AEA800S
Power Supply Product Specification

An APM Electronics USA, Inc.Power Supply Specification For 1U Power Supply

SPECIFICATION

Model Name: AEA800S

Rev:	Description	Author / Editor	Date
0.1	Initial Engineering Specification	Rain Yuan	2009-10-19
0.2	1.Update Hot-plug requirements 2.Update Drawing 3.Add output mating connector description 4.Add output pin definition	Rain	2010-05-26
0.3	Cancel Output Voltage Timing Figure	Rain	2010-11-16
1.0	Update for spec format	Gilbert	2010-11-20
1.1	Modify Output Pin Assignment	Sarah	2011-11-18

Design			Product Verification	
Mechanical	**Electrical**	**Approval**	**Safety**	**Approval**

TABLE OF CONTENTS

1. Purpose

This specification defines the performance characteristics and functions of a 800 watts 1U form factor of power module with Active PFC (Power Factor Correction) and PMBus.

2. AC Input Requirements

2.1 Input Voltage and Frequency

Voltage (sinusoidal) : 100~240 VAC full range, with ±10% tolerance. Input frequency ranges from 47hz~63hz

2.2 AC Input Current and Inrush Current

AC line inrush current shall not damage any component nor cause the AC line fuse to blow under any DC conditions and with any specified AC line input voltage and frequency. Repetitive On/Off cycling of the AC input voltage shall not damage the power supply.

Table 1: AC Input Current and Inrush Current

Input Voltage	Input Current	Maximum Inrush Current
100~240Vac	10A ~6A	60A peak@115VAC

The charging current for X capacitors is not considered as inrush current.

2.3 Input Power Factor Correction (Active PFC)

The power factor at 100% of rated load shall be ≥ 0.97 at nominal input voltage.

2.4 AC Line Fuse

The power supply shall have one line fused in the **single line fuse** on the line (Hot) wire of the AC input. The input fuse shall be a slow blow type; the line fusing shall be acceptable for all safety agency requirements.

2.5 AC Line Transient Specification

AC line transient conditions are characterized as “sag” and “surge” conditions. Sag conditions (also referred to as “brownout” conditions) will be defined as the AC line voltage dropping below nominal voltage. Surge conditions will be defined as the AC line voltage rising above nominal voltage. The power supply shall meet the regulation requirements under the following AC line sage and surge condition

Table 2: AC Line Sag Transient Performance

Duration	Sag	Operating AC Voltage	Line Frequency	Load	Performance Criteria
Continuous	10%	Nominal AC Input ranges	50/60 Hz	100%	No loss of function or performance
0-1 AC cycle	100%	Nominal AC Input ranges	50/60 Hz	70%	No loss of function or performance
> 1 AC cycle	> 10%	Nominal AC Input ranges	50/60 Hz	100%	Loss of function Acceptable, Self- recoverable

Table 3: AC Line Surge Transient Performance

Duration	Surge	Operating AC Voltage	Line Frequency	Performance Criteria
Continuous	10%	Nominal AC Voltage	50/60 Hz	No loss of function or performance
0 - ½ AC cycle	30%	Mid-point of Nominal AC Voltage	50/60 Hz	No loss of function or performance

3. DC Output Specification

3.1 Output Power / Current

Table 4: Load Range

Voltage	Minimum Continuous Load	Maximum Continuous Load
+12V	0.8A	66A
+5VSB	0.1A	3.5A

Notes:
1: Noise bandwidth is from DC to 20 MHz

3.2 Voltage Regulation, Ripple and Noise

Table 5: Regulation, ripple and noise

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

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 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 Capacitive Loading

The power supply shall be stable and meet all requirements in the following table, except dynamic loading requirements.

Table 6: Capacitive Loading Conditions

Output	MIN	MAX	Units
+12V	10	11,000	uF
+5VSB	1	350	uF

3.4 Dynamic Loading

The output voltages shall remain within the limits specified in ***Table-Regulation, ripple and noise*** for the step loading and within the limits specified in ***Table-Transient Load Requirement*** for the capacitive loading. The load transient repetition rate shall be tested between **50Hz and 5kHz** at duty cycle ranging from 10%-90%. The load transient repetition rate is only a test specification. The Δ step load may occur anywhere within the MIN load to the MAX load shown in ***Table-Load Range.***

Table 7: Transient Load Requirements

Output	ΔStep Load Size	Load Slew Rate	Capacitive Load
+12V	50% of Max. Load	0.5 A/uS	2200 uF
+5VSB	30% of Max. Load	0.5 A/uS	1 uF

