ASPOWER
深圳欧陆通电子股份有限公司

深圳欧陆通电子股份有限公司 SHENZHEN HONOR ELECTRONIC CO.,LTD ASPOWER Electrical Specification	Model Name	U1A-D10550-DRB-H
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Electrical Specification

(with +12V&+12VSB (SGCC))

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1.0 SCOPE

This specification defines the key characteristics for the 550W power supply, which is intended for worldwide use in IT equipment such as server application. This unit contains +12V and +12Vsb output ports with CRPS golden finger. The input connector is compatible with IEC C14 standard. All the specifications are applicable under all operating conditions when installed in the end used system unless other noted.

2.0 INPUT PARAMETER

2.1 Input Voltage/Input Current/Frequency

The power supply shall operate within input limited voltage range as defined as Table 1, which includes the limited value of input current, input voltage, working frequency. The power supply shall be capable of start up from min load to max load at line input as low as 90VAC.

Table1.

	Min	Rated	Max	Units
AC input voltage	90	100-240	264	VAC
Frequency	47	50-60	63	Hz
DC input voltage		160-240 or 160-340		VDC
Input current		<8A@100-240VAC @full load <8A@160-240VDC @full load <8A@160-340VDC @full load		

Note: Any long period of time for 265Vac-300Vac input shall not cause damage to the power supply.

2.2 Inrush Current

When input AC/HVDC is applied to the power supply, The AC line inrush current shall not exceed 50A @230Vac peak for up to one-quarter of the AC cycle per module with the condition of cold start at 25˚C ambient. Any additional inrush current surges or spikes in the form of AC cycles or multiple AC cycles dropout should be less than the ratings of the critical components(including input fuse, bulk rectifier, and surge limiting device).

And 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. but the peak current during time should < 0.2ms.

2.3 Efficiency

The power supply achieves the 80 plus level by testing at the 230Vac/50Hz, 18degC-27degC ambient temperature and the loading condition show in Table 2. The efficiency testing delay time should be 30min after running the PSU, and so that the PSU in under steady state. Fan power loss must be ignored.

Table2.

Load	+12V	+12Vsb	EFF
20%	8.76A	0.41A	≧90%
50%	21.89A	1.02A	≧94%
100%	43.79A	2.04A	≧91%

Note:

1. Add external +12Vcc for fan and the fan power is not included in efficiency calculation.

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 input, the power supply should meet dynamic voltage range.

1. Hold up time +12Vout>=12ms@100% load (115~230VAC).

2.5 Power Factor

The power supply must meet the power factor requirements stated in the Energy Star Program Requirement for Computer Servers V2.0. The power factor shall meet the requirement as below table at 230Vac/50Hz and 115Vac/60Hz input voltage condition.

Table3.

Load	20% Load	50% Load	100% Load
PF	>0.9	>0.95	> 0.98

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. AC Line Sag Transient Performance

Duration	Sag	Input Voltage	Frequency	Performance Criteria
=1/2 AC cycle	95%	100~240VAC	50/60Hz	No loss of function or performance
>1.0 AC cycle	>30%	100~240VAC	50/60Hz	Loss of function acceptable, power supply can turn on automatically

Table5. AC Line Surge Transient Performance

Duration	Surge	Input Voltage	Frequency	Performance Criteria
Continuous	10%	100~240VAC	50/60Hz	No loss of function or performance
0 to 1/2 AC cycle	30%	100~240VAC	50/60Hz	No loss of function or performance

3.0 OUTPUT PARAMETER

3.1 Output Current

The following table defines the output current ratings. The combined output power of all outputs shall not exceed the rated output power (550W). The power supply shall meet both static, dynamic voltage regulation and timing requirements for all loading conditions defined in specification.

Table6.

Output Voltage	Min Current	Max current
+12V	0.5A	45A
+12Vsb	0A	2.1A

Note:

1. The continuous total output power is 550W max for 90~264Vac input.

3.2 Voltage Regulation

The power supply output voltages 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.

Table7.

Output Voltage	Min	Max	Tolerance
+12V	11.4V	12.6V	+/-5%
+12Vsb	11.4V	12.6V	+/-5%

3.3 Ripple & Noise

Table8.

Output voltage	Ripple & noise
+12V	<120mV
+12Vsb	<120mV

Note:

1. The ripple & noise is measured over a bandwidth of 20MHz at the power supply output connectors. A 10μF Electrolytic capacitor in parallel with a 0.1μF ceramic capacitor is placed at the point of measurement.

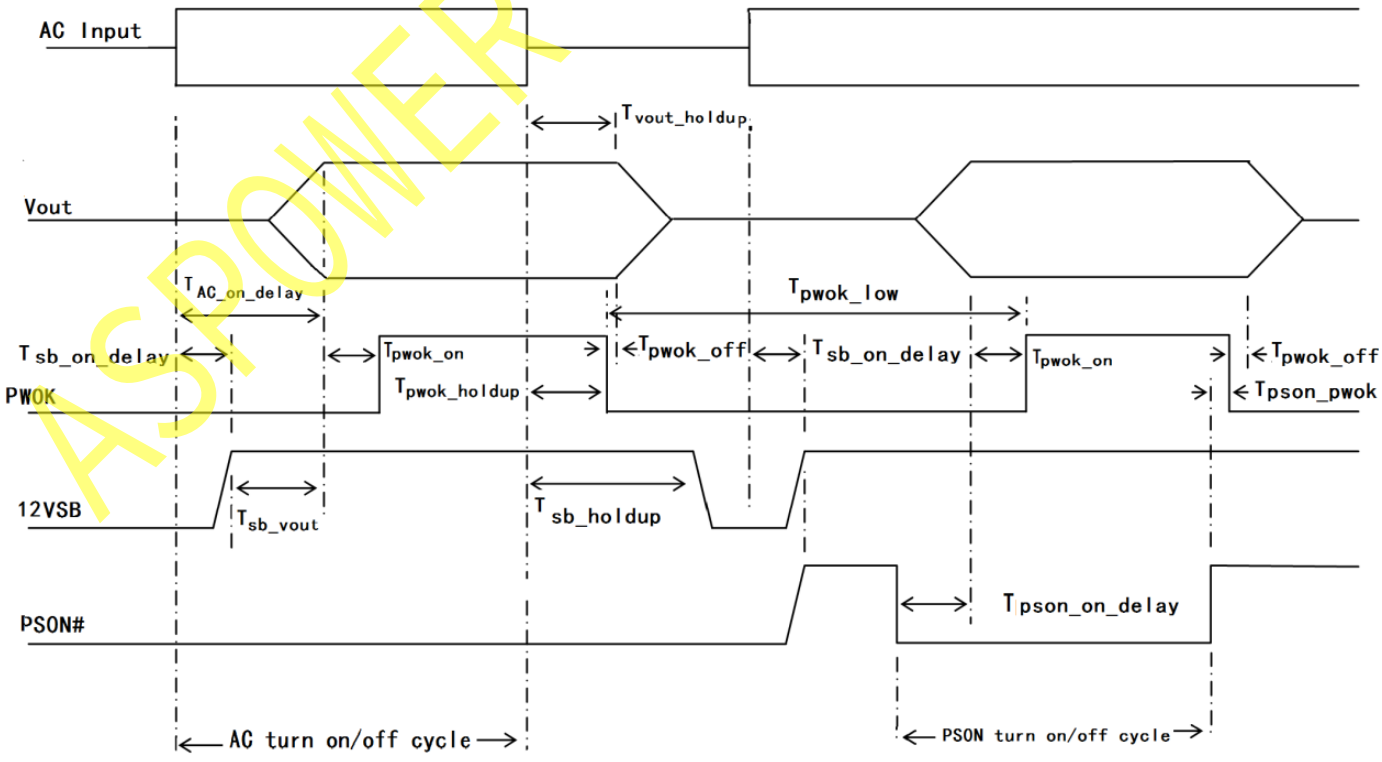
3.4 Timing

These timing requirements for power supply operation include alone module's output and multi modules' outputs. All outputs shall rise and fall monotonically. In additional, PSU timing must meet the requirement of mother board. The timing characteristics must be evaluated and verified 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 for +12V.	5	70	ms
T12Vsb_rise	Output voltage rise from 10% to 90% time for +12Vsb.	1	50	ms
Tsb_on_delay	Delay from AC being applied to +12Vsb being within regulation.		1500	ms
Tac_on_delay	Delay from AC being applied to +12V being within regulation.		3000	ms

