

CUS30E

Instruction Manual

BEFORE USING THE POWER SUPPLY UNIT

Be sure to read this instruction manual thoroughly before using this product. Pay attention to all cautions and warnings before using this product. Incorrect usage could lead to an electrical shock, damage to the unit or a fire hazard.

⚠ DANGER

Never use this product in locations where flammable gas or ignitable substances are present. There are risks of igniting these substances and exploding by an arcing.

⚠ WARNING

- Do not touch this product or its internal components while circuit is live, or shortly after shut down. There may be high voltage or high temperature present and you may receive an electric shock or burn.
- When this product is operating, keep your hands and face away from it as you may be injured by an unexpected situation.
- Do not make unauthorized changes to this product, otherwise you may receive an electric shock and void your warranty.
- Do not drop or insert anything into this product. It might cause a failure, fire and electric shock.
- Do not use this product under unusual condition such as emission of smoke or abnormal smell and sound etc. It might lead to fire and electric shock. In such cases, please contact us. Do not attempt repair by yourself, as it is dangerous for the user.
- Do not operate these products in the presence of condensation. It might lead fire or electric shock.

⚠ CAUTION

- This power supply is designed and manufactured for use within an end product such that it is accessible to SERVICE ENGINEERS only.
- Confirm connections to input/output terminals are correct as indicated in the instruction manual before switching on.
- Input voltage, Output current, Output power, ambient temperature and ambient humidity should be kept within specifications, otherwise the product will be damaged.
- Do not use this product in environment with a strong electromagnetic field, corrosive gas or conductive substances.
- For applications, which require very high reliability, it is necessary to provide a fail-safe mechanism in the end equipment.
- Do not inject abnormal voltages into the output of this product. The injection of reverse voltage or over voltage exceeding nominal output voltage into the output terminal might cause damage to internal components.
- Never operate the product under over current or short-circuit conditions for more than 30 seconds, or outside its specified Input Voltage Range. Insulation failure, smoking, burning or other damage may occur.
- This product contains a printed circuit board utilizing surface mounted devices. PCB stress such as bending, twisting etc. could cause damage. Therefore, please handle with care.
- When handling this product, hold the board edge and take care not to touch the component side. If the application environment with strong vibration, please mount it on spacers, when installing this product in apparatus or equipment.
- The outputs of this product may, under fault conditions, exceed SELV voltage limits. Therefore the outputs must be earthed in the end equipment to maintain SELV. If the outputs are not earthed, they must be considered hazardous and must not be made user accessible.
- This product has used Power Thermistor to protect the circuit from Inrush Current. Frequent repetition of input on/off might cause damage to internal components because of generating surge current.
- Breaking of internal fuse is considered internal failure. In such cases, please contact us.
- The information in this document is subject to change without prior notice. Please refer to the latest version of the data sheet, etc., for the most up-to date specifications of the product.
- No part of this document may be copied or reproduced in any form without prior written consent of TDK-Lambda.

Important safety instructions

Servicing

These products are not customer serviceable. Repairs may only be carried out by TDK-Lambda or their authorized agents. These products are not authorized for use as critical components in nuclear control systems, life support systems or equipment for use in hazardous environments without the express written approval of the Managing Director of TDK-Lambda Corporation.

Safety Class of Protection

These products are designed for the following parameters : Material Group IIIa, Pollution Degree 2, Over voltage Category II, Class I (earthed), Indoor use as part of an overall equipment such that the product is accessible to service engineers only.

Input markings and symbols

 Caution refer to supplementary documents

EMC performance

Immunity

Test	Standard	Passed	Comments
Electrostatic discharge	IEC61000-4-2	Level 4	Air discharge 15kV Contact discharge 8kV
Electromagnetic field	IEC61000-4-3	Level 3	10V/m
Fast / burst transient	IEC61000-4-4	Level 4	4kV
Surge immunity	IEC61000-4-5	Level 3 Level 4	Normal mode 2kV Common mode 4kV
Conducted RF immunity	IEC61000-4-6	Level 3	10V
Power frequency magnetic field	IEC61000-4-8	Level 4	30A/m
Voltage dips, variations, interruptions	IEC61000-4-11	Class 3	*1 , *2 , *3 , *4

*1. On the condition of 30% dip and 500ms duration, the output voltage will recover after the power turn on again.

*2. On the condition of 60% dip and 200ms duration, the output voltage will recover after the power turn on again.

*3. On the condition of 100% dip and 20ms duration, the output voltage will recover after the power turn on again.

*4. On the condition of 100% dip and 5000ms duration, the output voltage will recover after the power turn on again.

