500W AC/DC Switching Power Supply
Model: TN24-0500-XX



FEATURES

- Universal 85 - 265VAC or 120 - 370VDC input voltage.
- Operating ambient temperature range: -20°C to +70°C.
- Built-in active PFC function.
- Output short circuit, over-current, over-voltage protection, over-temperature protection.
- 240W with convection cooling, 500W with forced air cooling.
- High efficiency up to 94%.
- Remote control option.
- High power density, compact size: 7.09"x3.31"x1.30" (above PCB).
- Overvoltage category: OVC II (for 5000m) & OVC III (for 2000m).
- Operating altitude up to 5000m.
- Safety according to IEC62368, IEC61558, IEC60335.
- Suitable for Powering Capacitive, Inductive and Thermal Printer.

Models & Ratings

Model No.	Cooling Method	Output Power (W)	Output Voltage/ Current	Peak Output Power (W) (4)	Efficiency at 240VAC (%) Typ.	External Cap. Load (μF)
TN24-0500-12	Convention Cooling	240	12V / 20.0A	480	92	10,000
	Forced Air Cooling	400	12V / 33.3A	480	91	
TN24-0500-24	Convention Cooling	240/300W(option)	24V / 10.0A	480	94	5,000
	Forced Air Cooling	500	24V / 20.8A	600(option)	93	
TN24-0500-36	Convention Cooling	240	36V / 6.7A	480	94	4,000
	Forced Air Cooling	500	36V / 13.9A	-	93	
TN24-0500-42	Convention Cooling	240	42V / 5.7A	480	94	3,000
	Forced Air Cooling	500	42V / 11.9A	-	93	
TN24-0500-48	Convention Cooling	240	48V / 5.0A	480	94	2,500
	Forced Air Cooling	500	48V / 10.4A	-	93	
TN24-0500-56	Convention Cooling	240	56V / 4.3A	480	93	2,000
	Forced Air Cooling	500	56V / 8.9A	-	93	

Notes:

1. Under any conditions, the total power of the product should not exceed the rated power. When the output voltage is increased, the total output power cannot exceed the rated output power.
2. When measuring the full load efficiency, the fan should be connected to an external power supply. Fan loss is not included in the input power.
3. The equipment tested with forced air cooling fan min 22CFM outwardly and installed in final system, see below figure (Fig. A) for details.
   Disclaimer:
   The force air flow and structural diagrams are for reference only of the PSU standalone safety declaration, actual requirements should be based on system configuration and measurement of component temperature rise.

