Huntkey
Power Your Dream

Server Power

HK550A-C1

550 Watts 12 V

Distributed Power System

Distributed Power Bulk Front-End
Total Output Power: 550 Watts
+12 Vdc main Output
+12 Vdc Stand-by Output
Wide Range Input voltage: 90 - 264 Vac

RoHS
2002/95/EC

Special Features

- Active power factor correction
- EN61000-3-2 harmonic compliance
- Active AC inrush control
- 1U X 3U form factor

- +12 Vdc output
- 12 Vdc Stand-By
  (5 V standby - consult factory)
- No minimum load required
- Hot plug operation
- N + 1 redundant
- Internal OR'ing fets
- Active current sharing
  (10 - 100% load)
- Built-in cooling fans
  (40 mm x 28 mm)

- PM Bus compliant
- EERPOM for FRU data
- Red/Green bi-color LED status
- Internal fan speed control
- INTEL, SSI Std. logic timing
- INTEL, SSI Std. FRU data format
- Three years warranty

Safety

UL/cUL 60950 (UL Recognized)
GS Geprufte Sicherheit
EN60950
CE Mark
China CCC
CB Certificate & Report, IEC60950
IEC60950-1 (International)

Electrical Specifications

Input	
Input range	90-264 Vac (wide range) 188-288 Vdc
Frequency	47-63 Hz, single phase AC
Inrush current	40A maximum inrush current
Efficiency	90%,94%,91% (20%;50%;100% load) 230Vac
Conducted EMI	FCC Subpart J EN55022 Class B
Radiated EMI	FCC Subpart J EN55022 Class B
Power factor	0.99 typical
Leakage current	<1mA at 240V RMS, and <0.5mA at 120VRMS
Hold up time	14 ms minimum
Output	
Main DC voltage	+12 V @ 45A 90 - 264 Vac
Stand-By	+12 Vsb @ 3 A (5 V @ 5 A TBA)
Adjustment range	Factory Set, no pot adjustments
Regulation	+12 Vdc; ±4% +12 Vsb; ±5%
Over current	+12 Vdc;51A max,The keep time of peak load is 12S +12 Vsb, 10A max
Over voltage	+12 Vdc; 13.5 - 15 Vdc +12 Vsb; 13.5 - 15 Vdc
Under voltage	+12 Vdc; 10.5 - 11 V (latch off)
Turn-on delay	2.5 Second max
+12 V Output Rise Time	5 - 50 ms, Monotonic Rise

Ordering Information

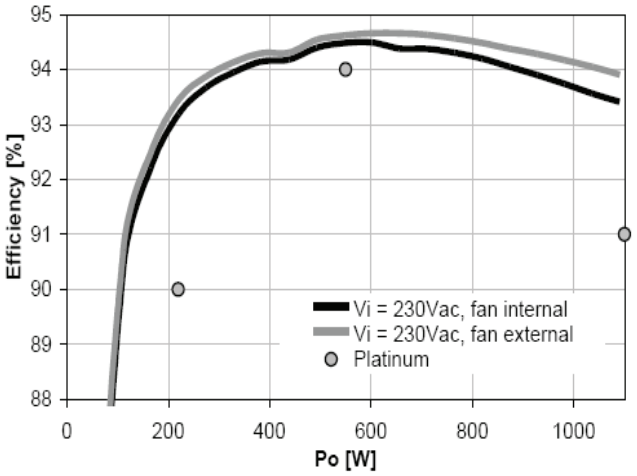
Output	Nominal Output Voltage Set Point	Set Point Tolerance	Total Regulation	Minimum Current	Maximum Current	Output Ripple P/P	Over Current
HK550A-C1	12.0 Vdc 12 Vsb	±0.2% ±1%	±4% ±5%	0A 0A	65A 3A	120 mV 120 mV	150% of nominal 5-10A

*Over current latches off if overcurrent lasts over 2 second, otherwise it is auto recovery.

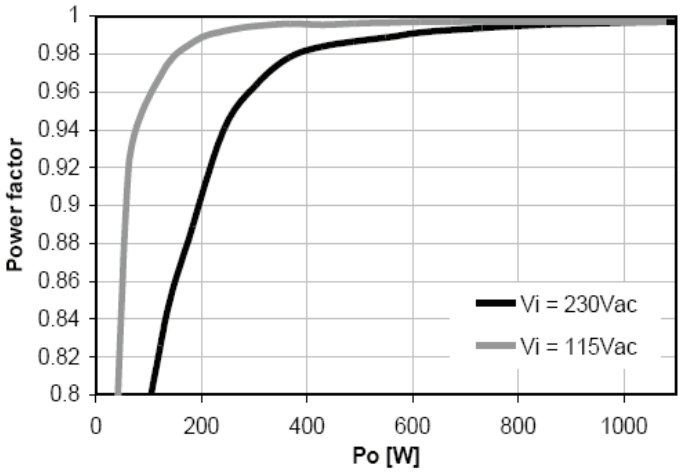
Logic Control	
PS_ON	When this signal is not pulled low by the system, or left open, all the outputs (except for 12Vsb) shall be turned off
POK	Active TTL HIGH when output is within regulation limits.
PS_KILL	If PSkill signal is high or open state, the power supply shall locked and can not turn on.
SMB_ALART	Complies with SMBus standard

Environmental Specifications

Operating temperature	0 °C to 55 °C
Storage temperature	-40 °C to +70 °C Altitude, operating 10,000 ft
Electromagnetic susceptibility / Input transients	-EN61000-3-2, -3-3 -EN61000-4-2, 4.3, 4-4, -4-5, 4-11 Level -EN55024:1998
RoHS & lead-free compliant (no tantalum caps).	RoHS6
Humidity	5 to 95% RH, non-condensing
Shock and vibration	Operating :Half-sine 5 G;None operating: Half-sine 140 G
MTBF (Demonstrated)	250 K Hrs at full load, 55 °C



Efficiency vs. load current(ratio metric loading)



