Power Supply Specification

Model Number: SAK560L-F4

AC PFC I/P, ATX12V 560 Watts 5 Outputs

RoHS Compliance & 80+ Efficiency

Date revised: 06/28/2013

Revision History

SAK560L-F4 power supply module

Rev	Description	Owner	Date
GX-01	Initial release	Feilong Wang	05/08/09
GA-01	Production release	Feilong Wang	06/26/09
GA-02	+3.3V O/P rise time increased – (C90: was 104, now 473) System board required; Effective on date code 1102 and after	Feilong Wang	01/10/11
GA-03	Power supply handle mounting location changed, retainer ears added (see outline drawing in detail)	Feilong Wang	06/13/11

RAK560LV-BP 560W power distributor:

Rev	Description	Owner	Date
GX-01	Initial release	Feilong Wang	05/08/09
GA-01	Production release	Feilong Wang	06/26/09
GA-02	Removed PF siganl pull up resistor, R539, from +3.3V O/P --- to avoid system red LED ON	Feilong Wang	01/10/11
GA-03	220ohm 1/4W resistor, R12, added to the +5VSB O/P --- system board required	Feilong Wang	05/22/12
GA-04	104 capacitor added to PS Fail Signal at 5 PIN signal connector --- system buzzer was affected by noise from signal cable	Feilong Wang	04/22/13
GA-05	PCB layout modified at the O/P wiring area to increase the spacing between O/P rails to improve the yield rate.	Feilong Wang	06/28/13

1. Scope

This document defines a 560W ATX12V power supply module for 1U and 2U system application. The power supply system consists of one power supply module and a backplane providing the removable function of the power supply module, or the power supply system consists of one or two power supply modules and a backplane providing the removable or redundancy function of the power supply module. The AC Input is rated 90-264Vrms with power factor corrected. There are five outputs: +12V/45.0A, +5V/20.0A, +3.3V/20.0A, -12V/0.5A, and+5VSB/3.0A. A 38mm high reliable fan is applied to the power supply module for cooling the power supply module and part of the system.

2. Electrical

The electrical specifications that follow are to be met over the environmental ranges specified in Section 3 unless otherwise noted.

2.1. AC Input

Table 1 lists AC input voltage and frequency range for continuous operation. The power supply is capable of supplying full-rated output power over the input voltage ranges specified.

Parameter	Min	Nominal Input	Max	Unit
V_{in} Voltage	90	100-240	264	Vrms
V_{in} Frequency	47	50/60	63	Hz
V_{in} Current		8.0		A

Table 1. AC input

- The inrush current of power supply module is less than 100A under the conditions of 240Vrms input and 25°C ambient cold start.
- The leakage current of the power supply module is less than 1.50mA measured at 240Vac input.
- The repetitive ON/OFF cycling of AC input voltage will not damage the power supply.
- The power supply can automatically recover from AC power loss.
- The power supply is equipped with primary fuse for input over-current protection, and meet product safety requirement.

2.2. DC Output

2.2.1. DC Output Voltage Regulations

The DC output voltages remain within the regulation ranges shown in Table 2 when measured at the load end of the output connectors under all AC line, O/P loads, and environmental conditions. The voltage regulation will be maintained under continuous operation for a period of time equal to the MTBF specified in section 5.2 at any steady state temperature and operating conditions specified in section 3.

	+12V	+5V	+3.3V	-5V	-12V	+5Vsb	Unit
Range	±3%	±3%	±3%	N/A	±10%	±4%	Volt
Min	+11.64	+4.85	+3.20	N/A	-10.80	+4.80	Volt
Nom	+12.00	+5.00	+3.30	N/A	-12.00	+5.00	Volt
Max	+12.36	+5.15	+3.40	N/A	-13.20	+5.20	Volt

Table 2. DC Output Voltage Regulations

- The remote sensing is provided to +12V, +5V, and +3.3V outputs to compensate for excessive cable drops.

2.2.2. DC Output Load Distributions

The Table 3 defines the power supply typical output load distribution.

