

# CUS75EB 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 and 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 operate and store this product in an environment where condensation might occur. In such case, waterproof treatment is necessary.
- 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, 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. When installing this product in apparatus or equipment, mount it on spacers.
- 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 can 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

This power supply is a switch mode power supply for use in applications within a Pollution Degree 2, overvoltage category II environment. Material Group IIIb PCB is used within it.

## 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	4.0kV (100kHz)
Surge immunity	IEC61000-4-5	Level 3 Level 4	Normal mode 2.0kV Common mode 4.0kV
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	Pass	

### Emissions

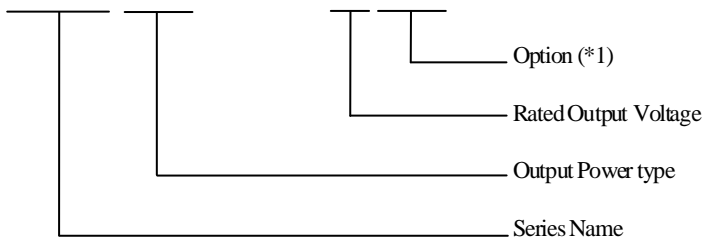
Test	Standard	Comments
EMI	EN55032	Class B (as per CISPR 32)
Conducted harmonics	IEC61000-3-2	Meet Class A

## General installation instructions

- 1) CUS75EB is for installation in Class I end equipment only, and therefore must be reliably earthed and professionally installed.
- 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

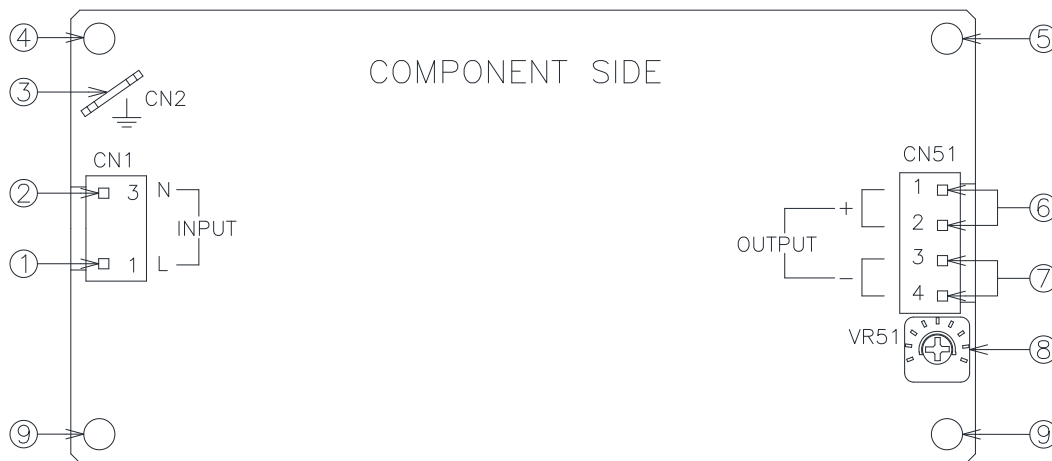
**CUS 75 EB – 5 / □**



- (\*1) Blank : Standard model  
 /A : With chassis and cover model  
 /B : With base plate model

### 2. Terminal Explanation

③④⑤⑨ are for standard model except for /A and /B model.  
 For the Protective Earth of /A and /B model, please refer to 5-3-2 and 5-3-3.



- ① L : AC Input terminal Live line (Fuse in line.)
- ② N : AC Input terminal Neutral line
- ③  $\perp$  :  $\perp$  Terminal CN2(Protective Earth)
- ④  $\perp$  :  $\perp$  Mounting hole (hole diameter :  $\phi 3.5\text{mm}$ )  
 This hole is electrically connected to CN2.
- ⑤ Mounting hole (hole diameter :  $\phi 3.5\text{mm}$ )  
 ④ and ⑤ Must be connected to earthed metal plate/chassis of the equipment by metal spacers in Class I installation.
- ⑥ + : + Output Terminal
- ⑦ - : - Output Terminal
- ⑧ V.ADJ : Output voltage adjust trimmer. The output voltage rises when the trimmer is turned clockwise.
- ⑨ Mounting hole (hole diameter :  $\phi 3.5\text{mm}$ )  
 This hole is used for support the unit.