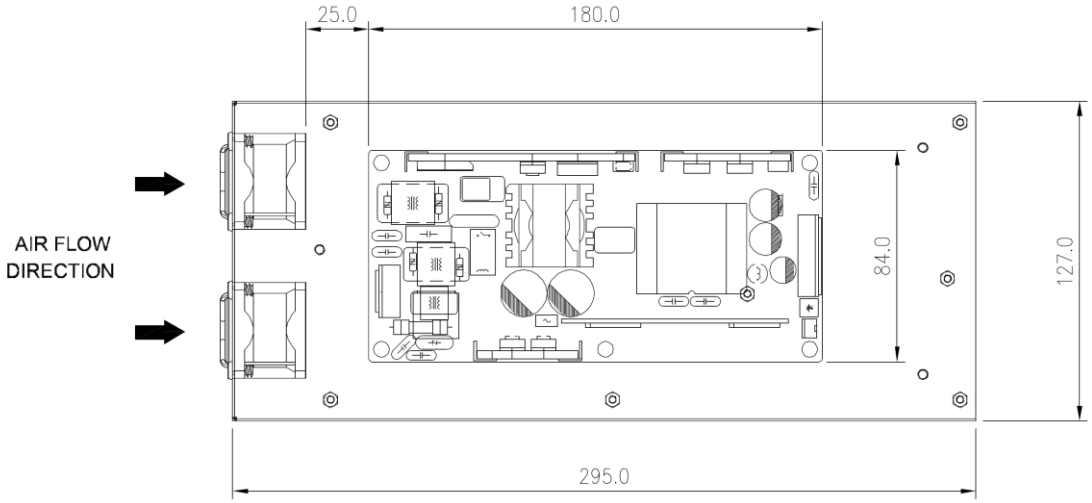


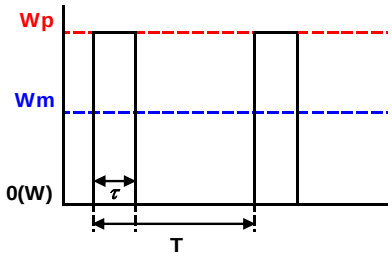
Fig. A

4. Operating time at peak output is less than 5sec, duty is less than 40%, for details, refer to peak output condition. This product must be use to satisfy (a) and (b). Allowable peak output operating time is less than 5sec. Peak output power and average output power use less than specification. Peak output power is limited depending on Duty. The details see at (b). The product might be damage to use beyond the limits of (a) and (b) or trigger the internal over-temperature protection circuit to shut down the power supply. When using pulse load, a noise may be heard from power supply unit. Please evaluate and check before using.

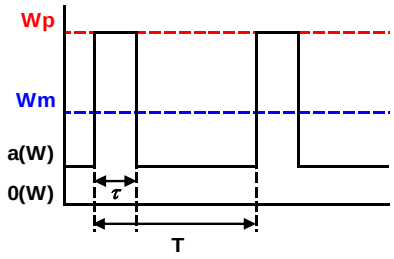
(a) Expression of relations formula about Duty formula about average output power.

$$\text{Duty} = \frac{\tau}{T} \times 100(\%)$$

Formula about average output power



$$\text{Wavg} \geq \text{Wm} = \frac{\text{Wp} \times \tau}{T}$$



$$\text{Wavg} \geq \text{Wm} = \frac{(\text{Wp} - a) \times \tau}{T} + a$$

Wp : Peak output power (W)
Wavg : Average output power of Specification (W)
Wm : Average output power (W)
τ : Pulse width of peak output power (sec)
T : Period (sec)
Duty : The duty is pulse width of peak output power of one period(%)

(b) Peak output power vs Duty, refer to Fig. B.

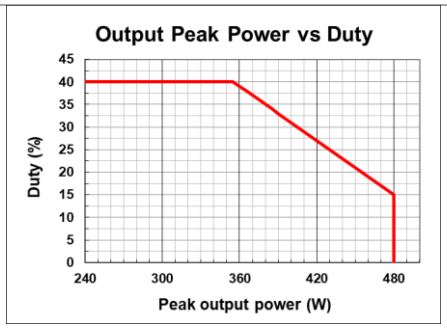

Output Peak Power vs Duty
Duty (%)
45
40
35
30
25
20
15
10
5
0
240
300
360
420
480
Peak output power (W)

Fig. B

Input Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Input Voltage Range	AC input		85	-	265	VAC
	DC input		120	-	370	VDC
Input Frequency	-		47	-	63	Hz
Input Current	100VAC & Full load		-	-	6	Arms
	200VAC & Full load		-	-	3	
Inrush Current	100VAC	At 25°C, Cold start	-	15	-	A peak
	200VAC		-	30	-	
Power Factor	100VAC & Full load		0.98	-	-	-
	200VAC & Full load		0.93	-	-	-
No Load Input Power	100/200VAC, when inhibit used		-	-	-	W
Earth Leakage Current	264VAC/63Hz		-	-	0.5	mA
Input Protection	8A/250V time delay fuse (internal fuse)		-			