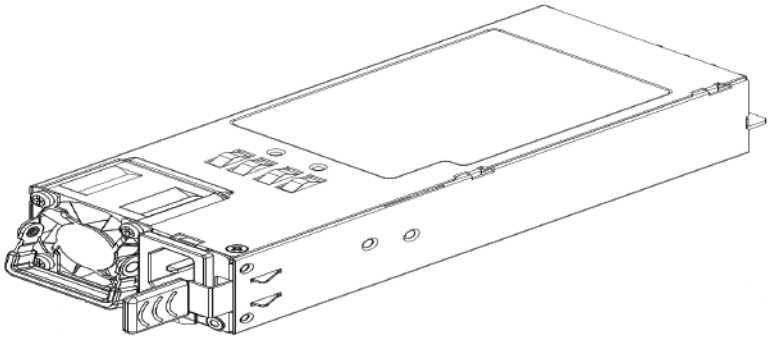
Power factor vs. load current

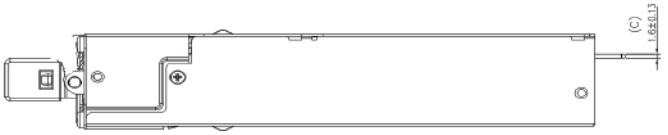
Huntkey
Power Your Dream

Server Power

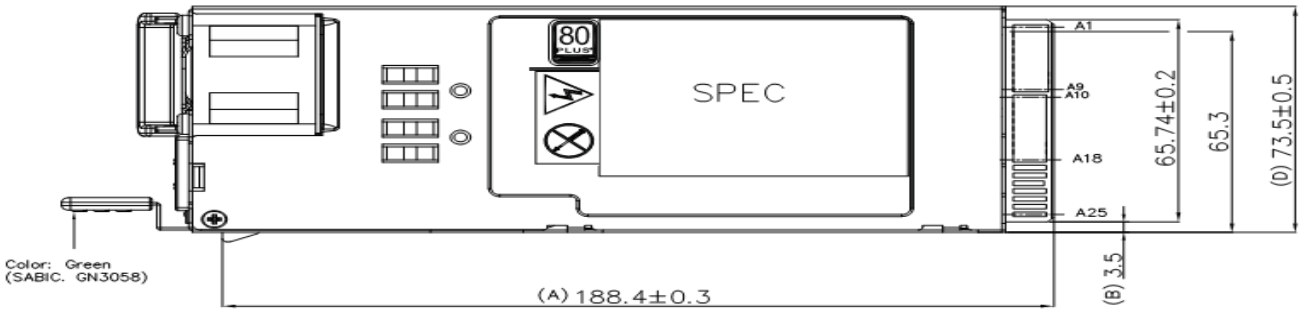
Mechanical Drawing

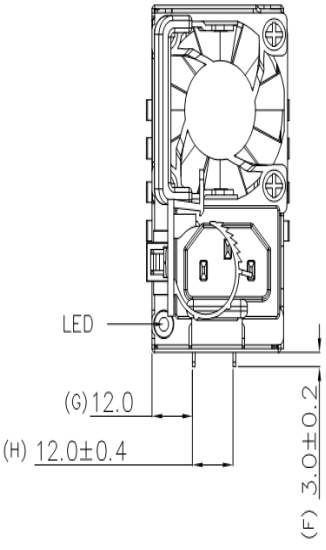
Condition	LED Status
PDB fault/ protection	Green blinking at 2second high and 500ms low
Normal work	Green Color
Module fault/protection in operating mode	Amber continuously
Warning	Amber blinking at 1Hz
Communication failure between primary side and secondary side	Amber blinking at 0.5Hz.
Power cord unplugged/AC loss	Green blinking at 0.5Hz

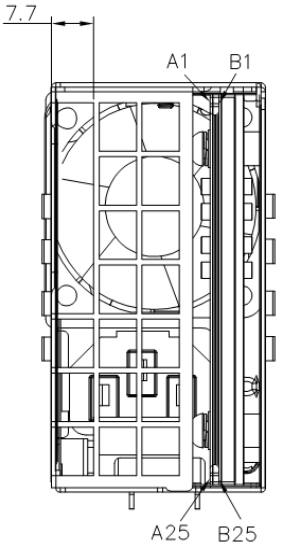


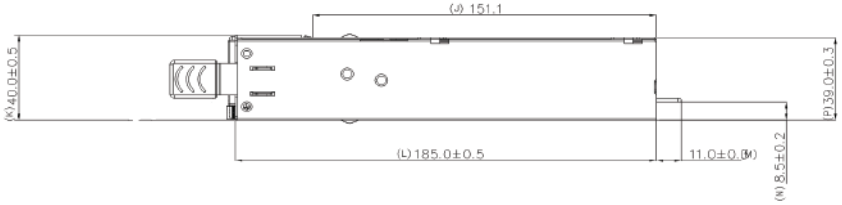


AIR FLOW DIRECTION









DIMENSIONAL TOLERANCES

HOLES : ±0.05 ANGLES : ±0.5°

( )		( )		( )				( )	
<30	:±0.25	DECIMALS		UP~100	:±0.2	250~300	:±0.4	UP~600	:±1.5
>30~100	:±0.35	X	:±0.3	100~150	:±0.25	300~350	:±0.45	600~900	:±2.4
>100~300	:±0.5	X.X	:±0.2	150~200	:±0.3	350~400	:±0.5	900~OVER	:±3.1
ABOVE 300	:±0.6	X.XX	:±0.1	200~250	:±0.35				

Huntkey
Power Your Dream

Server Power

O/P PIN ASSIGNMEN

PIN	SIGNAL NAME	PIN	SIGNAL 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	12VSB
A22	SMB-ALERT	B22	CR_1
A23	RETRUN_S	B23	12LS
A24	+12VRS	B24	PSKill
A25	PWOK	B25	NC

Huntkey HongKong Development Co., Ltd
ADD: Huntkey Industrial Park, Banxue Road,
BanTian, ShenZhen, 518129, China
Tel: +86-755-8960 6658
Fax: +86-755-8960 6699
www.huntkey.com
www.huntkeydiy.com
E-mail: webmarks@huntkey.com

Huntkey FPT Power.
The global leader in enabling business-critical continuity.

- PC Case
- Power Supply
- Power Bank
- **Server Power**
- USB Charger
- Car Charger
- Power Strip
- LED Lighting
- Home Appliance
- Notebook Adapter

Contents

1. Scope

1.1. The document details the electrical, mechanical and environmental specifications of a SMPS, the server power supply provides 550W continuous output power.

1.2.The power supply shall meet the **RoHS** requirements.

Description:

☐ SMPS Adapter(Wall mount) ☐ SMPS Adapter(Desk-top)

☐ Open Frame ■ SMPS Unit (With Case)

☐ Others

2. Input Characteristics

2.1. Voltage/current/frequency

The power supply shall operate within all specified limits over the following input voltage range. Harmonic distortion of up to 10% THD shall not cause the power supply to go out of specified limits. The power supply shall be capable of start-up (power-on) with mini load and full rated power load, at line input as low as 90 VAC whatever AC line is pure sine wave or 10% THD ,or 188Vdc.

Table 1 AC Input Rating

PAPARAMETER	MIN	RATED	MAX	PEAK
Voltage220Vrms	90Vrms	200-240Vrms	264Vrms	300Vrms
Voltage110Vrms		100-127Vrms		
DC input	188Vdc	240Vdc	288Vdc	
Current		<10A@100-127VAC		
Frequency	47HZ	50/60	63 Hz	
Inlet	1 per module,IEC320C-14，10A/250VAC			
V THD	< 10% THD			
iTHD	<5%@50% Load,3.5%@100% load, test at 110Vac/60HZ& 220Vac/50HZ			
Range	Universal range			

2.2. Inrush Current

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.

For Vdc input HVDC, Input current shall be less 30A.

2.3. Hold up time(For ac AND HVDC)

1) Hold up time Vout>=13mS for full load. Vout>=17mS for half load(90V~264V/192-288vdc)
2) Hold up time PG>=12mS for full load. PG>=16mS for half load(90V~264V/192-288Vdc)

3) Hold up time +12Vsb>=25mS for full load.(90V~264V/192-288Vdc)

2.4. AC Turn off Requirements

Power supply shall shutdown at the AC voltage 73±5Vdc.

For HVDC,Power supply shall turn up at the DC voltage 173V±5Vdc

No ouput voltage and signal(POK and other signals) oscillate while AC turn off .

2.5. AC Turn on Requirements

Power supply shall turn up at the AC voltage 80V±5Vdc

For HVDC,Power supply shall turn up at the DC voltage 178V±5Vdc

2.6. Efficiency

1) 80 Plus Pt gold level or Platinum standard is necessary.

Module:

90%,94%,91% (20%;50%;100% load) 230VAC for Platinum level

Power supply must meet climate saver gold /Platinum level standard, the certification is necessary.

Table 2 Efficiency requirememnts for PSUS

Input Voltage 115VAC	MIN	
20% Loading（12V/9A，12SB/0.6A）	**90**	
50% Loading（12V/22.5A，12SB/1.5A）	**92**	
100% Loading1（12V/45A，12SB/3A）	**89**	
Input Voltage 230VAC		
20% Loading（12V/9A，12SB/0.6A）	**90**	
50% Loading（12V/22.5A，12SB/1.5A）	**94**	
100% Loading1（12V/45A，12SB/3A）	**91**	

2) EUP: input power shall not exceed below criteria with the specific condition when 12Vsb current is 0.05A in standby mode at 115V/230Vac/50Hz;

< 4.5W,Fan run at a minimum RPM

2.7. Power factor

1) 80Plus standard for Power factor.

