ABLECOM®
大訊科技股份有限公司

Ablecom Technology Power Department

Power Supply Specification for 280/300 Watts

Model Name: PWS-281-1H

Revision : V1.1

Prepared	
Checked	
Approved	

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1 Purpose

This specification defines non-redundant power supplies that support 1U rack mount entry server systems. The entry–level power supply is not intended to be a hot swap type of power supply. The parameters of this supply are defined in this specification for open industry use. This specification defines a 280W/330W power supply with five outputs; +3.3V, +5V, +12V, -12V and +5VSB. This form factor fits into a 1U system and provides a wire harness solution for output connections. An IEC connector is provided on the external face for AC input to the power supply. The power supply contains fans for cooling, while meeting acoustic requirements.

2 AC Input Requirements

The power supply shall incorporate universal power input with active power factor correction, which shall reduce line harmonics in accordance with the EN61000-3-2 and JEIDA MITI standards.

2.1 AC Inlet Connector

The AC input connector shall be an IEC 320 C-14 power inlet. This inlet is rated for 10A / 250 VAC.

2.2 AC Input Voltage Specification

The power supply must operate within all specified limits over the following input voltage range. Harmonic distortion of up to 10% THD must not cause the power supply to go out of the specified limits. The power supply shall operate properly at 90 VAC input voltage to guarantee proper design margins.

Table 1: AC Input Voltage Rating

Parameter	MIN	Rated	MAX
Voltage	90 Vrms	100 – 240 Vrms	264 Vrms
Frequency	47 Hz	50 / 60 Hz	63 Hz

Note: The rated input voltage is range from 180Vac to 240Vac when output power is greater than 280W.

2.3 Input Under Voltage

The power supply shall contain protection circuitry such that application of an input voltage below the minimum specified in section 2.2 shall not cause damage to the power supply. Input voltage range for AC minimum startup voltage, 84-89VAC, and maximum turn off voltage range 79 to 83VAC.

2.4 Efficiency

The power supply will have a minimum efficiency of 85% at full load (see table 4) under 115V /60Hz and 230V/50Hz, it is provided to allow for proper power supply cooling (7.5 CFM) when installed in a system.

2.5 AC Line Fuse

The power supply shall incorporate one input fuse on the LINE side for input over current protection to prevent damage to the power supply and meet product safety requirements. Fuses should be slow blow type or equivalent to prevent nuisance trips. AC 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. This includes DC output load short conditions.

2.6 AC Inrush

The power supply must meet inrush requirements for any rated AC voltage, during cold start; during turn on at any phase of AC voltage, during a single cycle AC dropout condition, during repetitive ON/OFF cycling of AC, and over the specified temperature range. The peak inrush current shall be less than 30A peak.

3 DC Output Specification

3.1 Grounding

The ground of the pins of the power supply wire harness provides the power return path. The wire harness ground pins shall be connected to safety ground (power supply enclosure).

3.2 Remote Sense

The power supply may have remote sense return (Return_S) to regulate out ground drops for all output voltages; +3.3V, +5V, +12V, -12V and +5VSB. The +5V, +12V, and +5VSB outputs only use remote sense referenced to the Return_S signal. The remote sense input impedance to the power supply must be greater than 10 Ω on the Return_S. This is the value of the resistor connecting the remote sense to the output voltage internal to the power supply. The remotes sense return (Return_S) must be able to regulate out a minimum of 200mv drop in the power ground return. The current in any remote sense line shall be less than 5mA to prevent voltage-sensing errors. The power supply must operate within specification over the full range of voltage drops from the power supply's output connector to the remote sense points.

3.3 Output Load Condition

The following table defines the output power and current ratings. The combined output power of all output shall not exceed the rated output power. The tables show the load ranges of the two power supply power levels. Power supply should not be damaged when any output voltage has zero loading.

Table 4：280/330W Load Ratings			
Load Range			
Voltage	Min. Continuous	Full Load	Max. Continuous
+3.3V	0.5A	9.18A	15A
+5V	1.0A	10.0A	18A
+12V	2) 1.0A	1) 16.17A/20.7A	1) 23A/27A
-12V	0 A	0.0A	1.0A
+5VSB	0.1A	1.21A	2.0A

Note：

1. The maximum load of 12V should not be greater than 23A for total output 280W application; the maximum load of 12V should not be greater than 27A for total output 330W application.
2. When +5V load over 10A, the +12V load shell not less than 2A.

