MODEL NO. ENR0540&0550&0560 SERIES (ACTIVE PFC)

This specification defines the performance characteristics of a single-phase (3-wire)400W,500W 600W watt power supply with wide range input AC capability (100-240VAC/50-60Hz) under operation temperature 50 degree C. The power supply shall be designed for parallel operation. In the event of a power supply failure, the redundant power supply continues to power the system. The number of power supplies per system will be limited to a maximum of two. The power supply shall be designed for "hot swap" exchange and contain the OR-ing isolation MOSFETs for all outputs and shall communicate to external devices through Inter-Integrated (I2C) Circuit protocol. The power supply will have an EEPROM for storing powers supply FRU information.

☞1. Input Requirement

1.1 AC input requirements

The Power supply must be having a universal power input with active power correction to reduce the line harmonics in accordance with the EN61000-3-2 standard.

The power supply must be capable of operating with the following Conditions

Parameter	Min	Nom.		Max	Unit
Vin	90	**100**	**240**	264	VACrms
Vin Frequency	47	**50**	**60**	63	Hz
Iin		**8**	**4**		A

1.2 Power Factor

Power factor correction (PF)>0.9 at full load.

1.3 Inrush current regulation

When input power is applied to the power supply any initial current surge or spike of 10ms or less will not exceed 25A peak. Any additional inrush current surges or spikes in the form of AC cycles or multiple AC cycles than 10ms, greater and less than 150ms, must not exceed 15A peak. After 150ms the AC input current must meet the requirements in Section

1.3.2 It is acceptable that AC line inrush current may reach up to 60A peak within 1 ms caused by capacitors of EMI filter.

1.3.3 Hot Inrush Current

Not applicable

Note: For any conditions during turn-on the inrush current will not open the primary input fuse or damage any other components.

1.4 Efficiency

The Power supply efficiency typical 85% at 230VAC/50Hz and full load without Fan.

☞2. Output Requirements

2.1Output regulation Requirements

All outputs must maintain their regulation with the below limits when measured at the output connector point or across the remote sense(if applicable) in any load condition defined in Section 2.1

Parameter	Range	Min	Nom.	Max	Unit
+3.3V	+/-5%	+3.14	+3.3	+3.47	Volts
+5V	+/-5%	+4.75	+5	+5.25	Volts
+12V	+/-5%	+11.4	+12	+12.6	Volts
-12V	+/-10%	-10.8	-12	-13.2	Volts
+5VSB	+/-5%	+4.75	+5	+5.25	Volts

Note:1>Voltage tolerance is requied at main connector and S-ATA connector(if used)

2>Output transient response tested DC voltage regulation range +5V,+12V,+3.3V,+5Vsb±5%,-12V±10%.

2.2 Output Current Requirements

All outputs must maintain their regulation as per Section 2.2 when loaded to the following loading combination:

(400W)

Parameter	Min	Nom.	Max	Peak	Unit
+3.3V	0.5	-	**20**		Amps
+5V	0.5	-	**20**		Amps
+12V1	1	-	**33**		Amps
+12V2	1	-	**33**		Amps
-12V	0.0		**0.3**		Amps
+5VSB	0.0	-	**3.0**		Amps

Notes:(1) The maximum continuous average DC output power shall not exceed 400W.

(2) Maximum continuous combined load on +3.3VDC and +5VDC outputs shall not exceed 105W.

(3) The maximum continuous load on +12V outputs shall not exceed 33A(400W).

(4) The maximum peak total DC output power shall not exceed 420W .

(5) The maximum peak total DC output power not to exceed 12 seconds in duration .

(6) The +5V standby output shall remain on with the AC input power connected, whether the powersupply DC outputs are disabled (Off) or enabled (On) by the remote on control signal.

500W

Parameter	Min	Nom.	Max	Peak	Unit
+3.3V	0	-	**20**		Amps
+5V	0	-	**20**		Amps
+12V1	0.5	-	**40**		Amps
+12V2	0.5	-	**40**		Amps
-12V	0		**0.3**		Amps
+5VSB	0	-	**3.0**		Amps

Notes:(1) The maximum continuous average DC output power shall not exceed 500W.

(2) Maximum continuous combined load on +3.3VDC and +5VDC outputs shall not exceed 120W.

(3) The maximum continuous load on +12V outputs shall not exceed 40A(500W).

(4) The +5V standby output shall remain on with the AC input power connected, whether the powersupply DC outputs are disabled (Off) or enabled (On) by the remote on control signal.