Tsb_vout	Delay from +12Vsb 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	400	ms
Tpwok_on	Delay from output voltages within regulation limits to PWOK asserted at turn on.	100	500	ms
Tvout_holdup	Time 12V output voltage dropping to 11.4V after loss of AC.	12		ms
Tpwok_holdup	Delay from loss of AC to de-assertion of PWOK.	11		ms
T12Vsb_hold up	Time the +12Vsb output voltage stays within regulation after loss of AC.	70		ms
Tpwok_off	Delay from PWOK de-asserted to output voltages dropping out of regulation limits.	1		ms
Tpwok_low	Duration of PWOK being in the de-asserted state during an OFF/ON cycle using AC or the PSON signal.	100		ms
Tpson_pwok	PWOK being de-asserted delay from PSON deactivate.		5	ms



3.5 Overshoot

The turn-on overshoot due to application of AC input or remote enable shall be < 10% of the nominal output voltage for any application of input voltage within the specified range.

Overshoot/undershoot on turn on or restart must meet under all loading conditions, including minimum output capacitance on all output voltages.

3.6 Dynamic

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

The load transient repetition rate shall be tested between 50Hz to 5KHz at 50% duty cycles. The test shall be at least in 50Hz/1KHz/5KHz condition. The output current transient repetition rate is only a test specification.And +12V outputs' min load is 1A when do dynamic loading test.

Table10.

Output Voltage	Transient Step (A) Percent of Rated Current	Slew rate (A/us)	Frequency (Hz)	Cap (uF)
+12V	60% of max load	0.5	50-5K	2800
+12Vsb	1.0	0.25	50-5K	470

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 all load conditions.

Table11.

Output Voltage	+12V	+12Vsb
Capacitive loading (uF)	500~25000	20~2200

3.8 Current Sharing

PSU shall have output Or-ing devices for 12V, and active load sharing for 12v, No requirement for 12vsb current share, 12V load sharing shall be a single wire type. Connecting the load share bus pins of each power supply together shall enable the current share feature. Load sharing accuracy is displayed in the following table.

Table12.

12V Load Sharing Specification (1+1)	
Load current	Specification
<50% of full load	no requirements
>= 50% of full load	<=5%

Table13. 12V load sharing signal (12VLS) specification

Item	Meaning	Specification	Units
V-share; I out=Max for 12V	12V maximum load sharing bus voltage	8	V
△Vo/△Io for 12V	12V load sharing bus voltage change rate	8/Imax	V/A

Note: 1+1 redundant mode the current sharing precision calculating formula is ｜Iout1-Iout2｜/(Iout1+Iout2).

Shorting or opening of a current share pin shall not cause the output voltage to go out of steady state regulation. For 45A load the LS voltage shall be 8 V+/-0.8V for a single power supply. The LS pin's voltage VS load requirements are as below table and curve when single power supply.

3.9 Hot Swap Requirement

Hot swapping is the process of inserting and extracting a power supply from an operating power system. During this process the output voltage shall remain within the limits. The hot swap test must be conducted when the system is operating under static, dynamic and no loading conditions. The power supply shall use a latching mechanism to prevent insertion and extraction of the power supply when the AC power cord is inserted into the power supply. The power supplies must be able to operate in a hot-swap/redundant configuration.

3.10 Control Signal

3.10.1 Control and Status Signals

All control signals shall be TTL compatible with respect to the output return and shall be isolated from the primary circuit and be SELV (safety extra-low voltage circuit) rated.

3.10.2 Input OK Signal

Input OK signal is an input voltage OK signal and will be asserted low when the power supply to indicate that the input voltage are within range. When input voltage is out of range, the input OK signal will be pulled to a high state. This signal is an output signal pulled up to +3.3Vs with a 1Kohm current limit resistor in PSU.

Table14. Input OK Signal Characteristic

Signal Type	Power State	Logic Level (Min)	Logic Level (Max)
Input OK Signal=Low	Input OK	0V	0.6V
Input OK Signal=High	Input Fail of Range	2.4V	3.46V
Sink Current (Low)			4mA
Source Current (High)			0.2mA
Input OK Rise and Fail Time			0.5ms

3.10.3 PSON Input Signal

The PSON signal is required to remotely turn on/off the power supply. PSON is an active low signal that turn on the +12V power rail. When this signal is not pulled low by the system, or left open, the output is turned off. This signal is pulled to a standby voltage by a pull-up resistor internal to the power supply. Refer to section 3.4 for the timing diagram. This signal accepts an open collector/drain input from the system and a 5.1K resistor pull-up to +3.3Vs located in PSU

Table15. PSON Signal Characteristic

Signal Type	Power State	Logic Level (Min)	Logic Level (Max)
PSON=Low	ON	0V	1.0V
PSON=High or Open	OFF	2.0V	3.46V
Source Current (Low)	ON		4mA

3.10.4 PWOK (Power OK) Output Signal

PWOK is a power OK signal and will be pulled high when the power supply to indicate that all the outputs are within the regulation limits of the power supply. When any output voltage falls out of regulation limits or when AC power has been removed for a time sufficiently long so that power supply operation is no longer guaranteed, PWOK will be de-asserted to a low state. The start of the PWOK delay time shall inhibited as long as any power supply output is in current limit. This signal is open collector/drain output and a 0.27K ohm resistor pull-up to +3.3Vs in power supply.

Table16. PWOK Signal Characteristic

Signal Type	Power State	Logic Level (Min)	Logic Level (Max)
PWOK=Low	Power Not OK	0V	0.6V
PWOK=High	Power OK	2.4V	3.46V
Sink Current (Low)			0.4mA
Source Current (High)			2mA
PWOK Rise and Fall Time			0.5ms

3.10.5 SMBAlert Signal

This is low active, sideband and open collector signal indicates that the power supply is experiencing a problem, warning or fault that the user should investigate. The signal shall activate in the case of critical component temperature reached a warning threshold,output over current warning. It's also to be asserted in parallel with LED turning solid Amber or blink Amber. This signal is open collector output and a 2K ohm resistor pull-up to +3.3Vs in power supply.

Table17. Alert Signal Characteristic

Signal Type	Power State	Logic Level (Min)	Logic Level (Max)
Alert=Low	Alert to system	0V	0.6V
Alert=High	Power OK	2.4V	3.46V
Sink Current, Alert=Low			4mA
Alert Rise and Fall Time			0.5ms

3.10.6 SDA and SCL Signal

SDA and SCL pins (for I2C bus) is designed to operate at +3.3V volts. The pull-up resistors are 10K ohm to +3.3Vs in power supply.

3.10.7 A0, A1 Signal

PSU module address line 0 and line 1. This signal line is provided for determining the address for the specific PSU FRU and SMBus address. Two 10Kohm pull-up resistors should be located in the PSU and the pull-up voltage should be limited to +3.3Vs. The address line should be either float or pull low with equal to or less than 100ohm in the motherboard design.

3.10.8 EEPROM

The power supply shall have a 24LC02 256 bytes serial EEPROM, which contains power supply specific information, this device will be programmed by the unit vendor with detailed information on the unit. This device shall have its highest order address bit (A2 internally wired to ground). The A0 & A1 address bit are wired to the output connector.