Emissions

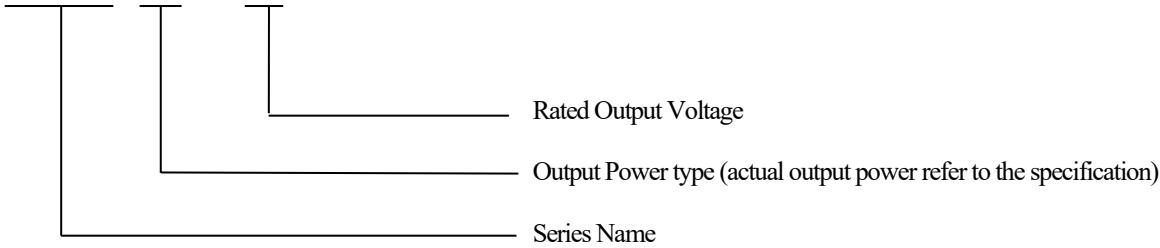
Test	Standard	Comments
EMI	EN55032	Class B (as per CISPR 22)
Flicker	IEC61000-3-3	Compliant

General installation instructions

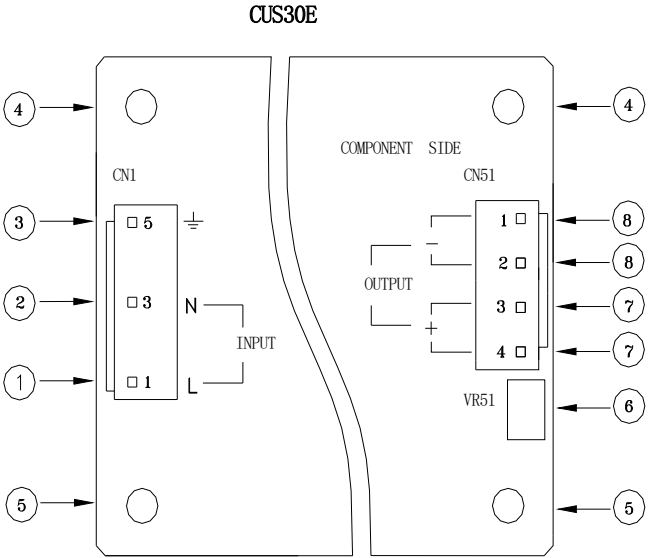
- 1) These products are Class I and must therefore be reliably earthed and professionally installed in accordance with the prevailing electrical wiring regulations and the safety standards covered herein.
- 2) These products are IPX0, and therefore chemicals/solvents, cleaning agents and other liquids must not be used.
- 3) The first protective earth connection in the final installation must be marked with the protective earth symbol.

1. Model name identification method

CUS 30E – 5



2. Terminal Explanation



- ① L : AC Input terminal Live line (Fuse in line.)
- ② N : AC Input terminal Neutral line
- ③ \perp : \perp Terminal (Protective Earth)
- ④ Mounting hole (hole diameter : ϕ 3.5mm)
If the application environment with strong vibration, the product should be fixed with spacers.
The mounting surface of the spacer should be within Max ϕ 8mm.
- ⑤ Mounting hole (hole diameter : ϕ 3.5mm)
This hole is not connected to Protective Earth of CN1. If the application environment with strong vibration, the product should be fixed with spacers.
The mounting surface of the spacer should be within Max ϕ 8mm.
- ⑥ V.ADJ : Output voltage adjust trimmer. The direction of the adjustment is on the side. The output voltage rises when a trimmer is turned clockwise .
- ⑦ + : + Output Terminal
- ⑧ - : - Output Terminal

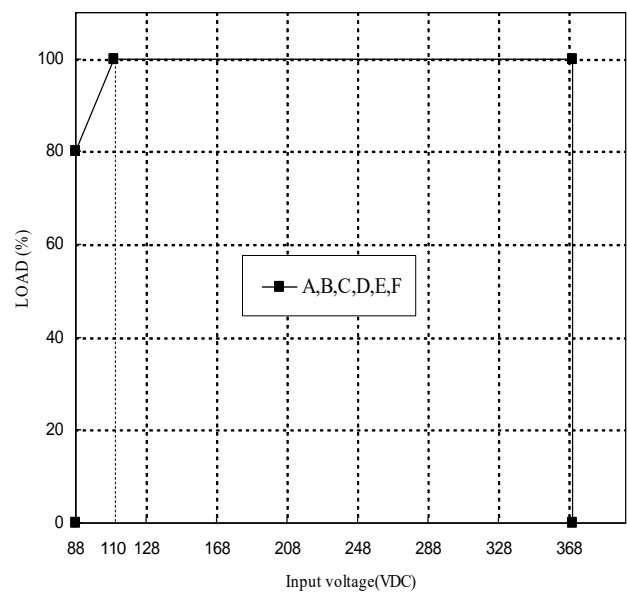
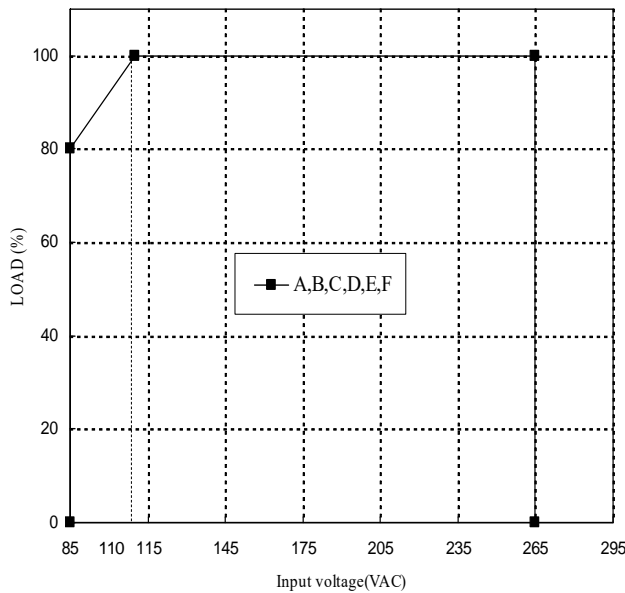
3. Explanation of Function and Precautions