600W

Parameter	Min	Nom.	Max	Peak	Unit
+3.3V	0	-	**20**		Amps
+5V	0	-	**20**		Amps
+12V1	0.5	-	**50**		Amps
+12V2	0.5	-	**50**		Amps
-12V	0		**0.3**		Amps
+5VSB	0	-	**3.0**		Amps

Notes:(1) The maximum continuous average DC output power shall not exceed 600W.

(2) Maximum continuous combined load on +3.3VDC and +5VDC outputs shall not exceed 120W.

(3) The maximum continuous load on +12V outputs shall not exceed 50A(600W).

(4) The +5V standby output shall remain on with the AC input power connected, whether the powersupply DC outputs are disabled (Off) or enabled (On) by the remote on control signal.

2.3 Output Dynamic Loading

The output voltages shall remain within the limits specified in 2.3 for the step loading and within the limits specified in 2.4 for the capacitive loading. The load transient repetition rate shall be tested between 50 Hz and 5 kHz at duty cycles ranging from 10%-90%. The load transient repetition rate is only a test specification. The △ step load may occur anywhere within the MIN load to the MAX load shown in 2.2

2.3 Transient Load Requirements

Output	△ Step Load Size	Load Slew Rate	Capacitive Load
+3.3V	30% of max load	1 A/μs	4700 μF
+5V	30% of max load	1 A/μs	1000 μF
+12V	40% of max load	1 A/μs	2200 μF
+5VSB	25% of max load	1 A/μs	330 μF

2.4 Capacitive Loading

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

2.4 Capacitve Loading Conditions

Output	MIN	MAX	Units
+3.3V	10	12000	μF
+5V	10	12000	μF
+12V	10	11000	μF
-12V	1	350	μF
+5VSB	1	350	μF

2.5 Output Ripple and Noise

The following output ripple/noise requirements will be met throughout the load ranges specified in Section 2.3 and under all input voltage conditions specified in Section 1.1. Ripple and noise are defined as periodic or random signals over the frequency band of 10Hz to 20MHz.

Parameter	Ripple&Noise	Unit
+3.3V	50	mVp-p
+5V	50	mVp-p
+12V	120	mVp-p
-12V	120	mVp-p
+5VSB	50	mVp-p

Measurements will be made with an oscilloscope set to 20MHz bandwidth limit. The ripple voltage of the outputs shall be measured at the pins of the output connector when terminated in the load impedance specified in figure1. Ripple and noise are measured at the connectors with a 0.1uF ceramic capacitor and a 10uF electrolytic capacitor to simulate system loading.

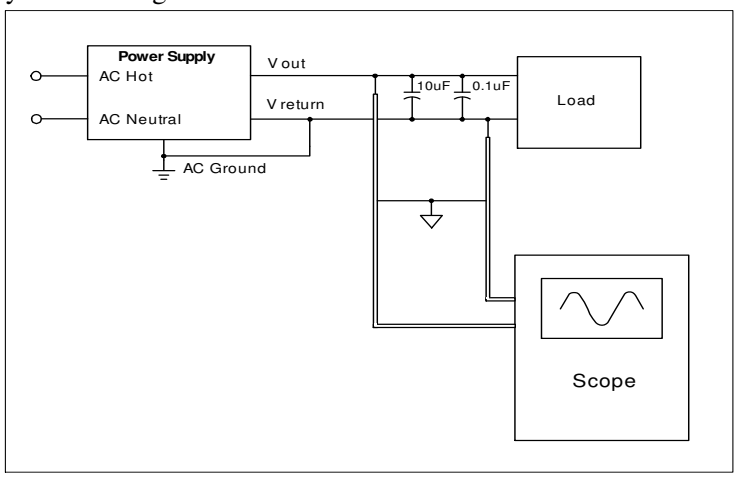


Figure 1. Ripple voltage test circuit

2.6 Overshoot at Turn-on / Turn-off

The output voltage overshoot upon the application or removal of the input voltage, or the assertion/de-assertion of PS_ON#, under the conditions specified in Section1.0, shall be less than 10% above the nominal voltage. No opposite polarity voltage of shall be present on any output during turn-on or turn-off.

☞3. Protection Circuits

3.1 Over-power protection

The power supply will be shutdown and latch off when output power at 105~150% of rated DC output.

3.2 Over current protection

In an over current fault occurs, the supply will latch all DC outputs into a shutdown state for +3.3V or +5V or +12V1,+12V2.