3.3.1 Standby Output

The +5VSB output shall be present when an AC input greater than the power supply turn on voltage is applied.

3.4 Voltage Regulation

The power supply output voltages must stay within the following voltage limits when operating at steady state and dynamic loading conditions. All outputs are measured with reference to the return remote sense (Return_S) signal. The +5V, +12V, -12V, and +5VSB outputs are measured at the power supply connectors referenced to Returns. The +3.3V is measured at its remote sense signals (3.3VS) located at the signal connector.

Table 5 ：Voltage Regulation Limits					
Parameter	MIN	NOM	MAX	Units	Tolerance
+3.3V	+3.140	+3.30	+3.465	Vrms	+5 / -5%
+5V	+4.75	+5.00	+5.25	Vrms	+5 / -5%
+12V	+11.40	+12.00	+12.60	Vrms	+5 / -5%
-12V	-10.80	-12.00	-13.20	Vrms	+10 / -10%
+5VSB	+4.75	+5.00	+5.25	Vrms	+5 / -5%

3.5 Dynamic Loading

The output voltage shall remain within the limits specified in Table 5 for the step loading and within the limit specification in Table 6 for the captive loading. The load transient repetition rate shall be tested of 1KHZ at duty cycles ranging from 10% - 90%. The load transient repetition rate is only a test specification. The △ step load may occur anywhere within the MIN load to the MAX load shown in table 4.

Table 6 ： Transient Load Requirements			
Output	△ Step Load Size	Load Slew Rate	Capacitor Load
+3.3V	20% of max load	0.5A/us	2000uf
+5V	20% of max load	0.5A/us	2000uf
+12V	40% of max load	0.5A/us	2000uf
+5VSB	20% of max load	0.1A/us	10uf

3.6 Capacitance Loading

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

Table 7 ： Capacitive Loading Conditions			
Output	MIN	MAX	Units
+3.3V	2,000	6,600	‘uF
+5V	2,000	10,000	‘uF
+12V	2,000	10,000	uF
+5VSB	1	350	‘uF

3.7 Ripple / Noise

The maximum allowed ripple / noise output of the power supply is defined in Table 8 Ripple / Noise below. This is measured over a bandwidth of 0Hz to 20MHz at the power supply output connector. A 10μF tantalum capacitor in a parallel with a 0.1μF ceramic capacitor is placed at the point of measurement.

Table 8 Ripple and Noise

	+3.3V	+5V	+12V	+5VSB
Ripple	50mVp-p	50mVp-p	120mVp-p	50mVp-p
Ripple & Noise	80mVp-p	100mVp-p	200mVp-p	80mVp-p

3.8 Timing Requirements

These are the timing requirements for single power supply operation. The output voltages must rise from 10% to 90% within regulation limits. (Tvout_rise) within 0.1mS to 20ms. All output shall rise monotonically. Each output voltage shall reach regulation within 0.1mS to 65ms (Tvout_on) except +5SB and begin to turn off within 400ms (Tvout_off) of each other. Refer to (Figure 2 Output Voltage Timing) (Figure 3 Turn On/ Off Timing) shows the timing requirements for a single power supply being turned on and off via the AC input, and the PSON signal with PSON held low and high, with the AC input applied.

Table 9 Output Voltage Timing

ITEM	DESCRIPTION	MIN	MAX	UNITS
Tvout_rise	Output voltage rise time from each main output	0.1	20	msec
Tvout_on	All main outputs must be within regulation of each other	0.1	65	msec
Tvout_off	All main outputs must leave regulation within this time	0.1	400	msec

