A	41A	0.5A	1A	2A
Min. Load	2A	1A	2A	0A	0A	0.1A
Max. Combined	**220W**					
Total Output	**525W**			**2.5W**	**12W**	**10W**

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 550W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of
10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
T_{vout_rise}	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
T_{vout_on}	All main output must be within regulation of each other within this time.		50	mS
T_{vout_off}	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

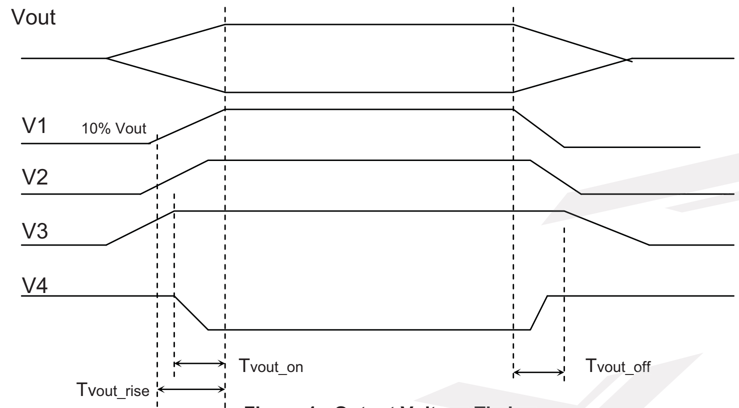
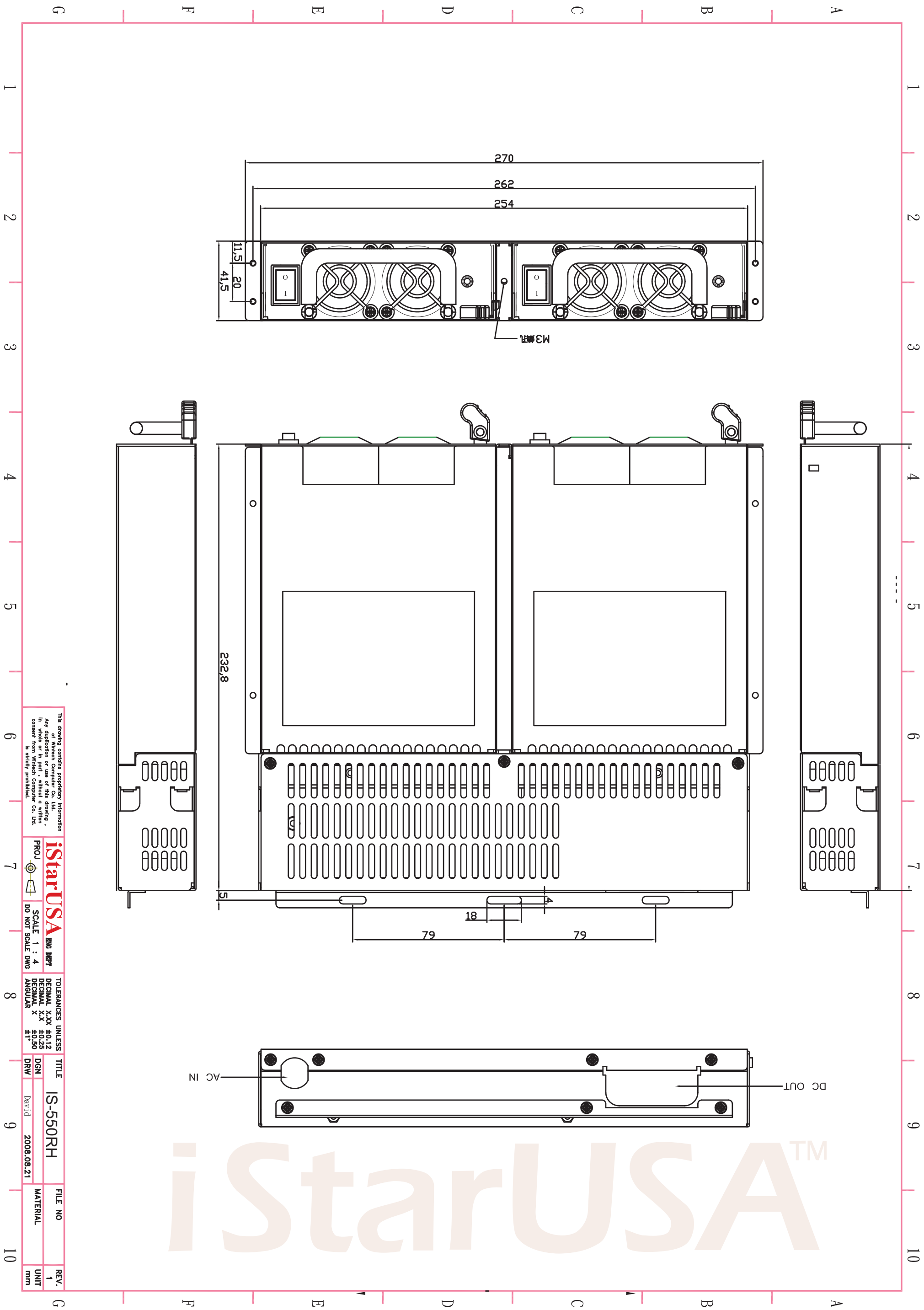


Figure 1 : Output Voltage Timing
Table 5 – Turn On/Off Timing



1. General

This is the specification of Model IS-550RH; it is intended to describe the functions and performance of the subject power supply. This 550watts Redunda nt Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 10-5A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	10A
Voltage (230V)	180Vac	200-240Vac	264 Vac	5A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class “D” standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=N (460W+460W=460W) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply's exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

Technical information in this specification is subject to change without notice.
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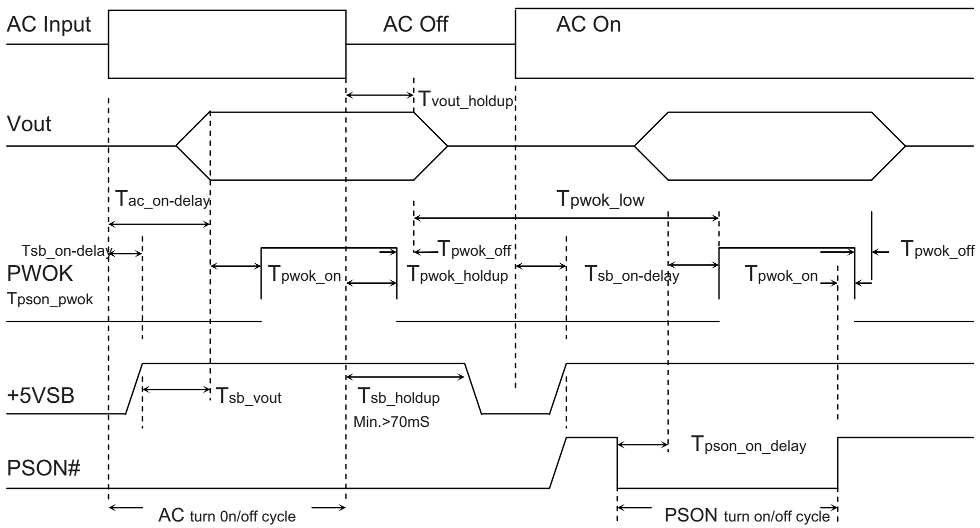

Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	**Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.**
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

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3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	35A	22A	32A	0.5A	1A	2A
Min. Load	2A	1A	2A	0A	0A	0.1A
Max. Combined	220W					
Total Output	435W			2.5W	12W	10W

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 460W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
Tvout_rise	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
Tvout_on	All main output must be within regulation of each other within this time.		50	mS
Tvout_off	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

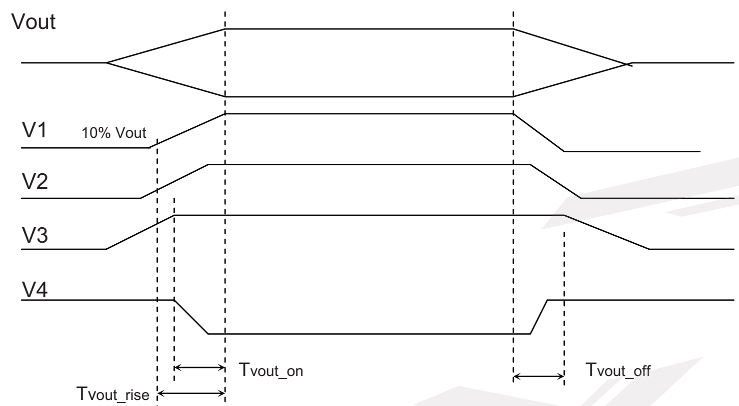
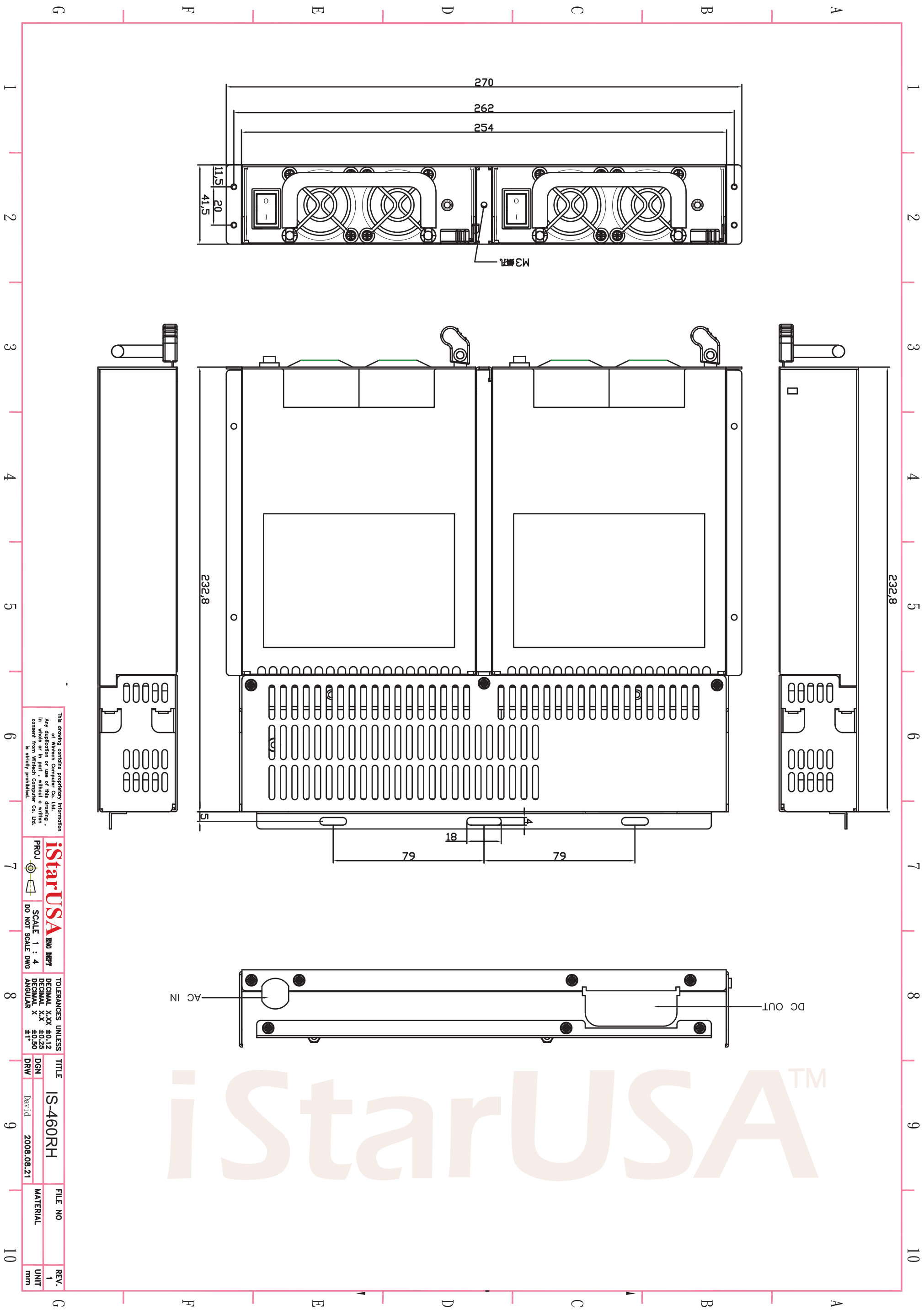


