ASPOWER

深圳欧陆通电子股份有限公司

Electrical Specification

(With ATX output (SGCC) CRPS Module)

Drawn: 王宝玲

Design (EE): 彭清君

Design (ME): 黄栗崇

Design (FE): 辉供权

Approve: 李秀腾

REV	Description	Date
S0	Release	2020/06/18

深圳欧陆通电子股份有限公司

Contents

1.0 SCOPE

This specification defines the key characteristics for the 1600W power supply, This unit contains +12V,+5V,+3.3V,-12V and +5Vsb output ports. 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 below table, which includes the limited value of input current, input voltage, working frequency.

Table1.

	Min	Rated	Max	Units
AC input voltage	90	100~240	264	VAC
Frequency	47	50-60	63	Hz
DC input voltage	190	240	310	VDC
Input current	<15A@100-127Vac @full load，<10A@200-240Vac/240Vdc @full load			

2.2 Inrush Current

AC line inrush current shall not exceed 35A peak per module, after which, the input current should be no more than the specified maximum input current. Ignore the instantaneous charge current for X, Y caps, but the peak current during time should <0.2ms. The power supply must meet the inrush requirements for any rated input voltage, during cold start at any phase of AC voltage and under 25℃ ambient temperature.

2.3 AC Line Fuse

The power supply has a fuse in the live line wire of the input. The input fuse shall be a fast blow type. The input inrush current shall not cause the AC line fuse to blow under any conditions. All protection circuits in the power supply shall not cause the AC fuse to blow unless a component in the power supply has failed.

2.4 Efficiency

The power supply achieves the 80 plus platinum level by testing at the 230Vac/50-60Hz input, 25℃ ambient temperature and the loading condition show in below table.

Table2.

Load	+12V(A)	+5V(A)	+3.3V(A)	-12V(A)	+5Vsb(A)	Efficiency requirement
10%	11.7	2.2	1.8	0.0	0.4	>83%
20%	23.4	4.5	3.6	0.1	0.7	>88%
50%	58.6	11.2	9.0	0.2	1.8	>91%
100%	117.1	22.4	17.9	0.4	3.6	>88%

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

2.5 AC Line Dropout

An AC line dropout is defined to be when the AC input drops to 0VAC at any phase of the AC line for any length of time. During an AC dropout the power supply must meet dynamic voltage regulation requirements. An AC line dropout of any duration shall not cause tripping of control signals or protection circuits. If the AC dropout lasts longer than the holdup time, the power supply should recover and meet all turn on requirements. The power supply shall meet the AC dropout requirement over rated AC voltages and frequencies. A dropout of the AC line for any duration shall not cause damage to the power supply.

2.6 Power Factor

The power supply module 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/50-60Hz input condition.

Table3.

Load	10% Load	20% Load	50% Load	100% Load
PF	>0.80	>0.90	>0.95	> 0.96

2.7 Surge and Sag

AC line transient conditions are defined as "sag" and "surge". "Sag" is defined as the AC line voltage drops below nominal voltage. "Surge" is defined as the AC line voltage rises above nominal voltage. The power supply should meet below AC line sag and surge conditions.

Table4. AC Line Sag Transient Performance

Duration	Sag	Input Voltage	Frequency	Performance Criteria
=1/2 AC cycle	95%	100~127VAC 200~240VAC	50/60Hz	Full load and no loss of function or performance
>1.0 AC cycle	>30%	100~127VAC 200~240VAC	50/60Hz	Loss of function acceptable, self-recoverable

Table5. AC Line Surge Transient Performance

Duration	Surge	Input Voltage	Frequency	Performance Criteria
Continuous	10%	100~127VAC 200~240VAC	50/60Hz	No loss of function or performance
0 to 1/2 AC cycle	30%	115VAC/230VAC	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 (1000W/1600W). The power supply shall meet both static, dynamic voltage regulation and timing requirements for all loading conditions defined in specification.

Table6.

Input	Output Voltage	Min Current	Max current
90~140Vac	+12V	0	80.5
	+5V	0	25
	+3.3V	0	20
	-12V	0	0.5
	+5Vsb	0	4
180~264Vac 190~310Vdc	+12V	0	130.5
	+5V	0	25
	+3.3V	0	20
	-12V	0	0.5
	+5Vsb	0	4

Note:

1. The total max continuous output power is 1000W for 90~140Vac low input and 1600W for 180~264Vac /190~310Vdc high input,and should be derated at high ambient temperature reference to 5.0 OPERATE ENVIRONMENT .

2. The power supply can support no load working.

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	Rated	Max	Tolerance
+12V	11.4V	12.0V	12.6V	+/-5%
+5V	4.75V	5.00V	5.25V	+/-5%
+3.3V	3.14V	3.30V	3.46V	+/-5%
-12V	-10.8V	-12.00V	-13.20V	+/-10%
+5Vsb	4.75V	5.00V	5.25V	+/-5%

3.3 Ripple & Noise

Table8.