Table18. Address Signals

A1	A0	EEPROM Address	MCU Address	PSU
0	0	A0	B0	1
0	1	A2	B2	2
1	0	A4	B4	3
1	1	A6	B6	4

3.10.9 No Load Condition

The power supply shall not be damaged nor cause abnormal operation at no load condition.

3.11 Power Cold redundancy Require

3.11.1 Power MCU Address Settings

Power should support N+1 cold redundant, N≤3. Power address settings is refers to the below table.

Table19. Power MCU Address Settings

A1 (B20 Pin)	A0 (B19 Pin)	Power Internal MCU Address	Power slot Position
0	0	B0	1
0	1	B2	2
1	0	B4	3
1	1	B6	4

3.11.2 Cold Redundancy Configuration

There is a Cold_Redundancy_CONFIG (FCh) command in power supply, the system can read or write access. The format of the command for example: the command S B0 w FC 55 PEC P is to set the register of power supply B0 to 55h. According to the requirements, the value of the register can be set to 00h / 55h / 0Eh. The different value represents the diffident meaning that can refer to the descriptions from the below table.

Table20. Cold Redundant Configuration Description

Cold Redundant Configuration (FCh)		
Value	State	Description
00h	Standard Redundancy	Power loading in average cold redundant.
55h	Cold Redundant Active	Normal operating output power from cold redundant.
0Eh	Cold Redundant Standby	Standby power without output power from cold redundant.
Remarks: The power supply which is in cold standby mode will not involve the output loading by slightly decreases its output voltage.		

The default factory setting state is standard redundant, its value is 00h.

When power supply occurs any abnormal conditions (including AC cord plugging in/out, power off reset, over-temperature warning, ambient temperature out of range; 12V short protection, UVP, OVP, OCP, Fan alert and abnormal internal circuit) will make the register value reset to default 00h, and also set the CRB (B22 PIN) to low level, force the other paralleled operating power supplies into standard redundancy state.

3.11.3 Cold Standby Signal Require

The essential condition for power supply access into cold standby state: PSON is low level, the register value should be 0Eh. At the same time the requirements for the power supply which is access into cold standby state as below:

When CRB is low level, the power of cold redundant active and cold standby should be awaked immediately and the FCh value recovers to 00h, moving into standard redundancy state.

Keep PWOK (A25 PIN) as high level.

Every power status should keep normal, could not report any fault or abnormal condition, unless it is indeed existed.

Indicator light should flicker as the specification requirements.

Table21. CR_Bus Signal Characteristic

Signal Type	Power State	Logic Level (Min)	Logic Level (Max)
CR_Bus=Low	Active Redundant Mode	0V	0.6V
CR_Bus=High	Standby Redundant Mode	2.4V	3.46V

3.11.4 Access Cold Redundancy Status

For example , the cold redundancy operating mode of power supply should follow the below descriptions.

Cold Redundancy BUS (B22 PIN) abbreviate CRB, power Supply Unite abbreviate PSU.

Table22. Power Access Cold Redundancy example sheet

PSU	FCh Register Value (hex)		
	Step1	Step2	Step3
1#	00	55	55
2#	00	55	0E
CRB	Low Level	High Level	High Level

3.11.5 Exit Cold Redundancy State

PSU could exit cold redundant mode by system command or load over threshold.

1. Exit Cold Redundancy command by system command

When PSU is working in cold redundant mode, system can send command to order the PSU in cold standby mode. By setting the FCh to 55h or 00h to exit cold redundant standby mode and move into cold redundant active or standard redundancy mode. When setting the cold standby PSU to 00h, to let PSU move into standard redundancy state, at the same time pull low the CRB from high level to low level. Then drive all the paralleled PSU to move in standard redundancy state.

2. Exiting Cold Redundancy by Output Load Over Threshold

When output loading is greater than 70% full load, CR Standby PSU will exit cold standby automatically and move into standard redundancy state. When output loading is less than 40% full load, the PSU will automatically enter cold standby state.

4.0 PROTECTION

When the +12V output OVP /UVP /OCP is triggered, the power supply will shut down and latched off. The latch can be cleared by toggling the PSON signal or by an AC power interruption. When the input UVP/OVP, +12Vsb output's OVP/OCP, or OTP is triggered, the power supply will shut down and self-recovery when the fault condition removed.

4.1 Input Under and Over Voltage Protection (Input UVP/OVP)

Table23.The input UVP and OVP should meet the below table.

Input voltage	Under Voltage warning	Under Voltage protection	Self-recovery Voltage
HVDC	145V±10V	140V±10V	150V±10V
AC	79V ±5V	74V ±5V	84V±5V
Input voltage	Over Voltage warning	Over Voltage protection	Self-recovery Voltage
HVDC	410V ±10V	415V ±10V	400V ±10V
AC	315V ±10V	320V ±10V	310V ±10V

4.2 Over Voltage Protection (OVP)

The power supply should have over and under voltage protection to prevent the outputs from exceeding limits or abnormal operation. If the +12Vsb's OVP occurred, the power supply should shut down and self-recovery after the fault condition removed. If the +12V's OVP occurred, the power supply will shut down and latched off. The latch state can be cleared by toggling the PSON signal or by an AC power interruption.

+12V and +12Vsb OVP range: 13.3Vdc~15.6Vdc

4.3 Over Temperature Protection (OTP)

The power supply will be protected against over temperature conditions caused by loss of fan cooling or excessive ambient temperature. In over temperature protection (OTP) condition the PSU will shut down. When the power supply temperature drops to within specified limits, the power supply shall restore power automatically, while the +12Vsb remains always on.

The first temp sensors is on the transformer PCB board to sense the synchronous MOSFET copper temperature, The second sense resistor on the control board and located at the air intake to sense the ambient temperature.

Table24.

The temp sensors	OT warning	OTP	OTP_Recovery
Second ambient	60±5℃	65±5℃	55±5℃

4.4 Short Circuit Protection (SCP)

The power supply shall be protected from damage due to faults between output (+12V or +12Vsb) and GND. Short circuit of the power supply outputs shall not result in fire hazard, shock hazard, or damage to the power supply. Components shall not be damaged during the short circuit conditions. If the +12V shorted to GND, the power supply will shut down and latch off, the latch can be cleared by toggling the PSON signal or by an AC power interruption. All outputs shut down upon a short circuit of the +12Vsb and when the short is removed, the power supply shall self-recovery.

4.5 Over Current Protection (OCP)

The power supply should have over current protection to prevent the outputs from exceeding limits, if the +12V OCP occurred, the power supply should shut down and and and latched off. The latch can be cleared by toggling the PSON signal or by an AC power interruption. If the +12Vsb OCP occurred, the power supply should shut down and will be auto recovery after removing OCP limit.

Table25. OCP Limited Table

Item	Min	Max
+12Vsb OCP	3A	6A
+12V OC Warning	47A	52A
+12V OCP	52A	62A

4.6 FAN Warning and Fault

If the fan speed control duty cycle was set greater than 10%, but the fan speed is 100-2000 RPM, the PSU should send out fan alarm signal, when it less than 100RPM, the PSU should send out fan failure signal.

4.7 Output LED Description

There will be a dual color LED lamp on the case's front panel. The color is green and orange to indicate the power supply status. There will be a (slow) blinking green to indicate that AC is applied to the PSU and the standby voltage is available. It shall go steady to indicate that all the power outputs are available. This same LED will (slowly) blink or be solid ON orange to indicate that the power supply has failed or warning status and the replacement of the unit is may be necessary. The LED operation is defined as below table.

The LED shall be visible on the power supply's exterior face. The LED locations shall meet ESD requirement. The LED shall be securely mounted in such a way that incidental pressure on the LED will not cause it falling into panel.