Figure 1 : Output Voltage Timing

Table 5 – Turn On/Off Timing



1. General

This is the specification of Model IS-460RH; it is intended to describe the functions and performance of the subject power supply. This 460 watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 8-4A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	8A
Voltage (230V)	180Vac	200-240Vac	264 Vac	4A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class "D" standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=N (400W+400W=400W) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply’s exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

Technical information in this specification is subject to change without notice.
The revision of specification will be marked on the cover.

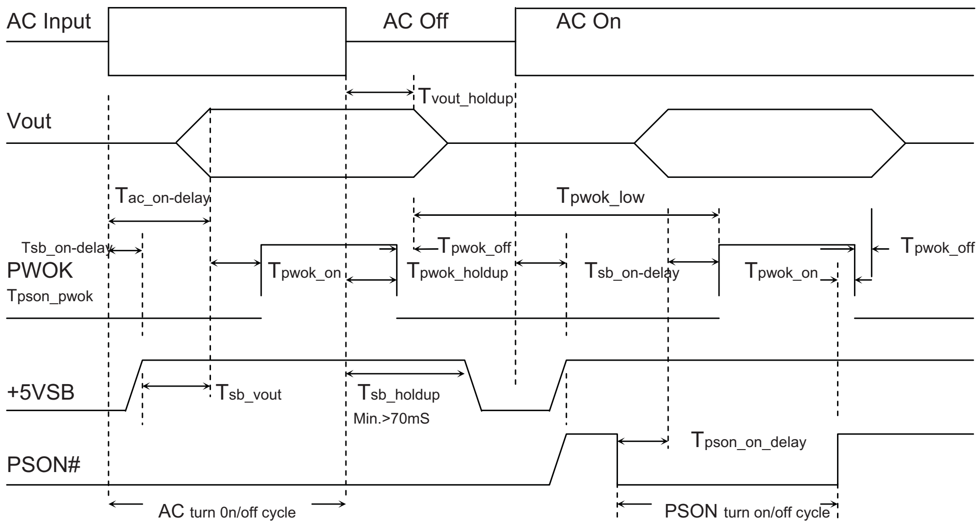


Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	**Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.**
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

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3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	25A	20A	28A	0.5A	1A	2A
Min. Load	1A	1A	2A	0A	0A	0.1A
Max. Combined	180W					
Total Output	378W			2.5W	9.6W	10W

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 400W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
Tvout_rise	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
Tvout_on	All main output must be within regulation of each other within this time.		50	mS
Tvout_off	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

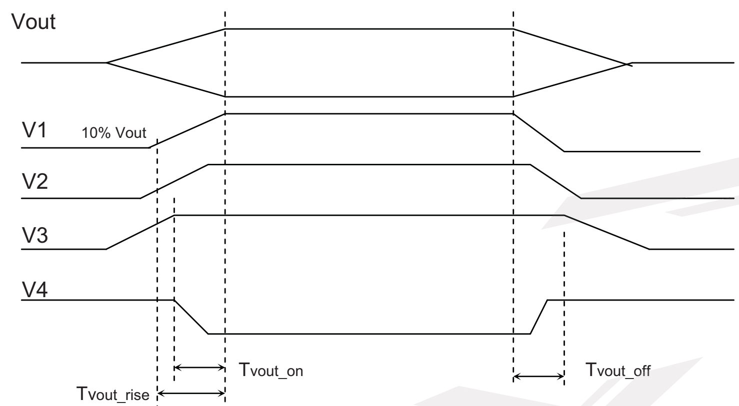
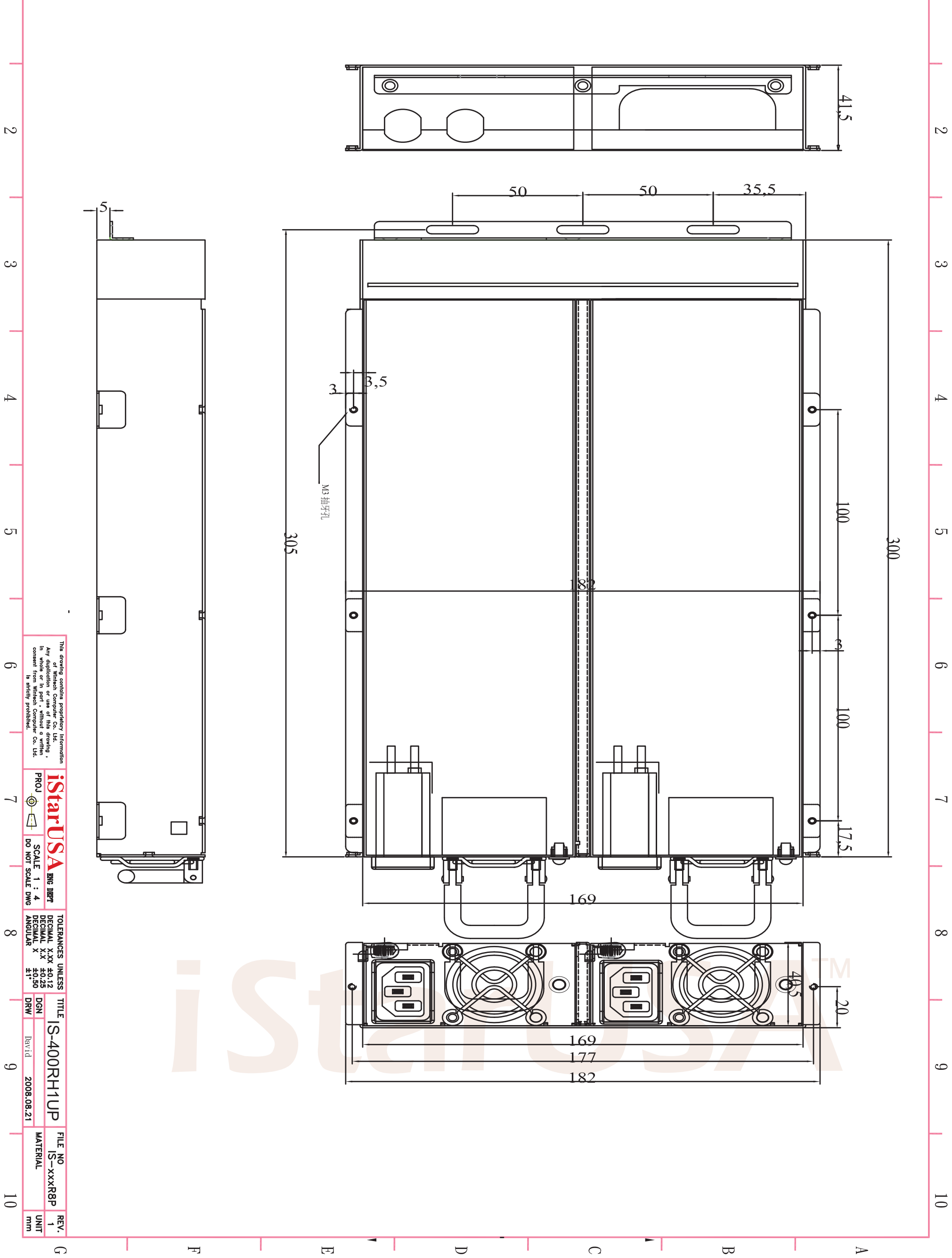


Figure 1 : Output Voltage Timing

Table 5 – Turn On/Off Timing

Power Supply Dimension: 169mm(W) x 41.5 mm(H) x 300 mm(D)



1. General

This is the specification of Model IS-400RH1UP; it is intended to describe the functions and performance of the subject power supply. This 400 watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 6-3A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	6A
Voltage (230V)	180Vac	200-240Vac	264 Vac	3A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class “D” standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=800W(400W N+1) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply's exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

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The revision of specification will be marked on the cover.