Parameter	Min.	Max.	Unit
+3.3V	23	60	A
+5V	23	60	A
+12V1	40	80	A
+12V2	40	80	A

3.3 Over voltage protection

In an over voltage fault occurs, the supply will latch all DC outputs into a shutdown state. The supply shall provide latch mode over voltage protection as defined right.

Parameter	Min.	Max.	Unit
+3.3V		5	V
+5V		7	V
+12V		16.5	V

3.4 Short circuit

The power supply shall shutdown and latch off for shorting +3.3V, +5V, -5V, +12V1,+12V2, -12V rails. The main output short circuit of any impedance shall less than 0.1 ohms.

The maximum short circuit current in any outputs shall not exceed 240VA.

NOTES: 5Vsb will be auto-recovery when the fault removed.

☞4. Controls and Signal

4.1 Timing Requirements

Figure 2 is a reference for signal timing for main power connector signals and rails.

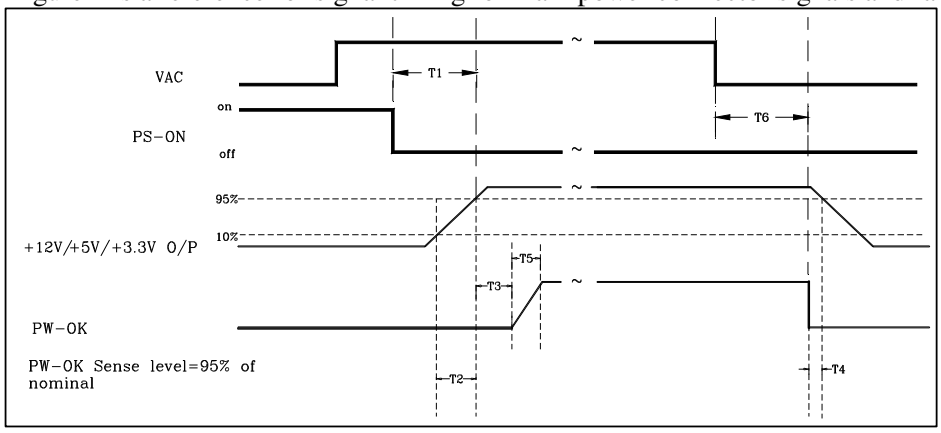


Figure 2. PS-OK Timing Sequence

(1)T1:Power on delay time (5~400ms)
(2)T2:Each main output voltage rise time (0.1ms~70ms)
(3)T3: PW- OK signal turn on delay time (100ms~500ms)
(4)T4: PW- OK signal turn off delay time (1ms min)
(5)T5: PW- OK rise time (10ms max)
(6)T6:Hold up delay time(17mS Min)

4.2 Remote on/off control

When the logic level "PS-ON" is low, the DC outputs are to be enabled.
When the logic level is high or open collector, the DC outputs are to be disabled.

4.3 LED Indicator

A green/red double color Light Emitting Diode (LED) shall be mounted as indicated in mechanical drawing and shall indicate the status of the DC GOOD signal with green color. The LED shall continue to glow under normal operation of the power supply. If this LED is blinking or not lit or in red color, the power supply is not operating properly.

4.4 I2C to meet Super Micro standard.

Power supply I2C operation shall not latch system I2C bus for over certain time period needed for normal operation.
Power supply I2C shall have auto reset function in case of waiting for clock pulse over a reasonable time period.

☞5. Redundancy Requirements

5.1 Current Sharing Operation

The power supply shall be designed for active current sharing.
Two power supplies will be paralleled in a system. Each power supply must be able to share load to within +/- 25% share error measured 25% and share load to within +/- 10% share error measured 50%, 100% of single power load supply full current.
5Vsb requires an “ORing” diode to provide protection against internal short circuit fault.

5.2 Output Isolation Oring MOSFET

The 12.2V output current must pass through an Oring MOSFET to protect the bus voltage against a power supply internal fault.

5.3 Power Supply Behavior When Faulted

1. The faulted supply shall not sink more than 100 mA current.
2. I2C bus status shall be operational and valid, refer to “I2C Bus/VPD Interface”.
3. The "DC Good" signal and "DC Good Fault" bit status shall be valid.
4. A power supply that fails due to a 12V or 5Vsb Over-Voltage condition will shutdown gracefully and will not cause shutdown of the other power supplies in parallel.

5.4 Parallel Stability

The power supply shall be unconditionally stable under all system load and AC line conditions while operating alone or in parallel mode.

5.5 Hot Swap

The power supply must be designed with "hot swap" function with or without active AC line cord. After Hot swap I2C address shall be same as host power supply backplane hardware assigned. Host existing working power supply shall not be affected by hot swapping power supply.