PF:

0.95 at 50% load for platinum level.

Table 3 power factor requirememnts for PSUS

Rated Output Power	10% Load	20% Load	50% Load	100% Load
Output Rating > 500 W and Output Rating ≤ 1,000 W	0.65	0.80	0.95	0.95

2.8. dropout(FOR AC AND HVDC)

An AC line dropout is the condition when AC or HVDC input drops to 0VAC at any phase of the AC line for any length of time. During an AC or HVDC dropout of 12mS or less the power supply shall meet dynamic voltage regulation (Table 5) in the rated load at all AC or HVDC input voltages. An AC or HVDC line dropout of 12mS or less shall not cause malfunction of control signals or protection circuit trip. If the AC or HVDC dropout lasts longer than 12mS the power supply shall recover and meet all turn on requirements.

During an AC or HVDC dropout of 17mS or less the power supply shall meet dynamic voltage regulation (Table 5) in the half load at all AC or HVDC input voltages. An AC or HVDC line dropout of 17mS or less shall not cause malfunction of control signals or protection circuit trip. If the AC or HVDC dropout lasts longer than 17mS the power supply shall recover and meet all turn on requirements.

The power supply shall meet the AC or HVDC dropout requirement over rated AC or HVDC input voltages, frequencies, and output loading conditions. Any dropout of the AC or HVDC line shall not cause damage to the power supply.

Any exceptions must be subject to Lenovo approval.

2.9. Brownout

Power supply shall contain protection circuitry such that the application of an input voltage below the minimum specified in table 1 shall not cause damage to the power supply unit nor cause failure of the input fuse and overstress to any other component. In the event of shutdown due to extended brownout, the power supply shall automatically restart after the AC /HVDC input is within specified limits. The voltage level between shutdown and recovery shall have a minimum of 5 VAC/HVDC of voltage hysteresis, so that the power supply will not oscillate on and off due to voltage change condition. The power supply shall meet dynamic voltage regulations (Table 5) and all turn on requirements or turn off requirements while shutdown or recovery.

3. Output Characteristics

3.1. Power/Currents Rating

The following tables define the power and current ratings. The combined output power of all outputs shall not exceed the rated output power. Load ranges are provided for each output level. The power supply shall meet both static, dynamic voltage regulation and timing requirements for the minimum/maximum/cross loading conditions.

Table 4 output power and current rating

signal	Minimum load (A)	Maximum load(A)	Power limit	
+12V	0.1	45 for 550W	51Afor 550W	
+12Vsb	0.1	3	Peak 10A	
Total		≤550w		

Footnotes:

3) Peak load on the combined 12V output shall not exceed 51A for550W. The keep time of peak load shall be 12S.

4) 12Vsb should be able to withstand 10A inrush current when power cord is inserted into power supply. The duration of the inrush current shall be 100ms.

3.2. Voltage Regulation

The power supply output voltages must stay within the following voltage limits shown in *Table 5* when operating at steady state, dynamic loading conditions. And the overshoot at turn on conditions shall also meet the voltage limits. All outputs are measured with reference to the return remote sense (ReturnS) signal. The 12V and 12Vsb outputs are measured at the power supply connectors referenced to ReturnS. AC line Harmonic distortion of up to 10% THD shall not cause the power supply to go out of specified limits.

Table 5, voltage regulation limits

outputs	min	max	units	tolerance
+12V	+11.52	+12.48	Vdc	+ 4%-4%
12Vsb	+11.4	+12.6	Vdc	+ 5%-5%

3.3. Ripple noise

Table5 Ripple and Noise

VOLTAGE	Ripple/Noise pk-pk
+12V	120 mV
12Vsb	120 mV

Footnotes:

1)This is measured over a bandwidth of 20Hz to 20MHz at the output connector.
A 10μF tantalum capacitor in parallel with a 0.1μF ceramic capacitor are placed at the point of measurement.

2) Ripple noise test must be at least in 5us/1ms/10ms sweep and peak detect mode.

3.4. Dynamic Loading

The load transient repetition rate shall be tested between 50Hz to 10 KHz at duty cycles rang from10%-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 voltages shall remain within limits specified in table 5 for the step loading, Slew rate, and capacitive loading in the table6.

Table 6 Transient Load Requirements

Output	Transient Step (A) XX % of rated current	A/us	Freque	Cap(uF)	Min load

	module	PDB or None redundant		ncy Hz		
+12V	65%	65%	0.5		2200	0.5A
12Vsb	65%	30%	0.5		20	0.1A

3.5. Capacitive Loading

The power supply shall be stable and meet all requirements with the following capacitive loading ranges.

Table7 Output Capacitive loading

outputs	12V	12Vsb
Cap load uF	1000-22000	1--11000

3.6. Residual Voltage in Standby mode

Residual voltage at the power supply outputs for no load condition shall not exceed 100mV when AC voltage is applied and the PSON# signal is de-asserted

3.7. Redundant and hot swap

3.7.1 Hot swap

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

a) The output voltage shall stay within the limits shown in Table 5.
b) DC signal, such as PG, PS-ON, present and other signals shall not oscillate or change,
c) Current Sharing bus shall not oscillate,
d) LED color shall not change,
e) Power supply shall not be overload and other protection,
f) The newly inserted power supply may get turned on by plugging AC into the external and meet the turn on requirements, including the voltage shown in table 5 and timing shown in table 8.
g) The two modules shall be synchronous while the power supply turn on, turn off, dropout and brownout. Any oscillation of voltage waveform due to the non-synchronous is not acceptable.

3.7.2 Forced Load Sharing

+12V output current from each power supply shall be within (+10%, -10%) of Iload / (no. of PS) when supplying total output load current of 0.2I max. < I load < I max. where, I max. = 10A for 2 power supplies connected in parallel.

Current sharing below 20% of maximum load is not required.

The error shall be calculated by：（M1-Mmean）/Mmean，or（M2-Mmean）/Mmean.

3.7.3 I share bus voltage

12LS is an analog output signal used to help equalize the load sharing of the main 12V output between multiple power supplies. It also represents the amount of the loading on the

power supply (or supplies).

Voltage level VS output current for single module

Output current (A)	Voltage level of I share bus(VDC)			Desription
	Minmum	Nominal	maxmum	
49.5(110%rated current)	8.6	8.8	9.0	
47.25(105%rated current)	8.21	8.4	8.59	
45(100%rated current)	7.8	8	8.2	
42.75(95%rated current)	7.41	7.6	7.79	
40.5(90%rated current)	7.02	7.2	7.38	
38.25(85%rated current)	6.63	6.8	6.97	
36(80% rated current)	6.24	6.4	6.56	
33.75(75%rated current)	5.85	6.0	6.25	
31.5(70%rated current)	5.46	5.6	5.74	
29.25(65%rated current)	5.07	5.2	5.33	
27(60%rated current)	4.68	4.8	4.92	
24.75(55%rated current)	4.29	4.4	4.51	
22.5(50%rated current)	3.9	4.0	4.1	
20.25(45%rated current)	3.51	3.6	3.69	
18(40%rated current)	2.99	3.2	3.50	
15.75(35%rated current)	2.65	2.8	2.98	
13.5(30%rated current)	2.25	2.4	2.65	
11.25(25%rated current)	1.8	2.0	2.25	
9(20%rated current)	1.4	1.6	1.8	
6.75(15%rated current)	1.0	1.2	1.4	
4.5(10%rated current)	0.6	0.8	1.0	
2.25(5%rated current)	0.2	0.4	0.6	
0	0	0	0.4	

12Vsb is required to share current between power supplies, current share accuracy between power supplies for this output shall be within (+20%, -20%) of Iload / (no. of PS)

3.8. Smart on

Power supply shall meet Smart on redundant requirement. The slave module shall be in the cold standby state when the system load is less than 40% full load, and recovery to normal redundant state when the system load is more than 70% full load.