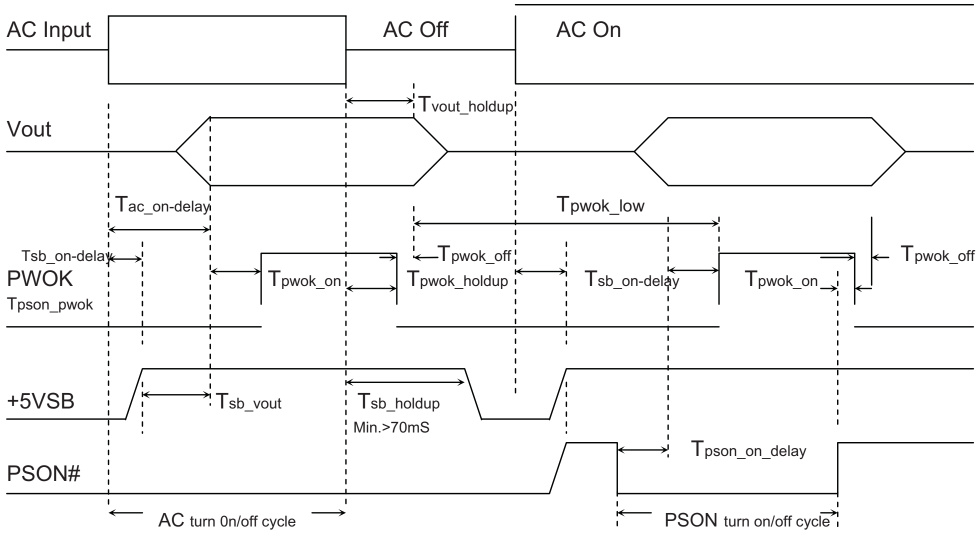

Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

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3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	40A	32A	65A	0.5A	0.8A	2A
Min. Load	1A	1A	2A	0A	0A	0.1A
Max. Combined	220W					
Total Output	778W			2.5W	9.6W	10W

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 800W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of
10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
Tvout_rise	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
Tvout_on	All main output must be within regulation of each other within this time.		50	mS
Tvout_off	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

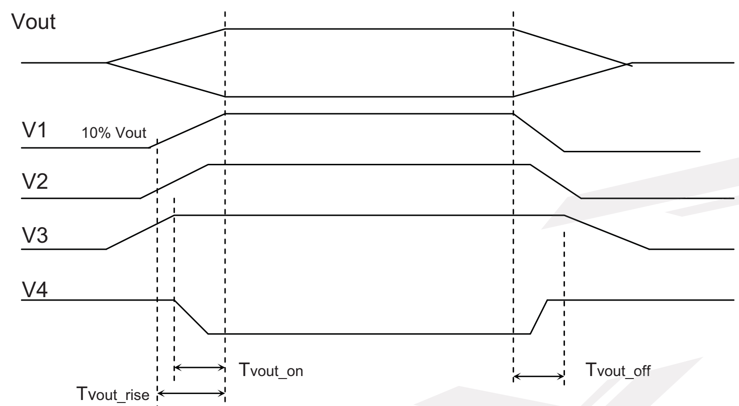
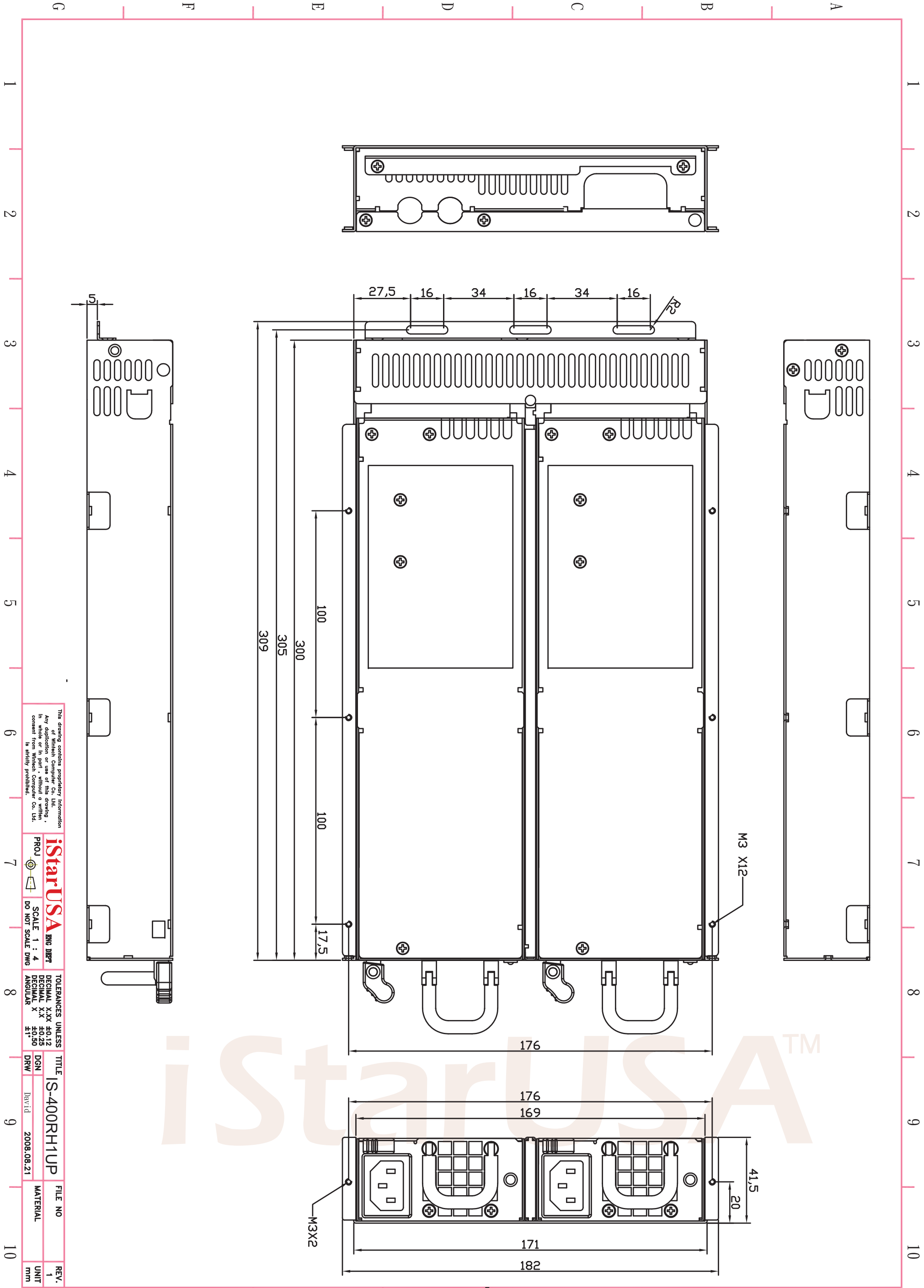


Figure 1 : Output Voltage Timing
Table 5 – Turn On/Off Timing



1. General

This is the specification of Model IS-400RH1UP; it is intended to describe the functions and performance of the subject power supply. This 400 watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 6-3A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	6A
Voltage (230V)	180Vac	200-240Vac	264 Vac	3A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class “D” standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=700W(350W N+1) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply's exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

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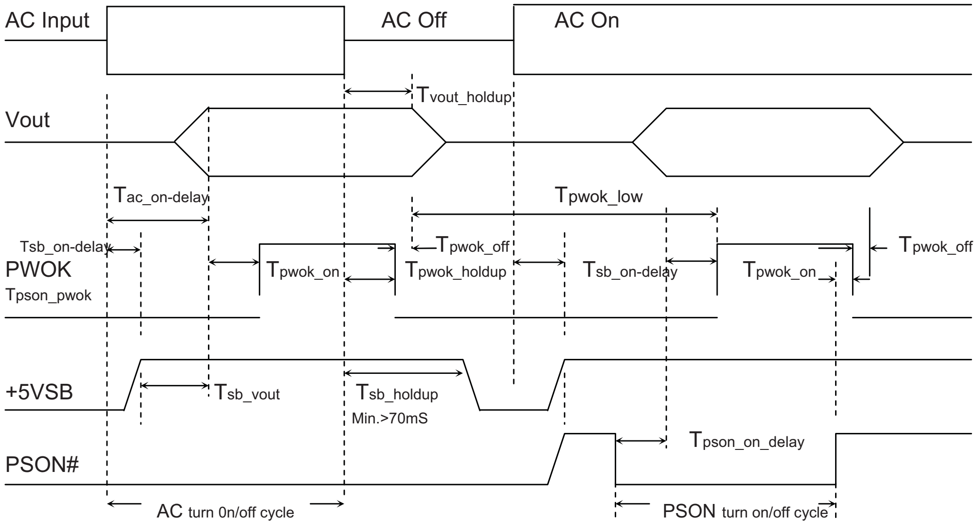

Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	**Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.**
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

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3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	40A	32A	56A	0.5A	0.8A	2A
Min. Load	1A	1A	2A	0A	0A	0.1A
Max. Combined	**220W**					
Total Output	**678W**			**2.5W**	**9.6W**	**10W**

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 700W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
T_{vout_rise}	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
T_{vout_on}	All main output must be within regulation of each other within this time.		50	mS
T_{vout_off}	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

