



深圳欧陆通电子有限公司

深圳欧陆通电子有限公司

HONOR ELECTRONIC CO., LTD

ASPOWER

Electrical Specification

Model Name

R1A-KH0400

Version

S1

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# Electrical Specification

(With ATX output (SGCC) 1+1 Redundant)

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[illegible]



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## 1.0 SCOPE

The specification defines the key characteristics for the power supply. The power supply can be used for Server storage filed, and normal AC or HVDC input voltage can apply in the power supply. Output connector is output cable, and output port include +3.3V/+5V/+12V/-12V and +5VSB. The max output power is 400W.

## 2.0 INPUT PARAMETER

### 2.1 Input Voltage/Input Current/Frequency

The power supply should operate in input limited voltage range, and follow the specification defined as below table, includes the limited value of input current, input voltage, working frequency. The power supply should be turned on when 90VAC or 135VDC at min load and max load.

**Table1.**

	Min	Rated	Max	Units
AC input voltage	90	100~127	264	Vrms
		200~240		Vrms
Frequency	47	50/60	63	Hz
HVDC input voltage	135	145~350	380	Vdc
Input current	$<6.3A@100-240VAC$ $<6.3A@145-350VDC$			

Note:

1. For 350V-380V only meet turn on at full load.

### 2.2 Inrush Current

Cold start at 230Vac/350Vdc input voltage at 25°C, when input power is applied to the power supply and any initial inrush current surge or spike of 1ms or less shall not exceed 40A peak per module. Any additional inrush current surges or spikes in the form of AC cycles or multiple AC cycles greater than 5ms shall not exceed 60A peak per module. Inrush current difference between line and neutral is under 0.1A per half cycle of input current and/or the phase difference between line and neutral is less than +/-20 degrees during each AC input voltage half-cycle.

The inrush shall be less than the ratings of the critical components. Any inrush current of the AC line shall not cause damage to the power supply. Surge current does not contain the current spike due to X-CAP.

## 2.3 Efficiency

Efficiency testing should be in ambient temperature: 18degC-27degC, input voltage at 230Vac/50Hz. Efficiency testing delay time should be 15min after running the PSU, and so that the PSU in under steady state. Negligible fan loss and the power of the fan should be supplied by an external DC source.

**Table2.**

Load	+3.3V	+5V	+12V	-12V	+5Vsb	EFF
20%	2.4A	2.4A	4.77A	0.07A	0.4A	>84%
50%	6A	6A	11.91A	0.15A	1.0A	>89%
100%	12A	12A	23.82A	0.3A	2.0A	>88%

## 2.4 Hold up Time

Hold up time is defined length of time from AC input drops to 0V to +12V dropping out of voltage regulation range at any phase of the AC, the power supply should meet dynamic voltage range.

1. Hold up time +12Vout  $\geq 12\text{ms}$  with 80%load (90-264VAC)
2. Hold up time PG  $\geq 10\text{ms}$  with 80%load (90-264VAC)

## 2.5 Power Factor

Power factor is used to measure the power efficiency of the data used in electrical equipment. It is necessary for meeting the energy star's computer server 2 standard requirements. Input voltage condition: 230Vac/50Hz, power factor meets the requirement as below table.

**Table3.**

Load	100% Load
PF	> 0.95

## 2.6 Surge and Sag

The dynamic conditions of mains input are defined as sag and surge. Sag is mains drop to below normal voltage, surge refers to the input voltage rises above the normal range, the PSU should meet sag and surge requirement.

**Table4. Surge and Sag**

Duration	Surge/Sag	Input Voltage	Frequency	Performance Criteria
500ms	10%	220/110VAC 240VDC	50/60Hz	No loss of function or performance
0 to 1/2 AC cycle	30%	220/110VAC 240VDC	50/60Hz	No loss of function or performance
=1/2 AC cycle	30%	220/110VAC 240VDC	50/60Hz	No loss of function or performance
>1/2 AC cycle	>30%	220/110VAC 240VDC	50/60Hz	Loss of function acceptable, Power supply can turn on automatically

## 3.0 OUTPUT PARAMETER

### 3.1 Output Current

The following table defines the current ratings. The combined output power of all outputs shall not exceed the rated output power. The power supply shall meet both static, dynamic voltage regulation and timing requirements for the min/ max loading conditions.

**Table5. Output Current**

Output Voltage	Min Current	Max current
+3.3V	0A	18A
+5V	0A	18A
+12V	0.5A	33A
-12V	0A	0.5A
+5VSB	0A	3A

Note:

1. The continuous total output power is 400W max.
2. The combined power of +5V and +3.3V is 110W max.

### 3.2 Voltage Regulation

The power supply output voltage must stay within the following voltage limits shown in below table when operating at steady state, dynamic loading conditions. All outputs are measured with reference to the return remote sense (ReturnS) signal.

**Table6. Output Voltage**

Output Voltage	Min	Rated	Max	Tolerance
+3.3V	3.135V	3.3V	3.465V	+/-5%
+5V	4.75V	5.0V	5.25V	+/-5%
+12V	11.4V	12.0V	12.6V	+/-5%
-12V	10.8V	12.0V	13.2V	+/-10%
+5VSB	4.75V	5.0V	5.25V	+/-5%

**Table7. Load Regulation Test Table**

	+3.3V	+5V	+12V	-12V	+5VSB
Load1	0.0A	0.0A	0.5A	0.0A	0.0A
Load2	12A	12A	23.8A	0.3A	2.2A
Load3	6A	6A	11.9A	0.15A	1.1A
Load4	2.4A	2.4A	4.7A	0.06A	0.44A
Load5	18A	10A	22.5A	0.5A	3A
Load6	6.06A	18A	22.5A	0.5A	3A
Load7	1A	1A	32A	0.2A	1A

### 3.3 Ripple & Noise

**Table8. Ripple and Noise**

Output voltage	Ripple & noise
+3.3V	<50mV
+5V	<50mV
+12V	<120mV
-12V	<120mV
+5VSB	<50mV

Note:

1. This is measured over a bandwidth of 20MHz at the output connector. A 10 $\mu$ F Electrolytic capacitor in parallel with a 0.1 $\mu$ F ceramic capacitor are placed at the point of measurement.