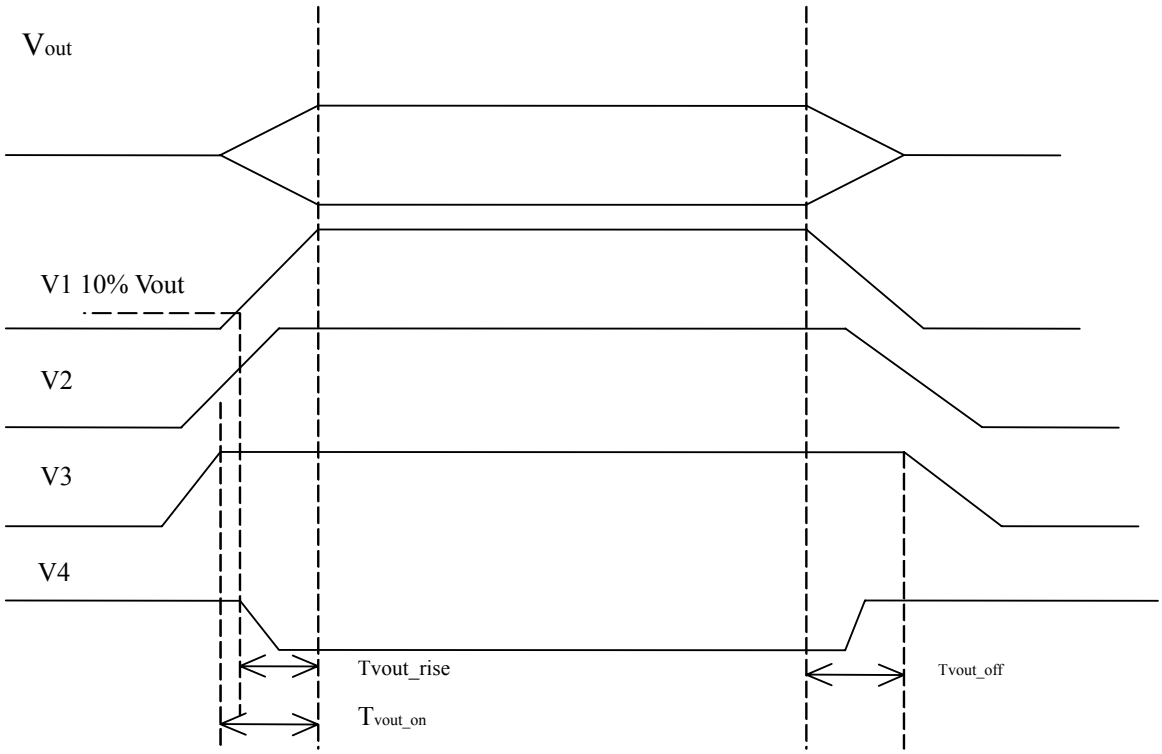


Figure 1 Output Voltage Timing

Table 10 Turn On / Off Timing

ITEM	DESCRIPTION	MIN	MAX	UNITS
T sb_on_delay	Delay from AC being applied to 5VSB being within regulation	*	2500	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, including 5VSB, stay within regulation after loss of AC	18/15.3 (Note 1)	*	msec
T pwok_holdup	Delay from loss of AC to desertion of PWOK	17/14.3 (Note 1)	*	msec
Tpson_on_delay	Delay from PSON# active to output voltages within regulation limits.	*	400	msec
T pson_pwok	Delay from PSON# deactivate to PWOK being disserted.	*	50	msec
T pwok_on	Delay from output voltages within regulation limits to PWOK asserted at turn on.	100	500	msec
T pwok_off	Delay from PWOK disserted to output voltages (3.3V, 5V, 12V,-12V, 5VSB) dropping out of regulation limits.	1		msec

T pwok_low	Duration of PWOK being in the disserted state during an off/on cycle using AC or the PSON signal.	100		Msec

Note1. T vout_holdup is 15.3mS and T pwok_holdup is 14.5mS for output power 330W application @ input voltage 180-264Vac