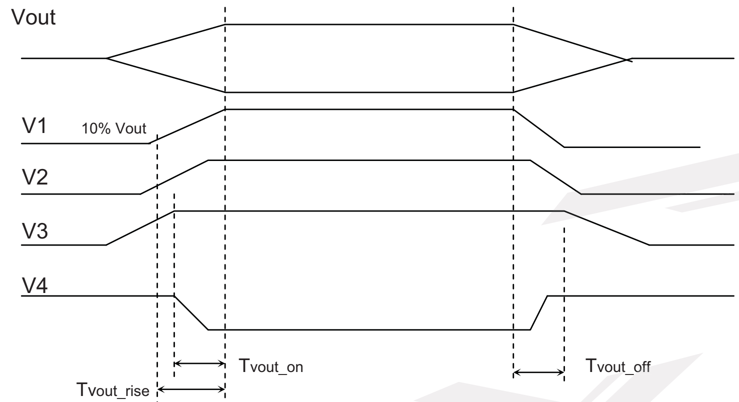
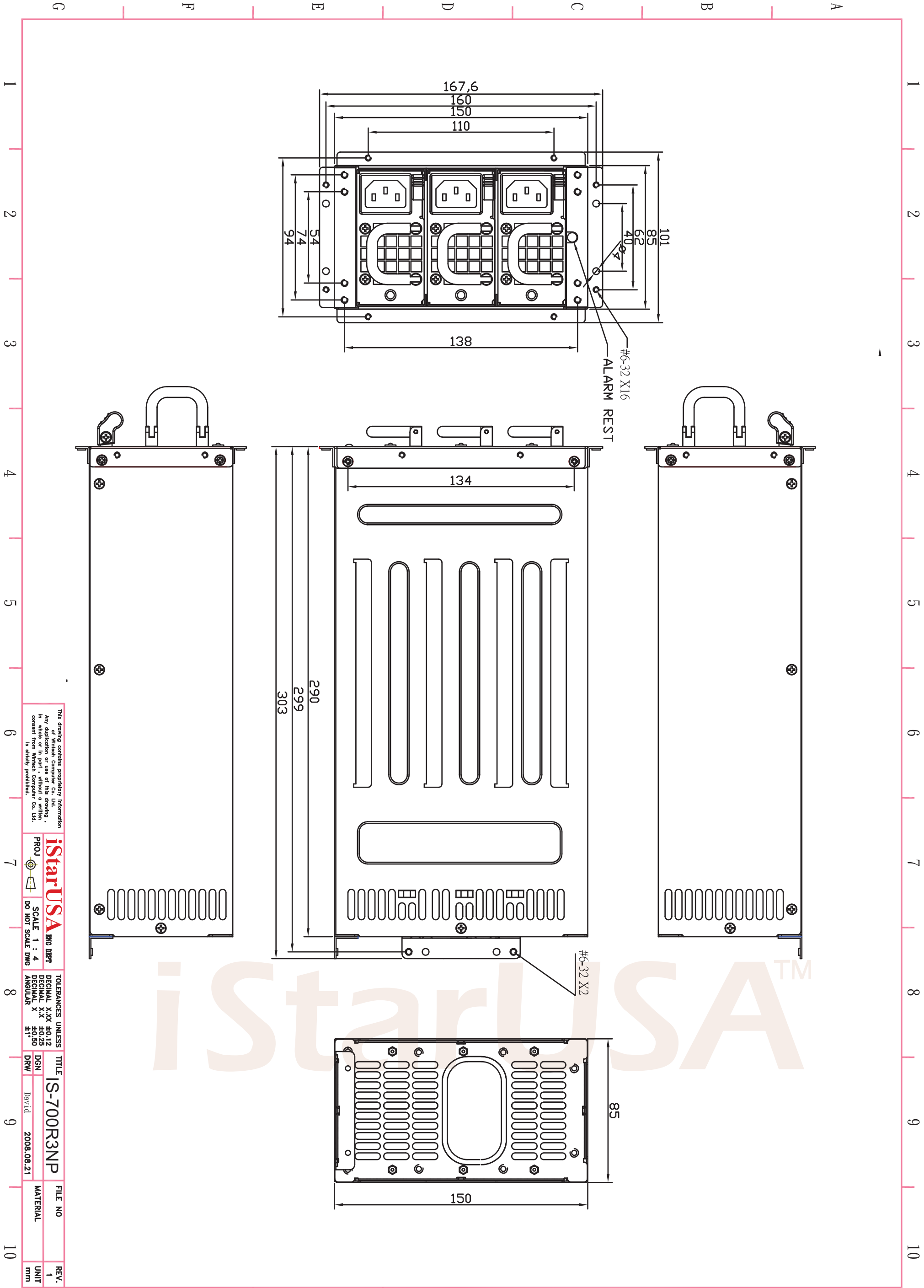


Figure 1 : Output Voltage Timing

Table 5 – Turn On/Off Timing



1. General

This is the specification of Model IS-700R3NP; it is intended to describe the functions and performance of the subject power supply. This 700 watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 12-6A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	12A
Voltage (230V)	180Vac	200-240Vac	264 Vac	6A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class “D” standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=N (550W+550W=550W) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply’s exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

Technical information in this specification is subject to change without notice.
The revision of specification will be marked on the cover.

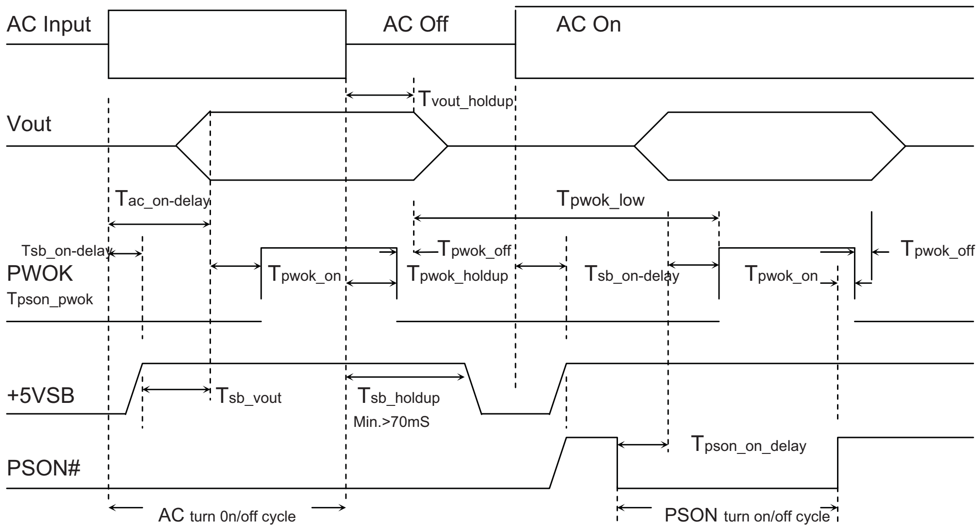


Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	**Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.**
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.
The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	30A	24A	41A	0.5A	1A	2A
Min. Load	2A	1A	2A	0A	0A	0.1A
Max. Combined	180W					
Total Output	525W			2.5W	12W	10W

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 550 W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
Tvout_rise	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
Tvout_on	All main output must be within regulation of each other within this time.		50	mS
Tvout_off	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

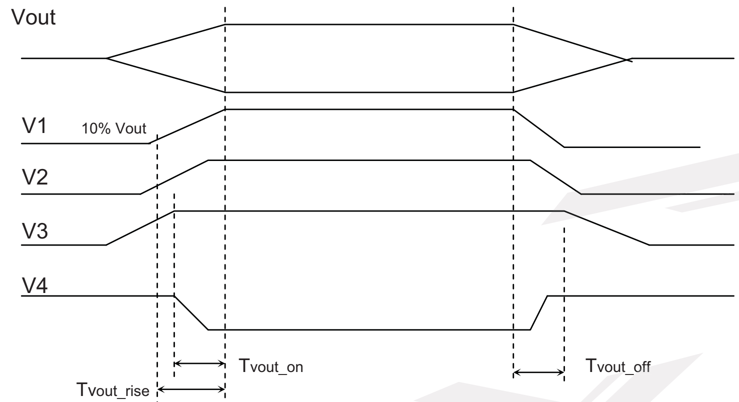
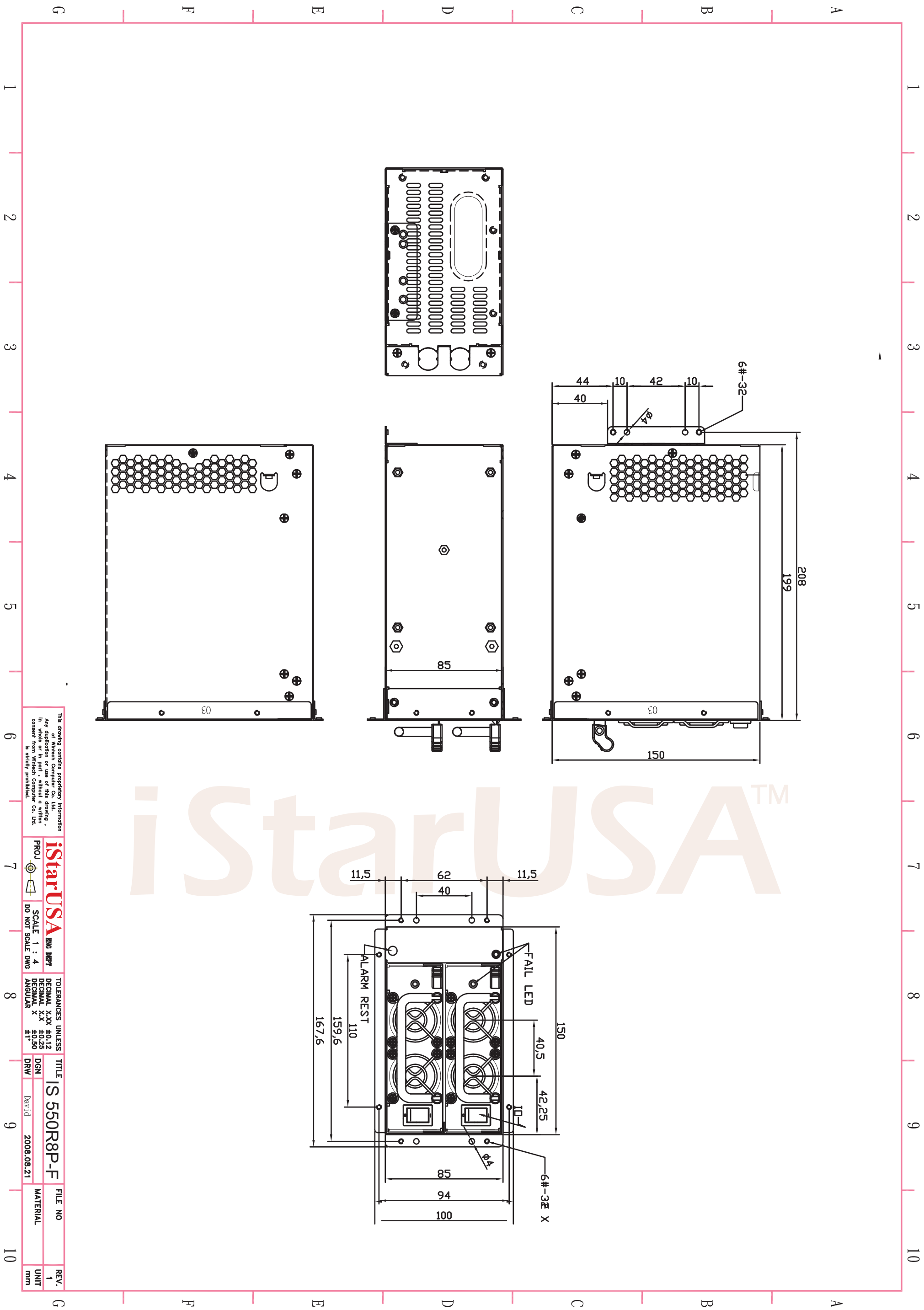


Figure 1 : Output Voltage Timing

Table 5 – Turn On/Off Timing



1. General

This is the specification of Model IS-550R8P-F; it is intended to describe the functions and performance of the subject power supply. This 550 watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 10-5A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	10A
Voltage (230V)	180Vac	200-240Vac	264 Vac	5A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class “D” standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=N (550W+550W=550W) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply’s exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