However, the cold standby module should immediately turn up and output all of system power once

the operating module predicts failure. The power supply module must meet the output regulation in table4 and timing requirement in table 8.

3.9. Remote sense

Remote sense is necessary at 12V and return sense. The remote sense should be able to regulate out voltage drop of 300mV minimum on 12V rail as well as return.

4. Timing & Sequence

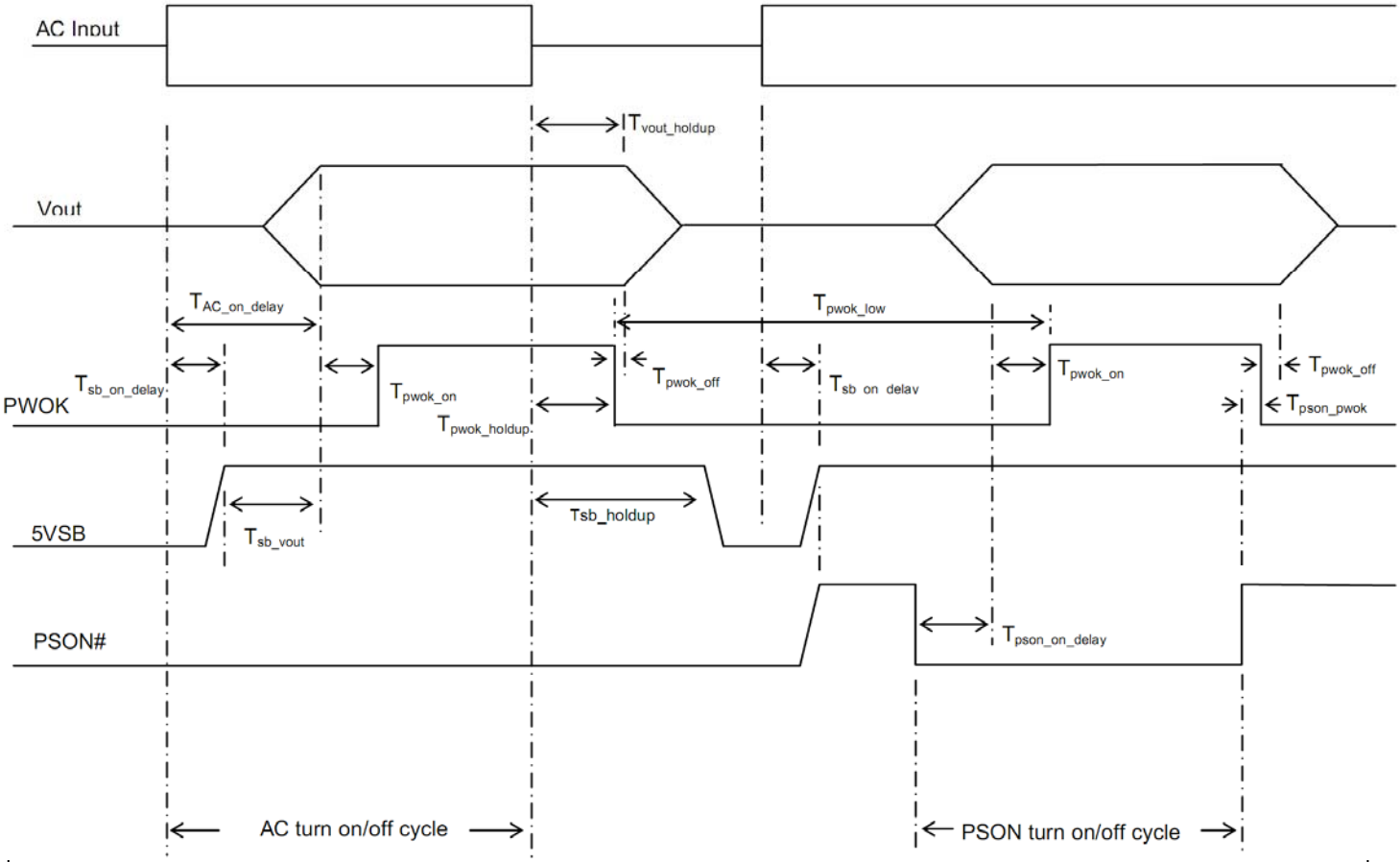
4.1.General timing

These are the timing requirements for power supply operation including alone module outputs and multi model outputs.

Table 8 Turn On/Turn Off Timing

ITEM	DESCRIPTION	MIN	MAX	UNIS
T_{vout_rise}	Output voltage rise time from each main output. For /XVsb	1 1	50 50	msec
T_{vout_on}	All main outputs must be within regulation of each other within this time.		50	msec
T_{vout_off}	All main outputs must leave regulation within this time.		400	msec
$T_{sb\_on\_delay}$	Delay from AC being applied to 12Vsb being within regulation.		1500	msec
$T_{ac\_on\_delay}$	Delay from AC being applied to all output voltages being within regulation.		2500	msec
T_{vout_holdup}	Time all output voltages stay within regulation after loss of AC.	14		msec
T_{pwok_holdup}	Delay from loss of AC to deassertion of PWOK	13		msec
$T_{pson\_on\_delay}$	Delay from PSON# active to output voltages within regulation limits.	5	400	msec
T_{pson_pwok}	Delay from PSON# deactive to PWOK being deasserted.		50	msec
T_{pwok_on}	Delay from output voltages within regulation limits to PWOK asserted at turn on.	200	500	msec
T_{pwok_off}	Delay from PWOK deasserted to output voltages (3.3V, 5V, 12V, -12V) dropping out of regulation limits.	1		msec
T_{pwok_low}	Duration of PWOK being in the deasserted state during an off/on cycle using AC or the PSON signal.	100		msec
T_{sb_vout}	Delay from XVsb being in regulation to O/Ps being in regulation at AC turn on.	10	1500	msec

Figure 1 Timing diagram



4.2.Control signal and other DC signals

4.2.1 PG signal (POK)

Table9 POK TTL Characteristics

Signal type	+3. 3VDC, TTL compatible
Logical low voltage	∠0.4V, 4mAsink current
Logical high voltage	2.4VDC—3.47VDC,2mAsource current
Sink current, PWOK= low	≤4mA
Source current, PWOK= high	≤2mA
POK rise and fall time	≤ 100us
High-state output impedance	A pull up resistor is between POK output and 12Vsb or other VCC internal to the power supple stanby circuit.

4.2.2 PS-ON signal

PSON# signal is required to remotely turn on/off the power supply module / PDB Combo. PSON# is an active low signal that turns on the +12V power rail and other DC to DC converters on the PDB. When this signal is not pulled low by the system, or left open, all the outputs (except for 12Vsb) shall be turned off. This signal is pulled to a 12Vsb voltage by a pull-up resistor internal to the PDB. Refer to Figure 1 On/Off Timing for timing diagram.

Table10 PS_ON TTL Characteristics

Signal type	+3.3VDC, TTL compatible
Logical low voltage （Vil）	0.0—1.0V
Logical high voltage（Vih; Iin=-200uA）	≥2V
Iil (Vin=0.4V 时)	≤-4mA
Open status（Iin=0）	≤ 3.47V
Power-on status	PS_ON= 0
Power-off status	PS_ON= 1 or open state
Rise & Fall time	0us---100us

4.2.3 PSkill(optional)

PSkill is used to hot swap. The PSkill shall connect to GND on PDB to enable power supply turn on, If PSkill signal is high or open state, the power supply shall locked and can not turn on.