Output voltage	Ripple & noise	Min Capacitive Load
+12V	<120mV	470uF
+5V	<50mV	470uF
+3.3V	<50mV	470uF
-12V	<120mV	-
+5Vsb	<50mV	180uF

Note: 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 are placed at the point of measurement.when testing ripple,a low ESR electrolytic capacitor should be added at the test point.

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
Tsb_on_delay	Delay from AC being applied to +5Vsb being within regulation.		1500	ms
Tac_on_delay	Delay from AC being applied to Vout being within regulation.		3000	ms
Tvout _rise	Output voltage rise from 10% to 90% time for +12V.	5	70	ms
Tvout _rise	Output voltage rise from 10% to 95% time for +5Vsb,+5V,+3.3V,-12V.	1	25	ms
Tsb_vout	Delay from +5Vsb being in regulation to main output being in regulation at AC turn on.	50	1000	ms
Tpson_on_delay	Delay from PSON active to main 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 stay within regulation after loss of AC.	12		ms
Tpwok_holdup	Delay from loss of AC to de-assertion of PWOK.	11		ms
TVsb_hold up	Time the +5Vsb 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

Note: 1. Tsb-on & Tac-on Delay Time: The Tsb-on delay time for +5Vsb should be ≤ 1.5s at rated input when full load. The Tac-on delay time for +12V,+5V,+3.3V,-12V should be ≤ 3s at rated input when full load.

2. Rise Time (Tvout _rise): The +12V must rise from 10% to 95% within regulation limits within 5 to 70ms. For +5V，+3.3V,-12V,+5Vsb, it is allowed to rise within 1.0 to 25ms. All outputs must rise monotonically.

3. Main Output Delay Time (Tsb_vout): The +12V,+5V,+3.3V,-1V being in regulation delay from +5Vsb being in regulation should be 50 to 1000ms when at AC turn on.

4. Tpson_on_delay: The main output must be within regulation after PSON active for 4 to 400ms.

5. Power Work OK Delay (Tpwok_on): PWOK should delay from +12V,+5V,+3.3V,-12V output within regulation for 100 to 500ms.

6. Hold Up Time(Tvout_holdup):This test should under 1+0 state. The hold up time for +12V,+5V,+3.3V,-12V≧12ms & PWOK≧11ms at any phase of rated voltage input when 70% full load. The hold up time for +5Vsb should≧70ms.

7. Power Fail Delay Time (Tpwok_off): This test should under 1+0 state.+12V,+5V,+3.3V,-12V output dropping out of regulation delay from PWOK should≥1ms when power off at 70% full load.

8. Duration Time for PWOK (Tpwok_low): The duration time of PWOK when OFF/ON cycle using AC or the PSON signal should ≥ 100ms.

9. PWOK Delay PSON Deactivate (Tpson_pwok): PWOK being de-asserted should delay from PSON deactivate≤ 5ms.
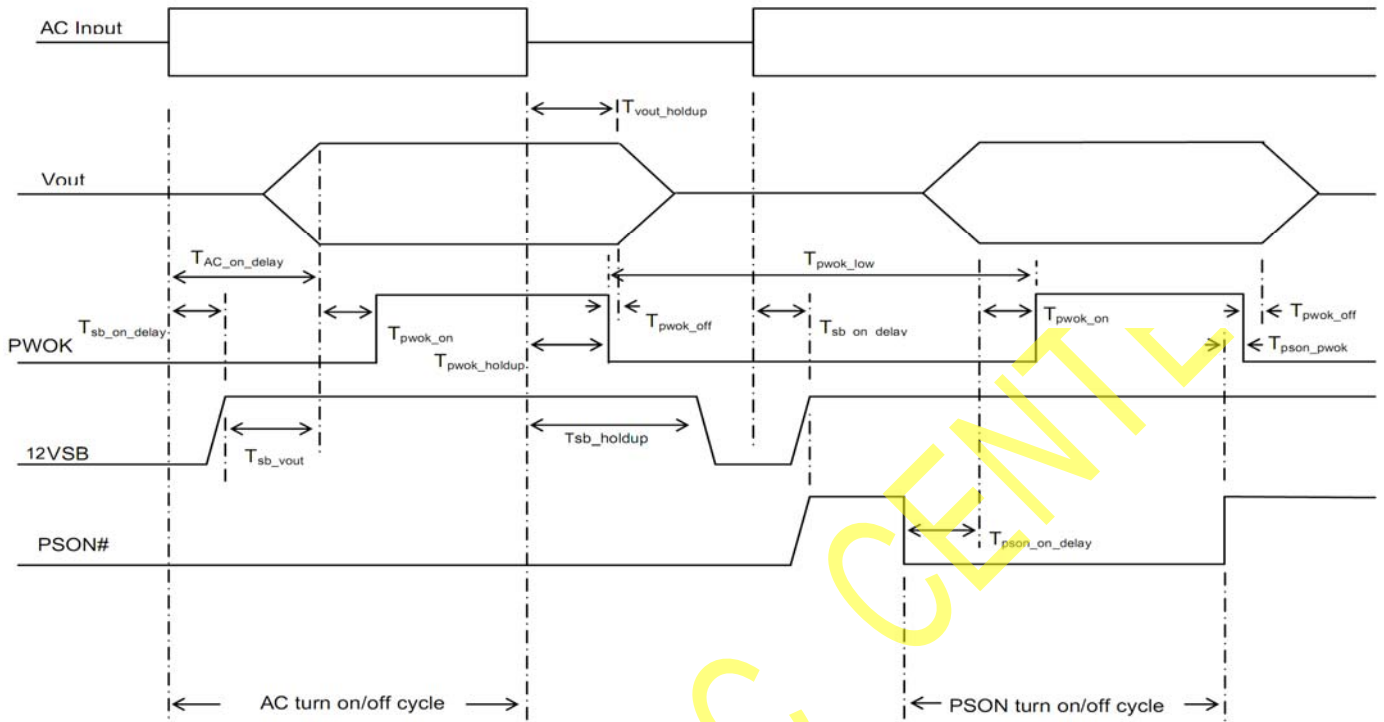
3.5 Overshoot