### 3. Terminal Connection Method

Pay attention to the input wiring. If it is connected to wrong terminal, the power supply will be damaged.

- Input must be off when making connections.
- Input terminal must be connected to protective earth of the equipment.
- Output current of each terminal pin must be less than 10A.
- The output load line and input line shall be separated to improve noise sensitivity.
- Do not apply stress to PCB, when connecting or removing connector.
- Use input/output connector (housing) specified by the table below.
- Use recommended crimping tool. Connector is not included with this product. (Refer to the following)

**Input/Output Connector**

	Model	Connector	Housing	Terminal Pin	Maker
Input (CN1)	Common	B2P3-VH(LF)(SN)	VAR-2 / VHR-3N	SVH-41T-P1.1 BVH-41T-P1.1	J.S.T.
Output (CN51)	Common	B4P-VH(LF)(SN)	VHR-4N		
FG TAB (CN2)	Common	---	22~18AWG: STO-21T-250N 18~14AWG: STO-61T-250N	---	J.S.T.

Hand Crimping Tool : YC-930R, YC-931R (J.S.T.)

**4. Explanation of Function and Precautions**

**4-1. Input Voltage Range**

Input voltage range is single phase 85-265VAC(47-63Hz) or 88-370VDC. Never operate the unit out of the specified input voltage range to avoid unit failure. For cases where conformance to various safeties required, input voltage range will be 100-240VAC (50-60Hz).

**4-1-1. Output Derating Versus Input Voltage for CUS75EB and CUS75EB/B**

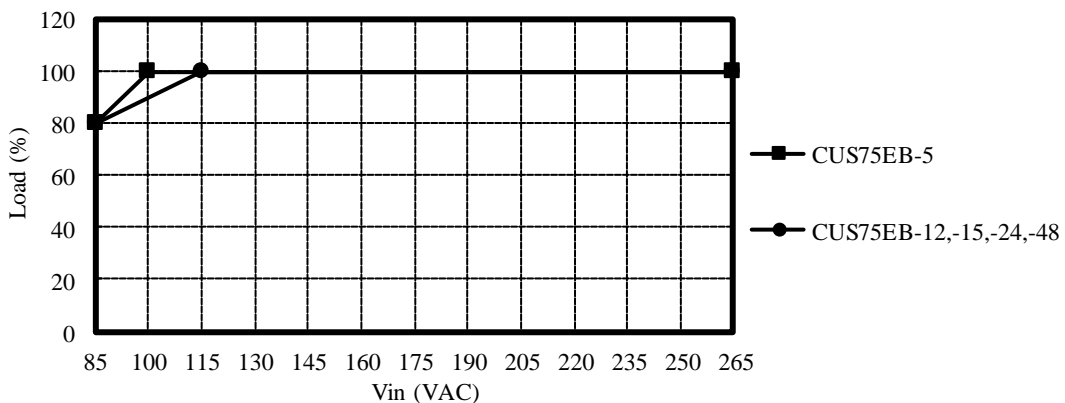
**(1) AC INPUT**

CUS75EB-5

Input Voltage (VAC)	Load (%)
85	80
100~265	100

CUS75EB-12, -15, -24, -48

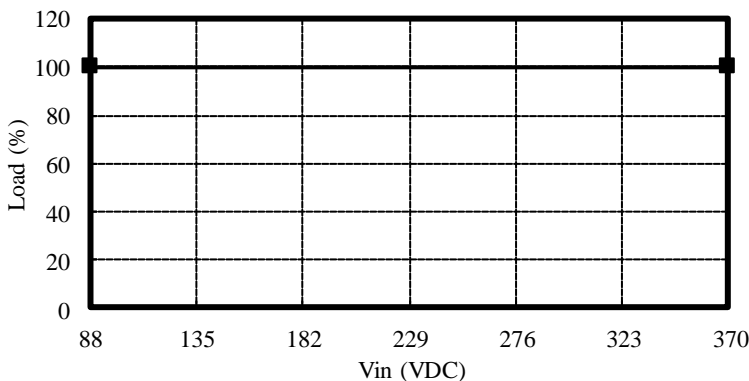
Input Voltage (VAC)	Load (%)
85	80
115~265	100