The PSKILL pin on gold finger of power supply module is shorter than the other signal pins. When a power supply is operating in parallel with other power supplies and then extracted from the system, the PSKILL pin will quickly turn off the power supply and prevent arching of the DC output contacts. The DC output contacts must not arch under this condition

4.2.4 SMBalert signal,

To meet the Nod manager 2.0,SMB Alert shall drop to 0v in below conditions, and must recovery by system PMBUS command:

A, AC line loss(lower than 20vac) more than 2ms ,and SMB should recover to high level when PSU get system clear command even if AC line does not recover.

B, Hotspot OT warning occurs

C, OP warning occurs,

D, The SMB alert should be logic “AND” from different power supply modules.

Table11 SMB TTL Characteristics

Signal type	+3. 3VDC, TTL compatible
Logical low voltage	∠0.4V, Alert to system
Logical high voltage	2.4VDC—3.47VDC,OK
Sink current, PWOK= low	Xx
Source current, PWOK= high	Xx
POK rise and fall time	≤ 100us
High-state output impedance	Open collect, pull up may be located on system side

E,SMB Alert High level condition:

a, Power supply module unplug.

b,The SMBAlert shall recover to high level if power cord re-plug or system clear command once SMBAlert change to low due to power cord unplug.

5. Power supply LED indicator

One indicator LED in power supply module next to the inlet socket.

This LED shall have 5 kind of status as below:

A. Standby /cold redundant state ---green blinking at 2second high and 500ms low
B. PDB fault/ protection ---green blinking at 2second high and 500ms low
C. Normal work---green color
D. Module fault/protection in operating mode----amber continuously
E. Warning----amber blinking at 1Hz(PSU can operate normally but high temperature without protection, fan speed slow down ,input voltage lower than 90Vac< not warning above 90v condition, must be warning state below 85V condition > ,high power, high current etc.)
F. If the communication failure between primary side and secondary side:---amber blinking at 0.5Hz.
G. Power cord unplugged/AC loss, green blinking at 0.5Hz,Vin lower than brownout turn off point.
H. LED preference shall be followed below rules if some LED colors may occur simultaneously by above definition:

a.The fault/protection shall be first preference.

b. warning is 2nd preference

c. AC loss shall be 3rd preference.

I. protection should contain standby output rails.

6. Protection

6.1. OCP/OC warning/OP warning

Table12 Over current protection

Voltage	Module	PDB or multi outpt		Unit
+12V	Peak current-150% of rated output current	Peak current-150% of rated output current		A
+12Vsb	5-10A	5-10A		A

Footnotes:

OCP state on Main outputs shall shut down and latch off, and shall be cleared by toggling the PSON # signal or by an AC input re-cycle，12Vsb OCP shall be Auto Restart when OCP condition is removed.

OC warning level should keep(boucing) for 800ms+/-200ms before the warning flag set to logic 1.

6.2. OVP

For redundant PS, once one power supply module (not PDB) is in OVP state due to the internal OVP trip point detected, another power supply module which not detects the OVP trip point shall be normally

running.

Table 13, Over/under voltage protection

Voltage	Min	Max	Unit
PFC	425	450	VDC
+12V	+13.5(10.5 fro UVP)	+15(11V for VUP)	VDC
12Vsb	+13.5	+17	VDC

Footnotes:

OVP state on Main outputs shall shutdown and latch off，12Vsb OVP shall be Auto Restart when OVP condition is removed.

6.3. SHORT CIRCUIT PROTECTION

The power supply shall shut down and latch off when any output is short circuit(impedance less than 0.1ohm) with any other outputs, whatever the outputs is shorten when power supply is running as well as before turn on.

1) The power supply shall be no physical damage when +12V,12Vsb output is shorted to its DC return or other outputs.
2) 12Vsb shall be Auto Restart when short condition is removed.

6.4. No load condition

No OVP protection occurs when power supply operates in no load condition.

6.5. Over temperature protection

The OTP circuit shall incorporate built in hysteretic(>5°C) such that the power supply does not oscillate on and off due to temperature recovering condition.

6.6. Over Current Protection/过流保护

OCP Point Limited: 110~200% of Max. Load/保护点限制:最大负载的 110~200%

The output shall hiccup when the over current applied to the output, and shall be self-recovery when the fault condition is removed

当过电流时,输出将进入打嗝模式,当过流情况解除后,产品将会自动恢复正常

6.7. Short Circuit Protection/短路保护

The input power shall decrease when the output is short to GND; the power supply shall not damage, and shall be self-recovery when the fault condition is removed

当输出对地短路时, 产品输入功率降低且不会损伤, 当短路情况解除后, 产品将会自动恢复正常

6.8. Over Voltage Protection/过压保护

The power supply shall be protected when the output is over voltage, and the power

supply shall not be damaged.
当输出过压时,产品保护且不会损伤

7. Environment Requirment

7.1. temperature

7.1.1 Operating temperature:

+0°C Min.，+55°C Max for module

(Full load and all input voltage range, temperature change rate 5°C/min~10°C/h is accepted))

7.1.2 None operating temperature(storage):

-40°C Min.，+70°C Max

7.2. Fan speed control

7.2.1 Fan speed control

The power supply design shall employ the PWM control to vary the fan speed.

7.2.2 In standby mode

Fan voltage is powered from 12v and Vsb. The fan will run by the 12V voltage while power supply turn on, and it shall run in low speed by 12Vsb voltage in standby mode.

7.3. HUMIDITY: operating (non-condensing): 5% to 90%

Make sure to thoroughly test the higher values (50 degrees and 93% humidity) for 120hrs.
Non-operating (non-condensing): 5% to 95%

7.4. ALTITUDE:3050M

7.5. MECHANICAL:

<table>
<tr><td>Shock</td><td>Operating :Half-sine 5 G, 11 ms pulse ,3 times in each direction.
None operating: Half-sine 140 G, 2 ms, pulse 3 times in each direction.</td></tr>
<tr><td>Drop packaged</td><td>Test height is based on the weight of the package (see below table).
Test requirement: 6 face,3 drops per face;2 corner(the weakest corner and the weakest corner’s corresponding diagonal corner),1drops;the related 3 edge to the weakest corner, 1 drop per edge.
<table>
<tr><th>Product Weight（kg）</th><th>Non-palletized Free Fall Height(m)</th><th>Palletized (Single product) Free Fall Height(m)</th></tr>
<tr><td>0-5</td><td>1.1</td><td>N/A</td></tr>
<tr><td>5-15</td><td>1</td><td>N/A</td></tr>
<tr><td>15-30</td><td>0.8</td><td>N/A</td></tr>
<tr><td>30-50</td><td>0.65</td><td>0.46</td></tr>
<tr><td>50-120</td><td>0.5</td><td>0.3</td></tr>
</table></td></tr>
</table>

Random Vibration

Non-operating

Sine sweep:

5Hz to 500Hz @ 0.5g RMS at 0.5 octaves per minute; dwell 15 min at each of 3 resonant points;

Random profile:

5Hz @ 0.01g²/Hz to 20Hz @ 0.02g²/Hz (slope up); 20Hz to 500Hz @ 0.02g²/Hz (flat);
Input acceleration = 3.13gRMS; 10 min. per axis for 3 axis on all samples

7.6. PACKAGE

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

8. Reliability

8.1. POWER CYCLES :

5000 full AC cycles, 10000 cycles remote on/off,.