The turn-on overshoot due to application of AC input or remote enable shall be < 5% 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. And +12V,+5V,+3.3V,-12V and +5Vsb output's min load is 1.0A,1.0A,1.0A,0.05A, 0.1A when do dynamic loading test. The test shall be at least in 50 Hz/1KHz/5KHz condition. The output current transient repetition rate is only a test specification.

Table10.

Output Voltage	Transient Step (A) Percent of Rated Current	Slew rate (A/us)	Frequency (Hz)	Cap (uF)
+12V	40% of max load	0.5	50-5K	1000uF
+5V	40% of max load	0.5	50-5K	1000uF

+3.3V	40% of max load	0.5	50-5K	1000uF
-12V	0.5	0.5	50-5K	1000uF
+5Vsb	1.0	0.5	50-5K	1000uF

3.7 Capacitive Loading

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

Table11.

Output Voltage	+12V	+5V	+3.3V	-12V	+5Vsb
Capacitive loading (uF)	2000~50000	2000~10000	2000~10000	10~1000	10~3100

3.8 Current Sharing

All outputs shall be capable of operating in a redundant current share mode. A maximum (TBD) of power supplies may be operated in parallel. All outputs shall incorporate an isolation diode or mosfet for fault isolation. The +5Vsb current sharing shall be a drop type. The +12V,+5V,+3.3V,-12V current sharing shall be an active type. Connecting the load share bus pins of each power supply together shall enable the current share feature. With the current share pins tied together, the +12V output load current shall be balanced to within 5% when 12V output at ≧15% total full load and no load for +5Vsb.

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 No Load Condition

The power supply shall not be damaged nor cause abnormal operation at any load conditions including no load. The power supply shall be able to turn on and off under no load condition. The on and off waveforms shall be monotonic.

3.11 Output Regulation

All outputs shall remain within the tolerances in section 3.2's table under all allowable load and temperature conditions during load variations on the other output voltage, any combination of the following conditions. The outputs will be measured at the output terminals.

1. Input operating rated range.

2. Specified load range.

3. Cross regulation on dual or multiple outputs.

4. Specified environmental conditions.

3.12 Grounding

The output ground of the pins of the power supply provides the output power return path. The output connector ground pins shall be connected to the safety ground (power supply enclosure). This grounding should be well designed to ensure passing the max allowed common mode noise levels. The power supply shall be provided with a reliable protective earth ground. All secondary return circuits shall be connected to protective earth ground.

3.13 Control Signal

3.13.1 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.

3.13.2 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 outputs (except the +5Vsb) turn 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 20K ohm resistor pull up to +3.3Vs located in power supply.

Table12. 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

3.13.3 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 0.36K ohm resistor pull-up to +5Vsb in power supply.

Table13. PWOK Signal Characteristic

Signal Type	Power State	Logic Level (Min)	Logic Level (Max)
PWOK=Low	Power Not OK	0V	0.4V
PWOK=High	Power OK	2.4V	5.25V
Sink Current (Low)			0.4mA
Source Current (High)			2mA
PWOK Rise and Fall Time			0.1ms

3.13.4 Power Cold Redundancy Requirement

3.13.4.1 Power MCU Address Settings

Power should support 1+1 cold redundant. Power module address settings is refers to the below table.

Table14. Power MCU address settings

A1	A0	Power Internal MCU Address	Power slot position
0	0	B0	1
0	1	B2	2

3.13.5 EEPROM

The power supply shall have an ID EEPROM which contains power supply specific information:
Specially assemble part number, serial number, assembly deviation, special configurations, test history, field test history, and field trace-ability data. This data is stored in an EEPROM device located inside of the power supply. A 256bytes serial EEPROM is used in power supply. 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). .

Table15. Address Signals

A1	A0	EEPROM Address	MCU Address	PSU
0	0	A0	B0	1
0	1	A2	B2	2

3.13.6 Power Module LED Indicators

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 reached a warning status or has failed and therefore a replacement of the unit is/maybe 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 requirements. The LED shall be securely mounted in such a way that incidental pressure on the LED won't cause it to become displaced.