**(2) DC INPUT**

CUS75EB-5, -12, -15, -24, -48

Input Voltage (VDC)	Load (%)
88~370	100



#### 4-1-2. Output Derating Versus Input Voltage for CUS75EB/A

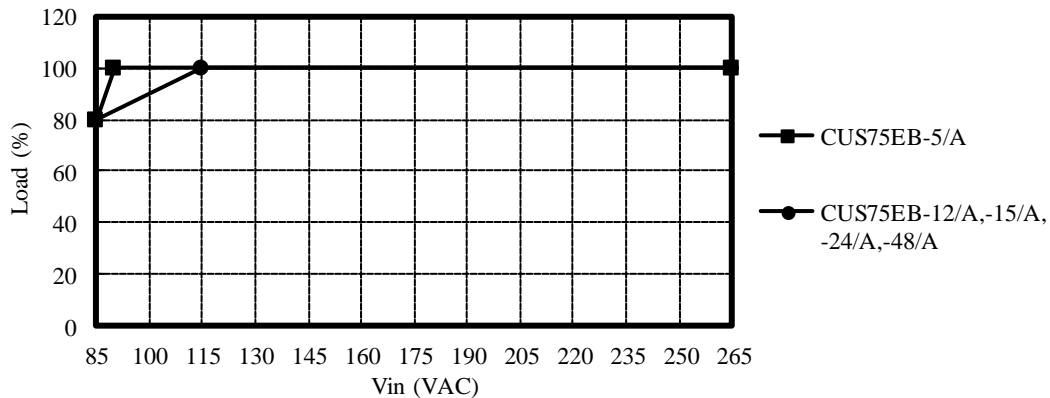
##### (1) AC INPUT

CUS75EB-5/A

Input Voltage (VAC)	Load (%)
85	80
90~265	100

CUS75EB-12/A, -15/A, -24/A, -48/A

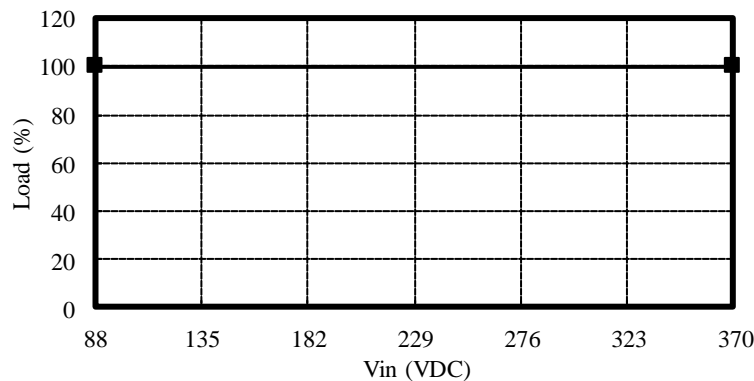
Input Voltage (VAC)	Load (%)
85	80
115~265	100



##### (2) DC INPUT

CUS75EB-5/A, -12/A, -15/A, -24/A, -48/A

Input Voltage (VDC)	Load (%)
88~370	100



#### 4.2. 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.

#### 4.3. Inrush Current

These products equipped Power thermistor to limit the inrush Current. Higher inrush 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.

#### 4-4. Over Voltage Protection (OVP)

The OVP function (Inverter shut down method, manual reset type) is provided. Please refer to its specification for OVP operating range. 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.