Table26. LED Requirement

Power Supply Condition	**LED State**
Output ON and OK	GREEN
No AC power to all power supplies	OFF
PSU standby state AC present / Only 12VSB on	1Hz Blink GREEN
Power supply is cold standby state or always standby state as defined in the Cold Redundancy section of the CRPS Common Requirements Specification	1Hz Blink GREEN
AC cord unplugged or AC power lost; with a second power supply in parallel still with AC input power.	Amber
Power supply critical event causing a shutdown; failure, over current, short circuit, over voltage, fan failure, over temperature	Amber
Power supply warning events where the power supply continues to operate; high temp, high power, high current, slow fan.	1Hz Blink Amber
Power supply FW updating	2Hz Blink GREEN

5.0 OPERATE ENVIRONMENT

5.1 Operate Temperature

Operate temperature: 0℃ to +50℃

5.2 Storage Temperature

Storage temperature: -40℃ to +70℃.

5.3 Operate Humidity

Operate Humidity (non-condensing): 10% to 90%.

5.4 Storage Humidity

Storage Humidity (non-condensing): 5% to 95%.

5.5 Operate Altitude

Operate Altitude: 0 to 5000m.

5.6 Storage Altitude

Storage Altitude: 0 to 10000m.

6.0 SAFETY

6.1 Safety Certification

NA

6.2 Hi-pot

Primary to secondary, HI-POT Withstand voltage: 1800Vac, 50/60Hz, 60s, leakage current <10mA or 2545Vdc, 60s, leakage current <5mA for power supply;

3000Vac, 50/60Hz, 60s, leakage current <10mA or 4242Vdc, 60s, leakage current <5mA when PCBA;

Primary to GND, HI-POT Withstand voltage: 1800Vac, 50/60Hz, 60s, leakage current <10mA or 2545Vdc, 60s, leakage current <5mA.

6.3 Grounding Impedance Test

Grounding impedance test using grounding current 40A and the impedance is less than 100mohm.

6.4 Leakage Current

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 264Vac/60Hz conditions to be less than 1.75mA test with customer system.

6.5 Insulation Resistance

Primary to Secondary: 500Vdc for 60S, the isolation resistance shall not be less than 100Mohm.

6.6 Smokeless

Parts failure in the power supply shall not have smoke and flame. And it is necessary to put a fuse in the front of DC-DC conversion circuit or equivalent circuit to prevent smoke and diffusion. Parts failure will trigger the fuse open. All power components are not limited in safety components, but it should be required to verify in the smoke-less testing.

6.7 Warning

1. The PSU must have insulation protection.

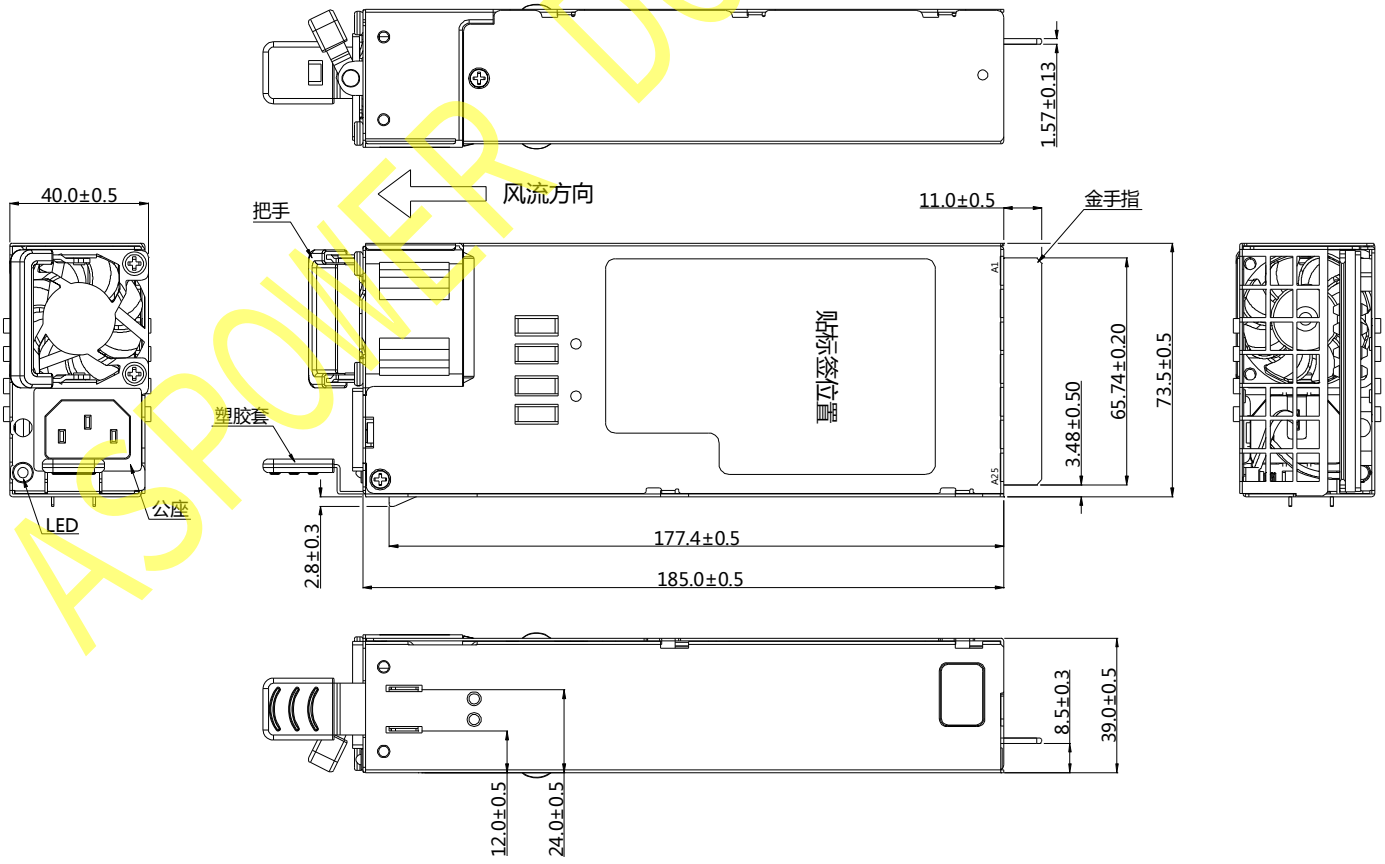
2. To avoid electric shock and injury, the PSU must not be energized before finishing installation.

3. This PSU only allows professional maintenance.

7.0 OUTLINE STRUCTURE

7.1 Outline Dimension

Outline dimension: 185mm (L)*73.5mm (W)* 39mm (T)



7.2 Output Connector

Pin	Name	Pin	Name
A1	GND	B1	GND
A2	GND	B2	GND
A3	GND	B3	GND
A4	GND	B4	GND
A5	GND	B5	GND
A6	GND	B6	GND
A7	GND	B7	GND
A8	GND	B8	GND
A9	GND	B9	GND
A10	+12V	B10	+12V
A11	+12V	B11	+12V
A12	+12V	B12	+12V
A13	+12V	B13	+12V
A14	+12V	B14	+12V
A15	+12V	B15	+12V
A16	+12V	B16	+12V
A17	+12V	B17	+12V
A18	+12V	B18	+12V
A19	SDA	B19	A0
A20	SCL	B20	A1
A21	PSON	B21	+12V SB
A22	Alert	B22	SM-Bus
A23	GND Sense	B23	LS
A24	+12V Sense	B24	Present
A25	PWOK	B25	Input OK