Table16. LED State Requirement

Power Supply Status	LED Status
+12V +5V +3.3V -12V Output ON and OK.	Green ON
No AC power to all power supplies.	OFF
+5V,+3.3V,-12V UVP/OVP/OCP,AC present/Only 5Vsb on (PS off).	1Hz Blink Green
AC cord unplugged or DC power lost; with a second power supply in parallels still with AC input power.	Orange ON
Power supply warning events where the power supply continues to operate: High temperature warning, Fan warning, Over current warning.	1Hz Blink Orange
Critical event causing a shutdown: +12V UVP, +12V OVP, +12V OCP, OTP, Fan fault.	Orange ON
When the power in cold redundant state.	0.33Hz Blink Green 1s off and 2s Green

4.0 PROTECTION

When the input UVP/OVP, OTP, +5Vsb output's UVP, unit's OTP or high ambient temperature protection is triggered, the power supply will shut down and self-recovery when the fault condition

removed. If +12V,+5V,+3.3V,-12V output's OVP/UVP/OCP is triggered, 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 of 5 seconds nominal. If the power module auxiliary converter's OTP or +5Vsb Output's OCP/OVP is triggered, the power supply will shut down and auto-restart immediately.

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

The input UVP and OVP should meet below table.

Table17.

Input voltage	Under voltage protection	Self-recovery voltage
HVDC	175V±5V	185V±5V
AC	74V±5V	84V±5V
Input voltage	Over voltage protection	Self-recovery voltage
HVDC	418V±8V	408V±8V
AC	316V±6V	310V±6V

4.2 Output Under and Over Voltage Protection (Output UVP/OVP)

The power supply should have over and under voltage protection to prevent the outputs from exceeding limits or abnormal operation. If the+5Vsb's UVP/OVP occurred, the power supply should shut down and self-recovery after the fault condition removed. If the +12V,+5V,+3.3V,-12V output OVP/UVP 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 of 5 seconds nominal.

Output	+12V	+3.3V	+5V	-12V	+5Vsb
UVP Range(V)	9.0-10.5	2.0-2.5	3.0-4.0	(-9.0)-(-10.5)	3.0-4.0
OVP Range(V)	13.3-14.5	3.9-4.5	5.7-6.5	(-13.3)-(-14.5)	5.7-6.5

The over and under voltage protection should tested at +12V/1.0A,+5V/0.5A,+3.3V/0.5A,-12V/0.1A, +5Vsb/0.1A load condition.

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 +5Vsb remains always on.

There are five temp sensors in the power supply, The first is on the main board to sense the PFC MOSFET copper temperature, it will trigger primary OTP and self-recovery when the PFC MOSFET

temperature return to a safe point. The second is on the main board to sense the auxiliary converter MOSFET's temperature, it will trigger module auxiliary converter +12Vsb output's OTP and auto-restart immediately for single module. The third is on the transformer PCB board to sense the synchronous MOSFET's copper temperature. It will trigger secondary OTP when the sensor resistor's temperature reached limit and self-recovery. The fourth one is a temperature sense resistor on the main board and located at the air intake to sense the ambient temperature.   The power supply will shut down if the ambient temperature reached the limit and self-recovery when the ambient temperature returns to normally.The last one is +5V converter control IC which can sense IC's temperature ,these will trigger redundant power supply OTP when then sensor resistor's temperature reached limit and self-recovery in about 5 minutes. Before the fourth OTP triggered, there is warming first, and the trigger points are as below table.

Table18.

The temp sensors	Over temperature protection	Self-recovery temperature
Forth ambient	69±8℃	55±5℃

4.4 Short Circuit Protection (SCP)

The power supply shall be protected from damage due to faults between output (+12V,+5V,+3.3V,-12V, +5Vsb) 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,+5V,+3.3V,-12V shorted to GND, the power supply will shut down and latched off. All outputs shut down upon a short circuit of the +5Vsb 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,+5V,+3.3V,-12V output's OCP occurred, the power supply should shut down and latched off.If the +5Vsb's OCP occurred,the power supply should shut down and self-recovery after the over current condition removed. It also has 150% peak load function when start up for 10s.The test should under 1+0 state.

Output	+12V(Low Input)	+12V(High Input)	+3.3V	+5V	-12V	+5Vsb
OCP Range(A)	90-100	145-165	30-40	30-40	0.7-1.5	5-6

4.6 Fan Warning and Fault

If the fan speed control duty cycle was set greater than 10%, but the fan speed is between 500 and 1000 RPM, the PSU should send out fan alarm signal, when it less than 500RPM, the PSU should send out fan failure signal.

5.0 OPERATE ENVIRONMENT

Table19. Environment Limits

Item	Unit	Min	Nominal	Max	Notes
Operating Temperature	℃	-5	35	50	The power supply should start up at -25℃, But no electrical property requirement. The output power should derating to 1076W for high input and 700W for low input from 45℃to 60℃ ambient temperature.
Storage Temperature	℃	-40	25	70	Non-operating, maximum rate of change of 20℃/hour.
Relative Humidity	%	10		90	Operating, non-condensing.
		5		95	Non-operating, non-condensing.
Operating Altitude	m	0		5000	The power supply max operating ambient temperature is defined at sea level. The max operating ambient temperature should drops at a slew of 0.33℃/100m altitude raised.
Storage Altitude	m	0		15000	
Mechanical Shock	50G trapezoidal wave, velocity change =170in./sec				Non-operating. Three drops in each of six directions are applied to each of the samples.