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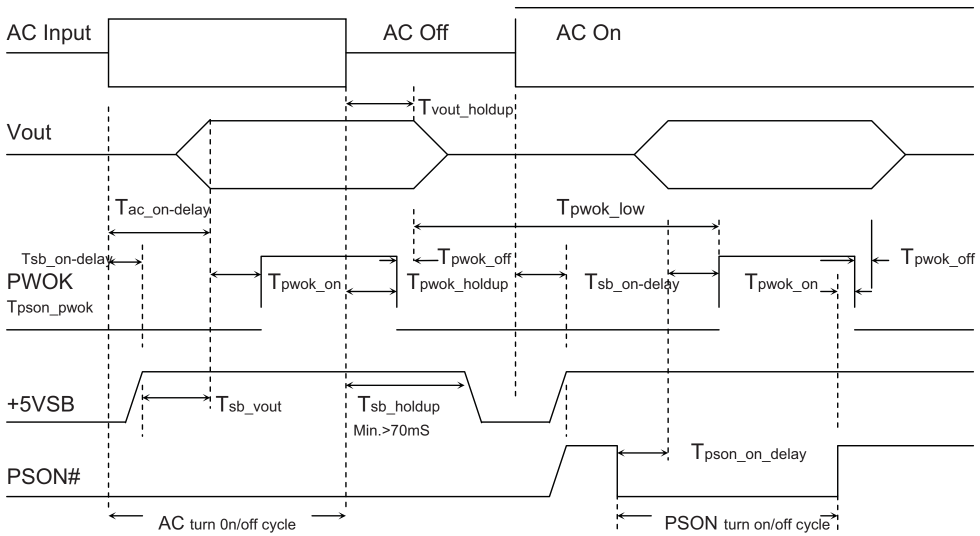

Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	**Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.**
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

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3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	30A	24A	41A	0.5A	1A	2A
Min. Load	2A	1A	2A	0A	0A	0.1A
Max. Combined	180W					
Total Output	525W			2.5W	12W	10W

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 550 W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
Tvout_rise	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
Tvout_on	All main output must be within regulation of each other within this time.		50	mS
Tvout_off	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

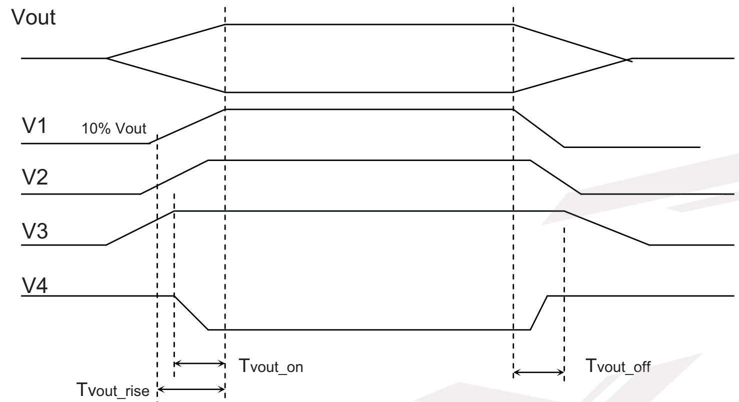
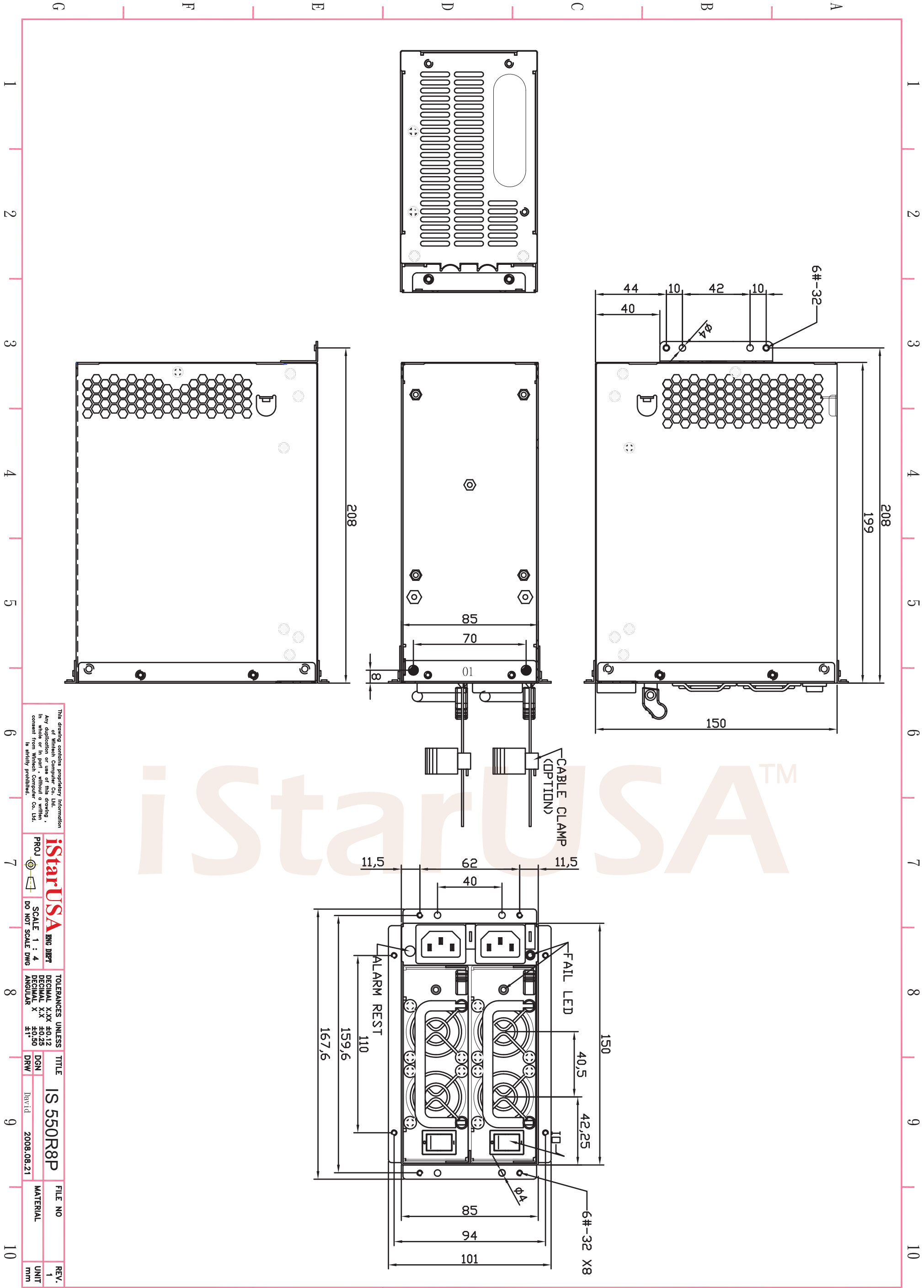


Figure 1 : Output Voltage Timing

Table 5 – Turn On/Off Timing



1. General

This is the specification of Model IS-550R8P; it is intended to describe the functions and performance of the subject power supply. This 550 watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 10-5A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	10A
Voltage (230V)	180Vac	200-240Vac	264 Vac	5A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class "D" standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=N (485W+485W=485W) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply’s exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

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The revision of specification will be marked on the cover.

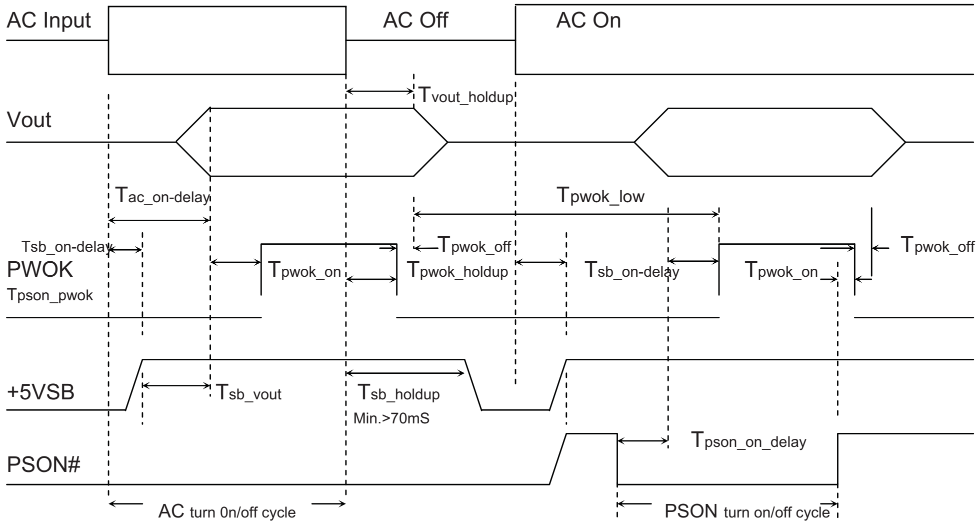

Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	**Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.**
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

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3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	30A	24A	36A	0.5A	1A	2A
Min. Load	2A	1A	2A	0A	0A	0.1A
Max. Combined	**180W**					
Total Output	**460W**			**2.5W**	**12W**	**10W**

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 485 W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
Tvout_rise	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
Tvout_on	All main output must be within regulation of each other within this time.		50	mS
Tvout_off	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