3-1. Input Voltage Range

Input voltage range is single phase 85-265VAC (47-63Hz) or 88- 370VDC. Input voltage, which is out of specification, might lead unit damage. For cases where conformance to various safeties required, input voltage range will be 100-240VAC (50-60Hz).

3-1-1. Input Voltage vs Output Derating

Output derating is required when the power supply operate below 85VAC/88VDC input. Refer to table below for details.



Input voltage	LOADING CONDITION(%)
	All Mounting (A,B,C,D,E,F)
85VAC / 88VDC	80
110VAC-265VAC / 110VDC-370VDC	100

3-2. Output Voltage Range

Output voltage is set the rated value at shipment. V.ADJ trimmer (VR51) can adjust the output voltage within the range. Output voltage range refers to the specification. To turn the trimmer clockwise, the output voltage will be increased. Take note when the output voltage is increased excessively, over voltage protection (OVP) function may be triggered and voltage will be shut down. Furthermore, when increasing the output voltage reduce the output current so as not to exceed the maximum output power.

3-3. Inrush Current

These products equipped Power thermistor to limit the inrush Current. This series are Power thermistor method so that higher current will flow at higher ambient temperature or re-input condition. Please select input switch and fuse carefully with the high temperature and re-input the power condition. The Inrush Current value is under cold start at 25°C in the specification.

3-4. Over Voltage Protection (OVP)

The OVP function (Inverter shut down method, manual reset type) is provided. OVP range refers to the specification. When OVP triggers, the output will be shut down. To reset OVP, remove the input of power supply for a few minutes, and then re-input. In addition, the setting value of OVP is fixed and not adjustable. Pay attention not to apply higher voltage externally to the output terminal to avoid unit failure. In case of inductive load, put protective diode in series to the output power line.

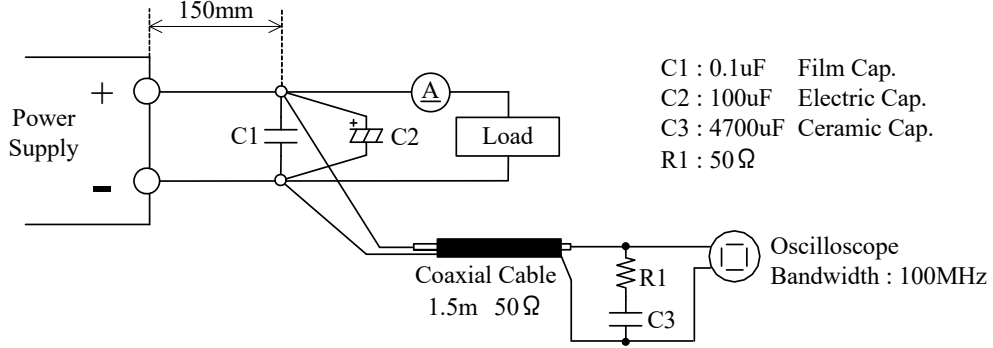
3-5. Over Current Protection (OCP)

These products provide the Hiccup mode with automatic recovery. OCP function operates when the output current exceeds 105% of maximum DC output current of specification. The outputs will be automatically recovered when the overload condition is canceled. Never operate the unit under over current or shorted conditions for more than 30seconds, which may leads damage or insulation failure. OCP setting is fixed and not to be adjusted externally.

3-6. Output Ripple & Noise

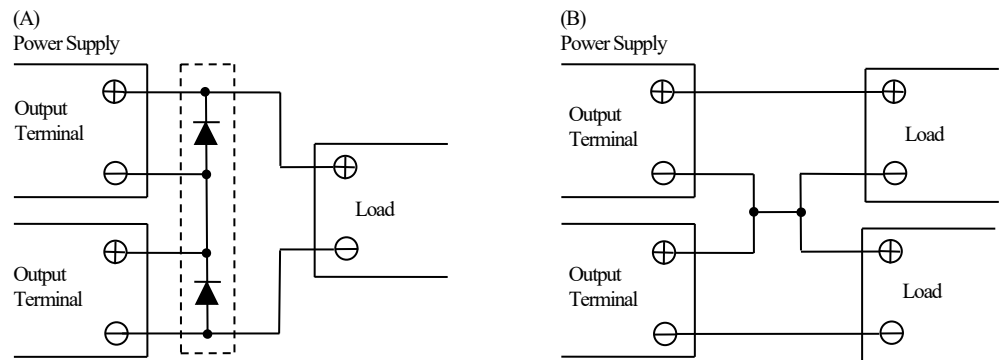
The standard specification for maximum ripple value is measured according to measurement circuit specified by JEITA-RC9131B. When load lines are longer, ripple will becomes larger. In this case, electrolytic capacitor, film capacitor, etc. might be necessary to use across the load terminal. The output ripple cannot be measured accurately if the probe ground lead of oscilloscope is too long. For start up at low ambient temperature and low input voltage, output ripple noise might not meet specification. However, output ripple noise specification can be met after one second.