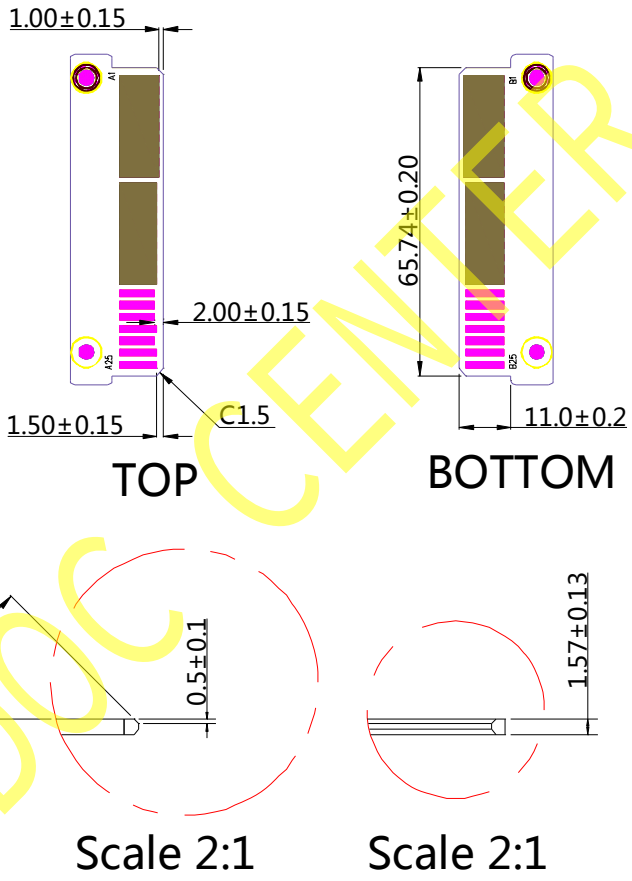


Table27. Output Terminals

Signal	Description
GND	Outputs return and it's also connected with the case.
+12V	The main output voltage.
PMBus*SDA	I2C Data bus.
PMBus*SCL	I2C Clock bus, 100kHz max.
A0(SMBus*address)	Address set Pin.
A1(SMBus*address)	Address set Pin.
PSON	Remote ON/OFF control signal: When the PSON signal is low, the power supply will turn on the +12V main output, and turn off when it's high.
+12Vsb	The auxiliary output voltage.

Alert	Power supply warning signal: When this pin get low signal will notice system the power supply has some fault occurred.
SM-Bus	Power supply cold redundancy control signal.
GND Sense	+12V output GND return sense for feedback.
+12V Sense	+12V output voltage sense for feedback.
LS	+12V output load sharing bus.
PWOK	Power supply work OK signal.
Present	Power supply online signal, connected to GND in the Power supply.
Input OK	Input voltage OK signal

8.0 EMI AND EMS REQUIREMENT

Table28. EMI (Electromagnetic Interference) Requirements Table

Item	Description and Requirement	Criterion	Notes
Radiated Emissions	Frequency: 30MHz~1GHz Class A	EN 55032	230V/50Hz input
		FCC Part 15	120V/60Hz input
Conducted Emissions (Voltage)	Frequency: 150KHz~30MHz Class A	EN 55032	230V/50Hz input
		FCC Part 15	120V/60Hz input
Harmonic	EN 61000-3-2 Class D	EN 61000-3-2	230V/50Hz input
Voltage Flicker	Pst≦1.0 and Plt≦0.65 Voltage change≦3.3% Relative Voltage change≦4% The voltage changed over 3.3% duration time should≦500ms	EN 61000-3-3	230V/50Hz input

Table29. EMS (Electromagnetic Susceptibility) Requirements Table

Item	Description and Requirement	Level	Criterion
Surge	Different Mode: ±1KV 2ohm Common Mode: ±2KV 12ohm	B	EN61000-4-5 EN 55035 GR-1089-CORE
Electrical Fast Transient Group (EFT)	±1KV	B	EN61000-4-4 EN 55035

			YD/T 1082
Electrical Static Discharge (ESD)	Touch: ±6KV Air: ±8KV	B	EN61000-4-2 EN 55035
Radiated Susceptibility (RS)	80M~2.7GHz 3V/m 80% AM	A	EN 61000-4-3 EN 55035
Conducted Susceptibility (CS)	150KHz~80MHz 3V 80% AM	A	EN 61000-4-6 EN 55035
Voltage Dips and Interruptions	0% Ut: 10ms 70% Ut: 500ms 0% Ut: 5000ms	B C C	EN 61000-4-11 EN 61000-4-29 EN 55024 / 60601 GB 19286

Note:

Performance criterion of the voltage fluctuation immunity test:

A: The power supply should have no loss of function or degradation of performance according to its specification during the test.

B: Temporary loss of function or degradation of performance is acceptable, but all the outputs should be in an acceptable range and should recover to normal after the test. The power supply shouldn't loss any of outputs, reset or any abnormal warning when doing the test with system.

C: Temporary loss of function or shut down is acceptable, but the power supply should restart with an operator intervention or auto-restart normally after the test.

9.0 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 (Safety Extra Low Voltage) 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.

10.0 MECHANICAL PERFORMANCE

Non-operating:

Sine sweep: 5~500Hz @0.5gRMS at 0.5 octave/min; dwell 15 min at each of 3 resonant points;

Random profile: 5Hz @0.01g^2/Hz (slope up); 20~500Hz @0.02g^2/Hz (flat);

Input acceleration = 3.13gRMS; 10min.per axis for 3 axis on all samples.

11.0 MTBF

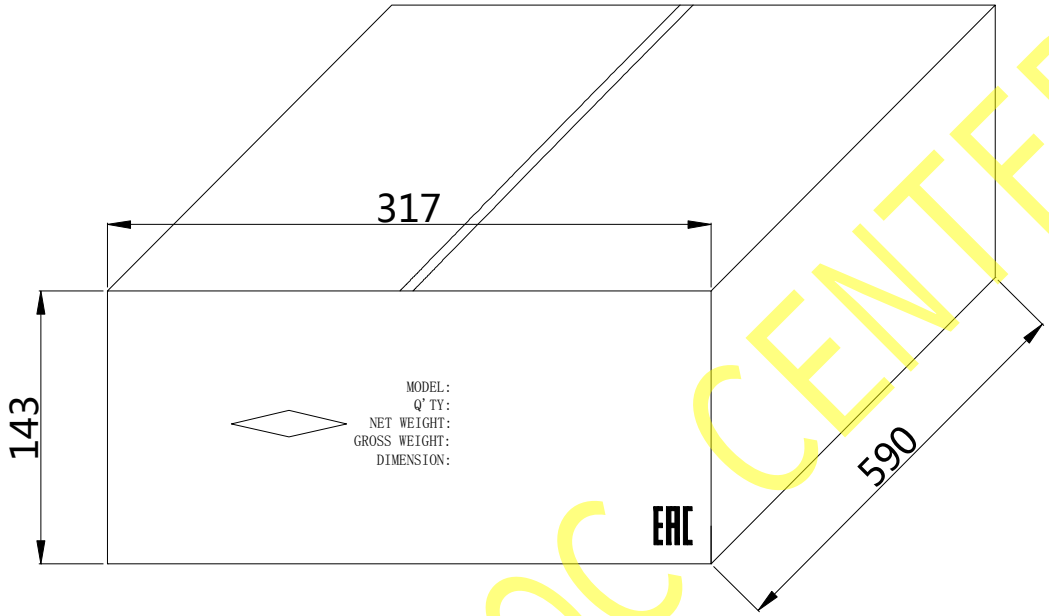
Quantitative reliability (Quantitative) performance requirements: MTBF (MTBF Mean Time between Critical Failure), according to the Bellcore standard: Telcordia Technologies SR-332 (Method I Case 3), the PSU operates continuously under 25degC condition, 230Vac/50Hz and 115Vac/60Hz under 100% load, the testing process should not be interrupted.

Table30.