8.2. Halt test

Supplier shall perform a HALT test on the product and provide test results to final approval.
The POS method of HASA test shall be used for halt test.50 cycles ,it shall be necessary.
Halt report must contain the failure mechanism and root cause.

8.3. QUALITY CRITERIA

Supplier must make sure Failure Rate:< 500DPPM per 1000 hours

8.4. SAFETY CONSIDERATION

(1) Hipot

One hundred percent (100%) of the Power Supply Module shall comply with the minimum Production Line Hipot (High Potential) Test as noted below. The test shall be applied between the PRIMARY (AC LINE and NEUTRAL) and EARTH GROUND ,PRIMARY AND SECOND.
Withstand voltage: Meet safety requirement, at least 1.8KAC or 2550VDC.
Dwell time:3s minimum/1.8KAC.

(2) Input leakage current:

<1mA at 240V RMS, and <0.5mA at 120VRMS

9. Certification overview

1) The safety , EMC/EMI and deviations certification must ensure the PSU product can sell to below countries, So the power supply must get any specific certification of these countries.
USA
Canada
UK
France
Germany
Italy
China
2) All of certifications shall be latest version in the early 2011'.

9.1. EMI

FCC /ICES-003 - Emissions (USA/Canada) Verification Class A-6dB
CISPR 22 – Emissions (International) Class A-6dB
EN55022 - Emissions (Europe) Class A-6dB

9.2. EMC Compliance

9.3. AC line transient

Compliable with EMC standard

Power supply shall operate within specifications under the following conditions:

a) Transients as defined in IEC 61000-4-4, Electrical Fast Transients standard, up to 1KV at AC line, Applied to six combinations of input AC/DC power (L1, L1-L2, L1-PE, L1-L2-PE, L2, L2-PE).

b) Transients as defined in IEC 61000-4-5, Electrical Surge standard. Up to and including ±2 kV limits,and phases 0 degrees, 90 degrees, 180 degrees, 270 degrees.

Surge should meet the criteria in following table as well.

	Unidirectional	Ring Wave
AC Leads	2.0 kV	2.0 kV
I/O Leads	1.0 kV	1.0 kV
DC Leads	0.5 kV	0.5 kV

c) Power supply shall comply with IEC 61000-4-3, Electrostatic Discharge standard, up to 8KV and with contact, 15KV with air mode.

d) Power supply must meet all the transient requirements for the CE mark designation.

9.3.1. Line Surge or Sag

Surge and Sag

Duration	Surge/sag	Operating AC Voltage	Line 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 cycles	30%	220/110VAC 240VDC	50/60Hz	No loss of function or performance
>1/2 AC cycles	30%/>30%	220/110VAC 240VDC	50/60Hz	Loss of function acceptable, Power supply can starts up automatically

9.3.2. Harmonic current

The power supply shall meet the requirements of IEC 61000-3-2 Class A and the Guidelines for the Suppression of Harmonics in Appliances and General Use Equipment Class A for harmonic line current content at all conditions of output power.

9.3.3. Voltage fluctuations flicks requirements

The power supply shall comply with the applicable limits for voltage fluctuations flickers IEC 61000-3-3.

9.3.4. EMC Compliance

EN55024 - Immunity (Europe)
a) IEC61000-4-2 Electrostatic Discharge
b) IEC61000-4-3 Radiated RFI Immunity
c) IEC61000-4-4 Electrical Fast Transients
d) IEC61000-4-5 Electrical Surge
e) IEC61000-4-6 RF Conducted
f) IEC61000-4-11 Voltage Dips and Interruptions
* EN6/IEC 1000-3-2 - Harmonics (Europe)
* EN/IEC 61000-3-3 - Voltage Flicker (Europe)

CE – EMC Directive 2004/108/EC (Europe)
GB 9254 – (EMC) Certification (China)
GB 17625.1 - (Harmonics) CNCA Certification (China)
GB/T17618-1998

10. Power supply monitor and control

1) PM bus1.2 specification shall be used for the communication with system.
2) Power supply shall comply with Intel Node manager2.0 specification. Any exceptions should be subjected to Lenovo approval.
3) PM bus must sense input and output current/voltage/power,and temperature. (GUI support reporting these parameters)
4) Protection: OVP/OCP/OPP/OTP status and which output is in protection mode. (GUI support)
5) Warning: Power supply work normally, PM bus can detect input/output high current, input/output high power, high temperature at hotspot, input voltage lower than 90Vac< not warning above 90v condition, must be warning state below 85V condition > and which output is in warning status, fan slows down etc. GUI and SMBAlert support
6) Power supply module present or not. For this function, Vcc of second side MCU must be from 12VSB bus. (PSkill checking)
7) Power supply has fan speed control by PM bus. If power supply does not connect to PM bus, power supply should control fan speed based on internal temperature limit. However, Fan speed control based on internal temperature limit at some critical component shall be first preference.
8) EEPROM: can save power supply model name and revision, power supply module location, manufacture name, (GUI support reporting)

FRU need to use Product Info Area Format.

9) Firmware revision on power supply, firmware date etc shall refer to PMBUS command list. (GUI

support reporting)

10) Power supply can turn on/off by PM bus by different address,

A) Power supply should turn on or off by front button on system panel or PMbus control. One turn on/off mode can't prohibit another mode. ((GUI provides On/Off soft control button))

B) Power supply module A may be in ON state, and module B may be in OFF state during a week. But it turns module B in ON state, and module A in OFF state during next week. This function can be changed to itemC) in system software by PM bus. It turns on/off each other between two modules once every week. This duration can be changed in system software by PMbus. (GUI provides configuration to simulation this function)

C) Two modules can turn on/off simultaneously by PM bus control. This function can be change to itemB) in system software by PM bus. (GUI provides configuration to simulation this function)

11) Measure tolerance: Voltage less than +/-5%. Temperature less than +/−3° C. (ATE and TestSuite software will work together to verify the accuracy)

Current/power tolerance: shall meet Energy start for server2.0.

Pin 10% load to 100% load: +/-5% or +/-3W

Iin 10% load to 100% load: +/-5% or +/-0.2A

Output current/power tolerance:

+/-10% tolerance @10%—20% load

+/-5%@ 20% load to 100% load.

12) PM bus resolution: (Verified in design stage, not tested in factory)

Power supply must meet below resolution:

Vin---------- 1/64V (Command 88h, A0h, A1h)

Iin ----------1/256A (Command 58h, 5Dh,89h, A2h)

Temperature---1/4'C (Command 51h, 8Dh, 8Eh, A8h, C0h, C1h)

Iout----------1/256A (Command 46h, 4Ah, 8Ch, A6h)

Pin----------1/32W (Command 6Bh, 97h, A3h)

Pout ----------1/32W (Command 6Ah, 96h, A7h)

Fan Speed-----1RPM (Command 90h)

13) Line loss:(Option, supplier must follow system requirement on this function) (Not completed yet)

If AC line loss time exceed 2ms line loss event log(FF) and time log should be written into 72H/71H register. The time should be Y/M/D/H/M/S and modified by system command.

Lineloss event log must meet below conditions:

A, AC line loss occurs

B, Voltage of bulk cap drops to low limit

C, POK drops to low level and main output voltage drops to low limit.

The 72H should be 00 if no lineloss occurs.