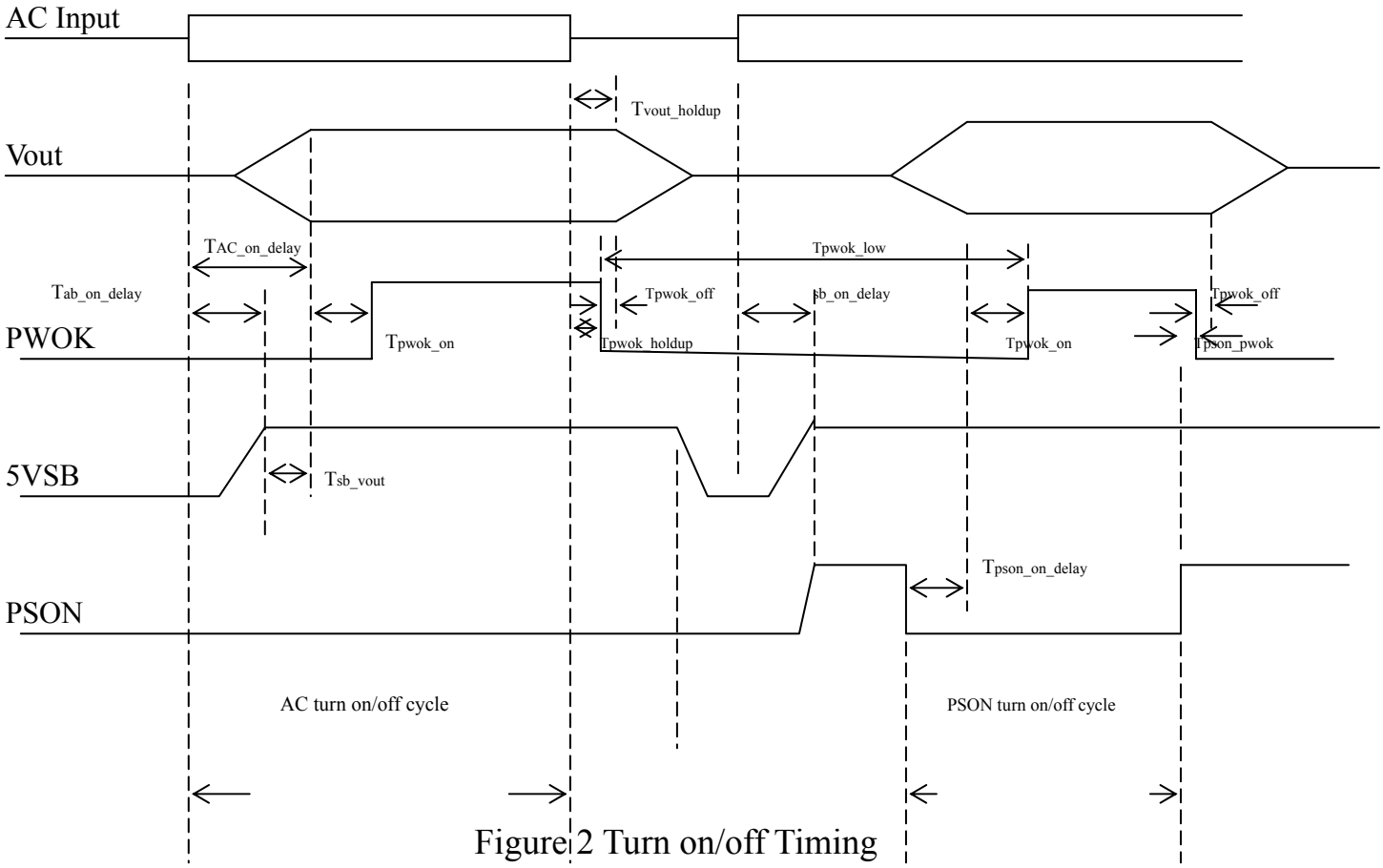


Figure 2 Turn on/off Timing

3.9 Output connector

P1: MOLEX* Housing: 24 Pin Molex Mini-Fit Jr. PN# 39-01-2240 or equivalent.

Pin No.	Description	Color	AWG#	Pin No.	Description	Color	AWG#
1	+3.3VDC	Orange	18	13	+3.3VDC	Orange	18
					+3.3V sense	Brown	22
2	+3.3VDC	Orange	18	14	-12VDC	Blue	18
3	COM	Black	18	15	COM	Black	18
4	+5VDC	Red	18	16	PS ON	Green	18
5	COM	Black	18	17	COM	Black	18
6	+5VDC	Red	18	18	COM	Black	18
7	COM	Black	18	19	COM	Black	18
8	PG	Gray	18	20	Reserved	N.C.	

Pin No.	Description	Color	AWG#	Pin No.	Description	Color	AWG#
9	+5VSB	Purple	18	21	+5VDC	Red	18
10	+12VDC	Yellow	18	22	+5VDC	Red	18
11	+12VDC	Yellow	18	23	+5VDC	Red	18
12	+3.3VDC	Orange	18	24	COM	Black	18

P2: MOLEX 39-01-2040 or equivalent

Pin No.	Description	Color	AWG#
1	Ground	Black	18
2	Ground	Black	18
3	+12VDC	Yellow	18
4	+12VDC	Yellow	18

P3, P4: LCU: H201-04(Rohs) or equivalent.