	+12V	+5V	+3.3V	-5V	-12V	+5Vsb	Unit
Min. Current	0.2	0.0	0.0	N/A	0.0	0.0	A
Max. Current	45.0	20.0	20.0	N/A	0.5	3.0/3.5	A
Peak Current	50.0	---	---	N/A	---	---	A

Table 3. DC Output Load Distribution

- The total continuous output power is 560W max.
- Both +5V and +3.3V outputs can be loaded to their max. rated current, and the total continuous output can be still maintained to the max rated output power as specified.
- The total combined output of 3.3V and 5V is 120W max. that was used for the efficiency calculation.
- The +5Vsb output can be loaded up to 3.5A only if the main output in ON and cooling fan is running.
- +12V peak current may last over 15 seconds with no more than one occurrence per minute.
- The +5V, +3.3V, –12V, and +5Vsb can be optional.

2.2.3. DC Output Efficiency

The power supply efficiency is 80% minimum measured at 20%, 50%, full load and nominal line input, which is 115Vrms and 230Vrms conditions. The efficiency is calculated in accordance with the definition released by the 80 Plus Organization. Please refer to the efficiency measurement table in details.

2.2.4. DC Output Ripple & Noise

The output ripple & noise specifications listed in Table 4 will be met throughout the load ranges as specified in section 2.2.2 and the nominal line input voltage conditions as specified in section 2.1. Ripple & noise is defined as periodic of random signals over a frequency band of 10Hz to 20MHz. Measurements should be made with an oscilloscope with 20MHz bandwidth. Add a 10uF electrolytic capacitor and a 0.1uF ceramic capacitor across output terminal during ripple & noise measurement.

	+12V	+5V	+3.3V	-5V	-12V	+5Vsb	Unit
Max. Ripple	120	50	50	N/A	120	50	mV P-P
Max Ripple & Noise	120	50	50	N/A	120	50	mV P-P

Table 4. DC Output Ripple & Noise

2.2.5. DC Output Transient Response

The output voltages will remain within the regulation limits specified in Table 2. The load-changing repetition rate is 50Hz to 10KHz, and the transient load slew rate 1A/us. The maximum step load size, and output capacitive loading are specified as followings in Table 5:

	+12V	+5V	+3.3V	-5V	-12V	+5Vsb
Step Load Size	60% of Max Load	30% of Max Load	30% of Max Load	N/A	0.1A	0.5A
Capacitive Load	10000	10000	10000	N/A	330	1000

Table 5. DC Output Ripple & Noise

2.2.6. DC Output Voltage Hold-up Time

The power supply will maintain outputs in regulation per section 2.2.1 despite a loss of input power at the nominal range of AC input and at 80% of maximum continuous output load as applicable for a minimum of 16 ms.