Output Specifications

Item		Operating Conditions		Min.	Typ.	Max.	Unit
Output Voltage		See Models and Ratings table		12	-	56	VDC
Initial Set Accuracy		100/200VAC, 50% load		-	±1	-	%
Output Voltage Adjustment		-		-	±10	-	%
Minimum Load		-		0	-	-	A
Line Regulation		85 - 265VAC, constant load		-	±0.5	-	%
Load Regulation		Output from 0 - 100% load		-	±1	-	%
Ripple & Noise (5)		Oscilloscope Bandwidth : 20MHz	0°C < Ta < 70°C	-	-	1	%
			-20°C < Ta < 0°C	-	-	1	%
Transient Response		50% load step, 1A/μsec slew rate, 0.1A min load		-	±5	-	%
Peak Load Response (6)		Peak load for 480W, Refer to peak output condition		-	±7	-	%
		Peak load for 600W(option) at 100VAC		-	±10	-	%
Sequence time (7)	Start-up Delay	100/200VAC full load from input AC turn on		-	-	1	S
	Rise Time	Full load, 10% to 90% of output voltage		10	-	50	mS
	Hold-up Time	At 25°C, 100VAC & Full load, 90% of output voltage		10	-	-	mS
Short Circuit Protection		Output shut down and auto recovery		-	-	-	-
Over-current Protection (8)		Output shut down and auto recovery		101	-	135	%
Over-voltage Protection		Output shut down and latch off, manual reset (Re-power on or Re-remote on)		110	-	130	%
Over-temperature Protection		Protection when over-temperature, auto-restart after temperature drops		-	-	-	°C
Remote Control (9)		Output condition on	Remote on = High	4.5	-	12.5	VDC
		Output condition off	Remote off = Low	0	-	0.8	
Remote Sensing		Not Provided		-	-	-	-
Operations Display		Not Provided		-	-	-	-

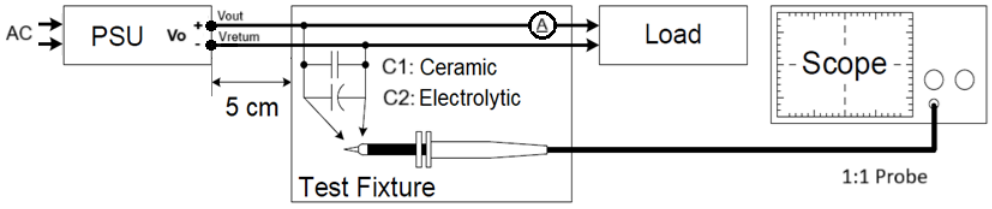
Parallel Operation	Not possible	-	-	-	-

Notes:

5. Please refer to Fig. C for measurement of Vo, line & load regulation and ripple voltage. Output voltage is measured at PSU output terminals, Ripple and noise were measured at a point 5 cm from the output connector with a 63V / 100μF electrolytic capacitor and a 0.1μF ceramic or film capacitor connected.

   Ripple and noise are the maximum peak-to-peak voltage values measured using an oscilloscope using a 1:1 probe and a 20 MHz bandwidth. The output ripple cannot be measured accurately if the probe ground lead of oscilloscope is too long.