#### 4-5. Over Current Protection (OCP)

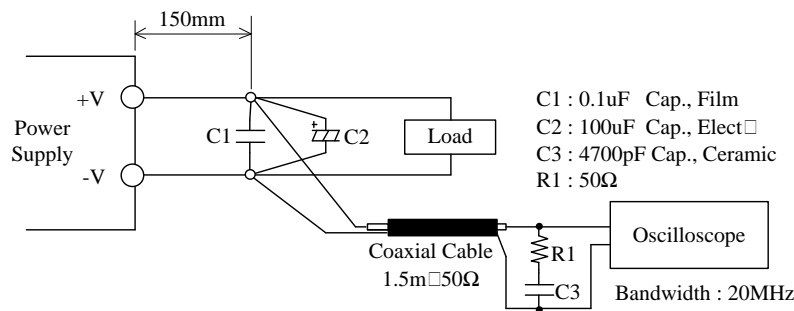
The OCP is hiccup mode with automatic recovery. The outputs will be automatically recovered when the overload condition is canceled.

OCP function operates when the output current exceeds 105% of maximum DC output current of specification. 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.

#### 4-6. Output Ripple & Noise

The standard specification for maximum ripple value is measured according to measurement circuit specified as below. 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.

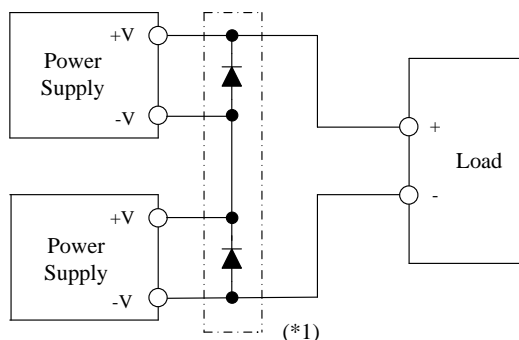
A circuit reducing light load input power consumption is built in this model. When output current is within 0-35% of rated load, the internal switch element is intermittent operated, and the switching loss is decreased. The specification of the Ripple & Noise changes by this intermittent operation. The 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.



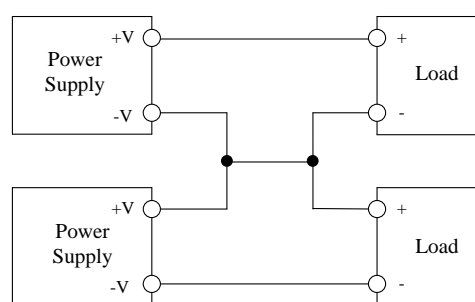
#### 4-7. Series Operation

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

Method (A)



Method (B)

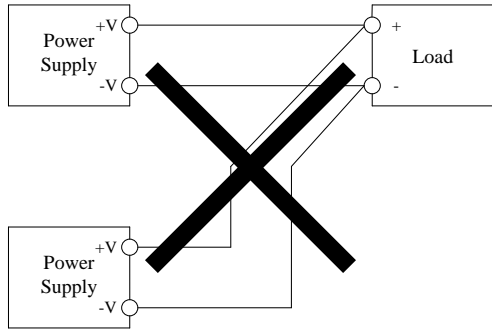


(\*1)Please select a bypass diode with maximum forward current rating more than output load current. And maximum reverse voltage must withstand each power supply output voltage.

### 4-8. Parallel Operation

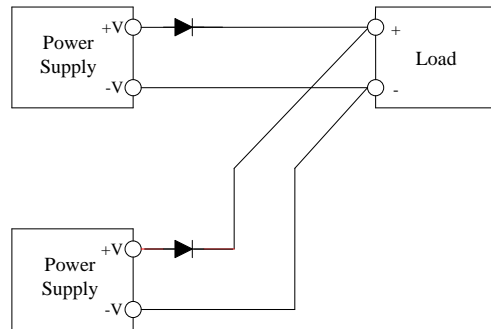
For parallel operation, method (B) is possible.

(A) To increase the Output Current is not possible.



(B) To use as Backup Power Supply.