### 3.4 Timing

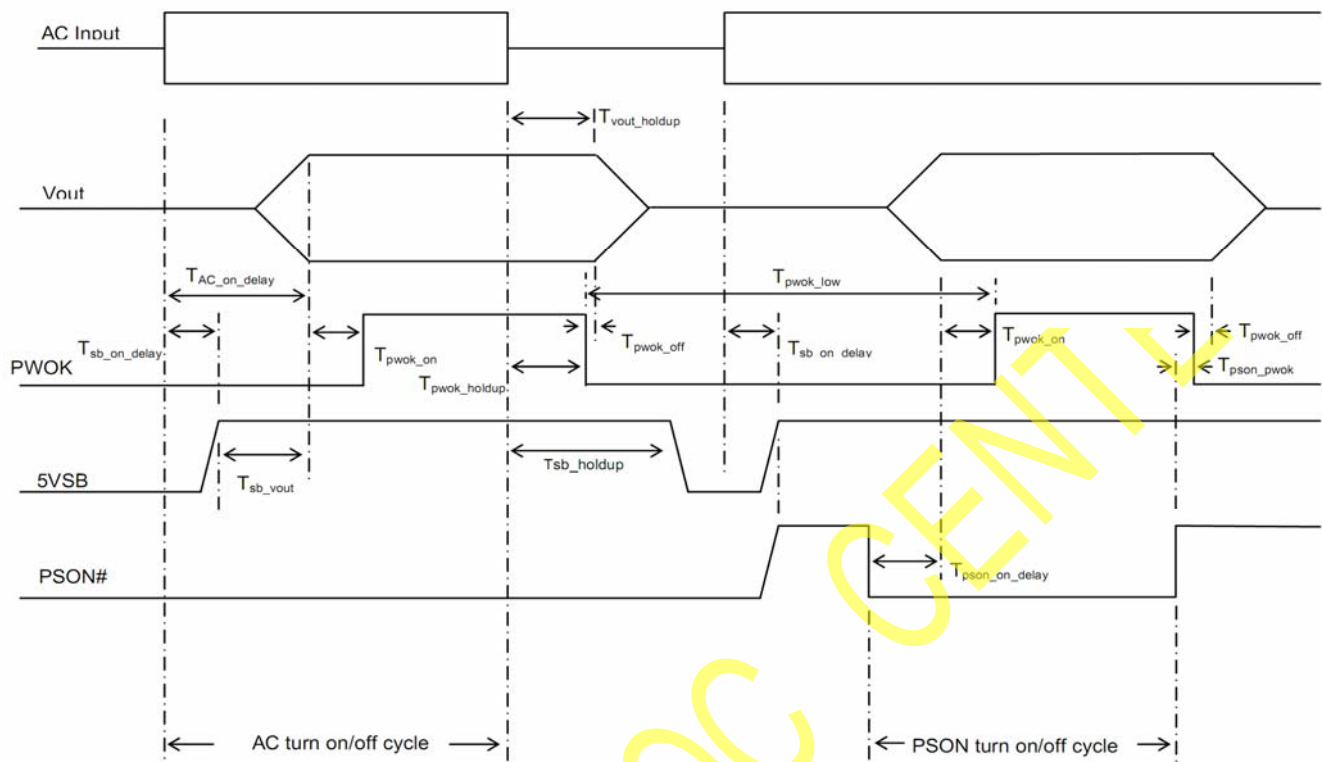
These are the timing requirements for power supply operation including alone module outputs and multi model outputs. All outputs shall rise and fall monotonically. However, PS timing must meet the



requirement of mother board. PS supplier must evaluate and verify the timing characteristics when in design stage and system test stage.

**Table9. Turn On/Off Timing**

Item	Description	Min	Max	Units
Tvout_rise	Output voltage rise from 10% to 90% time.	1	20	ms
Tsb_on_delay	Delay from AC being applied to 5Vsb being within regulaton.		2000	ms
Tac_on_delay	Delay from AC being applied to 12V being within regulaton.		2000	ms
Tsb_vout	Delay from 5Vsb being in regulation to 12V being in regulation at AC turn on.	50	1000	ms
Tpson_on_delay	Delay from PSON active to output voltages being within regulation limits.	5	500	ms
Tpwok_on	Delay from output voltages within regulation limits to PWOK asserted at turn on.	100	500	ms
Tvout_holdup	All output stay within regulation after loss of AC.	12		ms
Tpwok_holdup	Delay from loss of AC to de-assertion of PWOK.	10		ms
Tpwok_off	Delay from PWOK de-asserted to output voltages dropping out of regulation limits.	1		ms



### 3.5 Overshoot

Output voltage overshoot is less than 12.6V at any load and any input voltage, the output rising up waveform should be kept flat and smooth.

**Table10. Overshoot Table**

Output Voltage	Overshoot (Max)
+12V	12.6V

### 3.6 Dynamic

The overshoot is less than 10% with 30% load change. The load transient repetition rate shall be tested between 50Hz to 10 KHz at duty cycles rang from 10%-90%. The test shall be at least in 50 Hz/1KHz/10KHz condition. The load transient repetition rate is only a test specification.

The output voltage shall remain within limits specified for the step loading, slew rate, and capacitive loading in below table.

**Table11. Dynamic Table**

Output Voltage	Transient Step (A) Percent of Rated current	A/us	Frequency (Hz)	Cap (uF)
+3.3V	30%	1.0	50-10K	10000

+5V	30%	1.0	50-10K	10000
+12V	30%	1.0	50-10K	10000

### 3.7 Capacitive Loading

The power supply shall be stable and meet all requirements with the following capacitive loading range. The PSU is not damaged include normal turn on timing, running under light load and full load.

**Table12. Capacitive Loading Table**

Output Voltage	+3.3V	+5V	+12V	-12V	+5VSB
Capacitive loading (uF)	10000	10000	10000	330	5000

### 3.8 Redundancy and Hot Swap

Hot swapping a power supply is the process of inserting and extracting a power supply module from an operating power system both steady and dynamic conditions with power cord as well as without power cord. In general, a failed (off by internal latch or external control) supply module may be removed, and replaced with a good power supply module. However, hot swap needs to work with operational as well as failed power supply module.

The power supply shall meet following requirements while hot remove or insert the module to the cage:

1. The output voltage shall stay within the limits.
2. Output signal, such as PG, PS-ON shall not oscillate or change.
3. Current Sharing bus shall not oscillate.
4. Power supply shall not be overload and other protection.
5. The newly inserted power supply may get turned on by plugging AC into the external and meet the turn on requirements.

### 3.9 Return

All DC Returns (GND) are internally connected to frame ground.

### 3.10 Control Signal

#### 3.10.1 PS-ON Signal

PS-ON signal is required to remotely turn on/off the power supply PDB. PS-ON is an active low signal that turns on +12V output. When this signal is not pulled low by the system, or left open, all the outputs (except for 5VSB) shall be turned off. This signal is pulled to a 5V voltage by a pull-up resistor internal to the system.

**Table13. PSON Signal**

Signal Level	Status	Logical Level (Min)	Logical Level (Max)
PSON high level	Turn off power	2	5.25V
PSON low level	Turn on power	0V	1V
PG rise and fall time		$\leq 100\mu s$	
High-state output impedance		Pull up a resistor between PSON and 3.3V	

### 3.10.2 PG Signal

PG signal is the logical signal for PSU under normal status: high level is power normal, low level is power abnormal.