Pin No.	Description	Color	AWG#
1	+12VDC	Yellow	18
2	Ground	Black	18
3	Ground	Black	18
4	+5V	Red	18

P5 P6: JWT C5081T2B-2(Rohs) or equivalent

Pin No.	Description	Color	AWG#
1	+12VDC	Yellow	22
2	Ground	Black	22
3	Ground	Black	22
4	+5V	Red	22

P7 : Molex 39-01-2080 (Rohs) or equivalent

Pin No.	Description	Color	AWG#
1	+12VDC	Yellow	18
2	+12VDC	Yellow	18
3	+12VDC	Yellow	18
4	+12VDC	Yellow	18
5	Ground	Black	18
6	Ground	Black	18
7	Ground	Black	18
8	Ground	Black	18

4. Protection Circuits

Protection circuits inside the power supply shall cause only the power supply's main outputs to shutdown. If the power supply latches off due to a protection circuit tripping, an AC cycle OFF for 15sec and a PSON# cycle HIGH for 5sec shall be able to reset the power supply.

4.1 Over Current Limit

The power supply shall have current limit to prevent the +3.3V, +5V, and +12V outputs from exceeding the values shown in Table11. If the current limits are exceeded, the power supply shall shutdown and latch off. The Latch will be cleared by toggling the PSON # signal. The power supply shall not be damaged from repeated power cycling in this condition. Those outputs shall be protected so that no damage occurs to the power supply under a shorted output condition.

The +5VSB shall be protected and under over current limitation or shorted conditions so that no damage can occur to the power supply.

Table 11 ：Over current Protection	
Voltage	Over Current Limit (I out Limit)
+3.3V	110 % minimum , 130% maximum
+5V	110 % minimum , 130% maximum
+12V	110 % minimum , 130 % maximum

4.2 Over Voltage Protection

The power supply over voltage protection shall be locally sensed. The power supply shall shutdown and latch off after an over voltage condition occurs.

This latch shall be cleared by toggling the PSON # signal. Table13 contains the over voltage limits. The values are measured at the output of the power supply's connectors. The voltage shall never exceed the maximum levels when measured at the power pins of the power supply connector during any single point of fail. The voltage shall never trip any lower than the minimum levels when measured at the power pins of the power supply connector.

Table 13：Over Voltage Limits		
Output Voltage	MIN (V)	MAX (V)
+3.3V	3.9	4.5
+5V	5.7	6.5
+12V	13.3	15.0

4.3 Over Temperature Protection

The power supply will be protected against over temperature conditions cause by loss of fan cooling or excessive ambient temperature. In an OTP condition the PSU will shutdown. When the power supply temperature drops to within specified limits, the power supply shall restore power automatically by PSON signal on/off. The OTP circuit must have built in hysteresis such that the power supply will not oscillate on and off due to temperature recovering condition. The OTP trip level shall have a minimum of 4℃ of ambient temperature hysteresis.

5. Control and Indicator Functions

The following sections define the input and output signals from the power supply. Signals are defined as low true use the following convention: signal# = low true

5.1 PSON#

The PSON# signal is required to remotely turn on/off the power supply. PSON# is an active low signal that turns on the +3.3V, +5V, +12V, -12V power rails. 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 Figure 2 Turn on / off Timing for timing diagram.

Table 14 PSON# Signal Characteristics

Signal Type	Accepts an open collector/drain input from the system. Pull-up to VSB located in power supply.	
PSON# = Low	ON	
PSON# = Open or high	OFF	
	MIN	MAX
Logic level low (power supply ON)	0V	1.0V
Logic level high (power supply OFF)	2.0V	5.25V
Source current, Vpson = low	*	4mA
Power up delay: T pson_on_delay	*	400msec
PWOK delay: T pson__pwok	*	50msec

5.2 PWOK (Power OK)

PWOK is a power OK signal and will be pulled HIGH by the power supply to indicate that all the outputs are within the regulation limits of the power supply. When any output voltage falls below 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 dearest to a LOW state. See Figure 2 On/ Off Timing for a representation of the timing characteristics of PWOK. The start of the PWOK delay time shall inhibited as long as any power supply output is in current limit.

Table 15 PWOK Signal Characteristics

Signal Type	Open collector/drain output from power supply. Pull-up to 5VSB located in power supply.
PWOK = High	Power OK
PWOK = Low	Power Not OK

	MIN	MAX
Logic level low voltage, Isink = 4mA	0V	0.4V
Logic level high voltage, Isource = 200μA	2.4V	5.25V
PWOK delay: T pwok_ON	100ms	500ms
PWOK rise and fall time	*	100μsec
Power down delay: T pwok_off	1ms	*

6. MTBF

The life requirement shall be met the following condition:

MTBF should be more than 100,000 hours at 25℃ without fan MTBF be considered.