5.1 Output Power Derating Curve Vs Temp

Due to power supply module's Derating Limit at high ambient temperature,The power supply should operating above 45℃ ambient temperature with output power derated.The output power should derating to 1100W for high input(180~264Vac/190~310Vdc and 700W for low input(90~140Vac) from 45℃ to 60℃ ambient temperature.Then power derating curve is as below
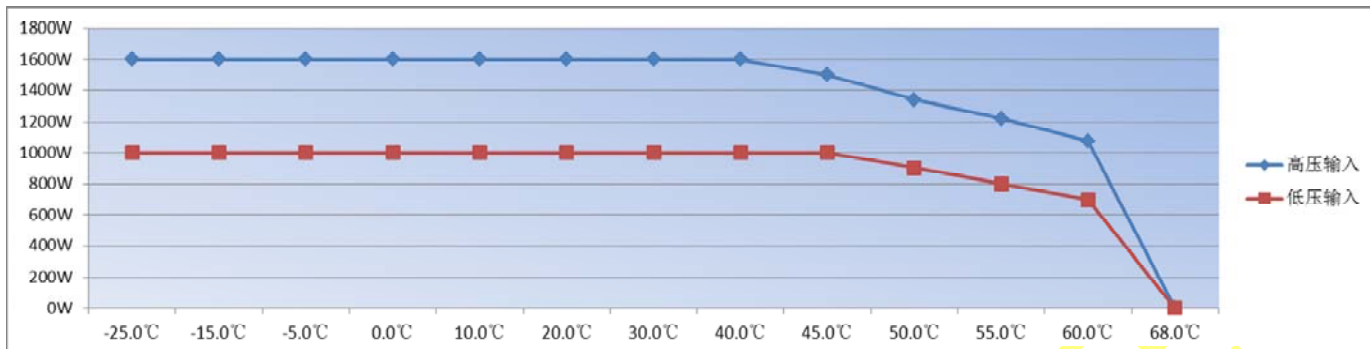
高压输入	1600W	1600W	1600W	1600W	1600W	1600W	1600W	1600W	1500W	1340W	1220W	1076W	0W
低压输入	1000W	1000W	1000W	1000W	1000W	1000W	1000W	1000W	1000W	900W	800W	700W	0W
环境温度	−25.0℃	−15.0℃	−5.0℃	0.0℃	10.0℃	20.0℃	30.0℃	40.0℃	45.0℃	50.0℃	55.0℃	60.0℃	68.0℃

6.0 SAFETY

6.1 Safety Certification

6.2 HI-POT

Primary to secondary, HI-POT Withstand voltage: 10mA max 1500Vac, 50/60Hz or 0.5mA max 2121Vdc for 60 seconds for power supply unit;

Primary to GND, HI-POT Withstand voltage: 10mA max 1500Vac, 50/60Hz or 0.5mA max 2121Vdc for 60 seconds.

6.3 Grounding Impedance Test

Grounding impedance test using grounding current 32A for 60s 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 240Vac/60Hz conditions to be less than 1.75mA test with customer system.

6.5 Insulation Resistance

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

7.0 OUTLINE STRUCTURE

Outline dimension: 275.0mm (L)*76.0mm (W)* 83.0mm (T)

风流方向

275.0±0.5

76.0±0.5

83.0±0.5

贴标签位置

#6-32(*2)

6.0±0.5

70.0±0.5

12.1±0.5

6.0±0.5

10.0±0.5

82.0±0.5

96.0±0.5

15.5±0.5(*2)

67.5±0.5(*2)

#6-32(*4)