Item	Requirement	Notes
E-CAP Life Time	≧5 years at 25℃ ambient	Should ≧3 years at 25℃ ambient when mating with the system of customer
CMTBF (Calculated MTBF)	≧250,000 hours, at 25℃ (≧100,000 hours, at 40℃) ambient temperature and full load	By Telcordia SR-332 issue 2

12.0 PACKAGE

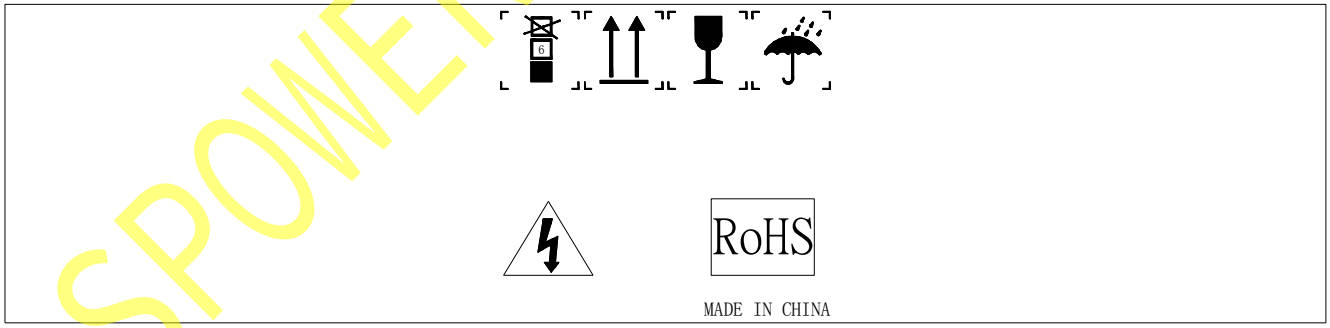
12.1 Outline Diagram of Carton



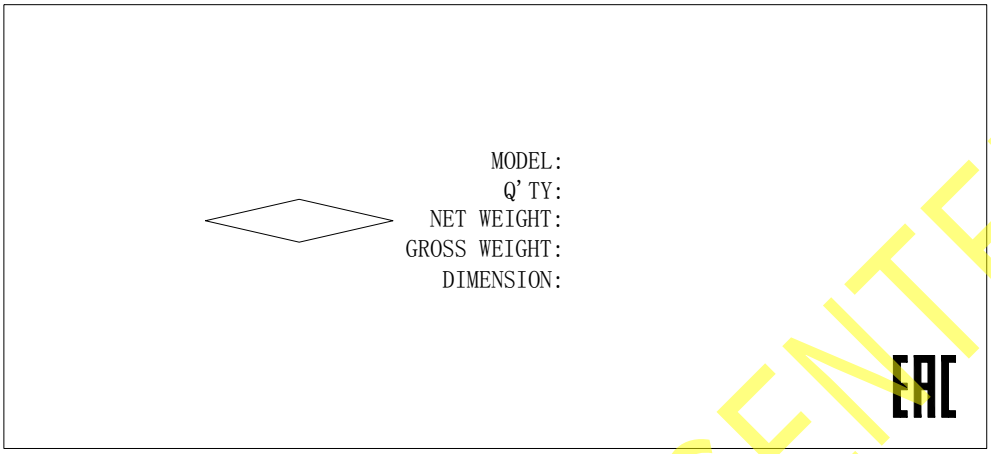
Note:

Material: K=K, five layers of corrugated paper

12.2 Side Label



12.3 Front Label



13.0 SOFTWARE

13.1 Data Precision Requirement

Some data read from power supply should have a precision requirement as below table:

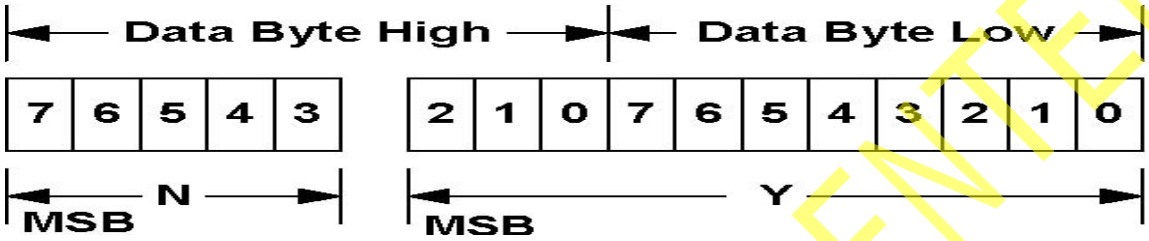
Table31. Required Accuracy

Input Voltage	Output load condition	<10%	10%-20%	>20%
115Vac/230Vac/240Vdc	Read_VIN(88h)	±5%	±5%	±5%
	Read_IIN(89h)	±5% or ±0.1A	±5%	±5%
	Read_PIN(97h)	±5% or ±10W	±5%	±5%
	Read_Vout(8Bh)	±5%	±5%	±5%
	Read_Iout(8Ch)	±5% or ±1A	±5%	±3%
	Read_Pout(96h)	±5% or ±10W	±5%	±3%
	Read_Temperature(8Dh) ambient temperature	±5℃	±5℃	±5℃
	Read_FAN_SPEED1(90h)	±300rpm	±300rpm	±300rpm

13.2 PMBus Specification

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 above:

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.

13.3 PMBUS Command Supported

The following PMBus STATUS commands shall be supported. All STATUS commands stated in Table 32 as supporting PAGE instances shall support the PAGE_PLUS_WRITE and PAGE_PLUS_READ commands since they are used by both the BMC and ME. The BMC and ME refer to the two instances of the commands accessed via the PAGE_PLUS_WRITE and PAGE_PLUS_READ commands. The status bits shall assert whenever the event driving the status bit is present.

The STATUS events are also used to control the SMBAlert# signal. The new SMBALERT_MASK command is used to define which status event control the SMBAlert# signal. Default values for these mask bits are shown in the table below.

Table 32. PMBus STATUS Commands Summary

PMBus command	Bit location	PSU state when bit is asserted ('1')	Instances No PAGE'ing PAGE 00h =BMC PAGE 01h = ME	SMBALERT_MASK defaults for each of the three instances (No PAGE, PAGE 00h, PAGE 01h)

				0 = causes assertion of SMBAlert# 1 = does not cause assertion of SMBAlert#
STATUS_WORD			No PAGE, 00h, 01h	
OFF	6 (lower)	OFF		NA
IOUT_OC_FAULT	4 (lower)	Refer to STATUS_IOUT		NA
TEMPERATURE	2 (lower)	Refer to STATUS_TEMPERATURE		NA
VIN_UV_FAULT	3 (lower)	Refer to STATUS_INPUT		NA
VOUT	7 (upper)	Refer to STATUS_VOUT		NA
IOUT/POUT	6 (upper)	Refer to STATUS_IOUT		NA
INPUT	5 (upper)	Refer to STATUS_INPUT		NA
POWER_ GOOD#	3 (upper)	OFF		NA
FANS	2 (upper)	Refer to STATUS_FANS		NA
STATUS_VOUT			No PAGE'ing	
VOUT_OV_FAULT	7	OFF		1, 1, 1
VOUT_UV_FAULT	4	OFF		1, 1, 1
STATUS_IOUT			No PAGE'ing, 00h, 01h	
IOUT_OC_FAULT	7	OFF		1, 1, 1
IOUT_OC_WARNING	5	ON		1, 1, 0
STATUS_INPUT			No PAGE'ing, 00h, 01h	
VIN_OV_FAULT	7	OFF		1, 1, 1
VIN_UV_FAULT	4	OFF		1, 1, 1
STATUS_TEMPERATURE			No PAGE'ing, 00h, 01h	
OT_FAULT	7	OFF		1, 1, 1
OT_WARNING	6	ON		1, 1, 0
STATUS_FANS_1_2			No PAGE'ing	
Fan 1 Fault	7	OFF		1, 1, 1
Fan 1 Warning	5	ON		1, 1, 1