2.3. Timing / Housekeeping / control

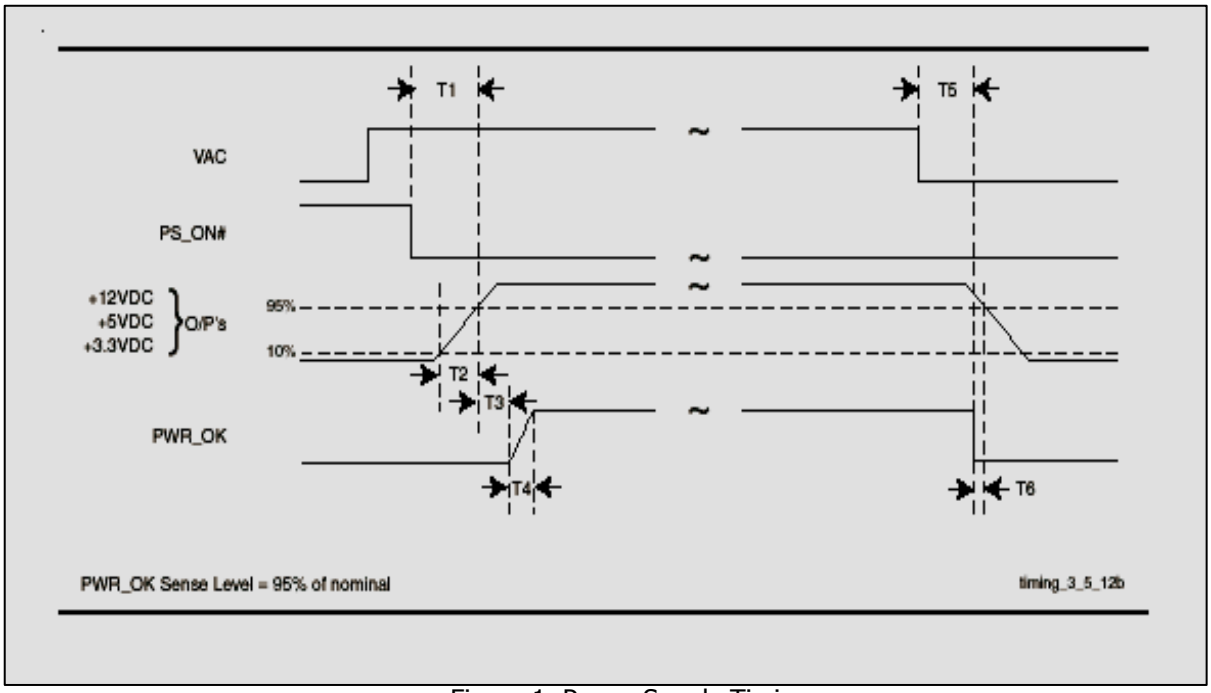


Figure 1. Power Supply Timing

Notes: T1 is defined is section 2.3.4
T2 is defined in section 2.3.5
T3, T4, T5 and T6 are defined in Table 6

2.3.1. PWR_OK (Power Good Signal)

PWR_OK is a "power good" signal. It will be asserted high by the power supply to indicate that the +5V output is above the under voltage threshold listed in Table 2 of Section 2.2. PWR_OK will be de-asserted to a low state when +5V output voltage falls below under voltage threshold, or when AC power has been removed for a time sufficiently such that power supply operation cannot work normally. The electrical and timing characteristics of the PWR_OK signal are given in Table 6 and in figure 1.

Signal type	+5V TTL compatible
Logic level low	Less than 0.4V while sinking 10mA
Logic level high	Greater than 4.75V while sourcing 500uA
High-state output impedance	1kΩ from output to common
PWR_OK delay	100ms < T_3 <500ms
PWR_OK rise time	$T_4 \leq$ 10ms
AC loss to PWR_OK hold-up Time	$T_5 \geq$ 16ms
Power-down warning	$T_6 \geq$ 1ms

Table 6. PWR_OK Signal Characteristics

2.3.2. PS_ON (DC Soft Start)

PS_ON is an active-low, TTL-compatible signal that allows a motherboard to remotely control the power supply in conjunction with features such as soft on/off, Wake on LAN, or wake-on modem. When PS_ON is pulled to TTL low, the power supply will turn on the main DC output rails: +12V, +5V, +3.3V, and –12V. When PS_ON is pulled to TTL high or open-collected, the DC output rails will not deliver current and will be held at zero potential with respect to ground. PS_ON has no effect to the +5Vsb output, which is always enabled whenever the AC power is present. Table 7 lists PS_ON signal characteristics.

	Min	Max
V_{IL}, Input Low Voltage	0.0V	0.8V
I_{IL}, Input Low Current (Vin = 0.4V)		-1.6mA
V_{IH}, Input high Voltage (Iin = -200uA)	2.0V	
V_{IH}, open circuit, Iin =0		5.25V

Table 7. PS_ON Signal Characteristics

2.3.3. +5Vsb (Standby Voltage Output)

+5Vsb is a standby voltage output that is active whenever the AC power is present. It provides a power source for circuits that must remain operational when the four main DC output rails are in a disabled state. Example uses include soft power control, Wake on LAN, wake on modem, intrusion detection, or suspend state activities. There is over current protection on the +5Vsb output to ensure the power supply will not be damaged if external circuits draw more current than the supply can provide.