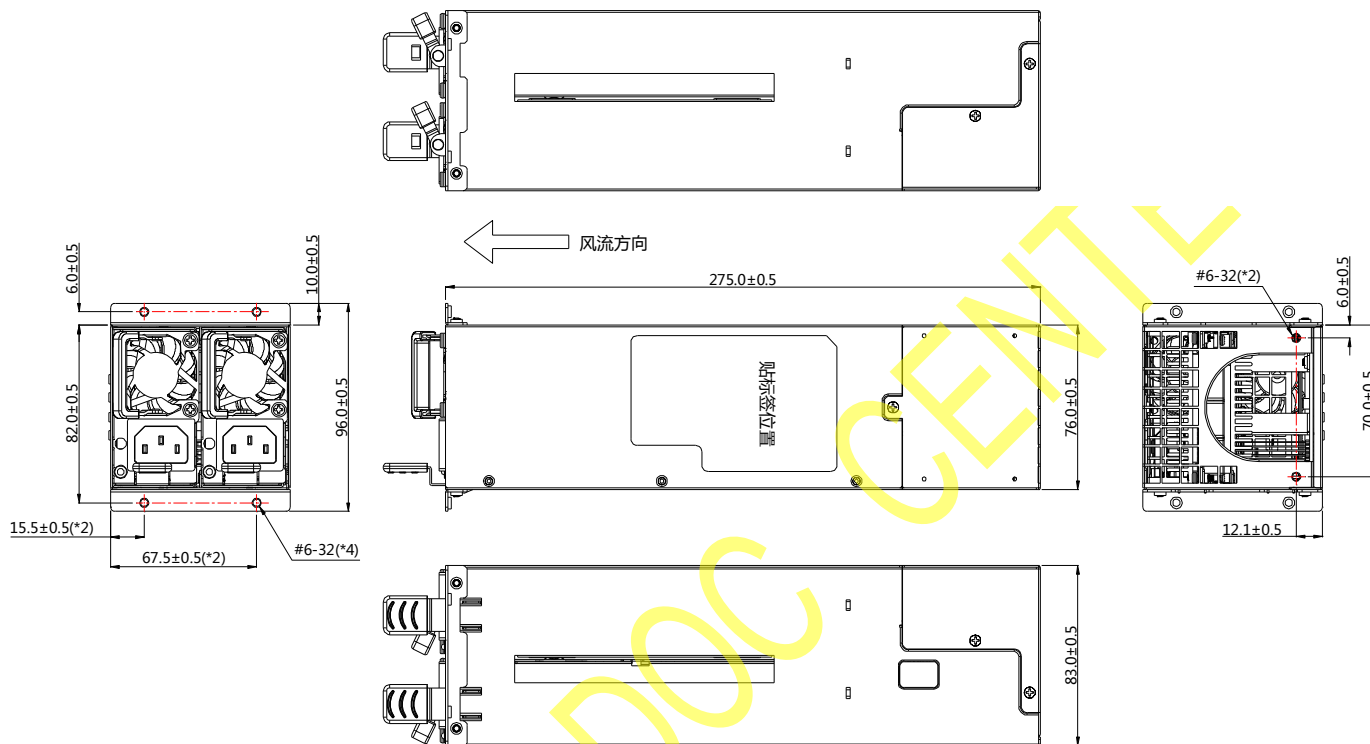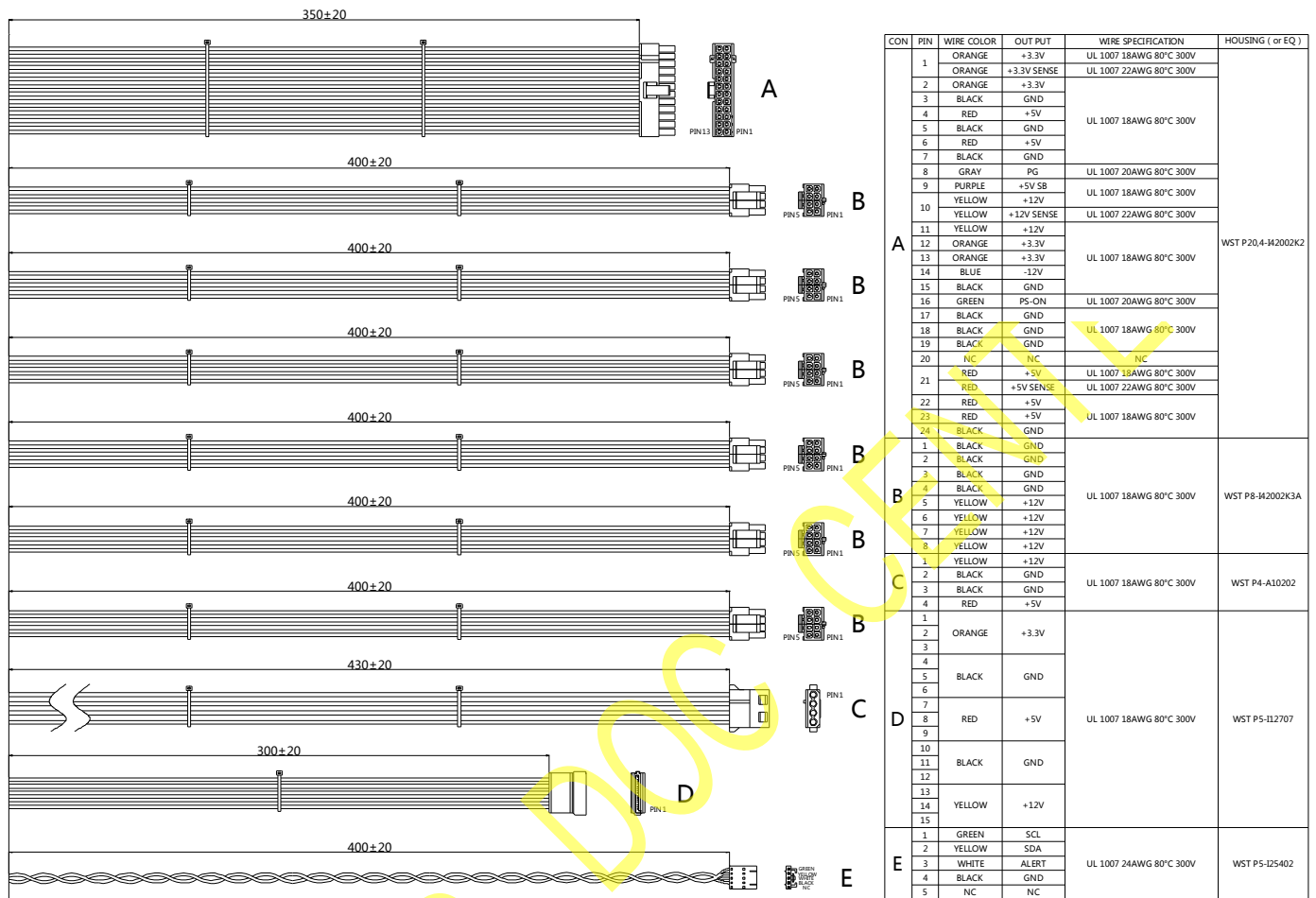| CON	PIN	WIRE COLOR	OUT PUT	WIRE SPECIFICATION	HOUSING (or EQ)
A	1	ORANGE	+3.3V	UL 1007 18AWG 80°C 300V	WST P20,4-I42002K2
		ORANGE	+3.3V SENSE	UL 1007 22AWG 80°C 300V	
	2	ORANGE	+3.3V		
	3	BLACK	GND		
	4	RED	+5V	UL 1007 18AWG 80°C 300V	
	5	BLACK	GND		
	6	RED	+5V		
	7	BLACK	GND		
	8	GRAY	PG	UL 1007 20AWG 80°C 300V	
	9	PURPLE	+5V SB	UL 1007 18AWG 80°C 300V	
	10	YELLOW	+12V		
		YELLOW	+12V SENSE	UL 1007 22AWG 80°C 300V	
	11	YELLOW	+12V		
	12	ORANGE	+3.3V		
	13	ORANGE	+3.3V	UL 1007 18AWG 80°C 300V	
	14	BLUE	-12V		
	15	BLACK	GND		
	16	GREEN	PS-ON	UL 1007 20AWG 80°C 300V	
	17	BLACK	GND		
	18	BLACK	GND	UL 1007 18AWG 80°C 300V	
	19	BLACK	GND		
	20	NC	NC	NC	
	21	RED	+5V	UL 1007 18AWG 80°C 300V	
		RED	+5V SENSE	UL 1007 22AWG 80°C 300V	
	22	RED	+5V	UL 1007 18AWG 80°C 300V	
	23	RED	+5V		
	24	BLACK	GND		
B	1	BLACK	GND	UL 1007 18AWG 80°C 300V	WST P8-I42002K3A
	2	BLACK	GND		
	3	BLACK	GND		
	4	BLACK	GND		
	5	YELLOW	+12V		
	6	YELLOW	+12V		
	7	YELLOW	+12V		
	8	YELLOW	+12V		
C	1	YELLOW	+12V	UL 1007 18AWG 80°C 300V	WST P4-A10202
	2	BLACK	GND		
	3	BLACK	GND		
	4	RED	+5V		
D	1			UL 1007 18AWG 80°C 300V	WST P5-I12707
	2	ORANGE	+3.3V		
	3				
	4				
	5	BLACK	GND		
	6				
	7				
	8	RED	+5V		
	9				
	10				
	11	BLACK	GND		
	12				
	13				
	14	YELLOW	+12V		
	15				
E	1	GREEN	SCL	UL 1007 24AWG 80°C 300V	WST P5-I25402
	2	YELLOW	SDA		
	3	WHITE	ALERT		
	4	BLACK	GND		
	5	NC	NC		