**Table14. PG Signal Characteristic**

Signal Status	Status	Logical Level (Min)	Logical Level (Max)
PG high level	Power normal	2.4V	5.25V
PG low level	Power abnormal	0V	0.4V
Source current (PG high level)		$\leq 2mA$	
Sink current (PG low level)		$\leq 4mA$	
PG rise and fall time		$\leq 100\mu s$	
High-state output impedance		Pull up a resistor between PSON and 5V	
Sink current		$\leq 4mA$	
Rise and fall time		$\leq 100\mu s$	

### 3.10.3 SCL and SDA Signal

They are I2C bus signal: SDA and SCL, and system can send and receive data through them. SCL and SDA are pull high with a resistor in power supply, and the pull high level is 5V.

**Table15. SCL and SDA Signal**

Signal	Logical Level (Min)	Logical Level (Max)
SCL SDA high level	2.4V	5.25V
SCL SDA low level	0V	0.4V

## 4.0 PROTECTION

To operation safely and reliably, inside circuit in the power supply should have necessary protection function for various abnormal situations, include OCP, OVP, OPP, OTP, and SHORT. The main outputs will be latched off. The main outputs can be reset by cycle the AC &DC remote on/off. +5VSB output is auto recovery when fault condition removed. Power supply shall shut down and latch-off by fault or protection. When this fault or protection is removed, power supply must be able to turn on through toggling PS ON/OFF or AC ON/OFF re-cycles. The toggling time is  $\leq 1s$  by PSON turn on, and  $\leq 15s$  by AC turn on. The 5VSB protection mode is auto restart once the fault or protection is removed.

#### 4.1 Over Voltage Protection (OVP)

When one module +12V occurs OVP, +12V should latch off, power supply must be able to turn on through toggling PS ON/OFF or AC ON/OFF re-cycle after remove the protection.

For redundant PS, once one power supply module (not PDB) is in OVP state due to the internal OVP trip point detected, another one will continue to work unless another one also occur internal OVP. Power supply must be able to turn on through toggling PS ON/OFF or AC ON/OFF re-cycle after remove the protection.

**Table16. OVP Table**

Voltage	Min(V)	Max(V)
+3.3V	3.7	4.5
+5V	5.9	7
+12V	13.2	15.6

#### 4.2 Over Power Protection (OPP)

When the total power is under 120%~160% of full load, the power supply will shut down and latch off.

#### 4.3 Over Temperature Protection (OTP)

The power supply shall be protected against over temperature conditions caused by loss of fan cooling or excessive ambient temperature, which could cause internal parts failure. When the PSU shutdown in an oven temperature condition. The +5VSB shall not shutdown during an OTP condition. When the temperature drops to within safe operating range for internal parts, the power supply shall restart power automatically.

The OTP circuit shall incorporate built in hysteric ( $>5^{\circ}C$ ) such that the power supply does not oscillate on and off due to temperature recovery.

The ambient over temperature protection is set at 55-65degC.

#### 4.4 Short Circuit Protection (SCP)

All output to GND. The power supply shall shut down and latch off when +12V output is short circuit (impedance less than 0.1ohm), and +5VSB shall be auto restart. The power should be under protection to keep component safe, whatever the outputs is shorten before turn on or shorten after turn on. The +12V can be recovery after removing short by AC on/off or PSON/OFF, but +5VSB can be auto restart after short is removed.

#### 4.5 Over Current Protection (OCP)

Table17. OCP Limited Table

Output	Min(A)	Max(A)
+3.3V	22	28
+5V	22	28
+12V	36	46

Note:

1. After OCP, the +12V output is turned off and locked, and by AC ON/OFF or PSON/OFF unlock, and +12VSB output can automatic restart. When the OCP conditions removed, +5VSB should return to normal.

#### 4.6 No Load Operating

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.

#### 4.7 Warning Method

Table18. Warning Method Table

Status	Module LED	Backplane LED	Buzzle	TTL Level
Normal	green	green	quiet	high
Fault	Only +5Vsb	yellow	flash	alarm
	No +5Vsb	off	flash	alarm
Reset	Yellow/off	flash	quiet	low

Note:

1. Audio alarm: buzzer sounds, Can be eliminated by the reset button.

After unplug the abnormal modules, all signals will be back to normal.



## 5.0 CURRENT SHARE

As this power supply has redundant function, the output current sharing should within  $\pm 10\%$  when half, full load and within  $\pm 15\%$  at light load as below. The supplies must be able to load share in parallel and operate in a hot-swap/redundant configuration.

**Table19. Load Regulation Test Table**

	+3.3V	+5V	+12V	-12V	+5VSB	SPEC
Load1	2.4A	2.4A	4.77A	0.06A	0.4A	$\pm 15\%$
Load2	6A	6A	11.91A	0.15A	1A	$\pm 10\%$
Load3	12A	12A	23.82A	0.3A	2A	$\pm 10\%$

Two PSU working in parallel, when the load is under 20% to 100%, the current of redundancy PSU are not exceed the scope of below table accuracy, sharing degree is calculated as follows sharing degree  $= (I1 - I2) / (I1 + I2)$ . I1, I2 is PSU1, PSU2 output current.

**Table20. Load Current Sharing**

$< 20\%$	$20\% \leq I < 50\%$	$50\% \leq I \leq 100\%$
NA	$< 15\%$	$< 10\%$

## 6.0 OPERATE ENVIRONMENT

### 6.1 Operate Temperature

Operate temperature:  $0^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ .

### 6.2 Storage Temperature

Storage temperature:  $-40^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$ .

### 6.3 Operate Humidity

Operating Humidity(non-condensing at  $40^{\circ}\text{C}$ ): 10% to 90%.

### 6.4 Storage Humidity

Storage Humidity(non-condensing at  $50^{\circ}\text{C}$ ): 5% to 95%.

### 6.5 Operate Altitude

Operate Altitude: 0 to 5000m.



## 6.6 Storage Altitude

Storage Altitude: 0 to 10000m.

## 6.7 Cold Start

The power supply shall be able to turn on at 0degC.

## 7.0 SAFETY

### 7.1 Safety Certification

Meet CCC.

Meet UL60950-1/CSA 60950-1 (USA/Canada).

Meet EN60950-1(Europe).

Meet GB4943.1-2011(CCC-CNCA Certification) (CHINA).

### 7.2 Hi-pot

Primary to secondary Hi-pot withstand voltage: 3000Vac or 4242Vdc, 60s, leakage current <10mA.

Primary to grounding Hi-pot withstand voltage: 1500Vac or 2121Vdc, 60s, leakage current <10mA.

### 7.3 Grounding Impedance Test

Grounding impedance test using grounding current 32A and the impedance is less than 100mohm.

### 7.4 Leakage Current

Leakage current refers to the voltage applied to the no fault, between the metal parts with electrical insulated from each other, or between charged parts and grounding parts, the current formed through the medium around the insulated surface called leakage current. Leakage current is the current flowing through the insulation part under the action of the electrical line or equipment in the absence of failure and voltage. Therefore, it is one of the important symbols to measure the insulation quality of electrical appliances, and is the main quota of product safety performance. The leakage current is limited to a very small value, which plays an important role in improving product safety performance.