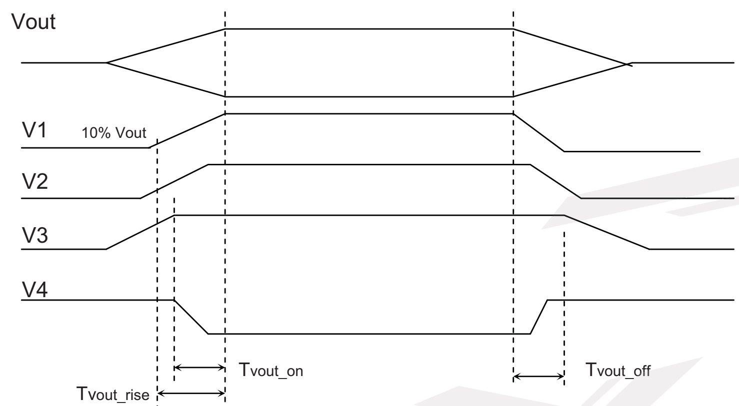
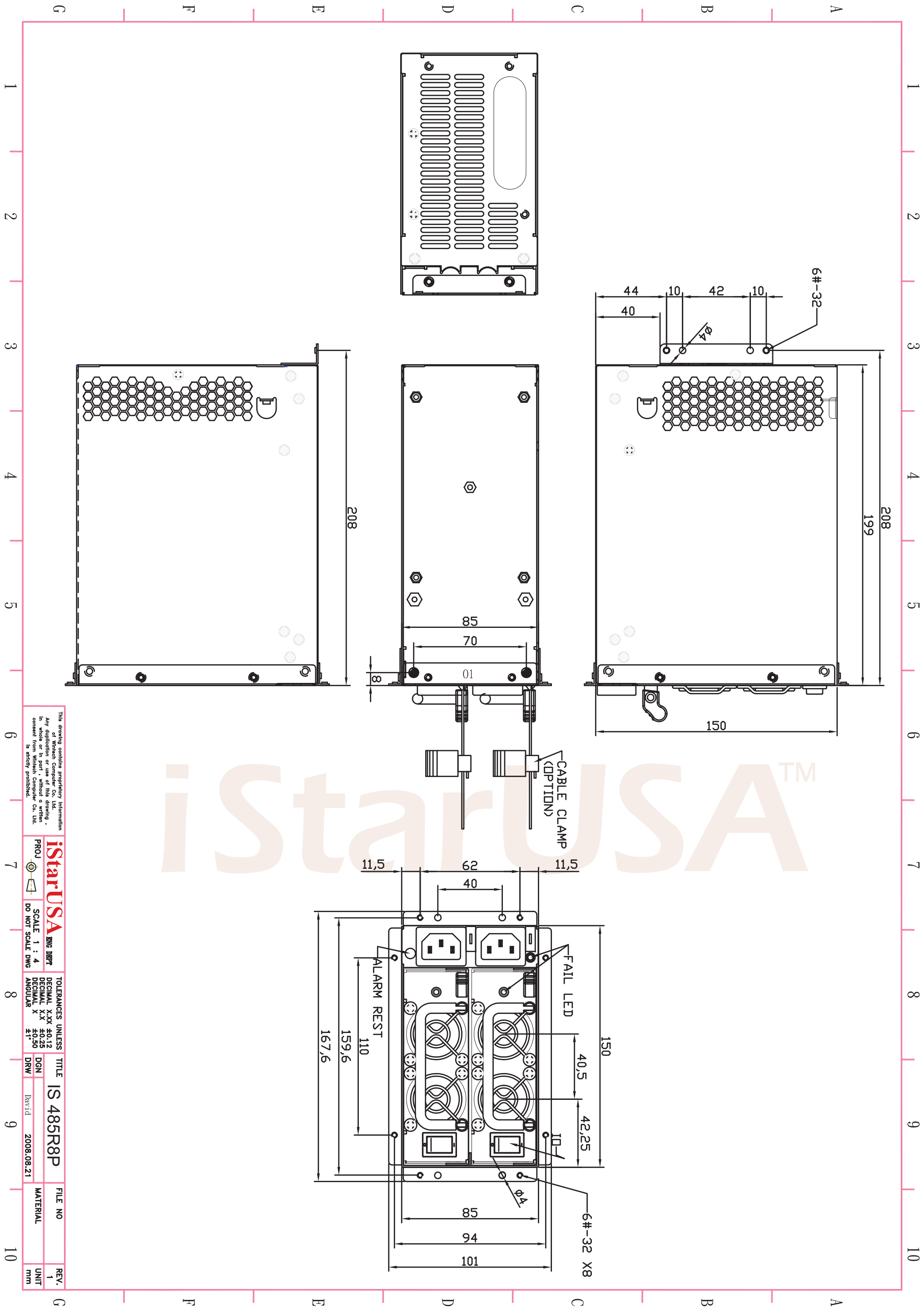


Figure 1 : Output Voltage Timing

Table 5 – Turn On/Off Timing



1. General

This is the specification of Model IS-385R8P; it is intendedto describe the functions and performance of the subject power supply. This 485 watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 8-4A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	8A
Voltage (230V)	180Vac	200-240Vac	264 Vac	4A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class “D” standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

6. Agency Requirements

6.1 Safety Certification.

Product Safety:	UL 60950-1 2000Edition, IEC60950-1, 3rd Edition EU Low Voltage Directive (73/23/EEC) (CB) TÜV
RFI Emission:	FCC Part15 (Radiated & Conducted Emissions) CISPR 22,3rd Edition / EN55022: 1998 + A1: 2000)
PFC Harmonic:	EN61000-3-2:2000
Flicker:	EN61000-3-3: 1995 + A1: 2002
Immunity against: **-Electrostatic discharge:** **-Radiated field strength:** **-Fast transients:** **-Surge voltage:** **-RF Conducted** **-Voltage Dips and Interruptions**	EN55024: 1998 + A1: 2001 and A2: 2003 -IEC 61000-4-2 -IEC 61000-4-3 -IEC 61000-4-4 -IEC 61000-4-5 -IEC 61000-4-6 -IEC 61000-4-11

Table 8 –Safety Certification

6.2 AC Input Leakage Current

Input leakage current from line to ground will be less than 3.5mA rms. Measurement will be made at 240 VAC and 60Hz.

7. Redundant Power Supply Function

7.1 Redundancy

The redundant power supply is N+1=N (385W+385W=385W) function power supply, each one module is redundancy when any one module was failed. To be redundant each item must be in the Hot swap power supply module.

7.2 Hot Swap Requirements

The redundant power supply modules shall be hot swappable. Hot swapping a power supply is the process of inserting and extracting a power supply from an operating. During this process the output voltage shall remain within the limits specified in Table 7 with the capacitive load specified Table 9. The Sub-system shall not exceed the maximum inrush current as specified in section 2.2. The power supply can be hot swapped by the following methods:

- AC connecting separately to each module. Up to two power supplies may be on a single AC power source.
  Extraction: The AC power will be disconnected from the power supply first and then the power supply is extracted from the sub-system. This could occur in standby mode or powered on mode. Insertion: The module is inserted into the cage and then AC power will be connected to the power supply module.

- For power modules with AC docking at the same time as DC. Extraction: The module is extracted from the cage and both AC and DC disconnect at the same Time. This could occur in standby or power on mode. No damage or arcing shall occur to the DC or AC contacts which could cause damage. Insertion: The AC and DC connect at the same time as the module is inserted into the cage. No damage to the connector contacts shall occur. The module may power on or come up into standby mode.

Many variations of the above are possible. Supplies need to be compatible with these different variations depending upon the sub-system construction. In general, a failed (off by internal latch or external control) supply may be removed, then replaced with a good power supply(must use the same model) , however, hot swap needs to work with operational as well as failed power supplies. The newly inserted power supply may get turned on by inserting the supply into the system or by system management recognizing an inserted supply and explicitly turning it on.

7.3 LED Indicators

There shell be a single bi-color LED. The GREEN LED shall turn ON to indicate that all the power outputs are available. The Red LED shall turn ON to indicate that the power supply has failed, shutdown due to over current, or shutdown due to component failure.The LED(s) shall be visible on the power supply’s exterior face. The LED location shall meet ESD requirements. LED shall be securely mounted in such a way that incidental pressure on the LED shall not cause it to become displaced.

8. Reliability

8.1 Mean Time Between Failures (MTBF)

The MTBF of the power supply shall be calculated utilizing the Part-Stress Analysis method of MIL217F or Bell core RPP. The calculated MTBF of the power supply shall be greater than 100,000 hours under the following conditions:

Full rated load
120V AC input
Ground Benign
25°C

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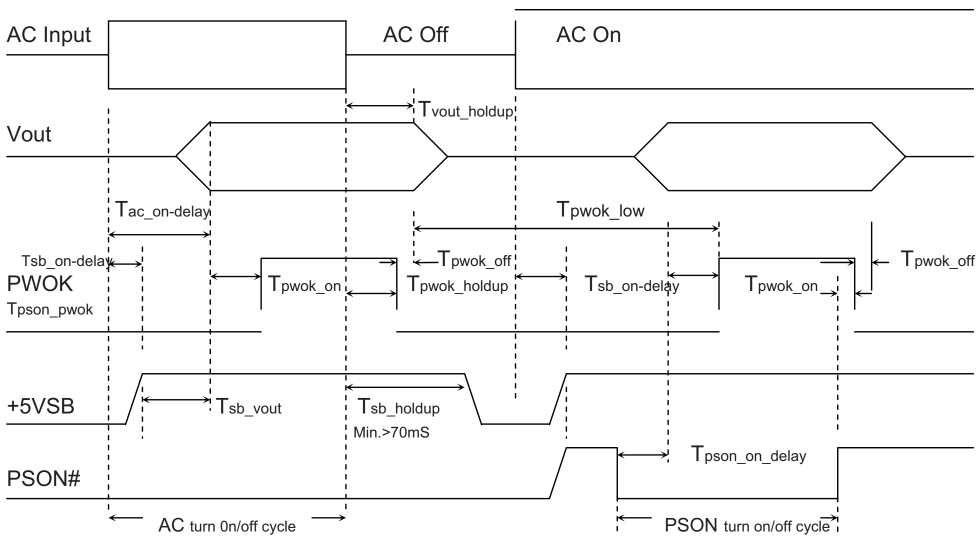

Figure 2 : Turn On/Off Timing

3.4 Remote On/Off Control : PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +5V, +3.3V, +12V,-5V and –12V power rails. When this signal is not pulled low by the system, or left open, the outputs (except the +5VSB and V bias) turn off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply.

Signal Type	Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.
PSON# = Low	Power ON
PSON# = High	Power OFF

Table 6 – PWOK Signal Characteristic

3.5 Efficiency

The efficiency is ≧ 74% at full loading condition to help reduce system power consumption at typical system loading conditions.

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3.6 +5VSB (Standby)

The +5VSB output is always on (+5V Standby) when AC power is applied and power switch is turned on.

The +5VSB line is capable of delivering at a maximum of 2A for PC board circuit to operate.

4. Protection

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, either a AC cycle OFF for 15 sec, or PSON# cycle HIGH for 1 sec must be able to restart the power supply.

4.1 Over Power Protection

The OPP function shall work at 130%~270% of rating of output power, then all outputs shut down in a latch off mode. The latch shall be cleared by toggling the PSON# signal or by cycling the AC power. The power supply shall not be damaged from repeated power cycling in this condition. If only one module works inside the power supply, the OPP is at 110%~170% of rating of power supply.

4.2 Over Voltage Protection

Each hot swap module has respective OVP circuit. Once any power supply module shut down in a latch off mode while the output voltage exceeds the over voltage limit shown in Table 7, the other modules should deliver the sufficient power to the device continually.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	+5.7V	+6.5V	Latch Off
+3.3V	+3.9V	+4.5V	Latch Off
+12V	+13.3V	+14.5V	Latch Off
5VSB	+5.7V	+6.5V	Auto recovery

Table 7 –Over Voltage protection

4.3 Over Current Protection

The power supply should contain the OCP function on each hot swap module. The power supply should be shut down in a latch off mode while the respective output current exceeds the limit as shown in Table 8. When the latch has been cleared by toggling the PSON# single or cycling the AC input power. The power supply module should not be damaged in this condition.