8.0 EMI AND EMS REQUIREMENT

Table20. EMI (Electromagnetic Interference) Requirements Table

Item	Description and Requirement	Criterion	Notes
Radiated Emissions	Frequency: 30MHz~1GHz Class A with 3dB Margin	EN 55032	230V/50Hz input
		FCC Part 15	120V/60Hz input
		VCCI V-3	100V/50Hz input
Conducted Emissions	Frequency: 150KHz~30MHz Class A with 3dB Margin	EN 55032	230V/50Hz input
		FCC Part 15	120V/60Hz input
		VCCI V-3	100V/50Hz input
Harmonic	EN 61000-3-2 Class A	EN 61000-3-2	230V/50Hz input
Voltage Flicker	Pst $\leqq$ 1.0 and Plt $\leqq$ 0.65 Voltage change $\leqq$ 3.3%	EN 61000-3-3	230V/50Hz input

	Relative Voltage change ≦ 4% The voltage changed over 3.3% duration time should ≦ 500ms		

Table21. EMS (Electromagnetic Susceptibility) Requirements Table

Item	Description and Requirement	Level	Criterion
Surge	Different Mode: ±1KV Common Mode: ±2KV	B	EN61000-4-5 EN 55035
Electrical Fast Transient Group (EFT)	±2KV	B	EN61000-4-4 EN 55035
Electrical Static Discharge (ESD)	Touch: ±6KV Air: ±8KV	B	EN61000-4-2 EN 55035
Radiated Susceptibility (RS)	80M~2.7GHz 3V/m	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	C C C	EN 61000-4-11 EN 61000-4-29 EN 55035 / 60601 GB 19286

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 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.

10.0 MTBF

The power supply shall have a reliability requirement as below table when under full load and 100Vac/60Hz or 230Vac/50Hz input.