Ripple & Noise measurement circuit

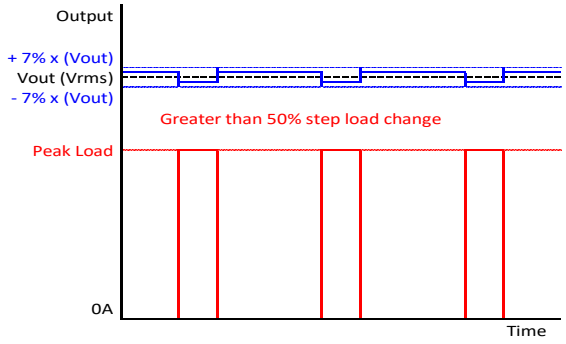


C1: 0.1μF Ceramic
C2: 100μF Electrolytic

Fig. C

6. Peak load and output voltage specifications, refer to Fig. D.

6-1 Peak load for 480W and output voltage



6-2 Peak load for 600W(option) and output voltage

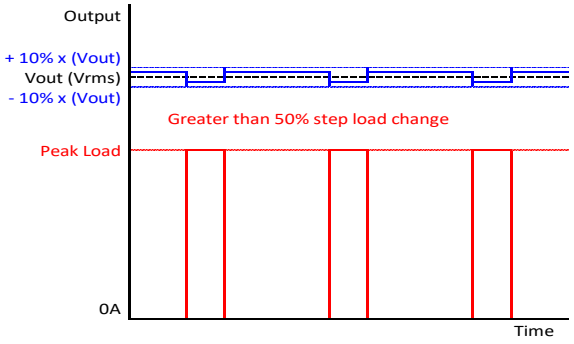
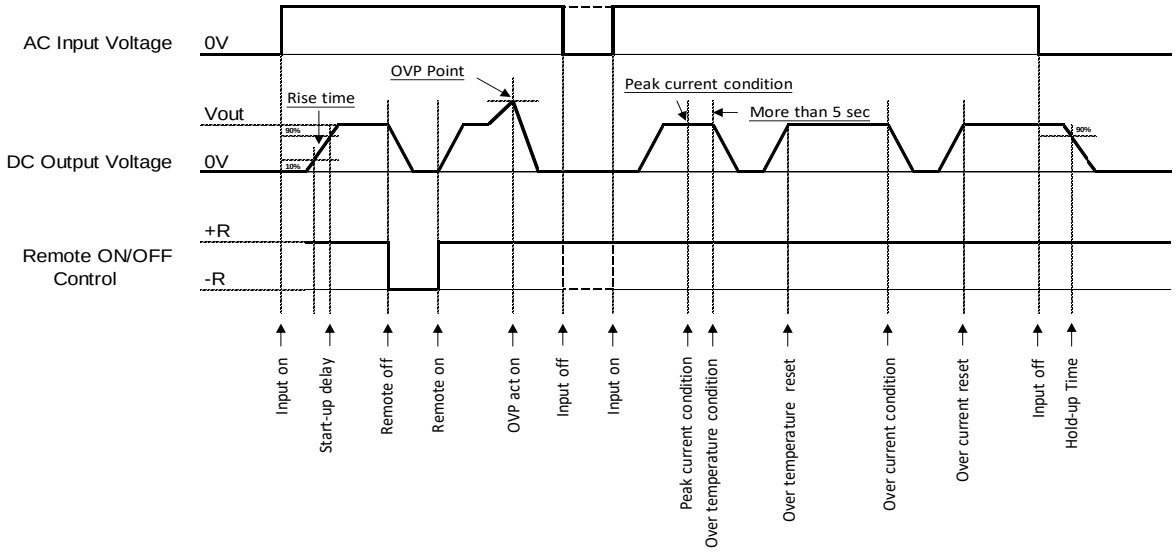


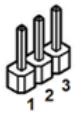
Fig. D

7. Sequence time chart



8. The overload current should ramp up from the maximum current or peak current at a minimum rate of 0.1A/10ms. When it detects that it is higher than 101-135 % of the maximum current or peak current, it will shut down and auto recovery.

9. Remote on/off control option (jumper JP1), please refer to Fig. E. When JP1 is completely disconnected or Pin 1-2 is short-circuited, remote power on/off can be achieved. After AC input, the power supply provides DC output through remote on/off control. JP1 pins 2-3 shorted (default) Remote on/off disabled. After the power supply AC input, it can directly provide DC output without the need for remote power switch control.

Pin 1-3 Open	Pin 1-2 Short	Pin 2-3 Short
		
Remote On/Off Control		Disabled Remote (Default)

PCB Layout

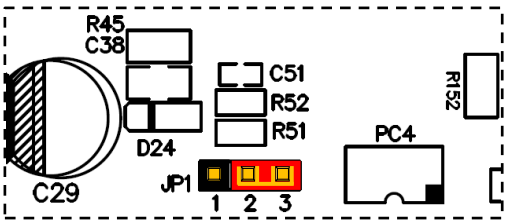


Fig. E

Remote ON/OFF control (CON102) function is available as option.
Using this function allows the user to turn the output on and off without having to turn the AC input on and off.
It is controlled by the voltage applied to +R and –R. This circuit is in the Secondary (output) side of the power supply unit. Do not connect in the Primary (input) side. And this circuit is isolated from the Secondary (output).

Remote ON/OFF control external voltage (E) and external resistance (R), Please refer to Fig. F.