Table33. STATUS_WORD Command

Byte	Bit No.	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	No
	0	UNKNOWN	A fault type not given in bits [15:1] of the SATUS_WORD has been detected	No

Table34. 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

Table35. 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	Yes
4	IOUT Undercurrent Fault	No
3	Current Share Fault	No
2	Power Limiting	No
1	POUT Overpower Fault	No
0	POUT Overpower Warning	Yes

Table36. STATUS_INPUT Command

Bit	Meaning	Support
7	VIN Over voltage Fault	Yes
6	VIN Over voltage Warning	Yes
5	VIN Under voltage Warning	Yes
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

Table37. 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	No
2	Reserved	No

1	Reserved	No
0	Reserved	No

Table38. STATUS_FAN_1_2 Command

Bit	Meaning	Support
7	Fan 1 Fault	Yes
6	Fan 2 Fault	No
5	Fan 1 Warning	Yes
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

Table39. Supported Command Summary

CMD Code	Name	Type	Bytes	Conditions
03h	CLEAR_FAULTS	Send Byte	0	
05h	PAGE_PLUS_WRITE	Block Write	Variable	
06h	PAGE_PLUS_READ	Block Write-Block Read	Variable	
19h	CAPABILITY	Read Byte	1	
1Ah	QUERY	Block Read	1	
1Bh	SMBALERT_MASK	Block Write-Block Read	2	
20h	VOUT_MODE	Read Byte	1	
40h	VOUT_OV_FAULT_LIMIT	Read Word	2	
44h	VOUT_UV_FAULT_LIMIT	Read Word	2	
46h	IOUT_OC_FAULT_LIMIT	Read Word	2	
4Ah	IOUT_OC_WARN_LIMIT	Read Word	2	

4Fh	OT_FAULT_LIMIT	Read Word	2	
51h	OT_WARN_LIMIT	Read Word	2	
55h	VIN_OV_FAULT_LIMIT	Read Word	2	
57h	VIN_OV_WARN_LIMIT	Read Word	2	
58h	VIN_UV_WARN_LIMIT	Read Word	2	
59h	VIN_UV_FAULT_LIMIT	Read Word	2	
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	
80h	READ_VIN_TYPE	Read Byte	1	00:NO AC; 01:AC; 02:HVDC
81h	STATUS_FANS_1_2	Read Byte	1	
86h	READ_EIN	Block Read	6	
87h	READ_EOUT	Block Read	6	
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	Ambient temperature
8Eh	READ_TEMPERATURE_2	Read Word	2	Primary Heatsink temperature
8Fh	READ_TEMPERATURE_3	Read Word	2	Secondary Heatsink temperature
90h	READ_FAN_SPEED_1	Read Word	2	Rpm value
96h	READ_POUT	Read Word	2	
97h	READ_PIN	Read Word	2	
98h	PMBUS_REVISION	Read Byte	1	V1.2

99h	MFR_ID	Read Block	7	See MFR Data table
9Ah	MFR_MODEL	Read Block	10	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
A6h	MFR_IOUT_MAX	Read Word	2	See MFR Data table
A7h	MFR_POUT_MAX	Read Word	2	See MFR Data table
A8h	MFR_TAMBIENT_MAX	Read Word	2	
A9h	MFR_TAMBIENT_MIN	Read Word	2	
FCh	SMART_ON_CONFIG	Write Byte Read Byte	1	00h Standard Redundancy 55h Smart On Active 0Eh Smart Standby

Table40. MFR Data table

CMD Code	Name	Content
99h	MFR_ID	ASPOWER#######
9Ah	MFR_MODEL	U1A-D10550-DRB
A0h	MFR_VIN_MIN	90
A1h	MFR_VIN_MAX	264
A4h	MFR_VOUT_MIN	11.4
A5h	MFR_VOUT_MAX	12.6
A6h	MFR_IOUT_MAX	45
A7h	MFR_POUT_MAX	550

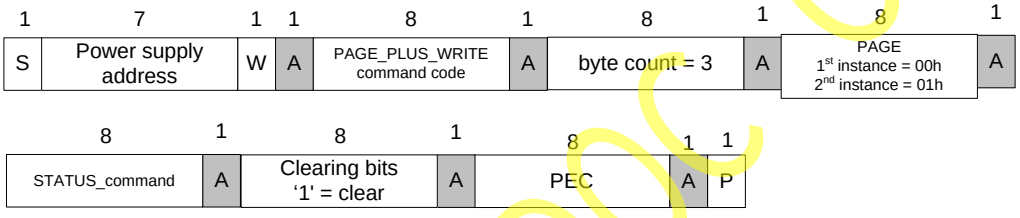
13.4 PMBUS Command Description

13.4.1 New PAGE_PLUS_WRITE / PAGE_PLUS_READ commands (05h/06h)

The new PAGE_PLUS_WRITE and PAGE_PLUS_READ commands are used with the STATUS_WORD, STATUS_INPUT, STATUS_TEMPERATURE, STATUS_IOUT, and STATUS_CML to create two instances of the same command. Each instance is set by the same events but cleared by their own master in the system. The instances at PAGE 00h are controlled by the system BMC and the instances at PAGE 01h are controlled by the system ME.

Below are the protocols used to write the STATUS_ commands using the PAGE_PLUS_WRITE command.

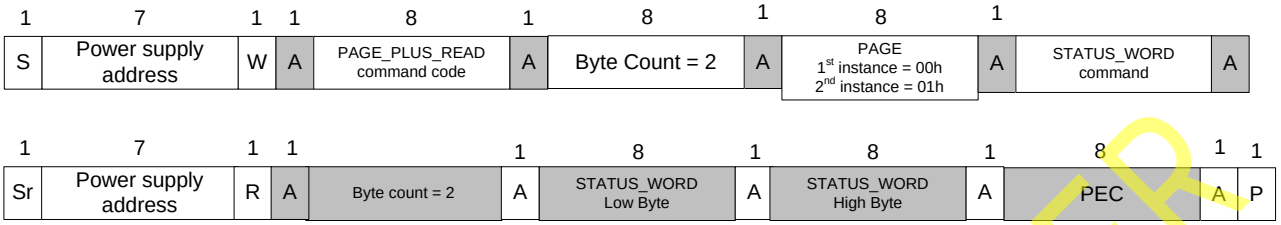
STATUS_TEMPERATURE, STATUS_IOUT, STATUS_INPUT, STATUS_CML
Block Write with PEC



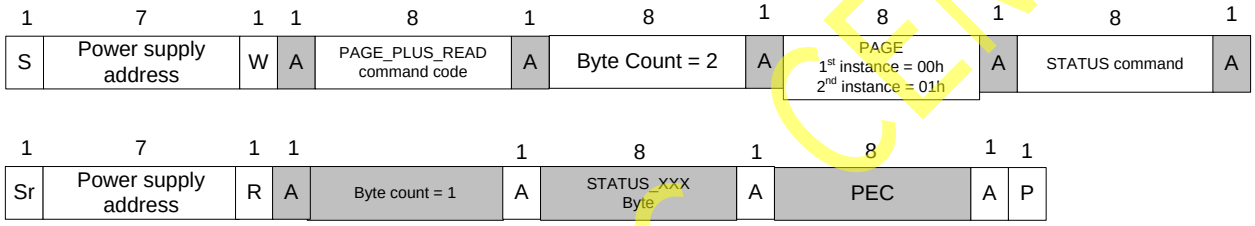
STATUS_WORD cannot be cleared directly It is cleared based on lower level status commands

Below are the protocols used to read the STATUS_ commands using the PAGE_PLUS_READ command.