☞6.Environmental Requirements

6.1 Normal Operating Ambient(at sea level):

Temperature	**0 to 50 °C**
Relative Humidity	to 85%,on-condensing

6.2 Shipping and Storage

Temperature	-40 to 70°C
Relative Humidity	to 95%,non-condensing

6.3 Altitude

Operating	10,000FT max.
Storage	50,000FT max.

6.4 Mechanical Shock

The device will withstand the following imposed conditions without electrical or mechanical failure:

Non-operating Square Wave Shock: 40G, Square wave at 200in/sec (508cm/sec); on all six sides

Non-operating Half Sine Shock: Half Sine pulse for 70in/sec (178cm/sec) for 2ms; on all sides except top

Operating Half Sine Shock: Half Sine pulse for 40in/sec (102cm/sec) for 2ms; on all sides except top

6.5 Vibration

Operating: Sinusoidal vibration, 0.5G (0-peak) acceleration. 3-500Hz, sweep at 1/2 octave/min from low to high frequency, and then from high to low. Thirty minute dwell at all resonant points, where resonance is defined as those exciting frequencies at which the device under test experiences excursions two times larger than non-resonant excursions. Plane of vibration to be along three mutually perpendicular axis.

Non-operating: Sinusoidal vibration, 1.0G (0-peak) acceleration. 3-500Hz, sweep at 1/2 octave/min from low to high frequency, and then from high to low. Thirty minute dwell at all resonant points, where resonance is defined as those exciting frequencies at which the device under test experiences excursions two times larger than non-resonant excursions.

☞7. SAFETY

7.1 Underwriters Laboratory (UL) recognition.

The power supply designed to meet UL 60950

☞8. ELECTROMAGNETIC COMPATIBILITY (EMC)

8.1 ELECTROSTATIC DISCHARGE (ESD) - IEC 61000 – 4 - 2：2008

8.2 ELECTRICAL FAST TRANSIENT / BURST (EFT/B) – IEC 61000 – 4 - 4：2012

8.3 SURGE – IEC 61000 – 4 - 5：2005

8.4 POWER FREQUENCY MAGNETIC FIELD – IEC 61000 – 4 - 8：2009

8.5 VOLTAGE DIPS – IEC 61000 – 4 - 11：2004

8.6 RADIATED SUSCEPTIBILTY – IEC 61000 – 4 – 3 ：2006+A1：2007+A2：2010

8.7 CONDUCTED SUSCEPTIBILTY – IEC 61000 – 4 - 6：2008

8.8 VOLTAGE FLUCTATION - EN 61000 – 3 – 3 ：2008

8.9 EN61000-3-2：2006+A2：2009 harmonic current emissions.

If applicable to sales in Europe, the power supply shall meet the requirements of EN 61000-3-2 Class D and the Guidelines for the Suppression of Harmonics in Appliances and General Use Equipment Class D for harmonic line current content at full-rated power.

8.10 EN55022：2010/AC：2011 Class B Radio interference (CISPR 22).

8.11 ANSI C63.4-2009/FCC Part 15, Subpart B /ICE-003 lssue 5 class B 115VAC operation.

☞9. MTBF

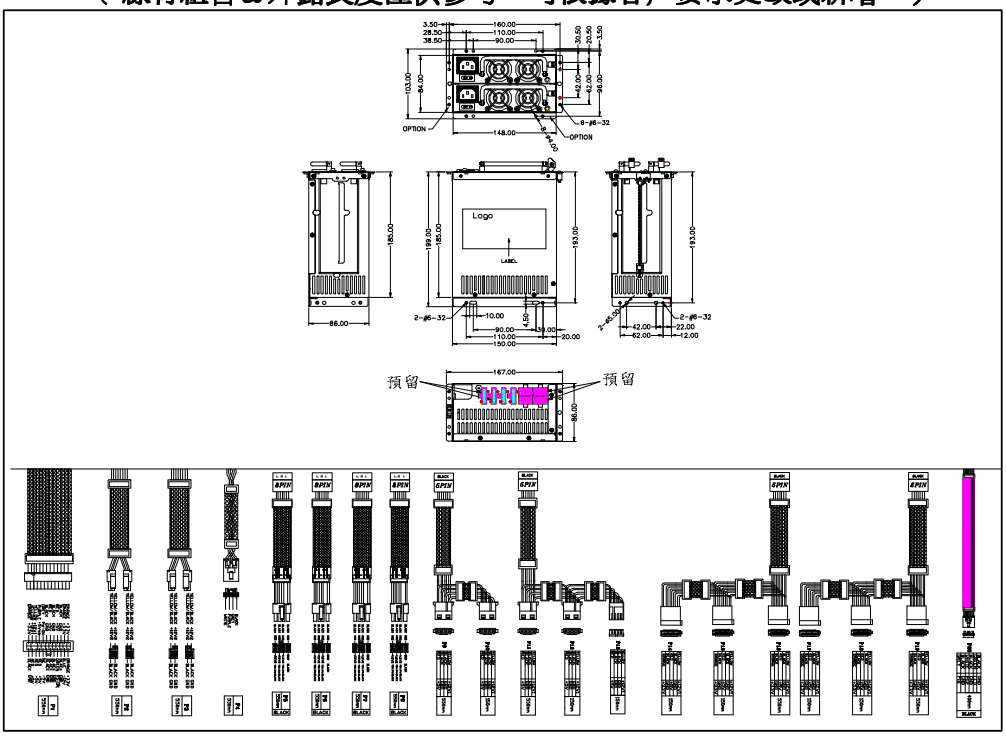
9.1 MTBF (mean time between failures) calculation