2.3.4. Power-on Time

The power-on time is defined as the time from when PS_ON is pulled low to when the12V, +5V, and +3.3V output are within the regulation ranges specified in Section 2.2.1. The power-on time will be less than 800ms (T_1 <800ms). +5Vsb has a power on time of two seconds max. after the valid AC Voltages applied.

2.3.5. Rise Time

The output voltage rise from ≤ 10% of nominal to within the regulation ranges specified in section 2.2.1 within 0.1 ms to 20 ms (0.1 ms ≤ T_2 ≤ 20 ms)

2.3.6. 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 will be less than 10% above the nominal voltage.

2.3.7. Reset after Shutdown

If the power supply latches into a shutdown state because of a fault condition on its outputs, the power supply can return to normal operation only after the fault condition has been removed and the PS_ON has been cycled OFF/ON with a minimum OFF time of 1 second.

2.3.8. +5Vsb at AC Power-down

After AC power is removed, the +5Vsb standby voltage output should remain at its steady state value for the minimum hold-up time specified in Section 2.2.6 until the output begins to decrease in voltage. The decrease can be monotonic in nature, dropping to 0.0V. There is no other perturbations of this voltage at or following removal of AC power.

2.4. Output Protection

2.4.1. Over Voltage Protection

The power supply can provide latch-mode over voltage protection as defined in Table 8.

Output	Min.	Nom.	Max.	Unit
+12VDC	13.6	14.6	15.6	Volts
+5VDC	5.5	6.25	7.0	Volts
+3.3VDC	3.7	4.1	4.5	Volts

Table 8. Over Voltage Protection

2.4.2. Over Current Protection

140% maximum for all outputs

2.4.3. Short-circuit Protection

Output short circuit is defined as any output impedance of less than 0.1 ohms. The power supply can shut down and latch off for shorting the +12VDC, +5VDC, and +3.3VDC rails to return or any other rails. Shorts between main output rails and +5Vsb will not cause any damage to power supply. The power supply will either shut down and latch off or fold back for shorting the negative rails. +5Vsb can be capable of being shorted indefinitely, but when the short is removed, the power supply will recover automatically or by cycling PS_ON. The power supply can be capable of withstanding a continuous short circuit to the output without damage or overstress to the unit (for example, to components, PCB traces, connectors) under the input conditions specified in section 2.1.

2.4.4. No-load Operation

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

2.4.5. Isolation

Primary to Secondary	4242Vdc
Primary to Earth GND	2500Vdc

2.5. Output Signals (for Redundant System only)

2.5.1. Audible Alarm & TTL Signal

The Audible alarm and TTL signal are available from the signal card located on the backplane. The audible alarm is silence and TTL signal is "High" when both modules are functioning properly. The audible alarm will be sound and TTL signal will be "Low" when following conditions happened:

a. One of the power supply module is not functioning and is still attached to the backplane.
b. One of the power supply module is attached to the backplane without AC power cord plugged in.

Removing the not functioning power module from backplane can reset the audible alarm and also the TTL signal.

2.5.2. LED light

The LED light installed on the power supply module is functioning as followings:

a. Green color – Power module is ON and working properly.
b. Amber color – Power module is under Standby Mode.
c. No color – Power module is not working properly.

2.5.3. Fan Failed Signal (I2C)

The Rotation Detector O/P signal is generated by fan: "0" fan is running well and "1" fan blade is locked or fan is not running properly.

2.5.4. PS Present Signal (I2C)

The Power Supply Present signal: "0" power supply is present and "1" power supply is not present

2.5.5. Power Good Signal (I2C)

The Power Good signal: "0" power supply is fail and "1" power supply is good

2.5.6. Temperature Warning Signal (I2C)

The Temperature Warning signal: "0" PS is under normal condition and "1" PS is under full load and over 55°C

3. Environmental

The following subsections define recommended environmental specifications and test parameters. Based on the typical conditions to which an ATX power supply may be subjected during operation or shipment.