Reading STATUS_WORD
Block Write – Block Read Process Call with PEC



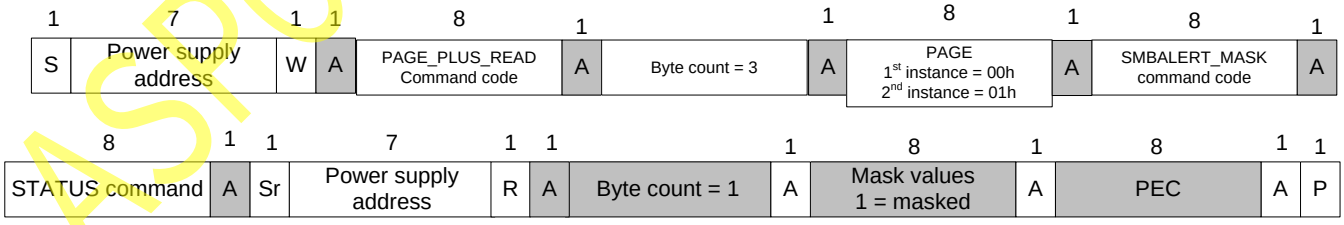
Reading STATUS_TEMPERATURE, STATUS_IOUT, STATUS_INPUT, STATUS_CML
Block Write – Block Read Process Call with PEC



13.4.2 SMBALERT_MASK (1Bh)

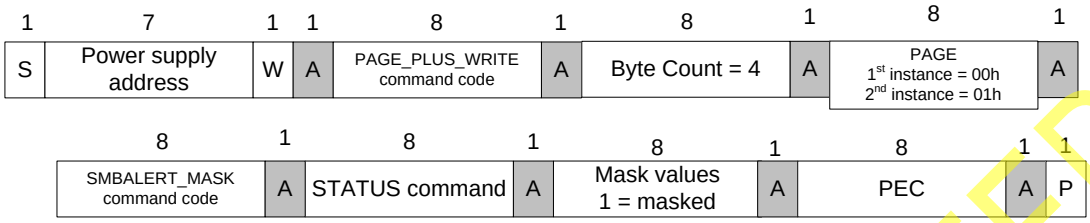
This allows the system to mask events from asserting the SMBAlert# signal and to read back this information from the PSU. SMBALERT_MASK command can be used with any of the supported STATUS events. The events are masked from asserting SMBAlert# by writing a '1' to the associated STATUS bits. The SMBALERT_MASK command is used in conjunction with the PAGE_PLUS command and STATUS_ commands. It is not supported for masking the Non-PAGE'd STATUS_ commands. Below are the protocols.

Reading mask values using PAGE_PLUS
Block Write – Block Read Process Call with PEC



PAGE_PLUS_READ command

Writing mask values using PAGE_PLUS
Block Write with PEC

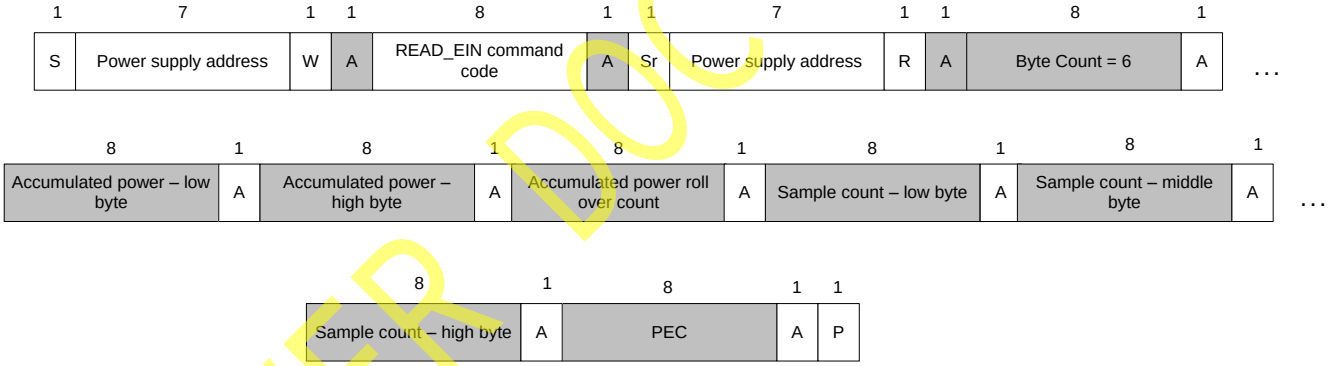


STATUS_WORD is not used with SMBALERT_MASK. Only the 'root' event bits are used to control the SMBAlert signal

PAGE_PLUS_WRITE command

13.4.3 READ_EIN & READ_EOUT commands (86h/87h)

The READ_EIN and READ_EOUT commands shall use the PMBus direct format to report an accumulated power value and the sample count. READ_EIN and READ_EOUT shall use the SMBus Block Read with PEC protocol in the below format.

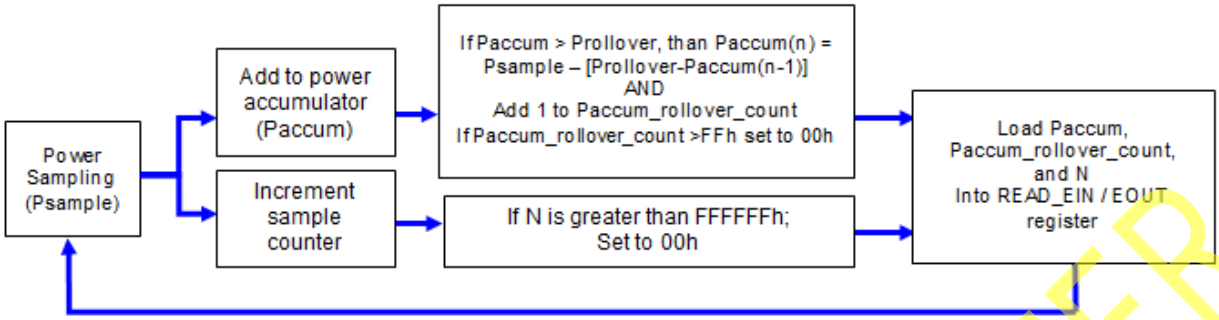


READ_EIN Command

READ_EIN and READ_EOUT Accumulators

The accumulated power data shall be the sum of input power values averaged over 4 AC cycles (or over 50ms for READ_EOUT). The value shall automatically roll-over when the 15 bit maximum value is reached (> 7FFFh). The sample count should increment 1 for each accumulated power value. The system shall calculate average power by dividing the accumulated power value by the sample count. The system must sample READ_EIN and READ_EOUT faster than the roll-over period to get an accurate power calculation. Below is a block diagram depicting the accumulator function in the PSU.

Important note: When the PSU responds to the system requesting READ_EIN or READ_EOUT data; the data in the sample count must always alignment with the number of samples accumulated in the power accumulator. To achieve this power accumulator, power rollover counter, and sample counter shall be loaded into a READ_EIN and READ_EOUT register at the same time.



Psample:	The sampled power value in linear or direct format
Paccum:	2 bytes in PMBus linear or direct format. The accumulated power values made up of Psample(0) + Psample(1) + … + Psample(n)
N:	3 byte unsigned integer value. The number of accumulated power values summed in Paccum
Prollover:	The max value of Paccum before a rollover will occur
Paccum_rollover_count:	1 byte unsigned integer counting the number of times Paccum rolls over. Once this reaches FFh; it will automatically get reset to 00h

READ_EIN PSU Functional Diagram

13.5 Black Box Data Recorder Requirements

This PSU supports "Blackbox" function, please refer the document which named "ASPOWER blackbox spec.docx"(Rev: 1.0).

13.6 Firmware Update Requirements

This PSU supports "In Application Programming"(IAP) function, please refer the document which named "ASPOWER bootloader spec.docx"(Rev: 1.0).