The demonstrated MTBF shall be 100,000 hours of continuous operation at 25°C, full load and 115V AC input. The MTBF of the power supply shall be calculated in accordance with MIL-HDBK-217F. The DC FAN is not included.

☞10. MECHANICAL REQUIREMENTS

10.1 Physical dimension ：L185mm*W150mm*H86mm

（ 線材組合＆外露長度僅供參考，可根據客戶要求更改或新增。）



P1 (Motherboard 20+4Pin) Power Connector

16AWG wire	Signal	Pin	Pin	Signal	16AWG wire
Orange	+3.3V	11	1	+3.3V	Orange
Orange(22AWG)	3.3V sense				
Blue(20AWG)	-12VDC	12	2	+3.3V	Orange
Black	COM	13	3	COM	
Black(22AWG)	COM sense				Black
Green(20AWG)	PS-ON	14	4	+5VDC	Red
Black	COM	15	5	COM	Black
Black	COM	16	6	+5VDC	Red
Black	COM	17	7	COM	Black
Black(22AWG)	COM sense				
White	NC	18	8	POK	Grey(20AWG)
Red	+5VDC		9	+5VSB	Purple
Red(22AWG)	+5V sense	19		+12V1DC	Yellow
Red	+5VDC	20	10	+12Vsense	Yellow(22AWG)
Red	+5VDC	B3	B1	+12V1DC	Yellow
Black	COM	B4	B2	+3.3VDC	Orange

P2,P3 (CPU 4+4Pin) Power Connector

16 AWG wire	Signal	Pin	Pin	Signal	16AWG wire
Black	GND	1	3	Yellow/Black	+12V2
Black	GND	2	4	Yellow/Black	+12V2

P5,P6,P7,P8 PCI(6+2)PIN (6+2PIN:Molex AP102XN8T1-204X-RS1 or equivalent)

16AWG wire	Signal	Pin	Pin	Signal	16AWG wire
Yellow/Black	+12V2	1	4	GND	Black
Yellow/Black	+12V2	2	5	GND	Black
Yellow/Black	+12V2	3	6	GND	Black
Black(18AWG)	GND	1	2	GND	Black(18AWG)

P9,P10,P11,P12 大4PIN(AMP 1-480424-0 or Molex 8981-04P or equivalent)

P13小4PIN(AMP 171822-4 or equivalent)

16 AWG wire	Signal	Pin	Pin	Signal	22AWG wire
Yellow	+12V	1	1	+12V	Yellow
Black	COM	2	2	COM	Black
Black	COM	3	3	COM	Black
Red	+5VDC	4	4	+5V	Red

P4 (4Pin) communicate to external Connector

24AWG wire	Signal	Pin
Gref	PF	1
Black	GND5	2
Purple	SCL	3
White	SDA	4

P14,P15,P16,P17,P78,P19 SATA Power Connector (Molex* 88751 or equivalent)(optional)

18AWG wire	Signal	Pin
Yellow	+3.3V	1
Black	COM	2
Red	+5V	3
Black	COM	4
Orange	+12V	5

P20 6PIN

18AWG wire	Signal	Pin
Grey	PG1	1
Black	COM	2
White	PG2	3
Black	COM	4
Green	LED+	5
Black	COM	6

10.2 Outside Mechanical Drawing

☞11. FAN SPEED CONTROL (optional)

Fan voltage varies with the ambient temperature or output power.

Fan speed control with PWM