Voltage	Minimum	Maximum	Shutdown Mode
+5V	110%	160%	Latch Off
+3.3V	110%	160%	Latch Off
+12V	110%	160%	Latch Off

Table 8 –Over Current protection

4.4 Short Circuit Protection

The power supply shall shut down in a latch off mode when the output voltage is short circuit.

5. Environmental Requirements

5.1 Temperature

Operating Temperature Range:	0°C ~ 50°C (32°F~ 104°F)
Non-Operating Temperature Range:	-40°C ~ 70°C (-40°F~ 158°F)

5.2 Humidity

Operating Humidity Range:	20% ~ 90%RH non-condensing
Non-Operating Humidity Range:	5% ~ 95%RH non-condensing

3. DC Output Specification

3.1 Output Current / Loading

The following table defines power and current rating. The power supply shall meet both static and dynamic voltage regulation requirements for minimum load condition.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Max. Load	24A	24A	30A	0.5A	1A	2A
Min. Load	2A	1A	2A	0A	0A	0.1A
Max. Combined	150W					
Total Output	360W			2.5W	12W	10W

Table 2– Output Loads Range 1:

Note 1: Maximum continuous total DC output power should not exceed 385 W.

3.2 DC Voltage Regulation, Ripple and Noise

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal. The +5V,+3.3V, +12V, -5V,-12V and +5VSB outputs are measure at the power supply connectors references to ReturnS. The +5V and +3.3V is measured at its remote sense signal (+5VS, +3.3VS) located at the signal connector.

Output Voltage	+5V	+3.3V	+12V	-5V	-12V	+5VSB
Load Reg.	+/-5%	+/-5%	+/-5%	+/-10%	+/-5%	+/-5%
Line Reg.	±1%	±1%	±1%	±1%	±1%	±1%
Ripple & Noise	50mV	50mV	120mV	100mV	120mV	50mV

Table 3 – Regulation, ripple and noise

Ripple and Noise shall be measured using the following methods:

a) Measurements made differentially to eliminate common-mode noise
b) Ground lead length of oscilloscope probe shall be 0.25 inch.
c) Measurements made where the cable connectors attach to the load.
d) Outputs bypassed at the point of measurement with a parallel combination of 10uF tantalum capacitor in parallel with a 0.1uF ceramic capacitors.
e) Oscilloscope bandwidth of 0 Hz to 20MHz.
f) Measurements measured at locations where remote sense wires are connected.
g) Regulation tolerance shall include temperature change, warm up drift and dynamic load

3.3 Timing Requirements

These are the timing requirements for the power assembly operation. The output voltages must rise from 10% to within regulation limits (T_{vout_rise}) within 5 to 70mS. The +5V, +3.3V and +12V output voltages should start to rise at about the same time. All outputs must rise monotonically. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50 mS (T_{vout_on}) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400 mS (T_{vout_off}) of each other during turn off. Figure 1 and figure 2 show the turn On and turn Off timing requirement. In Figure 2, the timing is shown with both AC and PSON# controlling the On/Off of the power supply.

Item	Description	MIN	MAX	Units
Tsb_on-delay	Delay from AC being applied to +5VSB being within regulation.		1500	mS
Tac_on-delay	Delay from AC being applied to all output voltages being within regulation.		2500	mS
Tvout_holdup	All main output voltage stay within regulation after loss of AC	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK.	17		mS
Tpson_on_delay	Delay from PSON# active to output voltage within regulation limits.	5	400	mS
Tpson_pwok	Delay from PSON# deactive to PWOK being deasserted.		50	mS
Tpwok_on	Delay from output voltage within regulation limits to PWOK asserted at turn on.	100	500	mS
Tpwok_off	Delay from PWOK deasserted to output voltages (+5V, +3.3V, +12V) dropping out of regulation limits.	1		mS
Tpwok_low	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON# signal. .	100		mS
Tsb_vout	Delay from +5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	mS
Item	**Description**	**MIN**	**MAX**	**Units**
Tvout_rise	Output voltage rise time from each main output.(+5Vsb < 70mS)	5	70	mS
Tvout_on	All main output must be within regulation of each other within this time.		50	mS
Tvout_off	All main output must leave regulation within this time		400	mS

Table 4 – Output Voltage Timing

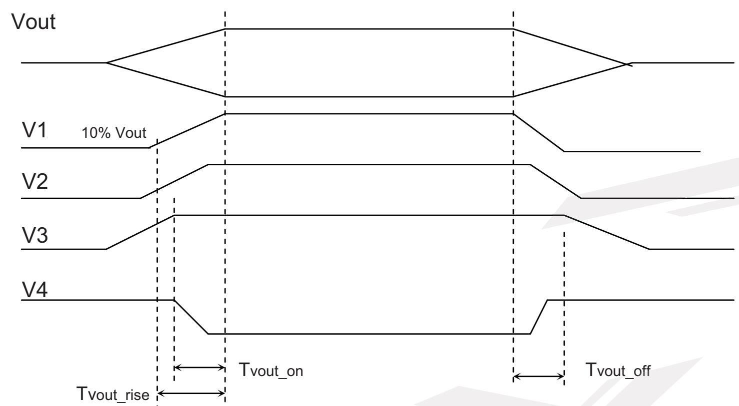
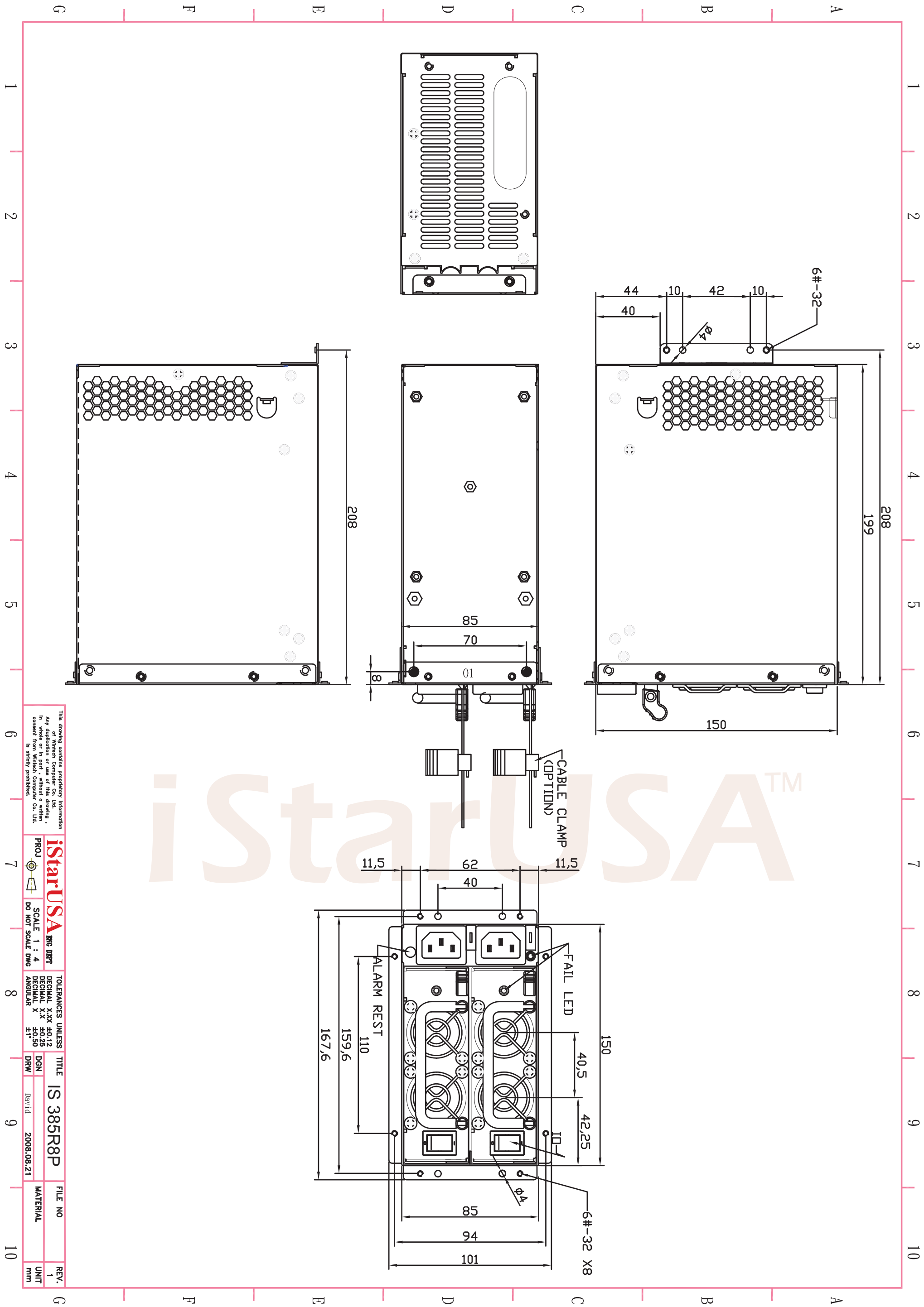


Figure 1 : Output Voltage Timing

Table 5 – Turn On/Off Timing



1. General

This is the specification of Model IS-385R8P; it is intendedto describe the functions and performance of the subject power supply. This 385 watts Redundant Power Supply with Active PFC (Power Factor Correction) capability, meets EN61000-3-2 and equips Full Range Input features.

2. AC Input Specifications

2.1 AC Input Voltage, Frequency and Current (Rating: 100V-240Vac, 47-63Hz, 8-4A)

The power supply must operate within all specified limits over the input voltage range in Table 1. Harmonics distortion of up to 10% THD must not cause the power supply to go out of specified limits.

Parameter	Minimum	Norminal	Maximum	Max. Current
Voltage (115V)	90 Vac	100-120Vac	132 Vac	8A
Voltage (230V)	180Vac	200-240Vac	264 Vac	4A
Frequency	47 Hz	50 / 60 Hz	63 Hz	

Table 1 – AC Input Voltage and Frequency

2.2 AC Inrush Current

The power supply must meets inrush requirements of any rated AC voltage, during turn on at any phase of voltage, during a single cycle AC dropout condition, during repetitive On/Off cycling of AC, and over the specified temperature range. The peak inrush current shall be less than the rating of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

2.3 Input Power Factor Correction (Active PFC)

The power factor at full load shall be ≥ 0.95 at nominal input voltage.