Attached is the lineloss detail spec:

AC LOST SPEC-0511.doc

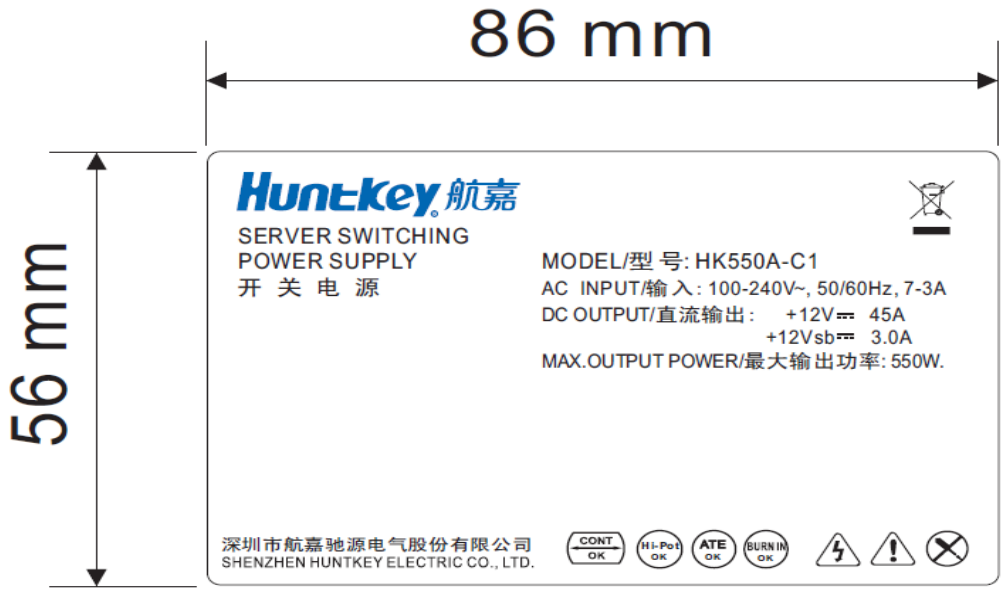
Below is the PMBUS command list:

Lenovo PMBus Spec 1.1.xls

Below is power supply detail definition,Supplier should meet this standard,any exception,must be subject to Lenovo to approval.

451620_451620_PMBus_Romley_ACDC_Ap

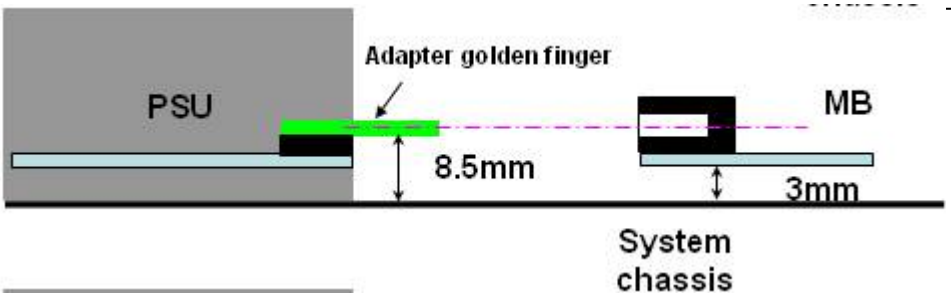
11. Label



SCALE 1:1

12. Mechanical requirement

1）Outline dimension
Width: 73.5mm
Thickness:40mm
Length: 185mm excluding golden finger
The height of adapter golden finger to 8.5mm

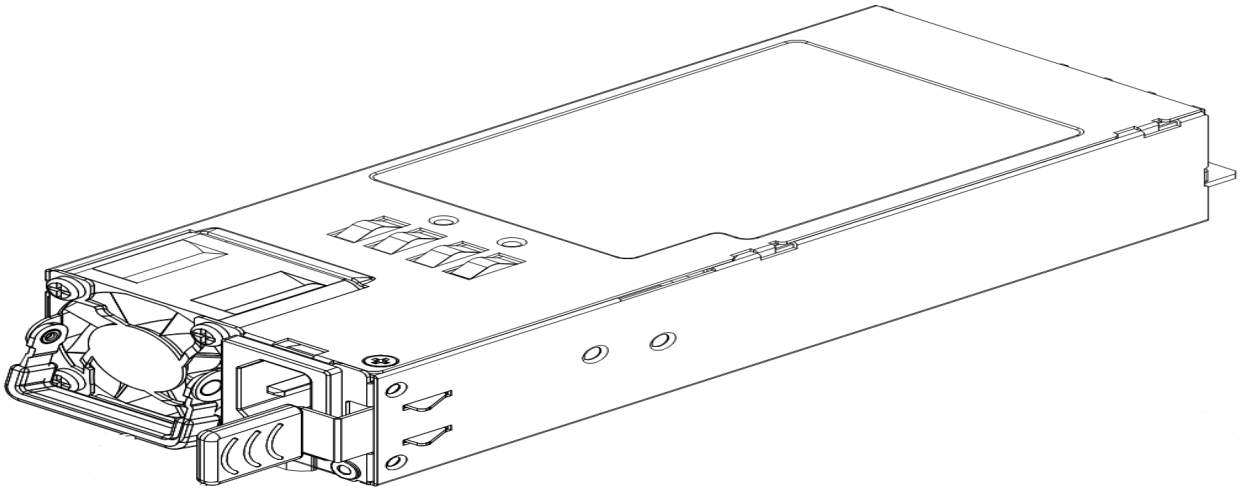


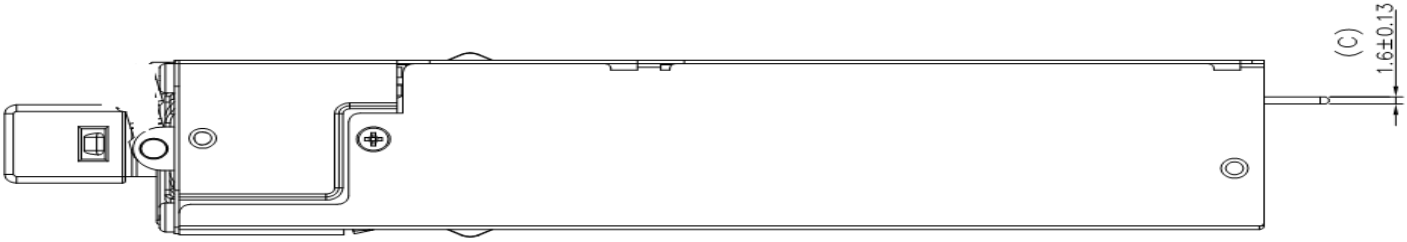
2）Gold finger pin assignment as below:

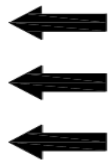
O/P PIN ASSIGNMEN

PIN	SIGNAL NAME	PIN	SIGNAL 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	12VSB
A22	SMB-ALERT	B22	CR_1
A23	RETRUN_S	B23	12LS
A24	+12VRS	B24	PSKill
A25	PWOK	B25	NC