7. Definitions / Terms / Acronyms

Table 16 ：Definitions, Terms, and Acronyms (listed alphabetically)	
Full Ranging	A full-ranging power supply automatically senses and adjusts itself to the proper input voltage range (110 VAC or 220 VAC). No manual switches or manual adjustments are needed.
CFM	Cubic Feet per Minute (airflow).
Dropout	A condition that allows the line voltage input to the power supply to drop to below the minimum operating voltage.
Latch Off	A power supply, after detecting a fault condition, shuts itself off. Even if the fault condition disappears the supply does not restart unless manual or electronic intervention occurs. Manual intervention commonly includes briefly removing and than reconnecting the supply or it could be done through a switch. Electronic intervention could be done by electronic signals in the Server System.
Monotonically	A waveform changes from one level to another in a steady fashion, without intermediate re-treatment or oscillation.
MTBF	Mean time between failure
Noise	The periodic or random signals over frequency band of 0 Hz to 20 MHz.
Over current	A condition in which a supply attempts to provide more output current than the amount for which it is rated. This commonly occurs if there is a “short circuit” condition in the load attached to the supply.
PFC	Power Factor Corrected. (PF > 0.95 @ Full load at 110 Vac and PF > 0.92 @ Full load at 220 Vac).
PWOK	A typical logic level output signal provided by the supply that signals the server System that all DC output voltages are within their specified range.
Ripple	The periodic or random signals over a frequency band of 0 Hz to 20 MHz.
Rise Time	Rise time is defined as the time it takes any output voltage to rise from 10% to 90% of its nominal voltage.
VSB or Standby Voltage	An output voltage that is present whenever AC power is applied to the AC inputs of the supply.

8. Airflow Requirements

The power supply shall have a speed fan(s) and provide cooling to both the supply and system. During low-speed fan operation. The power supply shall not exceed a noise level of 65 dB. A measured at one meter on all faces. At low fan speed, the power supply shall provide a minimum of 6.91 CFM of airflow with 0.5 m/s^2 in H2O of system backpressure. At high fan speed, the power supply shall provide a minimum of 15.31 CFM with 0.5 m/s^2 in H2O of system backpressure.