A circuit reducing light load input power consumption is built in CUS30E (Input power : 0.2W typ,0.5W max at no load). When output current is within 0-35% of rated load, the internal switch element is intermittent operated, and the switching loss is decreased. The specification of the Ripple & Noise changes by this intermittent operation. The dynamic load response characteristic changes by this intermittent operation too. Different input voltage and dynamic load condition has different dynamic load response characteristic. Please contact us for details.



3-7. Series Operation

For series operation, either method (A) or (B) is possible.



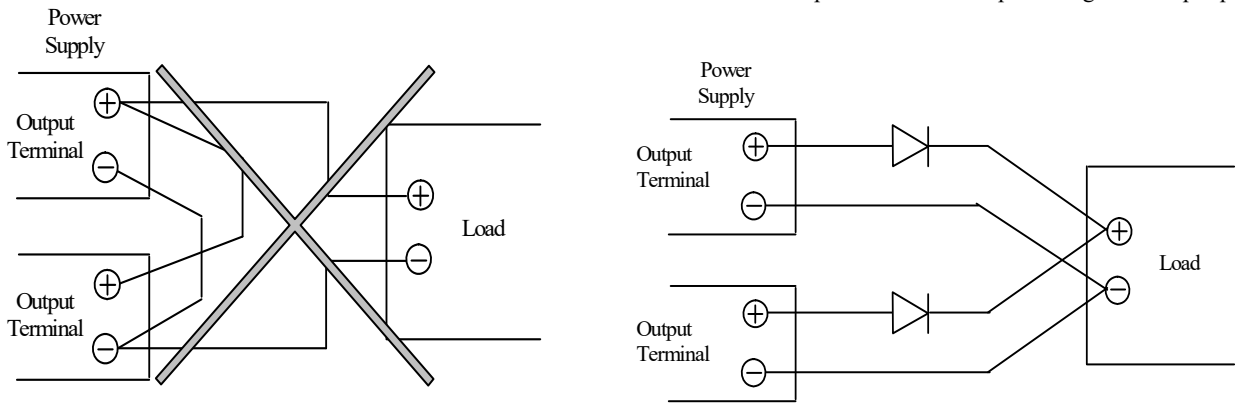
Note: If customer choose method (A), please select a bypass diode with maximum forward current rating more than output load current. And maximum reverse voltage must withstand each power supply output voltage.

3-8. Parallel Operation

For parallel operation, method (B) is possible.

(A) To increase the output current is not possible.

- (B) To use as Back-up Power Supply
1. Adjust the output voltage of each power supply to be same.
 2. Set power supply output voltage higher by the forward voltage drop (Vf) of diode.
 3. Use within the specification for output voltage and output power.

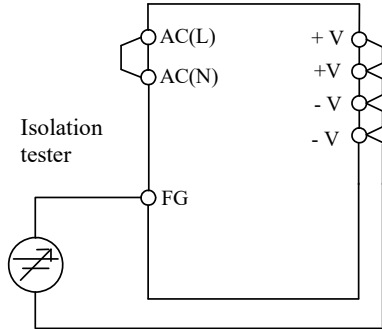


3-9. Isolation Test

Isolation resistance between Output and \perp (Protective Earth) is more than 100M Ohm at 500VDC. For safety operation, voltage setting of DC

isolation tester must be done before the test. Ensure that the unit is fully discharged after the test.

Output - \perp (Protective Earth) : 500VDC More than 100M Ω



3-10. Withstand Voltage

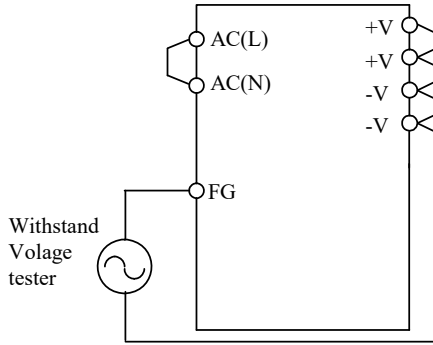
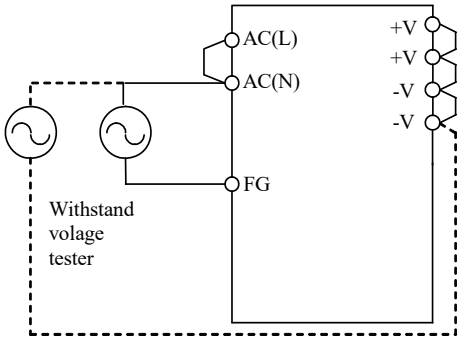
This series is designed to withstand 3kVAC(10mA) between input and output, 2kVAC (10mA)between input and \perp (Protective Earth) , 500VAC(20mA) between output and \perp (Protective Earth) , each for 1 minute. The applied voltage must be gradually increased from zero to the testing value and then gradually decreased for shut down. When timer is used, the power supply may be damaged by high impulse voltage at timer switch on and off.