In order to ensure that the leakage current of the power supply case not cause leakage damage to the human body, after inserting the AC power, the leakage current of the power supply should meet the requirements of safety. Under 240Vac/50Hz and 60Hz conditions to be less than 3.5mA.

## 8.0 OUTLINE STRUCTURE

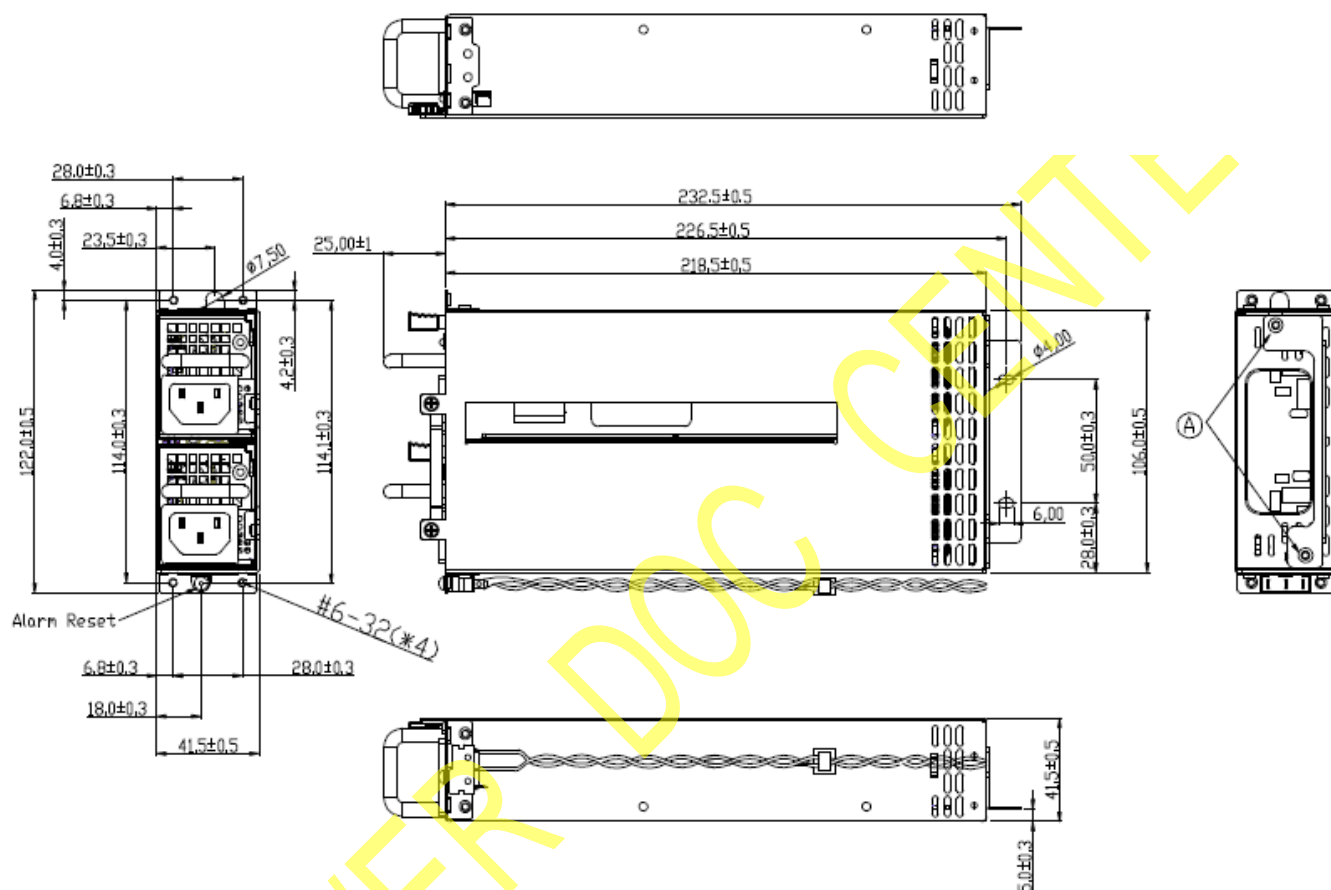
Outline dimension:



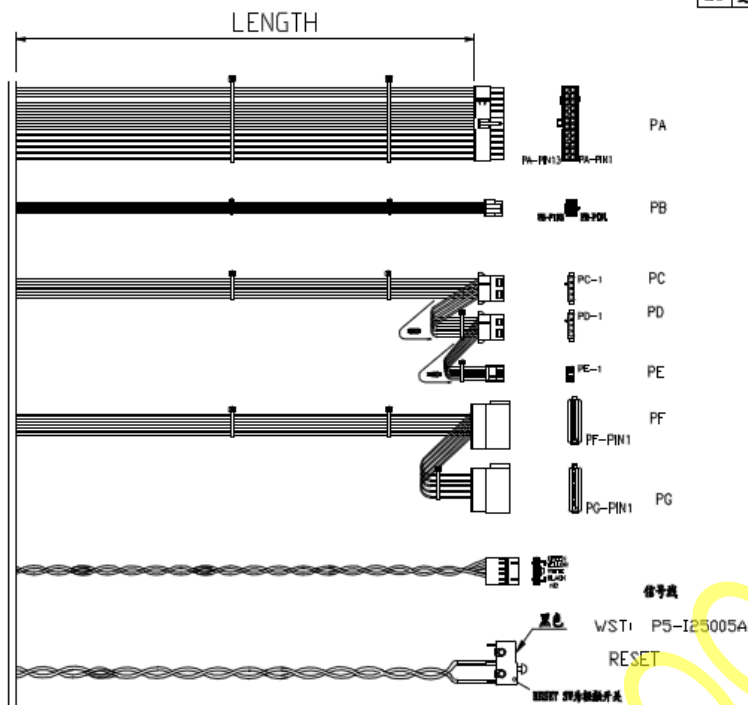
Length: 218.5mm

Width: 106.0mm

Thickness: 41.5mm



版本	变更记录	修改人	日期
1.0	首次发布	王登华	2014.05.09
1.1	取消TTL、L2D域	王登华	2015.12.02
1.2	变更格式。外网扇增加RESC扫描项	王登华	2017.07.19



Index	Pin	Logic Code	Symbol	Logic Description	Location
PA	1	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	4502 ± 20
	2	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	3	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	4	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	5	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	6	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	7	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	8	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	9	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	10	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	11	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	12	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	13	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	14	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	15	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	16	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	17	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	18	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	19	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	20	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
PB	1	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	4502 ± 20
	2	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	3	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	4	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	5	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	6	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	7	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	8	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	9	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	10	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
PC PD PE	1	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	PC04502020 PC04502020 PC04502020
	2	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	3	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	4	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
PF PG	1	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	PF04502020 PG04502020
	2	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	3	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	4	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	5	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	6	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	7	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	8	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	9	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	10	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
RESET	1	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	400202020
	2	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	3	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	
	4	STRAP	+3.3VDC	EL-C104 100 200V 800 300V	