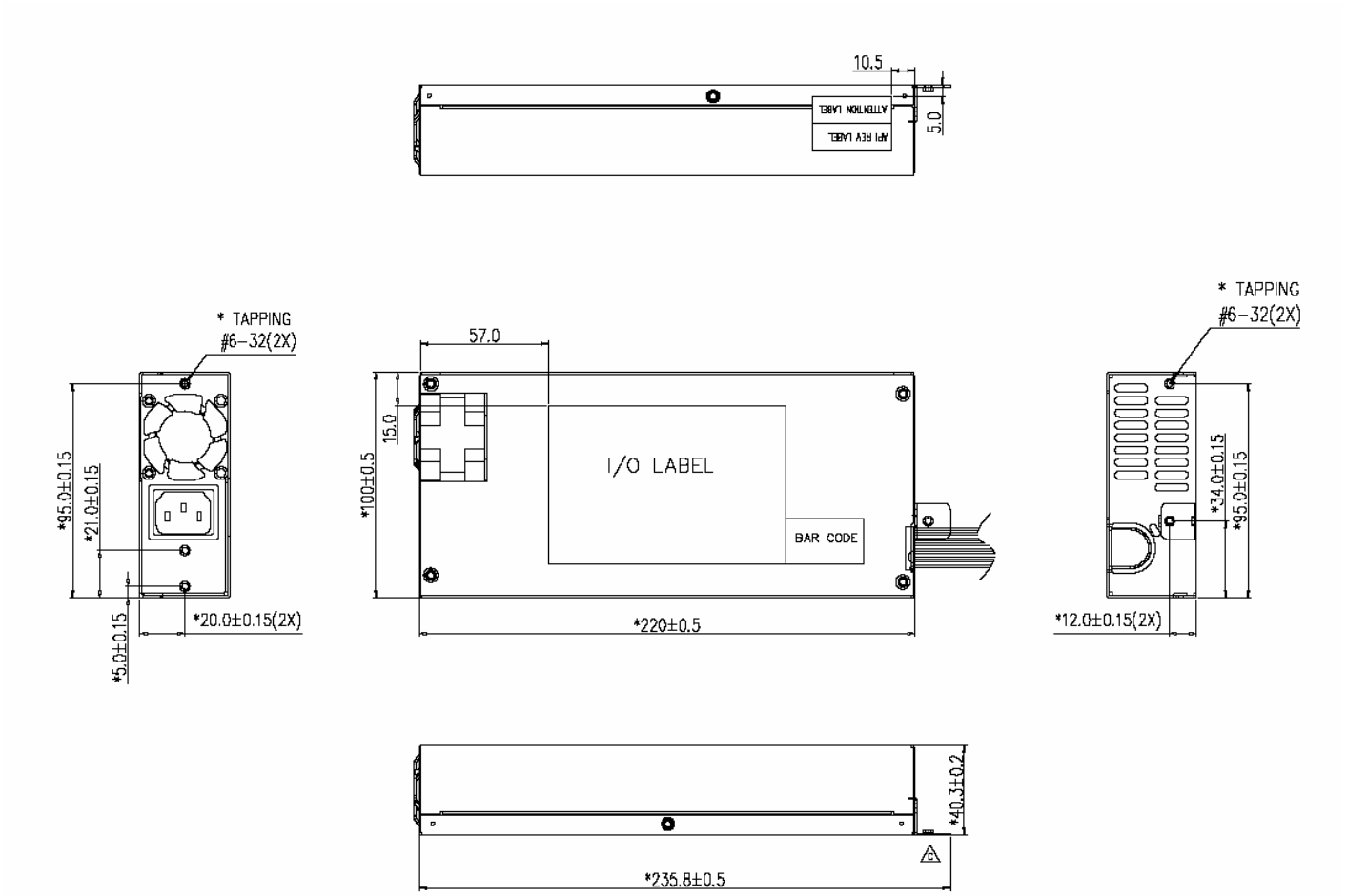
9. Temperature Requirement

The power supply shall operate within all specified limits over T_{op} temperature range. All airflow shall pass through the power supply and not over the exterior surfaces of the power supply.

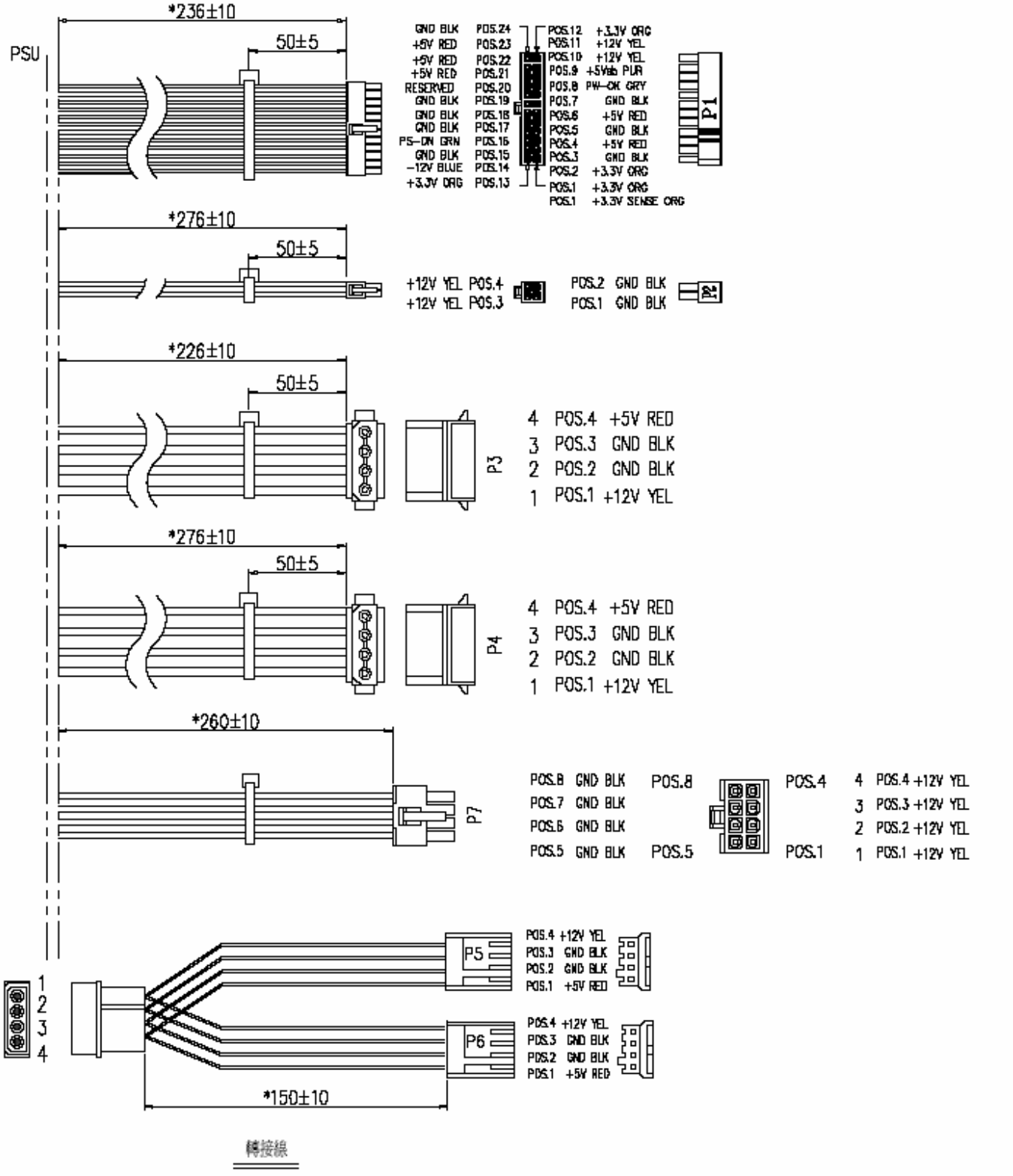
Table 17：Thermal Requirements				
Item	Description	MIN	MAX	Units
T_{op}	Operating temperature range	0	50	℃
T_{non-op}	Non-operating temperature range	-10	60	℃