Connect input and output as follows.

Input - Output(Dashed line) : 3kVAC 1min(10mA)

Input - \perp (Protective Earth)(Solid line) : 2kVAC 1min(10mA)

Output - \perp (Protective Earth) : 500VAC 1min(20mA)



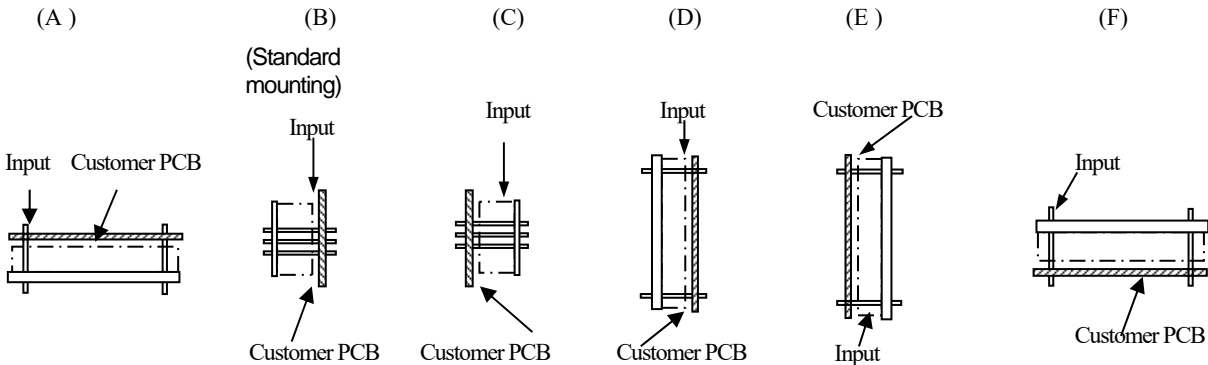
Instructions for using the power supply in customer’s system

1. If the output of power supply is connected to FG in the application, the withstand voltage test between input and output (FG) should be tested at 2kVAC.
2. If there is external noise filter and Y-caps connected at the input and output of the power supply, the voltage distribution between primary and secondary circuit will be changed during the withstand voltage test, and may cause test fail. In this case, please contact TDK-Lambda for the technical support and instructions.
3. Keep more than 5mm creepage and clearance between circuitry & components of output side and FG, to meet the power supply withstand voltage specification.

4. Mounting Directions

4-1.Mounting Directions.

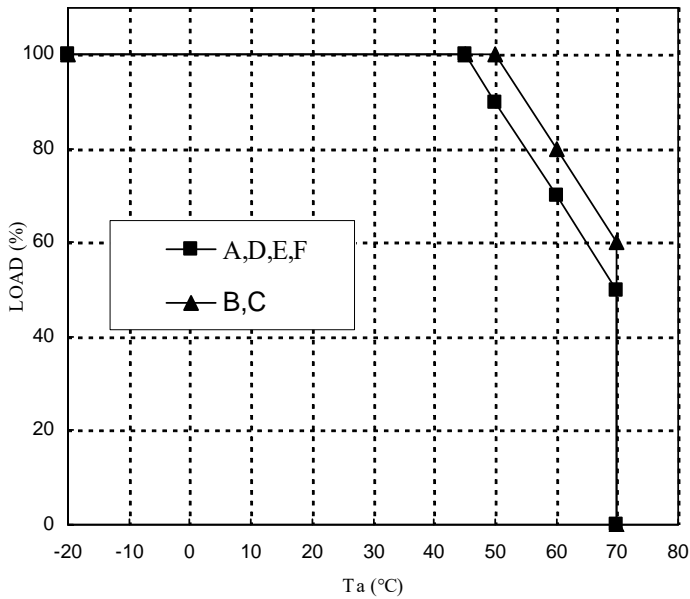
Recommended standard mounting direction is (B). (A) (C) (D) (E) (F) are also possible.



4-2. Output Derating

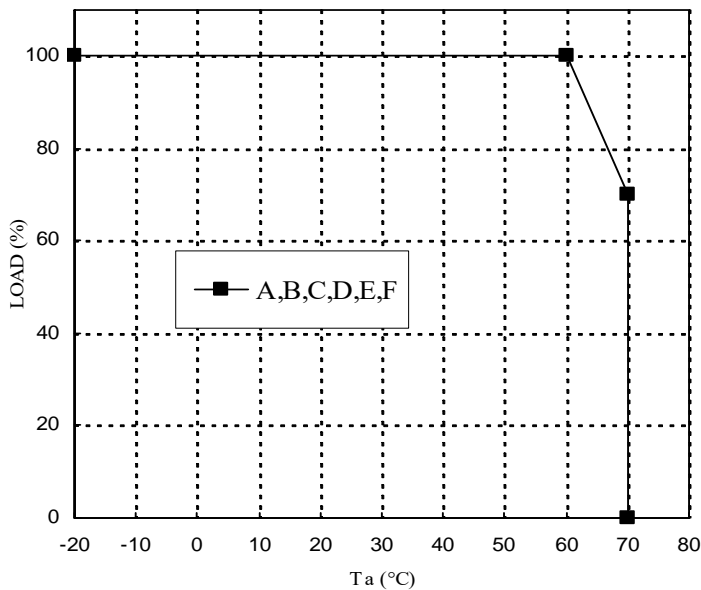
Make sure that the specified temperature range is maintained. Operate the unit out of the specified derating curve may trigger OTP (IC integrated). When OTP trigger, the output will be shut down. To reset OTP, remove the input of power supply for a few minutes, wait until the unit cool down, and then re-input.