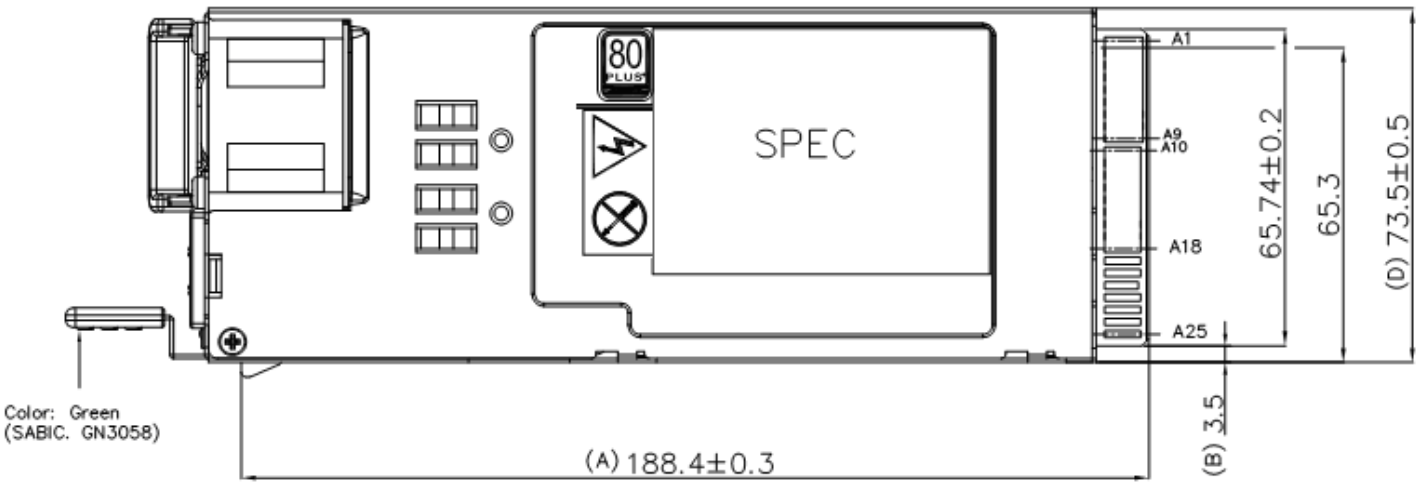
3) the mechanical drawing for chassis design. Reference as below:

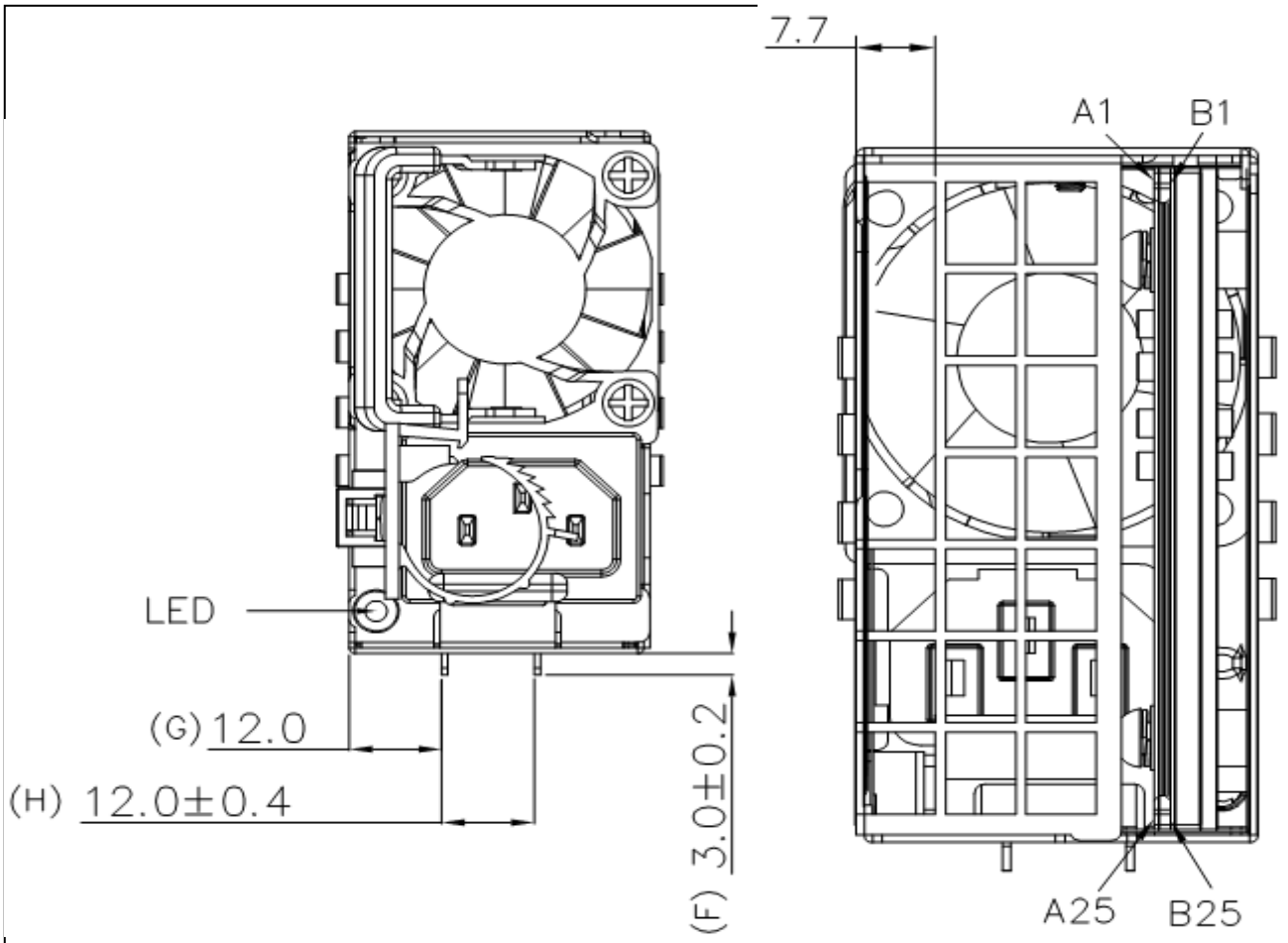


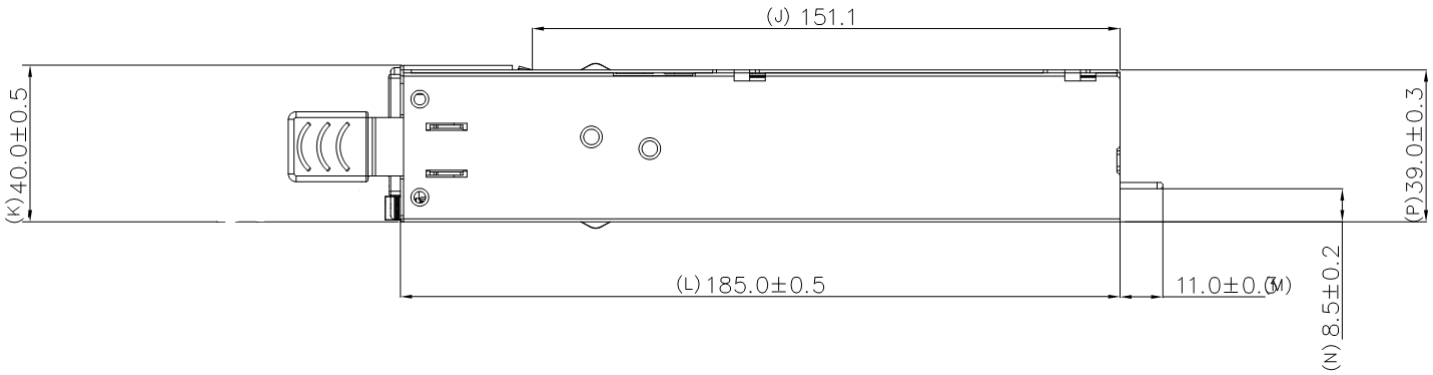




AIR FLOW DIRECTION







DIMENSIONAL TOLERANCES HOLES : ±0.05 ANGLES : ±0.5°

( )		( )		( )		( )	
<30	:±0.25	DECIMALS		UP~100	:±0.2	250~300	:±0.4
>30~100	:±0.35	X	:±0.3	100~150	:±0.25	300~350	:±0.45
>100~300	:±0.5	X.X	:±0.2	150~200	:±0.3	350~400	:±0.5
ABOVE 300	:±0.6	X.XX	:±0.1	200~250	:±0.35		

( )	
UP~600	:±1.5
600~900	:±2.4
900~OVER	:±3.1