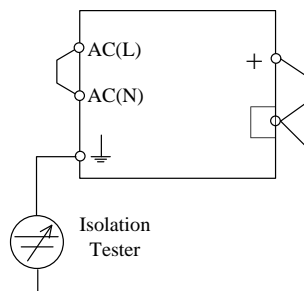
1. Adjust the output voltage of each power supply to be the same.
  2. Set power supply output voltage higher by the forward voltage drop ( $V_f$ ) of diode.
- Use within the specification for output voltage and output power.



### 4-9. Isolation Test

Isolation resistance between Output and  $\perp$  (Protective Earth) is more than  $100M\Omega$  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  $100M\Omega$



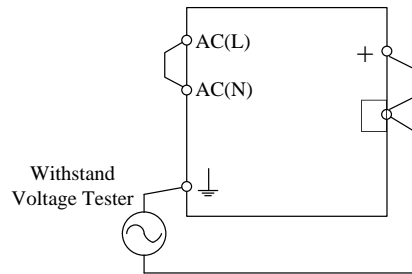
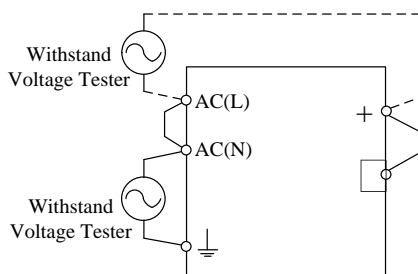
### 4-10. Withstand Voltage

These products are designed to withstand 3.0kVAC (10mA) between input and output, 2.0kVAC (5mA) between input and  $\perp$ , and 500VAC (20mA) between output and  $\perp$  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) : 3.0kVAC 1min(10mA)

Input -  $\perp$  (Protective Earth)(Solid line) : 2.0kVAC 1min(5mA)

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.

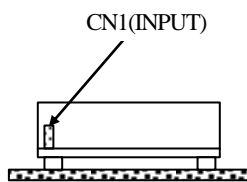
**5. Mounting**

**5-1. Mounting Directions**

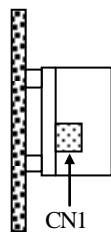
**5-1-1. Mounting directions for CUS75EB and CUS75EB/B**

Recommended standard mounting direction is (A). Mounting direction (B)-(E) are also possible.

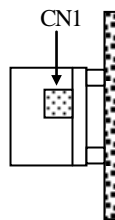
(A) Standard mounting



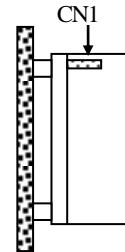
(B)



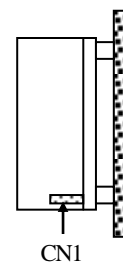
(C)



(D)



(E)

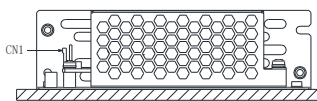


**5-1-2. Mounting directions for CUS75EB/A**

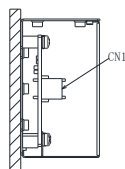
Recommended standard mounting direction is (A). Mounting direction (B)-(E) are also possible.

Please use the mounting holes on bottom side of the power supply, do not use the side of the chassis for power supply mounting.

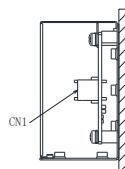
(A) Standard mounting



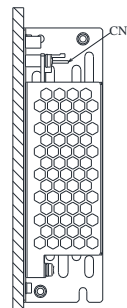
(B)



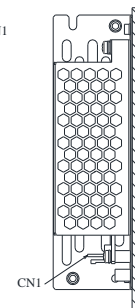
(C)



(D)



(E)



**5-2. Output Derating**

**5-2-1. Output derating for CUS75EB and CUS75EB/B**

Make sure that the specified temperature range is maintained.