▣ CONVECTION COOLING



Ta (°C)	LOADING CONDITION(%)	
	Mounting A, D, E, F	Mounting B, C
-20~45	100	100
50	90	100
60	70	80
70	50	60

▣ FORCED AIR COOLING



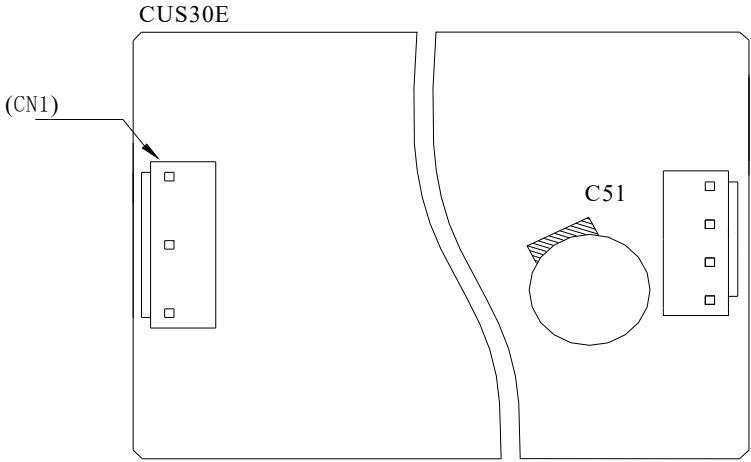
Ta (°C)	LOADING CONDITION(%)
	All Mounting (A, B, C, D, E, F)
-20~60	100
70	70

*Recommended minimum air velocity : 0.7m/s. (Measured at component side of PCB, air must flow through component side).
The judgment of the air velocity can refer to the table as follows.

Electrolytic capacitor allowable Max temperature

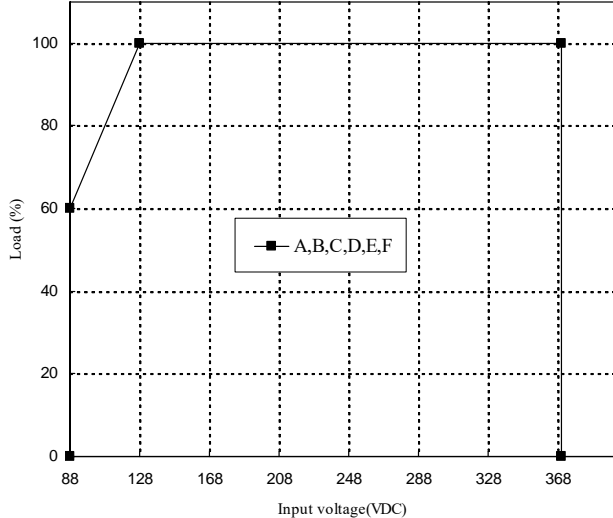
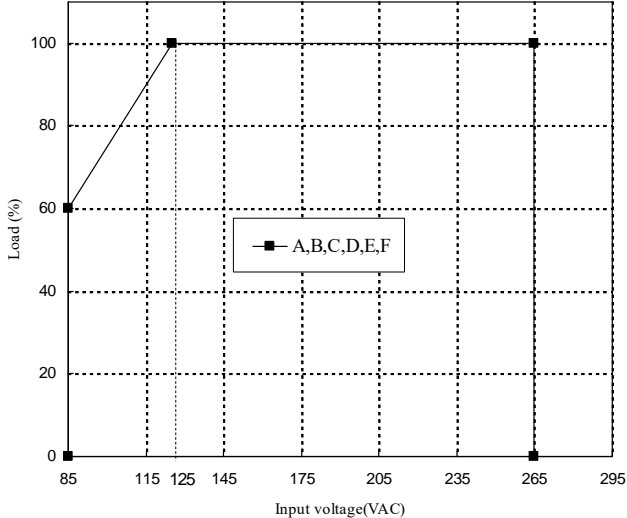
MODEL	Maximum Temperature of C51	
	Ta : -10°C ~ +60°C	Ta : +60°C ~ +70°C
CUS30E	70°C Max	Ta + 10°C

As a reference for forced Air Cooling, let air flow so that the C51 temperature is lower than Electrolytic capacitor allowable max temperature in the above table.