3.5 Overshoot at Turn-on/Turn-off

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

3.6 Timing Requirements

Table 8: Output Voltage Timing

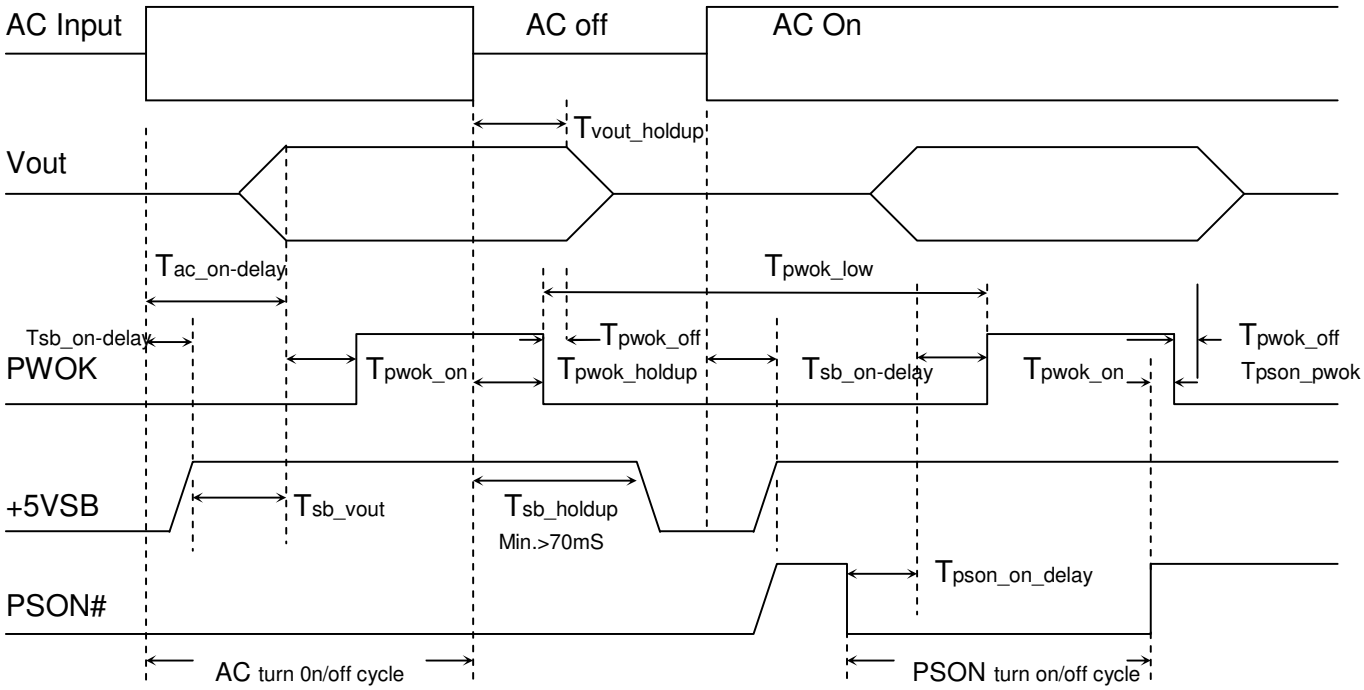
Item	Description	MIN	MAX	Units
Tvout_rise	Output voltage rise time from each main output	2	25	mS
	Output voltage rise time for the 5Vsb out put	1	25	mS
Tvout_on	All main output must be within regulation of each other within this time.		50	mS
Tvout_off	All main output must leave regulation within this time		400	mS

Table 9: 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	Time all output voltage stay within regulation after loss of AC tested at 80% of maximum load.	18		mS
Tpwok_holdup	Delay from loss of AC deassertion of PWOK tested at 80% of maximum load.	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 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



3.7 Efficiency

The power efficiency shall meet 80PLUS silver level standard, tested at 230VAC Input. FAN power is not included into total power consumption.

4. Protection Circuits

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

4.1 Over Current Protection (OCP)

The power supply shall have current limit to prevent the +5V, +3.3V, and +12V outputs from exceeding the values shown in ***Table-Over Current Protection.*** The power supply shall latch off if the current exceeds the limit.

Table 10: Over Current Protection

Voltage	Minimum	Maximum	Shutdown Mode
+12V	72A	99A	Latch Off

4.2 Over Voltage Protection (OVP)

The power supply shall shut down and latch off after an over voltage conditions occurs.

Table 11: Over Voltage Protection

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

4.3 Short Circuit Protection

The power supply shall shut down in a latch off mode when the +12V output voltage is short circuit.
The power supply shall shut down in auto recovery mode when the +5VSB output voltage is short circuit.