**(1) 5V model**

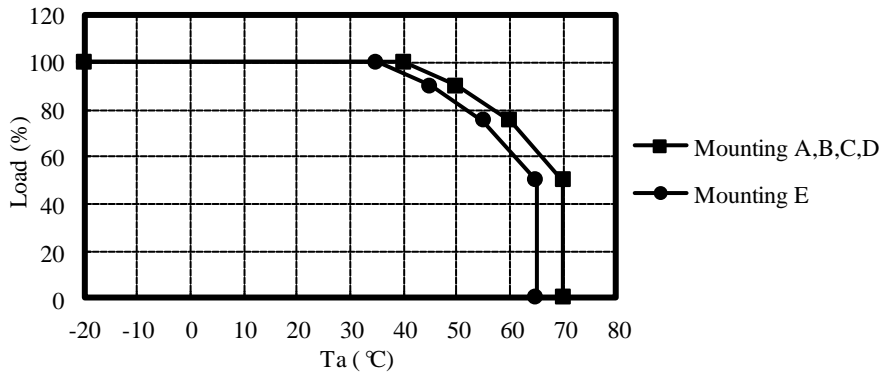
MOUNTING A,B,C,D

Ta ( °C )	Load (%)
-20 - +40	100
50	90
60	75
70	50

MOUNTING E

Ta ( °C )	Load (%)
-20 - +35	100
45	90
55	75
65	50

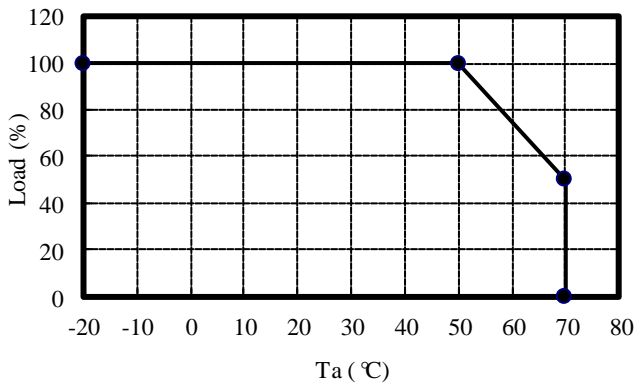




**(2) 12V, 15V, 24V, 48V model**

MOUNTING A,B,C,D,E

Ta (°C)	Load (%)
-20 - +50	100
70	50



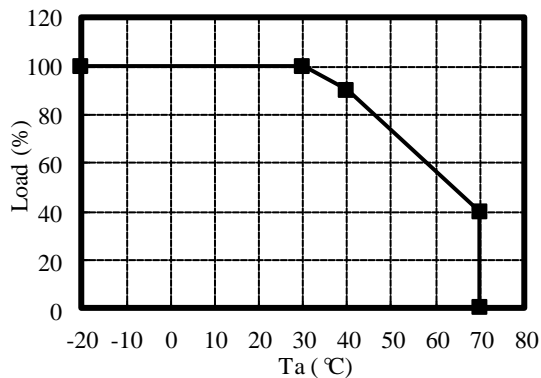
**5-2-2. Output derating for CUS75EB/A.**

Make sure that the specified temperature range is maintained..

**(1) CUS75EB-5/A**

Mounting: A, B, C, D, E

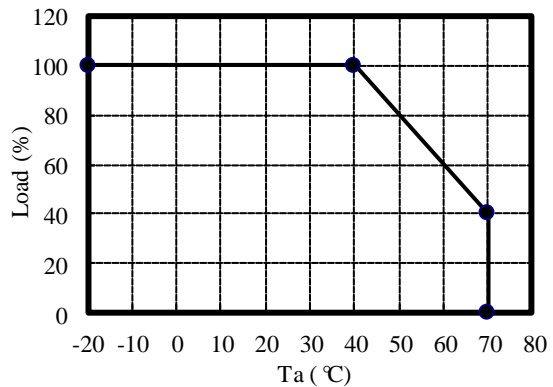
Ta (°C)	Load (%)
-20 - +30	100
40	90
70	40