Table22.

Item	Requirement	Notes
Life Time	≧5 years at 30℃ ambient	Should ≧7 years at 25℃ ambient when mating with customer system.
CMTBF (Calculated MTBF)	≧250,000 hours, at 30℃ ambient temperature and full load.	Telcordia Technologies SR-332 (Method I Case 3).
Electrolytic capacitor calculated life	≧5 years	30℃ ambient and full load using capacitors supplier equation.
Fan L10 Life	≧5 years	30 ℃ ambient and full load.
Fan Noise	60dBA (220Vac input)	30 ℃ ambient and full load.
Annual Return Rate	≦0.1%	
Warranty	≧3 years	

11.0 PACKAGE

11.1 Outline Diagram of Carton

TBD

Note:

Material: outside the box: K=K

11.2 Side Label

TBD

11.3 Front Label

TBD

12.0 SOFTWARE

12.1 Data Precision Requirement

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

Table23. Required Accuracy (230Vac@50Hz~60Hz or 240Vdc)

| Output Load Condition	<10%	10%-20%	20%-100%
Read_VIN(88h)	±5%	±5%	±5%
Read_IIN(89h)	/	±0.1A	±5%
Read_PIN(97h)	/	±20W	±5%
Read_Vout(8Bh)	±3%	±3%	±3%
Read_Iout(8Ch)	/	±1.5A	±5%
Read_Pout(96h)	/	±15W	±5%
Read_Ambient Temperature(0-70℃)(8Dh)	±5℃		

Note:

1. There is no accuracy requirement when PSU is in PS-OFF mode.

12.2 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.
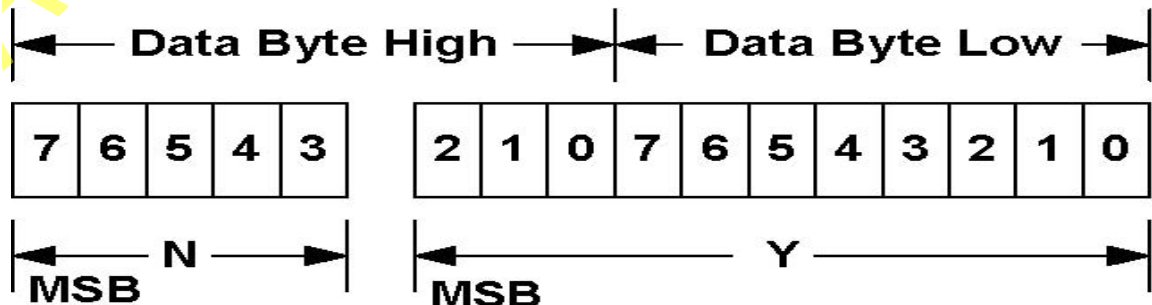
The relation between Y, N and the "real world" value is: $X = Y \cdot 2^N$

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.

12.3 PMBUS Command Supported

Table24. 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 STATUS_WORD has been detected.	No

Table25. 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

Table26. 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	No

Table27. 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

Table28. 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

Table29. 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	No
2	Fan 2 Speed Overridden	No
1	Airflow Fault	No
0	Airflow Warning	No

Table30. STATUS _OTHER Command

Bit	Meaning	Support
7	Reserved	No
6	Reserved	No
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

Table31. Supported Command Summary

CMD Code	Name	Type	Bytes	Remark
03h	CLEAR_FAULTS	Send Byte	0	
19h	CAPABILITY	Read Byte	1	
1Ah	QUERY	Block Read	1	
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	
7Fh	STATUS _OTHER	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	
84h	READ_Vsb_OUT(Mfr.	Read Word	2	

	Defined)			
85h	READ_Isb_OUT(Mfr. Defined)	Read Word	2	
86h	READ_EIN	Block Read	6	
87h	READ_EOUT	Block Read	6	
88h	READ_VIN	Read Word	2	
89h	READ_IIN	Read Word	2	
8Bh	READ_VOUT	Read Word	2	
8Ch	READ_IOUT	Read Word	2	
8Dh	READ_TEMPERATURE_1	Read Word	2	
8Eh	READ_TEMPERATURE_2	Read Word	2	
8Fh	READ_TEMPERATURE_3	Read Word	2	
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	14	See MFR Data table
9Ah	MFR_MODEL	Read Block	14	See MFR Data table
9Bh	MFR_REVISION	Read Block	6	Update
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	See MFR Data table
A9h	MFR_TAMBIENT_MIN	Read Word	2	See MFR Data table
D0h	SMART_ON_CONFIG	Write Byte Read Byte	1	00h Standard Redundancy 01h Smart On Active 02h Smart Standby

				03h Smart Standby
				04h Smart Standby

Table32. MODULE MFR Data

CMD Code	Name	Content
99h	MFR_ID	ASPOWER
9Ah	MFR_MODEL	U1A-D1600-G-11
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	130.5
A7h	MFR_POUT_MAX	1600
A8h	MFR_TAMBIENT_MAX	50
A9h	MFR_TAMBIENT_MIN	0

深圳欧陆通电子股份有限公司