External voltage level: E	External resistance : R
4.5 - 12.5VDC	No required
12.5 - 24.5VDC	1.5KΩ

R : External resistance
E : External voltage level

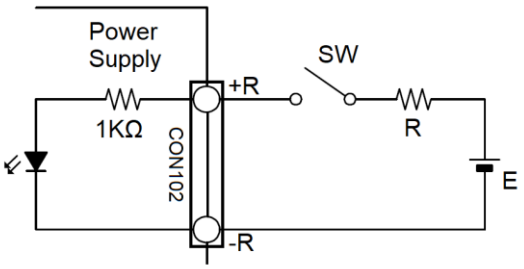


Fig. F

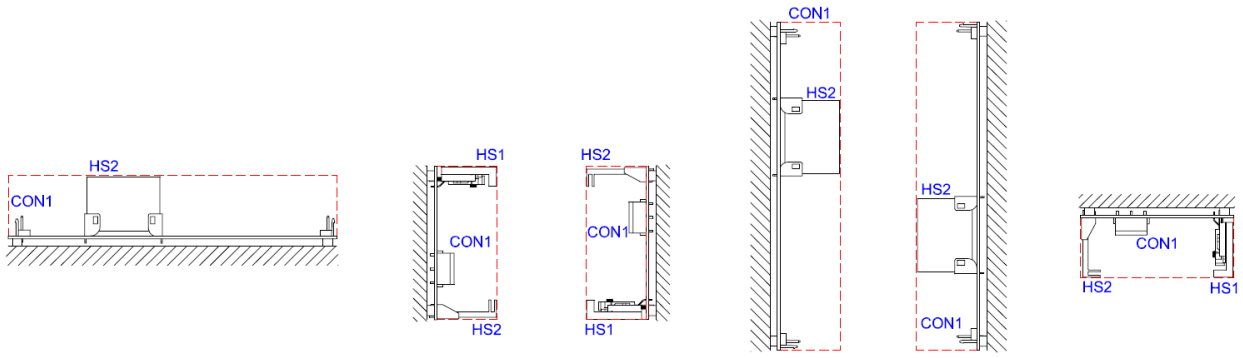
General Specifications

Item		Operating Conditions		Min.	Typ.	Max.	Unit
Operating Temperature (10)		Refer to power de-rating curve		-20	-	+70	°C
Storage Temperature		Non-operation		-40	-	+85	
Operating Humidity		Non-condensing		10	-	90	%
Storage Humidity				5	-	95	
Temperature Coefficient		At 0°C to +50°C		-	-	±0.05	%/°C
Power De-rating (11)	Operating Temperature	Convection cooling	+50°C to +70°C	2.5	-	-	%/°C
		Forced Air Cooling	+60°C to +70°C	3	-	-	
	Input voltage	85VAC – 90VAC		4.0	-	-	%/VAC
		120VDC – 127VDC		2.83	-	-	%/VDC
Altitude		Operating altitude		-	-	5000	meter
Electrical Strength Test (12)		Input - Output	Electrical strength test for 1 minute, leakage current is less than 10mA.	4000	-	-	VDC
		Input - FG ⏚		2500	-	-	
		Output - FG ⏚		500	-	-	
Insulation Resistance		Input - Output	25±5°C, 70% RH, non-condensing testing voltage 500VDC.	100	-	-	MΩ
		Input - FG ⏚		100	-	-	
		Output - FG ⏚		100	-	-	
Switching Frequency		PFC converter		25	65	130	KHz
		Main converter		50	100	200	
Mean Time Between Failure		At 100VAC/60HZ full load 25°C, Telcordia SR332, issue4.		900	-	-	Khrs.
Vibration		Operating：0.5G, 5 - 500Hz, 10 minutes per cycle, 30 minutes for each X, Y and Z axis.					
Shock		Non-operating (package)：20G, half sin-wave, each per axis.					
RoHS		Directive 2011/65/EU, (EU) 2015/863 COMPLIANT.					