LOW TEMPERATURE OPERATION

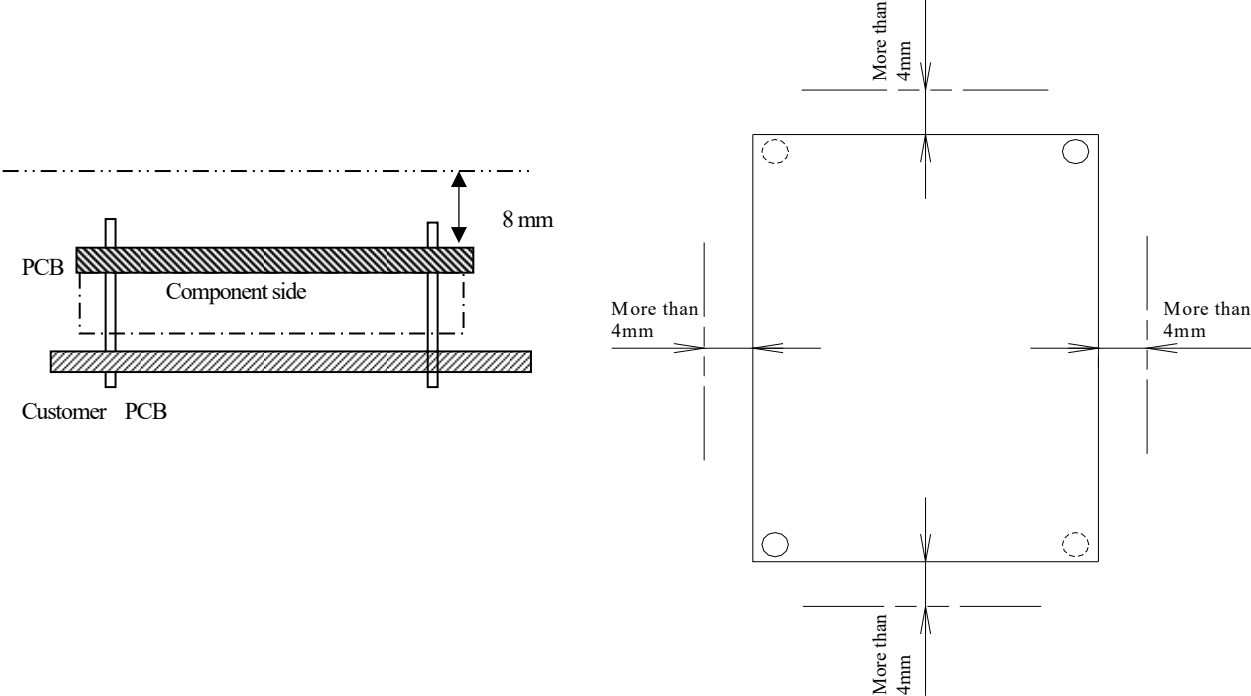
The power supply can start up at -40°C, but the electrical characteristics cannot be completely conform to the specifications. So output derating is required when the power supply operate below 125VAC/128VDC input. Refer to table below for details.



Input voltage	LOADING CONDITION(%)
	All Mounting (A,B,C,D,E,F)
85VAC / 88VDC	60
125VAC-265VAC / 128VDC-370VDC	100

4-3. Mounting Method

▣ Condition to meet Isolation & Withstand Voltage standard.

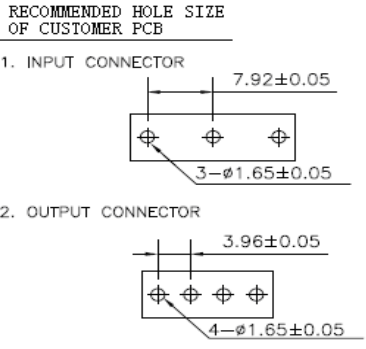
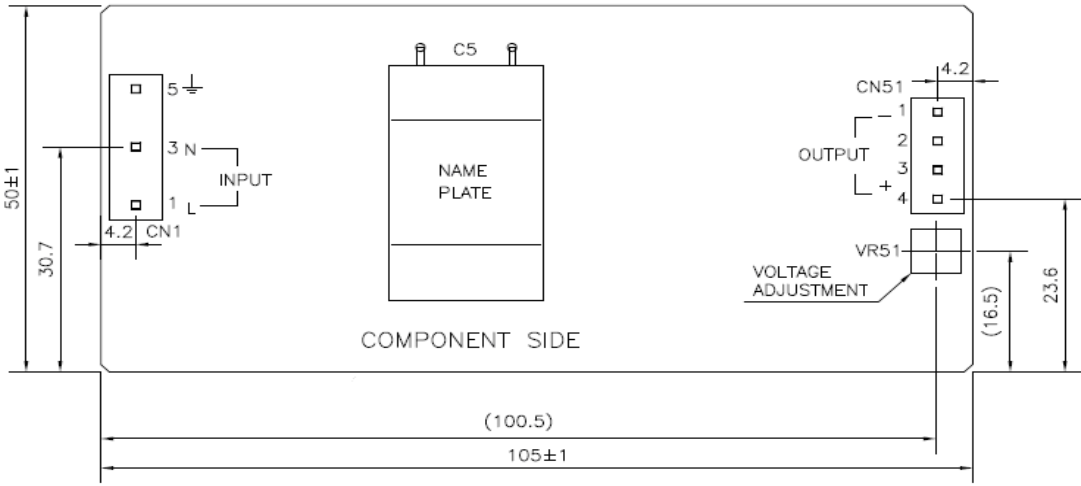


Keep 4mm space from the sides of PCB. Especially, 8mm space is necessary from the solder surface.