2.4 Input Current Harmonics

When the power supply is operated in 90-264Vac of Sec. 2.1, the input harmonic current drawn on the power line shall not exceed the limits set by EN61000-3-2 class “D” standards. The power supply shall incorporate universal power input with active power factor correction.

2.5 AC Line Dropout

An AC line dropout of 17mS or less shall not cause any tripping of control signals or protection circuits. If the AC dropout lasts longer than 17mS the power supply should recover and meet all turn on requirements. The power supply shall meet the regulation requirement over all rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply. An AC line dropout is defined as a drop in AC line to 0VAC at any phase of the AC line for any length of time.

Product Overview

Mini Redundant Series

Model Number	PFC	Power Output	+3.3V	+5V	+12V	-12V	-5V	+5Vsb	Dimension (W x H x D)
IS-385R8P	Active	385W	24A	24A	30A	1A	0.5A	2A	150 x 85 x 199 mm
			Max Load 150W						
IS-485R8P	Active	485W	24A	30A	36A	1A	0.5A	2A	150 x 85 x 199 mm
			Max Load 180W						
IS-550R8P	Active	550W	24A	30A	41A	1A	0.5A	2A	150 x 85 x 199 mm
			Max Load 180W						
IS-550R8P-F	Active	550W	24A	30A	41A	1A	0.5A	2A	150 x 85 x 199 mm
			Max Load 180W						
IS-700R3NP	Active	700W	32A	40A	56A	0.8A	0.5A	2A	150 x 85 x 290 mm
			Max Load 220W						
IS-800R3NP	Active	800W	32A	40A	65A	0.8A	0.5A	2A	150 x 85 x 290 mm
			Max Load 220W						

1U Redundant Series

Model Number	PFC	Power Output	+3.3V	+5V	+12V	-12V	-5V	+5Vsb	Dimension (W x H x D)
IS-400RH1UP	Active	400W	20A	25A	28A	1A	0.5A	2A	169 x 41.5 x 300 mm
			Max Load 180W						
IS-460RH	Active	460W	22A	35A	32A	1A	0.5A	2A	254 x 41.5 x 232.8 mm
			Max Load 220W						
IS-550RH	Active	550W	24A	30A	41A	1A	0.5A	2A	254 x 41.5 x 232.8 mm
			Max Load 180W						
IS-1500R4H1UP	Active	1500W	60A	60A	122A	0.8A	0.5A	3A	422 x 43 x 340 mm
			Max Load 440W						
IS-1800R4H1UP	Active	1800W	60A	60A	140A	0.8A	0.5A	3A	422 x 43 x 340 mm
			Max Load 440W						
IS-2000R4H1UP	Active	2000W	60A	60A	158A	0.8A	0.5A	3A	422 x 43 x 340 mm
			Max Load 440W						

2U Redundant Series

Model Number	PFC	Power Output	+3.3V	+5V	+12V	-12V	-5V	+5Vsb	Dimension (W x H x D)
IS-350R2UP	Active	350W	20A	25A	24A	1A	0.5A	2A	101 x 84 x 290 mm
			Max Load 180W						
IS-400R2UP	Active	400W	20A	25A	28A	1A	0.5A	2A	101 x 84 x 290 mm
			Max Load 180W						
IS-460R2UP	Active	460W	20A	25A	35A	1A	0.5A	2A	101 x 84 x 290 mm
			Max Load 180W						
IS-500S2UP	Active	500W	24A	24A	40A	0.8A	0.5A	3A	101 x 84 x 290 mm
			Max Load 180W						
IS-600S2UP	Active	600W	24A	24A	48A	0.8A	0.5A	3A	101 x 84 x 290 mm
			Max Load 180W						
IS-700S2UP	Active	700W	24A	24A	56A	0.8A	0.5A	3A	101 x 84 x 290 mm
			Max Load 180W						

3U Redundant Series

Model Number	PFC	Power Output	+3.3V	+5V	+12V	-12V	-5V	+5Vsb	Dimension (W x H x D)
IS-700R3KP	Active	700W	32A	40A	56A	0.8A	0.5A	2A	127 x 84 x 290 mm
			Max Load 220W						
IS-800R3KP	Active	800W	32A	40A	65A	0.8A	0.5A	2A	127 x 84 x 290 mm
			Max Load 220W						

PS2 80 Plus Switching Series

Model Number	PFC	Power Output	+3.3V	+5V	+12V1	+12V2	+12V3	+12V4	-12V	+5Vsb	Dimension (W x H x D) mm
IS-680PD8	Active	680W	28A	30A	18A	18A	18A	18A	0.5A	4A	150.00 x 86.00 x 190.00
			Max Load 180W		Max Load 56A						
			Max Load 660W						6W	20W	
IS-780PD8	Active	780W	28A	30A	18A	18A	18A	18A	0.5A	4A	150.00 x 86.00 x 190.00
			Max Load 180W		Max Load 62A						
			Max Load 760W						6W	20W	
IS-880PD8	Active	880W	28A	30A	18A	18A	18A	18A	0.5A	4A	150.00 x 86.00 x 190.00
			Max Load 180W		Max Load 72A						
			Max Load 860W						6W	20W	

Model Number	PFC		+3.3V	+5V	+12V1	+12V2	+12V3	+12V4	+12V5	-12V	+5Vsb	Dimension (W x H x D) mm
IS-1000PD8	Active	1000W	28A	30A	18A	18A	18A	18A	18A	0.5A	4A	150.00 x 86.00 x 190.00
			Max Load 180W		Max Load 80A							
			Max Load 980W							6W	20W	

Raid Storage Series

Model Number	PFC	Power Output	+3.3V	+5V	+12V	Form Factor	Dimension (W x H x D)
IS-550R8P-RAID	Active	550W	0	30A	41A	PS2	150 x 85 x 199 mm

IS Series Power Supply

iStarUSA new generation of Redundant Power Supply- IS-Series, offers your server and workstation zero down time with full power redundancy. Active PFC, temperature control fan, hot swappable power modules and load sharing function provide ultimate precision power and safety protection for all electronic equipment.

Features

- **Active PFC; Universal input**
- **Power Failure Alarm & Signals**
- **Automatic Thermal control**
- **5 year standard warranty**
- **Hot swappable**
- **Industrial DIN-Connector for reliability**
- **Backward Compatibility/ -5V Avaialble**
- **OVP (Over Voltage Protection)**
- **UVP (Under Voltage Protection)**
- **OCP (Over Current Protection)**
- **OPP (OVer Power Protection)**
- **OTP (Over Temperature Protection)**
- **SCP (Short Circuit Protection)**
- **MTBF > 100,000 Hours**

Active PFC

Providing a better quality than the older generation power supplies, the IS Series performs with Active PFC (Power Factor Correction) to help controlling the input current of the load so that the current waveform is proportional to the mains voltage waveform (sine wave). PFC helps to save energy by reducing the volt-amperes your electric utility has to deliver in order to provide a gene power level demanded by the power supply.

Type	PF value	Cost
None PFC	50~65%	Cheap
Passive PFC	70~80%	Normal
Active PFC	90~99%	High

DC-DC PWM switching circuit for 3.3V & 5V rail output

iStarUSA adops a new conecpt for making a 12V DC rail for primary PWM switching output then using this 12V rail for step down DC-to-DC PWM switching for 3.3V and 5V. The DC-DC PWM circuit has high energy efficient with accuracy voltage andreliable current output during the output wattage and environment temperature change.

Enviromental Friendly

The IS Series is built with a temperature sensor for fan speed control, for the best speed needed when loading according the internal temperature, this will help to save energy and reduce the fan noise to make your office become a quieter and more productive environment. It is also RoHS Compliant to help reducing the heating temperature for a healthier working enviroment and it alsohelps to increase the reliability of the power supply.

Energy Efficiency / 80 Plus PSU

Power efficiency = Total output power / Total input power. The IS Series performs high power efficiency during the power transferring procedure from AC to DC. When having a higher power efficiency, it means that the PSU saves electricity, cost effective, and it would reduce the thermal loading of power supply and system. 80 PLUS power supplies also helps to decrease energy consumption, it also improves AC power line efficiecy and reduces peak current draw by roughly 50 % allowing more compuers to run at the same time.

Non-Energy Value Added Benefit

- **Increased System Reliability** – reduced heat output increases computer system reliability by up to 40%.OCP (Over Current Protection)
- **Decreased System Maintenance Costs** – Increased reliability reduces costly repairs, IT support and lost worker productivity.
- **Lower TCO for PC Networks** – Increased reliability of PCs, decreased maintenance and lengthened equipment life combine with energy savings to significantly reduce the total cost of ownership (TCO) of PC networks.
- **Increased Comfort** – Reduced heat output minimizes the need for noisy PC fans, making for a quieter and more productive office environment.

iStarUSA established in 1989, iStarUSA Computer Inc. has over fifteen years of experience in designing and manufacturing Industrial Switching Power Supply, Rackmount Chassis and Server Cabinet. From the standard switching power supply to high-end redundant power supply, iStarUSA has grown to be one of major provider in IPC power supply industry. In recent years, we have also expanded our products to include 1U to 8U rackmount chassis and 6U to 42U server cabinets. Our goal is always to provide our customer with the best products and superior customer services. In the beginning, iStarUSA focused on providing our customers the combinations of cutting-edge technologies, high quality manufacturing, and superior customer services. It has been a proving record that these principles earned a strong partnership for iStarUSA in today's competitive market.

iStarUSA builds its strength upon its experience, technology, and strong partnership. We have been working closely with major computer components manufactures and system integrators for years to ensure that our products have high compatibility and solid stability. We also adopt new industrial standards to improve our design. Our ability to design according to customer's requirement also wins us a high reputation in the industry.

Our experienced design and project engineers complete an OEM project within the deadline and meet the product requirements. We believe that being a leader of innovative technology means able to integrate it into our products which is the key to be successful for us as well as for our customers. iStarUSA has a global ISO 9001 certification which means a consistency of delivering products that meets customer requirement and continue improvement for our product and services. We are proudly to provide cost effective solutions, responsive services and the best delivery time for our customers.

Our Core Value

Innovation

We provide not only the technology to our customer, but also develop our products to accompany modern life.

Customization

Our design is tailored specifically to fit our customer needs. We help our customer to build their branded enterprise.

Satisfaction

The goal of our products and services is to help our customer succeed in today's ever changing market.

Quality

iStarUSA uses high quality parts and materials for great reliability that meets the global standard.

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iStarUSA™

Product Drawing Guide Book

Power Division

IS Series:

- Mini Redundant
- 1U/2U/3U Redundant
- PS2 80 Plus Switching
- RAID Storage