Notes:

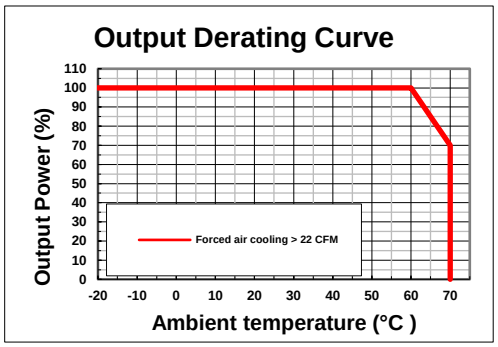
10. The impedance of THR1 (NTC), which suppresses inrush current, increases at low temperatures. When starting at a low temperature of -20°C, it can start normally at 100VAC and 100% load.
11. Mounting Directions & Output Derating, Recommended standard mounting method is (A). Method (B)-(F) are also possible. From an mounting method and power supply ambient temperature, use the output derating of the power supply in specifications value of standard. The details see at "Temperature Derating Curve & Table".

The following input voltage derating curve assumes average output load is 100%. (Peak power dose not have the derating.)



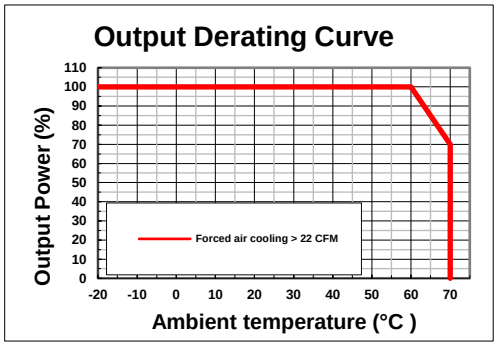
(A) (B) (C) (D) (E) (F)

a. Forced air cooling: output 12V, maximum power 400W.



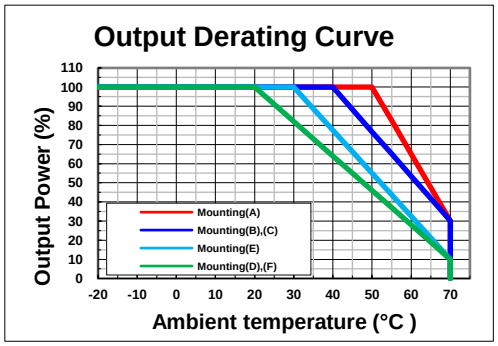
Ambient temperature (°C)	Average Load (%)
	Mounting(A) - (F)
-20 - +60	100
+70	70

b. Forced air cooling: output 24V-56V, maximum power 500W.



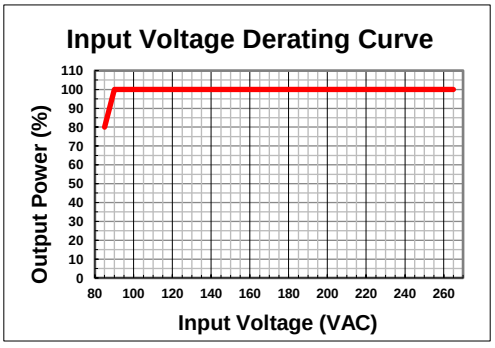
Ambient temperature (°C)	Average Load (%)
	Mounting(A) - (F)
-20 - +60	100
+70	70

c. Convection cooling: output 12V-56V, maximum power 240W.



Ambient temperature (°C)	Average Load (%)			
	Mounting(A)	Mounting(B),(C)	Mounting(E)	Mounting(D),(F)
-20 - +20	100	100	100	100
+30	100	100	100	82
+40	100	100	78	64
+50	100	77	55	46
+60	65	53	32	28
+70	30	30	10	10

d. Derating curve depending on input voltage



The following input voltage derating curve assumes average output load is 100%.
(Peak power dose not have the derating.)

12. The electric strength test of LY production line was conducted for 3 seconds, and the leakage current was less than 10mA.