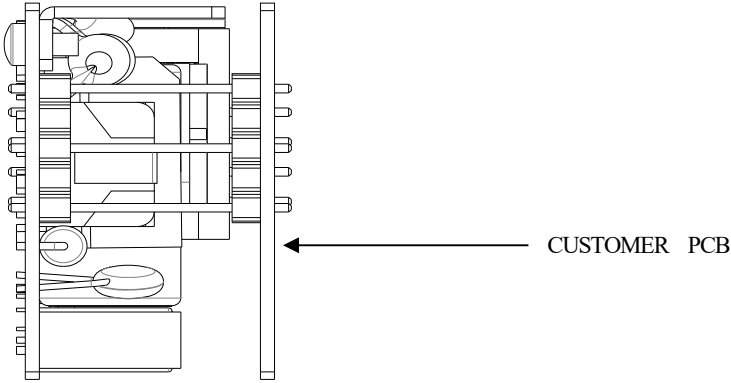
If the space is not enough, the specification of isolation and withstand will not be satisfied.

Keep enough space in the power supply surroundings and the upper area of components for convection cooling.

The location of input and output terminals, recommended hole size of customer PCB as follows.

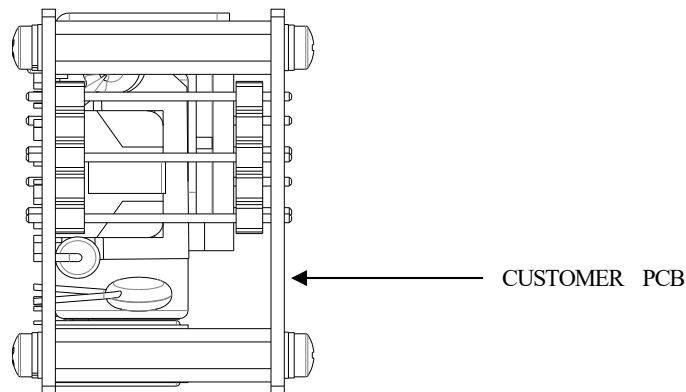


The figure for customer installation as follows:



If the application environment with strong vibration, the product should be fixed with four spacers. The height of spacers is 25.5 ± 0.25 mm.

The figure for customer installation as follows:
 The height of spacers is 25.5 ± 0.25 mm



5. Recommended Soldering Condition

Recommended Soldering Conditions are as follows.

- (1) Soldering dip
Dip condition :260°C within 10 seconds
Pre-heat condition : 110°C for 30-40 seconds
- (2) Soldering iron
350°C within 3 seconds

(Note) Soldering time changes according to heat capacity of soldering iron, pattern on printed circuit board, etc. Please confirm actual performance.

6. External Fuse Rating

Refer to the following fuse rating when selecting the external fuses that are to be used on input line. Surge current flows when line turns on. Have to use slow-blow or time-lag type fuse, not fast-blow fuse. Fuse rating is considered by in-rush current value at line turn-on. Do not select the fuse according to input current (RMS.) values under the actual load condition

CUS30E: 3.15A

7. Before concluding that the unit is at fault

- (1) Check if the rated input voltage is connected.
- (2) Check if the wiring of input and output is correct.
- (3) Check if the wire thickness is enough.
- (4) Check if the output current and output wattage dose not over specification.
- (5) Check if the output voltage control (V.ADJ) is properly adjusted. OVP might be triggered and output is shut down.
- (6) Audible noise can be heard when input voltage waveform is not sinusoidal wave.
- (7) Audible noise can be heard during Dynamic-Load operation.
- (8) Ensure that a large capacitor is not connected on the output side. Please use within maximum capacitance shown below.

MODEL	Maximum external capacitance				
	3.3V	5V	12V	15V	24V
CUS30E	10,000uF	10,000uF	2,700uF	1,500uF	600uF

8. Altitude

The clearance in power supply can meet 3000m altitude of IEC60664-1.

9. Warranty Condition

These products are under warranty for 3 years from the date of shipment. During the warranty period, TDK-Lambda will, either repair or replace products prove to be defective.

3 years warranty applies but not limited to the following items.

- (1) Average operating temperature (ambient temperature of the power supply unit)is under 40°C.

- (2) 3 years warranty base on 24 hours/day operation at 100% load.
Please refer to electrolytic capacitor life time from reliability data for various application conditions such as mounting, load derating, operating ambient temperature etc. .
Customer system design could be improved with better electrolytic capacitor life time by selecting proper application method.

Following cases are not covered by warranty.

- (1) Improper usage like dropping products, applying shock and defects from operation exceeding specification of the units.
- (2) Defects resulting from natural disaster (fire, flood etc).
- (3) Unauthorized modifications or repair by the buyers' defects not cause by our company.