NOTE:			
PA	HOUSING:	WST P20+4-I42002K2	OR EQUIV
	TERMINAL:	WST I42002BS(P5)-A	
PB	HOUSING:	WST P4-I42002K3	OR EQUIV
	TERMINAL:	WST I42002BS(P5)-A	
PC PD	HOUSING:	WST P4-A10202	OR EQUIV
	TERMINAL:	WST A10209BS(P5)	
PE	HOUSING:	WST P4-12500T1	OR EQUIV
	TERMINAL:	WST 125001BS(P5)	
PF PG	HOUSING:	WST P5-I12702 WST I12702PL	OR EQUIV
	TERMINAL:		

## 9.0 RESTRICTED SUBSTANCE

## 9.1 ROHS

Power supply must meet be RoHS6 compliant including the component, PCB, soldering material, case, wire, and so on.

## 9.2 Restricted Substance

Recycled Plastics: Post-consumer recycled content plastics to constitute have a minimum of 4% of total supplier plastic purchases.

Packaging: Minimum 50% total recycled content, including 30% post-consumer recycled content for corrugated materials. Corrugated - min. 50% total recycled content, min. 30% post-consumer content. Minimum 50% of total recycled content by weight is across all new systems for cushions.

## 10.0 EMC

## 10.1 Lighting

Lightning: for example, when lightning strikes outdoor lines, there are a large of current flowing into the external circuit or grounding resistor, and generating disturbance voltage, also, the indirect lightning (such as clouds or lightning in the clouds) induces voltage or current on the line, moreover, the lightning hit the adjacent objects and establish electromagnetic field in their surround. When outdoor line passes through the electromagnetic field, it will induce voltage or current on the line, also as lightning struck near ground, introduced the disturbance when the current pass through public grounding system.

1. Lightning test meet the IEC61000-4-4 electric fast transient standard, withstand voltage: +/- 2KV. Performance criterion: A.

**Table21. EFT Voltage Table**

Lighting	Withstand Requirement
EFT	±2KV

2. Surge defined in 61000-4-5 standard, including the upper limit of the standard: 2 KV, including phase angle: 0 degree, 90 degree, 180 degree, 270 degree. It is suitable for input AC/DC power supply of six combinations (L1, L1-L2, L1-PE, L1-L2-PE, L2, and L2-PE). Performance criterion: A.

The requirement for surge is listed in the table as below.

**Table22. Surge Voltage Table**

Lighting	Common	Different
surge	±2KV	±1KV
resistance	12ohm	2ohm

Performance criterion:

- A. Equipment can work in the specified conditions.
- B. Test equipment temporary performance decline, loss of function or reset phenomenon, but it can be recovery itself.
- C. Equipment has temporary performance decline or loss of function and it is restored by operator intervention or system.
- D. Equipment has non recoverable performance degradation or loss of function due to component damage, software affected or data loss.

## 10.2 ESD



Power supply should be able to meet the IEC61000-4-2 ESD standard, the need to meet the level 4 requirements of contact 8KV, isolation 15KV standard. It should not have power product shutdown, signal drop, product burning and other undesirable phenomena. Performance criterion: A.

A. Equipment can work in the specified conditions.

B. Test equipment temporary performance decline, loss of function or reset phenomenon, but it can be recovery itself.

C. Equipment has temporary performance decline or loss of function and it is restored by operator intervention or system.

D. Equipment has non recoverable performance degradation or loss of function due to component damage, software affected or data loss.

**Table23. ESD Degree of Severity**

ESD Grade	Contact	Air
3	6KV	8KV

### 10.3 EMI

Electromagnetic interference (EMI) project basic requirements: radiation interference (RE) and conduction interference (CE), and it shall meet the standard requirements of CLASS B. Electromagnetic interference EMI (Electromagnetic Interference), there are two kinds: conduction interference and radiation interference.

**Table24. Conduction Performance Requirement**

Item	Frequency Segment	Reference Standard	Note
Conduction interference	150KHz~30MHz	EN 55022	115V/60Hz, 230Vac/50Hz

**Table25. Conduction CLASS B Standard Limitation**

Frequency (MHz)	Limitation (dBuV/m)	
	QP	AVG
0.15-0.50	66~56	56~46
0.50-5	56	46
5-30	60	50

**Table26. Radiation Index Requirements**

Item	Frequency Segment	Reference Standard	Note
Radiation	30MHz~1GHz	EN 55022	115V/60Hz,230Vac/50Hz

interference			
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**Table27. Radiation Class B Standard Limitation**

FREQ	Limitation (dBuV/m)
30-230MHz	40
230-1000MHz	47

## 11.0 PART CONTROL REQUIREMENTS

1. All current limiting devices shall have UL, TUV or VDE certification and shall be identified as applications in which the device complies with IEC60950.
2. All printed circuit board ratings shall meet UL94V - 0 and those from UL certified PCB manufacturers.
3. All joints shall pass UL certification and UL flame retardant rating UL94V-0.
4. All wiring harness shall be from UL certified wiring harness manufacturer. SELV cable is rated at minimum 80V, 130degC.
5. Product safety labels must be printed with UL certified labels and ribbons. In addition labels can be purchased from UL label manufacturers for approval.
6. The product must have the correct regulatory marks to support the certification specified in this document.

## 12.0 MECHANICAL PERFORMANCE

Mechanical vibration experiment is mainly to simulate the product vibration experiment in the work and transport process, the purpose is to test whether the product can meet certain specifications of vibration intensity, the main test items include:

1. Work random vibration.
2. Work shock.
3. Packaging random vibration.

**Table28. Mechanical Requirement**

NO	Experiment Item	Sample	Standard	Parameter	Criterion
1	work random	≥3	IPC9592A-2010	ASD: 20~1000Hz: 0.04g <sup>2</sup> /Hz;	Power supply voltage is Within the



	vibration		IEC60068-2-64	1000~2000Hz: 6db/oct; 2000Hz: 0.01g <sup>2</sup> /Hz. About 8Grms. 3 axial, each axial at least 10min. Test process sample power on, normal input voltage, no load. During the test, each power output and signal output should be monitored continuously. The monitoring period should be less than 1ms.	specification limits during the test.
2	work shock	≥3	IPC9592A-2010 IEC60068-2-27	Half sine wave, 16ms, at least 30g. 3 axial, each axial 3 times. During the test, each power output and signal output should be monitored continuously. The monitoring period should be less than 1ms.	Power supply voltage is Within the specification limits during the test.
3	packaging random vibration	≥3	IPC9592A-2010 IEC60068-2-64	ASD: 5~1000Hz: 0.05g <sup>2</sup> /Hz; 1000~2000Hz: 6db/oct; 2000Hz: 0.0125g <sup>2</sup> /Hz. About 9Grms. About 9Grms, 3 axial, each axial at least 10min. Each PSU should have independent packaging follow normal delivery.	After the test, product should be inspected. Allows minor damage without affecting appearance, installation, or function. Connector pins are not allowed to bend, switch damage, handle damage. Label



					readability is poor, metal deformation or bending. All equipment through functional testing. Test shipment packaging damage degree does not make judgment requirements.
--	--	--	--	--	--

### 13.0 MTBF

100K hours minimum. Quantitative reliability (Quantitative) performance requirements: MTBF (MTBF Mean Time Between Critical Failure), according to the Bellcore standard SR-332 Issue3, the PSU operates continuously under 25degC condition, 230V/50Hz input voltage under max load, and MTBF is more than 100000 hours, the testing process should not be interrupted.