Safety Approvals

Safety Standard	All models	UL/cUL UL62368-1, 3rd Edition; CB IEC62368-1, 3rd Edition; (Meet IEC61558-1; IEC60335-1)
Safety Class	-	Class I only

Electromagnetic Compatibility (EMC)

Emissions (13)	CE	EN55032(CISPR32) CLASS B	
	RE	EN55032(CISPR32) CLASS B	
	Harmonic Current	IEC/EN61000-3-2 CLASS D	
	Flicker	IEC/EN61000-3-3	
Immunity	ESD	IEC61000-4-2, level 4, Contact +/- 8KV; Air discharge +/- 15KV	Criteria A
	RS	IEC61000-4-3, level 3, 10V/m	Criteria A
	EFT	IEC61000-4-4, level 3, +/- 2KV	Criteria A
	Surge	IEC61000-4-5, level 4, Line to Line +/-2KV; Line to Earth +/- 4KV	Criteria A
	CS	IEC61000-4-6	Criteria A
	PFMF	IEC61000-4-8	Criteria A
	DIP	IEC61000-4-11	Criteria A or B

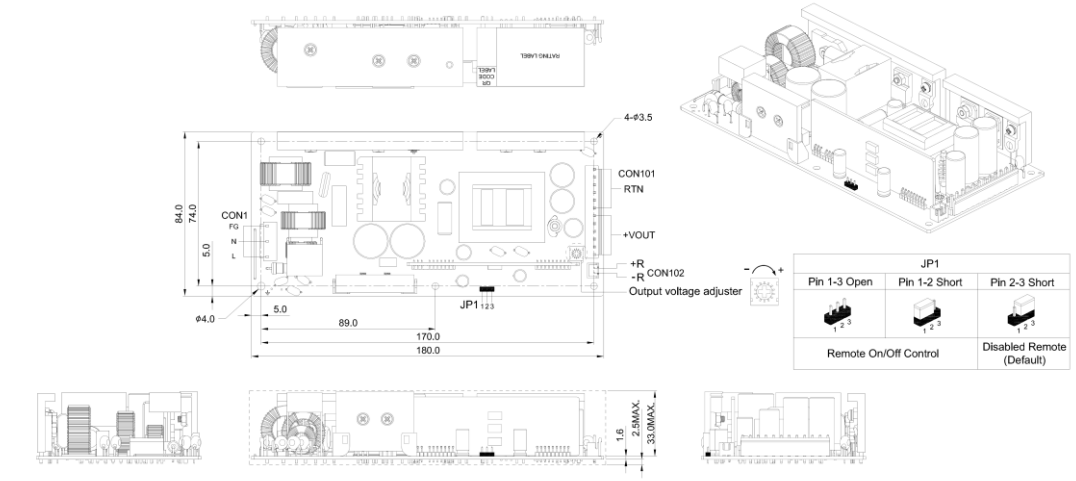
Note:

13. The power supply should be considered a part of the system component. All EMC tests conducted with the unit installed in a metal enclosure dummy system. The power supply needs to be confirmed for electromagnetic compatibility in conjunction with the terminal equipment.

Dimensions and Recommended Layout

Item	Value	Unit
Weight (Typ.)	460	g
Size (L x W x H)	180 x 84 x 33 (above PCB, Refer to outline drawing)	mm

Outline Drawing: (Unit: mm, Tolerance: ±1.0 mm)



CON1	CON101		CON102
Input Connector	12V Output 12Pin Connector	24V / 36V / 42V / 48V / 56V Ouput 10Pin Connector	Input Connector
JST B3P5-VH(LF)(SN) JWT A3963WV2-5P-A WST M5-I39606S TKP PVHI-05-N2,N4	JST B12P-VH(LF)(SN) MOST WELL 2WF7VD-202512T121A01 JWT A3963WV2-12P WST M12-I39606 TKP PVHI-12	JST B10P-VH(LF)(SN) MOST WELL 2WF7VD-202510T121A01 JWT A3963WV2-10P WST M10-I39606 TKP PVHI-10	JST B2B-XH-A MOST WELL 2WFKVD-202502T121A01 WST M2-I25002 TKP 8822-02 JWT A2501WV2-2P