4.4 No Load Operation

No damage or hazardous condition should occur with all the DC output connectors disconnected from the load. The power supply may latch into the shutdown state.

4.5 Over Temperature Protection (OTP)

The power supply will latch off when an over temperature condition occurs; no damage shall be caused.

5. Environmental Requirements

5.1 Temperature

Operating Ambient, normal mode (inlet air): 0℃ ~ 40℃ (32℉~ 104℉)
Non-operating Ambient:: -40℃ ~ 70℃ (-40℉~ 158℉)

5.2 Humidity

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

5.3 Altitude

Operating: Sea level to 10,000 ft
Non Operating: Sea level to 40,000 ft

5.4 Mechanical Shock

Non-Operating: 50 G Trapezoidal Wave, 11mS half sin wave. The shock is to be applied in each of the orthogonal axes.

5.5 Vibration (Non-Operating)

The power supply shall be subjected to a vibration test consisting of a 10 to 300 Hz sweep at a constant acceleration of 2.0g for duration of one (1) hour for each of the perpendicular axes X, Y and Z (0.1 octave/minute). The output voltages shall remain within specification.

5.6 Electromagnetic Compatibility

Electromagnetic Interference	FCC CFR Title 47 Part 15 Sub Part B EN55022/EN55024	Conducted B Class Radiated B Class		
Harmonics	IEC61000-3-2 Class D			
Flicker	IEC61000-3-3			
ESD Susceptibility	EN-61000-4-2	±8KV by Air, ±4KV by Contact Performance Criteria B		
Radiated Susceptibility	EN61000-4-3	80MHz~1000MHz (3V/m(mns) Amplitude 80% AM 1KHz Criteria A		
EFT/Burst	EN61000-4-4	5KHz, AC: 1KV, DC: 0,5 KV, Performance Criteria B		
Surge Voltage	EN61000-4-5	Line-to-Line: 1KV Line-to-Ground: 2KV Performance Criteria B		
Conducted Susceptibility	EN61000-4-6	0.15MHz~80MHz 3V/m Amplitude 80% AM 1KHz Performance Criteria A		
RF Conducted	EN61000-4-8	50 Hz/3A(ms)/m Performance Criteria A		
Voltage Dips and Interruptions	EN61000-4-11	30%(Voltage Dips) 60%(Voltage Dips) >95%(Voltage Dips)	10 ms 100ms 500ms	Criteria B Criteria C Criteria C
Leakage Current	EN60950-1	1.5mA@240VAC		

5.7 Safety Agency Requirements

This power supply is design to meet the following safety

Table 12: Product Safety

Product Safety:	UL,cUL UL60950-1

6 Reliability

6.1 Mean Time Between Failures (MTBF)

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

Full rated load; 120V AC input

6.2 Hot-Plug Requirements

The redundant power supply module support N+1 redundancy and hot plug activities. Hot-plug (Hot-swap) is the process of inserting and extracting a power module from an operating system. During the process, the output voltage shall remain within the limits specified in ***Table 5: Regulation, ripple and noise***.

7. Mechanical Requirements

7.1 Dimension: 98.5mm(W) x 40mm(H) x 220mm(D)

Weight: 1.2 Kg

Notes: All dimensions are in mm.

7.2 Output Pin Assignment

(Mating Connector: AMP 530843-8, 72 Pin/Pitch=2.54mm/Gold=30u")

Table 14: Output Pin Assignment

PDB–FAULT	36	PS–KILL	72
PGO	35	PSON	71
12VRS+	34	12VSHR	70
A1	33	SCL	69
A0	32	SDA	68
AC–OK	31	12VRS–(GND)	67
PDB–ALERT	30	SMB–ALERT	66
Vsense	29	PRESENT	65
GND	28	GND	64
GND	27	GND	63
GND	26	GND	62
GND	25	GND	61
GND	24	GND	60
GND	23	GND	59
GND	22	GND	58
GND	21	GND	57
GND	20	GND	56
+12V	19	+12V	55
+12V	18	+12V	54
+12V	17	+12V	53
+12V	16	+12V	52
+12V	15	+12V	51
+12V	14	+12V	50
+12V	13	+12V	49
+12V	12	+12V	48
+12V	11	+12V	47
5VSB	10	5VSB	46
5VSB	9	5VSB	45
X	8	X	44
X	7	X	43
X	6	X	42
AC–L	5	AC–L	41
AC–L	4	AC–L	40
X	3	X	39
AC–N	2	AC–N	38
AC–N	1	AC–N	37
Signal	Pin #	Signal	Pin #
Component Side		Solder Side	