3.1. Temperature

Operating	+0°C to +50°C
Non-operating	-40°C to +85°C

3.2. Humidity

Operating	10% to 90% relative humidity (non-condensing)
Non-operating	5% to 95% relative humidity (non-condensing)

3.3. Altitude

Operating	0 to 10,000 feet
Storage	0 to 50,000 feet

3.4. RoHS Compliance

The power supply meet the requirement of RoHS Compliance.

4. Electromagnetic Compatibility

The following subsections outline applicable product regulatory specifications for this power supply.

4.1. Emissions

The power supply can comply with FCC Part 15 and EN55022: 2006 meeting Class B for both conducted and radiated emissions with a 3 dB margin.

4.2. Immunity

The power supply can comply with EN 55024: 1998+A1: 2001+A2: 2003.

4.3. CE Testing

The following standards are applied during the CE testing

CE
EN 55022: 2006 Class B
EN 61000-3-2: 20006 Class D
EN 61000-3-3: 1995+A1: 2001+A2: 2005
EN 55024: 1998+A1: 2001+A2: 2003, including
IEC 61000-4-2: Criterion A
IEC 61000-4-3: Criterion A
IEC 61000-4-4: Criterion A
IEC 61000-4-5: Criterion A
IEC 61000-4-6: Criterion A
IEC 61000-4-11: Criterion A/B/B

5. Reliability

5.1. Component De-rating

The derating process promotes quality and high reliability. All electronic components are designed with conservative derating for use in commercial and industrial environments.

5.2. Mean Time between Failures (MTBF)

100K hours minimum at full load 25°C

6. Safety

6.1. Safety

cUL	UL 60950-1 (replaced by cTUVus)
TUV	EN 60950-1:2006+A11+A1+A122
CB	IEC 60950-1:2005 2nd Edition
CCC	GB4943.1-2011, GB9254-2008, GB17625.1-2003
BSMI	CNS14336-1:2010, CNS13438:2006

6.2. RoHS & REACH Compliance

The power supply meets the requirements of RoHS & REACH Compliance specified as followings:

- European Directive for Waste of electrical and electronic equipment (WEEE) 2012/19/EU
- European Directive for Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) 2011/65/EU
- ACPEIP, Administration on the Control of Pollution caused by Electronic Information Products (China RoHS), e.g. SJ/T 11363-2006 Requirements for Concentration Limits for Certain Hazardous Substances in EIP, SJ/T 11364-2006 Marking for Control of Pollution Caused by EIP

- Plastic and rubber parts are within the limits for 16 PAH and Benzopyrene polycyclic aromatic hydrocarbons
  - PAH (Polycyclic Aromatic Hydrocarbons):
    - 200mg/kg for components touched less than 30 seconds
    - 10mg/kg for components touched longer than 30 seconds
  - Benzopyrene are within the limits of:
    - 20mg/kg for components touched less than 30 seconds
    - 1mg/kg for components touched longer than 30 seconds