**Table29.**

Input Voltage	Load	MTBF
230VAC/50Hz	12V/27A	100000hours

### 14.0 HALT

Highly accelerated life test, HALT is a kind of process of defect detection, by setting the incremental stricter environmental stress, to expose accelerated test sample defects and weak points, and then have analysis and improvement to defects and faults at design, process and material aspects, so as to improve the purpose of reliability, the biggest feature is setting higher environmental stress of the designed sample running limitation, so that the exposure fault time is much shorter than the normal fault reliability time under the condition of force. Test procedure and test report must meet the "IPC9592B-2012" requirements.

High acceleration life test specific testing includes points as below:

1. Gradually apply stress until the product failure or fault.
2. Take temporary action to correct product failure or fault.

3. Continue to apply stress gradually until the product fails again and correct again.
4. Repeat the above test steps from failure to improve.
5. Find out the basic operating limitation and basic damage limits.

Experimental process:

1. Temperature uniformity test:

After the test at room temperature for the test sample, before low temperature step stress test and turn off test sample power, adjust wind tube position, Device surface temperature is at ambient temperature, adjust the temperature to 50degC, the Duration time for 5min, record temperature of the key chip, and the layout of the site after temperature stability, until the temperature difference of all points is less than Plus or minus 3degC, then start experiment.

2. Temperature step stress test:

Temperature step stress test, have two stages: low temperature and high temperature. The first implementation of low temperature stress test stage, then high temperature stress test, the specific steps are as follows: the test should start from room temperature (20 DEG to 30 DEG); the maximum temperature step level: -10degC (low step) and +10degC (high temperature step); each temperature dwell times should be enough long (at least 10 minutes), until the thermocouple measurements value on the sample reached stable. The function of the test sample can be carried out under temperature stable, may also have been carried out in the whole process of the test sample; until find the operating limits or test has reached limit capacity of HALT test box, the test can be stopped; After determining the operating limits of the product, temperature step test should to be continued. The stress range is between the sample operation and destroying limits and the limit of HALT test box.

3. Rapid temperature change cyclic stress test:

Rapid temperature cyclic stress tests shall be performed at least 5 cycles, unless the test sample exhibits a non-recoverable failure in the test. Temperature change test rate according to the provisions of test program (not to exceed the maximum temperature change rate of HALT equipment); the lowest temperature test than the lowest temperature limit of 10degC higher (or 80%), the highest temperature is 10 degrees lower than the maximum working temperature limit (or 80%). At least 5 minutes in the temperature extremes, dwell time should be long enough, until the thermocouple measurements on the sample to achieve stability. In the whole process of rapid temperature change cyclic stress test, the samples should be functional monitored to judge whether the test samples will cause failure due to rapid temperature changes.

4. Vibration step stress test:



The vibration order of the experiment was 5~10Grms (recommended 10Grms), the frequency was between 2 and 5000Hz, or higher frequency range. At the end of each vibration magnitude and sample dwell function tests, and then test the vibration magnitude increasing with 5~10Grms (recommended 10Grms), the dwell time at each order of magnitude should not be less than 10 minutes about vibration stress, then test the product function, Until find the sample's operation and destroying limits, due to the stress range, the sample may fail, so it is necessary in all vibration stress level test, reduce stress, determine whether the samples can return to normal.

#### 5. Comprehensive stress test:

The comprehensive stress test performed at least 5 cycles, unless the sample failure does not be recovered in the experiment; the temperature cycling curve of extreme settings is same as rapid temperature change of cyclic stress, the resident time at the extreme temperature is at least 10 minutes; Vibration level in the comprehensive vibration is the first four cycle, vibration =90%\* vibration limit cycle number /4\* operation, the fifth cycles of vibration stress reduced to 5Grms. After a certain period of time at vibration level, the test product should be functional detection. Test residence time will be appropriately extended according to the time required for product functional testing.

## 15.0 THERMAL SHOCK TEST

Thermal shock test is a testing technique to test the resistance of material to extreme high temperature or extremely low temperature. This situation is similar to the case of discontinuous in high temperature or low temperature. It can make various objects complete the test in the shortest time. The changing of chemical or physical damage producing in the TST is caused by Thermal changing or changing of other physical value. The effects of TST include electrochemical changes caused by product crack or fracture and displacement.

#### TEST method:

1. In the temperature controlling room, it change from normal temperature 25degC to low temperature -40degC usually, and bake for 30 minutes under low temperature.
2. Temperature of controlling room changes from low temperature -40degC to high Temperature 70degC usually, changing time is 2min., and high temperature baking for 30 minutes.
3. After 10 cycle changing between the high temperature of 70degC and low temperature -40degC, the temperature returned to normal temperature, and removed the power (at least restore for 4 hours).
4. Confirm the label, case withstand voltage and electrical performance of the tested product before and after test.



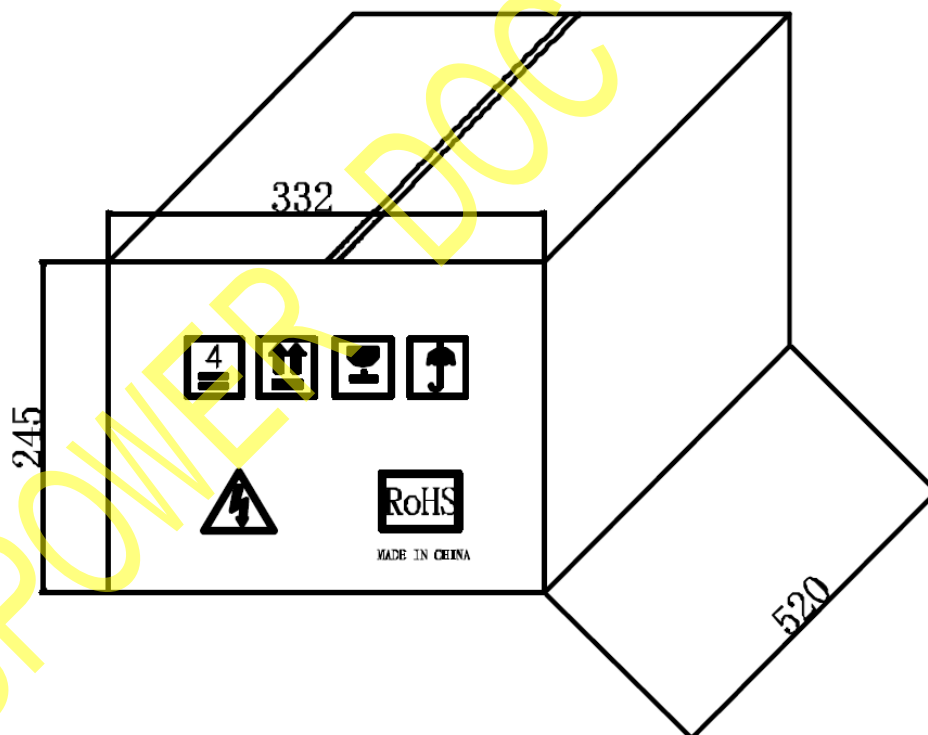
Note:

1. After TST test product, performance and appearance of PSU should not appear degradation and degradation phenomenon.
2. The dielectric strength and insulation resistance after thermal shock test products shall meet the requirements of specifications.
3. Products are non-operating condition.

## 16.0 PACKAGE

Power supply module package shall be the Anti-ESD bag to avoid power supply damage in shipment.

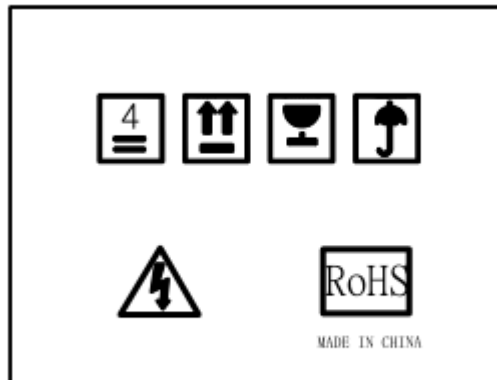
### 16.1 Outline Diagram of Carton



Note:

1. Material: outside the box: K=K, five layers of corrugated paper, the thickness: 6.0mm min, Naipoli: 11KG min.
2. Outline: bright and clean, no stain, yellow white and no color difference, no gap junction.
3. Dimension: above dimensions for carton size, tolerance +/-3mm.

### 16.2 Side Label



### 16.3 Front Label



## 17.0 SOFTWARE

### 17.1 PMBUS and EEPROM

There is an 8Kbyte EEPROM in power supply, communication with system via IIC bus.

### 17.2 PMBUS Communication

There is 4.5V voltage to supply the EEPROM and MCU's Vcc in power supply. The MCU and EEPROM in power supply can communication with system via PMBus1.2 protocol or IIC protocol bus. The power supply output terminal has two signals, one is SCL (clock bus), the other is SDA (data bus), and they are bidirectional communication and can get a continuous signal bus. The supply voltage of bus is 3.3 ~ 5V, so SDA (data bus) and SCL (clock bus) needs to be pulled up a 4.7K resistor from system board's 3.3V or 5V voltage.

We can address the power supply's MCU via A/D5 signal and MCU set the EEPROM's address via A0, A1 and A2. SCL- Serial Data Clock Input, 100KHZ max, SDA- Serial Data I/O.



## 17.3 Address

PSU address line corresponding address bit A0, A1, address PSU high four bits for 0xB0, defined as follows:

1	0	1	1	A2	A1	A0	R/W bit 1:read, 0:write
---	---	---	---	----	----	----	----------------------------

## 17.4 EEPROM

Address line corresponding address bit A0, A1, address four bits high 0xA0, defined as follows:

1	0	1	0	A2	A1	A0	R/W bit 1:read, 0:write
---	---	---	---	----	----	----	----------------------------

Byte address (decimal)	Byte address (hex)	Item	Format	Value	Description
00-06	00H-06H	Manufacturer Name	Char*7	“ASPOWER”	Use the ASCII Code
07-24	07H-18H	Product Name	Char*18	“R1A-KH0400 ”	Use the ASCII Code
25-34	19H-22H	Mfg. Date	Char*10	Mfg. Date	Use the ASCII Code Pad Pad ( Always 20H)
35-36	23H-24H	Checksum1	Uint16	6A45H	Checksum( 00H~22H )
37-66	25H-42H	Product Serial No.	Char*30	Series No.	Use the ASCII Code Pad Pad ( Always 20H)
67-86	43H-56H	Model No.	Char*20	Model No.	Use the ASCII Code Pad Pad ( Always 20H)
87-88	57H-58H	Checksum2	Uint16	0093H	Checksum( 25H~56H )
89-93	59H-5DH	Product Version	Char*5	“1.0 ”	Use the ASCII Code
94-98	5EH-	Firmware Version	Char*5	“3.1.0”	Use the ASCII Code



	62H				
99-100	63H-64H	Checksum3	Uint16	907DH	Checksum( 59H~62H )
101	65H	Block length	Uint8	00H	HEX Pad ( Always 00H)
102	66H	Block_count	Uint8	1	HEX
103-104	67H-68H	Power_consumption	Uint16	0000H	HEX Pad ( Always 0000H)
105	69H	Eeprom_size	Uint8	64 ( 64Kbit)	HEX
106-107	6AH-6BH	Checksum4	Uint16	240CH	Checksum( 65H~69H )
108-255	6CH-FFH	Unused Area	Uint8	FFH	Pad ( Always FFH)

### 17.5 Software Read Accuracy

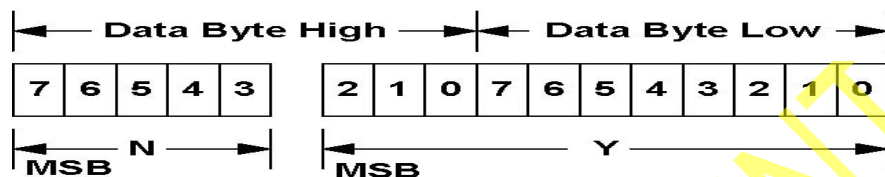
Read Content	Instruction	Input Voltage Range	Load Condition		
			<10%	10%~20%	20%~100%
Input voltage	Read_VIN(87h)	100Vac~264Vac	5%	5%	5%
Input power	Read_PIN(97h)		NA	15%	10%
Input current	Read_IIN(89h)		NA	15% or +/- 0.1A	10%
Output voltage	Read_Vout(8Bh)		5%	5%	5%
Amb temperature	READ_TEMPERATURE_2		+/-3℃	+/-3℃	+/-3℃
Input voltage	Read_VIN(87h)	240Vdc~400Vdc	5%	5%	5%
Input power	Read_PIN(97h)		NA	15%	10%
Input current	Read_IIN(89h)		NA	15% or +/- 0.1A	10%
Output voltage	Read_Vout(8Bh)		5%	5%	5%
Amb temperature	READ_TEMPERATURE_2		+/-3℃	+/-3℃	+/-3℃



## 17.6 Software Data Format

Linear Data Formats:

The Linear Data Format is a two byte value with: An 11 bit, two's complement mantissa and A 5 bit, two's complement exponent (scaling factor). The format of the two data bytes is illustrated in below Figure.