Table 15: Output Pin Definition

Pin NO.	Pin Name	Function	System/Backplane Connection
1,2,37,38	AC-N	AC Input - Neutral	For front AC access
4,5,40,41	AC-L	AC Input - Line	For front AC access
9,10,45,46	5VSB	+5V standby power	TO SYSTEM 5VSB BUS
11~18,47~55	+12V	+12V power output	TO SYSTEM 12V BUS
20~28,56~64	GND	Grounding	GND
29	Vsense	5VSB negative feedback	Grounded at backplane
30	PDB-ALERT	To receive ALERT signal from system or PSU backplane, If signal is pulled LOW, the power internal fan shall be forced to run at maximum speed to improve thermal performance	This signal pin can be controlled by system, or floating via backplane.
31	AC-OK	Detect AC status. Signal is pulled HIGH if 5VSB is enabled	This signal pin can be floating via backplane.
32	A0	I2C Address(LSB)	B0 = 0/0 ; B2 = 1/0 ; B4 = 0/1 ; B6 = 1/1
33	A1	I2C Address(MSB)	
34	12VRS+	+12V Remote sense	TO SYSTEM 12V BUS
35	PGO	Power Good Output. Signal is pulled HIGH to indicate all outputs ok.	TO SYSTEM Power Good
36	PDB-FAULT	To receive a FAULT signal. Power shall be shutdown if this pin is pulled HIGH.	floating via backplane.
65	Present	This pin is grounded with a 47R resistor. To indicate a power has been plugged in.	floating via backplane.
66	SMB-ALERT	If PSU FAIL,FAN FAIL,OCP occurs, signal will be pulled from High to Low , PSU normal =High(TTL LEVEL)	To system related bus
67	12VRS-	+12V negative feedback	Grounded at backplane
68	SDA	I2C DATA	TO SYSTEM I2C BUS
69	SCL	I2C CLOCK	TO SYSTEM I2C BUS
70	12SHR	12V current share	Connect pin to pin at backplane for each power module
71	PSON	Module PSON. Remote control power On/Off (Pulled LOW = POWER ON)	
72	PS_KILL	Activate PSU by hot-plug activity	Grounded at backplane

Appendix: PMBus Command Code
Command Summary

Command Code	Command Name	SMBus Transaction Type	Number of Data Bytes
19h	CAPABILITY	Read Byte	1
88h	READ_VIN(Note1)	READ WORD	2
89h	READ_IIN	READ WORD	2
8Bh	READ_VOUT	READ WORD	2
8Ch	READ_IOUT	READ WORD	2
8Dh	READ_TEMPERATURE_1	READ WORD	2
90h	READ_FAN_SPEED_1	READ WORD	2
91h	READ_FAN_SPEED_2	READ WORD	2
96h	READ_POUT	READ WORD	2
97h	READ_PIN	READ WORD	2
98h	PMBUS_REVISION	READ BYTE	1
99h	MFR_ID	READ Block	6
9Ah	MFR_MODEL	READ Block	9
9Bh	MFR_REVSION	READ Block	2
9Eh	MFR_SERIAL	READ Block	12
A0h	MFR_VIN_MIN	READ_WORD	2
A1h	MFR_VIN_MAX	READ_WORD	2
A7h	MFR_POUT_MAX	READ_WORD	2
B0h	USER_DATA_00	READ BYTE	1

Note1: If AC Input= 90V ~ 130V PMBus sent the value of 115V
If AC Input= 200V ~ 264V PMBus sent the value of 230V

MFR Meaning

Command Code	Command Name	Meaning
99h	MFR_ID	
9Ah	MFR_MODEL	
9Bh	MFR_REVSION	
9Eh	MFR_SERIAL	Serial Number
A0h	MFR_VIN_MIN	200VAC
A1h	MFR_VIN_MAX	240VAC
A7h	MFR_POUT_MAX	500W

Status BYTE Message Contents

Command code = B0h (Command name = USER_DATA_00)

Bit Number	Status Bit Name	Meaning
7	Reserved	Default=0
6	Reserved	Default=0
5	Reserved	Default=0
4	Reserved	Default=0
3	Reserved	Default=0
2	Module Status	Inserted=0, Not inserted=1
1	PS_ON Status	PS_OFF=0, PS_ON=1
0	AC Status	AC OK=0, AC Fail=1

Device Address Location

PDB address A0/A1	0/0	0/1	1/0	1/1
PSU PMBUS Device	B0h	B2h	B4h	B6h