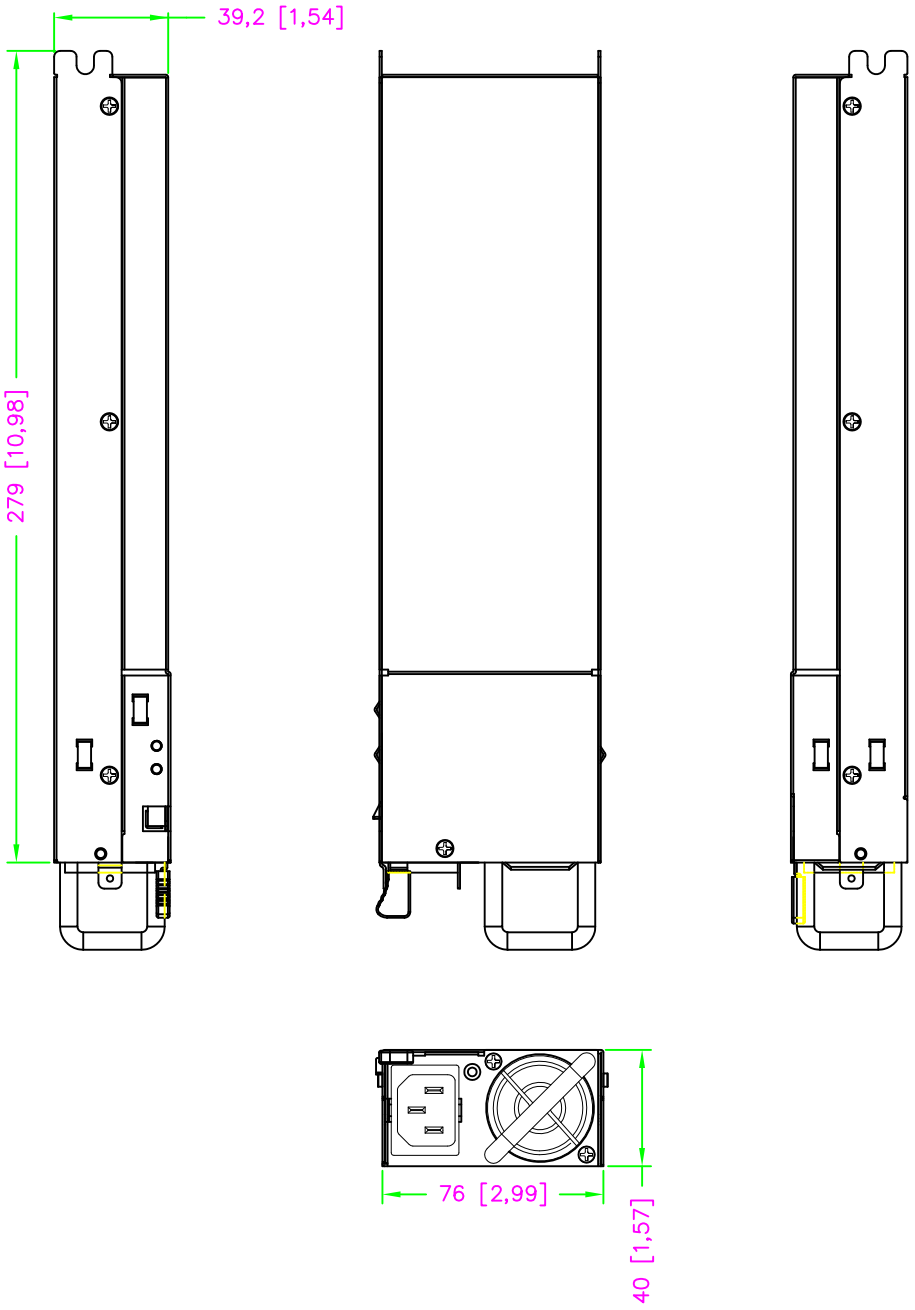
- Phthalate concentration is below 1mg/kg for:
  - Diisononyl phthalate
  - Bis(2-ethylhexyl)phthalate
  - Di-n-octyl phthalate
  - Diisodecyl phthalate
  - Butyl benzyl phthalate
  - Bis(n-butyl)phthalate

- Polychlorinated biphenyl (PCB) concentration limits are less than two (2) parts per million (ppm).

Regulation (EC) No 1907/2006 ... concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH): No substance of Very High Concern of the "Candidate List" exceeds more than 0,1 % of the global weight of the delivered item (without packaging of the item)

7. Mechanical

Please see attached outline drawing and output cable drawing in details.



APM Industrial Power Supply	APPROVED JH HUANG	DRAWING NO. L-1S-AC02-01	UNIT INCHES(MM)	REV. 0.2
TITLE SAK SERIES L CASE 560W OUTPUT	DATE May 05, 2011	MODEL NO. SAK560L-F4	TOLERANCES: .X = ±0.5	SHEET 1/1