The power supply must meet UL enclosure requirements for temperature rise limits. All sides of the power supply, with exception to the air exhaust side, must be classified as " Handle, Knobs, grips, etc. held for short periods of time only ".

10. Mechanical Drawing (Figure 4)



10.1 Connectors and Pin Assignment:



NOTE1: Supplier may choose colors of their choice for +12V outputs. However they must be unique from all other outputs, and from each other.

11. Safety Requirement

The power supply must comply with all regulatory requirements for its intended geographical market. Depending on the chosen market, regulatory requirements may vary. Although a power supply can be designed for worldwide compliance, there may be cost factors that drive different versions of supplies for different geographically targeted markets.

This specification requires that the power supply meet all regulatory requirements for the intended market at the time of manufacturing. Typically this includes：

- UL
- C-UL
- TUV
- CCC
- CB
- CISPR Class B
- FCC Class B

12. E/C History

Version	History Change	Remark
001	Draft Release	2006/03/14
002	1) 2.3 Add, input voltage range for AC minimum startup voltage, 84-89VAC, and maximum turn off voltage range 79 to 83VAC.	2006/03/21
	2) 2.6 The peak inrush current shall be less than 100A modified into 30A	
	3) 3.3 Power supply should not be damaged when any output voltage has zero loading.	
	4) 3.5 maximum step load of +12V size change 20% to 40% of max load	
	5) 4.1 Over current limit:+3.3V&+5V both change from 240VA to 130% maximum	
	6) 4.2 over voltage protection: +3.3V, add. Minimum 3.9V.	
	7) 6 MTBF should be more than 100,000 hours at 25 degree C without fan MTBF be considered.	
	8) 11 Safety Requirement: Add to meet CCC regulatory.	
003	1)3.8 T pwok_on minimum change to 100ms	2006/03/27
	2)5.2 T pwok_on minimum change to 100ms	
	3) 3.9 Add 8Pin/12V Molex 39-01-2080 Pin1,2,3,4, ground/black, Pin 5,6,7,8, +12V/yellow. Cable length is 260mm.	
004	1) Add Tvout_off to table 9 of page 7 2) Add customer PN on the first page	2006/06/06
005	1) 8. The power supply shall not exceed a noise level of 56 dB.	2006/06/12
006	1) 'maximum turn off voltage range 79 to 83VAC' change to 'maximum turn off voltage less than the range 79-83VAC'	2006/07/06
A	Released edition: 4.1 Over Current Limit: 130% maximum change to 140% maximum	2006/10/16
B	Add the 330W for 180-264Vac input voltage range, so adjust the hold up time of Vout and PG hold up time.	2007/01/23 Yorki