The relation between Y, N and the “real world” value is:  $X = Y \cdot 2^N$ .

Where, as described below:

X is the “real world” value being communicated.

Y is an 11 bit, two's complement integer.

N is a 5 bit, two's complement integer.

Devices that use the linear format must accept and be able to process any value of N.

## 17.7 Status Command

### STATUS\_WORD Command

Byte	Bit	Status Bit Name	Meaning	Support
Low	7	BUSY	A fault was declared because the device was busy and unable to respond.	No
	6	OFF	This bit is asserted if the unit is not providing power to the output, regardless of the reason, including simply not being enabled.	Yes
	5	VOUT_OV	An output over voltage fault has occurred	Yes
	4	IOUT_OC	An output over current fault has occurred	Yes
	3	VIN_UV	An input under voltage fault has occurred	Yes
	2	TEMPERATURE	A temperature fault or warning has occurred	Yes
	1	CML	A communications, memory or logic fault has occurred	No
	0	NONE OF THE ABOVE	A fault or warning not listed in bits [7:1] of this byte has occurred	No
High	7	VOUT	An output voltage fault or warning has occurred	Yes

6	IOUT/POUT	An output current or output power fault or warning has occurred	Yes
5	INPUT	An input voltage, input current, or input power fault or warning has occurred	Yes
4	MFR	A manufacturer specific fault or warning has occurred	No
3	POWER_GOOD#	The POWER_GOOD signal, if present, is negated	Yes
2	FANS	A fan or airflow fault or warning has occurred	Yes
1	OTHER	A bit in STATUS_OTHER is set	Yes
0	UNKNOWN	A fault type not given in bits [15:1] of the STATUS_WORD has been detected	No

#### STATUS\_VOUT Command

Bit	Meaning	Support
7	VOUT Over voltage Fault	Yes
6	VOUT Over voltage Warning	No
5	VOUT Under voltage Warning	No
4	VOUT Under voltage Fault	Yes
3	VOUT_MAX Warning (An attempt has been made to set the output voltage to value higher than allowed by the VOUT_MAX command)	No
2	TON_MAX_FAULT	No
1	TOFF_MAX Warning	No
0	VOUT Tracking Error	No

#### STATUS\_IOUT Command

Bit	Meaning	Support
7	IOUT Over current Fault	Yes
6	IOUT Over current And Low Voltage Shutdown Fault	No
5	IOUT Over current Warning	No
4	IOUT Undercurrent Fault	No
3	Current Share Fault	No
2	Power Limiting	No



1	POUT Overpower Fault	No
0	POUT Overpower Warning	No

**STATUS\_INPUT Command**

Bit	Meaning	Support
7	VIN Over voltage Fault	Yes
6	VIN Over voltage Warning	No
5	VIN Under voltage Warning	No
4	VIN Under voltage Fault	Yes
3	Unit Off For Insufficient Input Voltage	No
2	IIN Over current Fault	No
1	IIN Over current Warning	No
0	PIN Overpower Warning	No

**STATUS\_TEMPERATURE Command**

Bit	Meaning	Support
7	Over temperature Fault	Yes
6	Over temperature Warning	Yes
5	Under temperature Warnings	No
4	Under temperature Fault	No
3	Reserved	
2	Reserved	
1	Reserved	
0	Reserved	

**STATUS\_FAN\_1\_2 Command**

Bit	Meaning	Support
7	Fan 1 Fault	Yes
6	Fan 2 Fault	No
5	Fan 1 Warning	No
4	Fan 2 Warning	No
3	Fan 1 Speed Overridden	Yes
2	Fan 2 Speed Overridden	No



1	Airflow Fault	No
0	Airflow Warning	No

#### STATUS\_OTHER Command

Bit	Meaning	Support
7	Reserved	No
6	PFC voltage ok check(Mfr. Defined)	Yes
5	Input A Fuse Or Circuit Breaker Fault	No
4	Input B Fuse Or Circuit Breaker Fault	No
3	Input A Or-ing Device Fault	No
2	Input B Or-ing Device Fault	No
1	Output Or-ing Device Fault	No
0	Reserved	No

### 17.8 Supported Command

CMD Code	Name	Type	Bytes	Conditions
03h	CLEAR_FAULTS	Send Byte	0	
19h	CAPABILITY	Read Byte	1	Value 0x10
1Ah	QUERY	Block Read	1	Value 0xA0
78h	STATUS_BYTE	Read Byte	1	
79h	STATUS_WORD	Read Word	2	
7Ah	STATUS_VOUT	Read Byte	1	
7Bh	STATUS_IOUT	Read Byte	1	
7Ch	STATUS_INPUT	Read Byte	1	
7Dh	STATUS_TEMPERATURE	Read Byte	1	
7Fh	STATUS_OTHER	Read Byte	1	
81h	STATUS_FANS_1_2	Read Byte	1	
84h	READ_Vsb_OUT(Mfr. Defined)	Read Word	2	
88h	READ_VIN	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	Rpm value
96h	READ_POUT	Read Word	2	
98h	PMBUS_REVISION	Read Byte	1	V1.2
99h	MFR_ID	Read Block	Variable	See MFR Data table
9Ah	MFR_MODEL	Read Block	Variable	See MFR Data table
9Bh	MFR_REVISION	Read Block	Variable	See MFR Data table
A0h	MFR_VIN_MIN	Read Word	2	See MFR Data table
A1h	MFR_VIN_MAX	Read Word	2	See MFR Data table
A4h	MFR_VOUT_MIN	Read Word	2	See MFR Data table
A5h	MFR_VOUT_MAX	Read Word	2	See MFR Data table
A8h	MFR_TAMBIENT_MAX	Read Word	2	See MFR Data table
A9h	MFR_TAMBIENT_MIN	Read Word	2	See MFR Data table

Note:

1. The Power Supply (slave) receive a system (host) "CLEAR\_FAULTS" command, the Power Supply "SMBus\_Alert" signal goes high, but the Status Byte\word is set to "1" bit is not cleared.

**Table30. MFR Data Table**

CMD Code	Name	Conditions
99h	MFR_ID	ASPOWER
9Ah	MFR_MODEL	R1A-KHXXXX
9Bh	MFR_REVISION	1.0
A4h	MFR_VOUT_MIN	11.4V
A5h	MFR_VOUT_MAX	12.6V
A8h	MFR_TAMBIENT_MAX	50°C
A9h	MFR_TAMBIENT_MIN	0°C