**(2) CUS75EB-12/A, -15/A, -24/A, -48/A**

Mounting: A, B, C, D, E

Ta (°C)	Load (%)
-20 - +40	100
70	40



### 5-3. Mounting Method

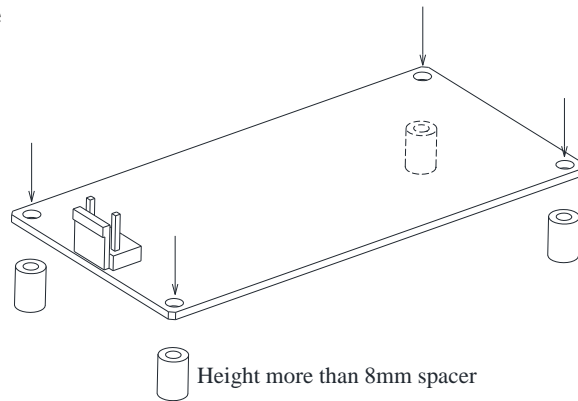
#### 5-3-1. Mounting method for standard model CUS75EB

Note: Except CUS75EB/A and CUS75EB/B model.

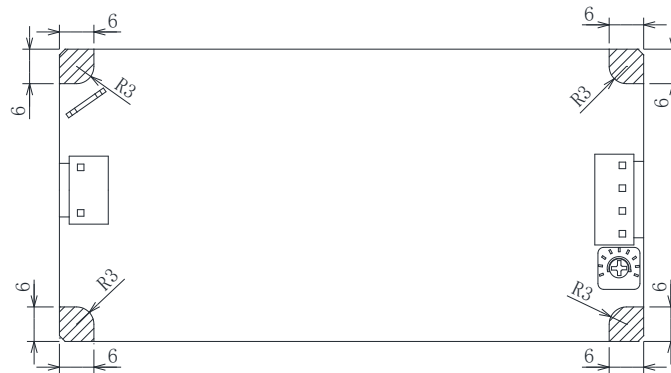
All four mounting holes on this model should be utilized for best electrical and mechanical performance, with 8mm (minimum height) metal standoffs.

▪ **Mounting Holes size**

4 holes  $\phi 3.5\text{mm}$ .



Refer to the shadow in the figure below for allowable area touched by conductive material on top and bottom side of the PCB.



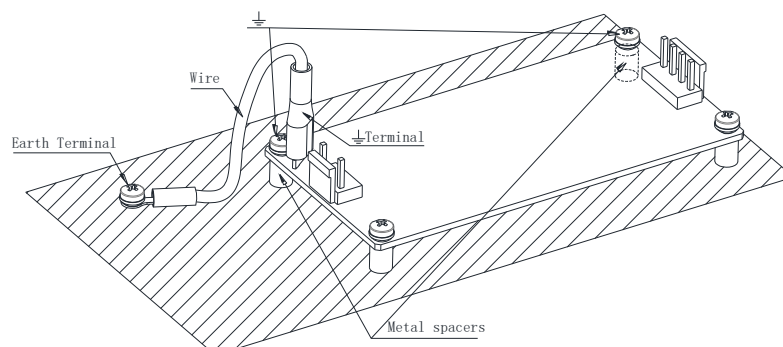
▪ **Condition to meet EMI, EMC, Isolation, Withstand Voltage and Cooling requirement.**

Keep 4mm space minimum from the surface and sides of power supply, 8mm space minimum from the bottom side of PCB to meet safety requirement, or more space depend on safety requirement. If the space is not enough, the specification of isolation and withstand voltage will not be satisfied.

More space may be required in the surrounding of power supply and the upper area of components for effective cooling depends on the application conditions.

⊥ terminal (Protective Earth) must be connected to the earth terminal of the equipment, also the two mounting holes (as shown below) needed to be connected to earthed metal plane or metal chassis of end product by metal spacer to ensure EMC and EMI performance.

All equipment ideally should be mounted inside an earthed shielded metal box. Alternatively an earthed metal plate can be used to mount the power supply and load.



### 5-3-2. Mounting method for CUS75EB/B

CUS75EB/B model is optional model with metal plate on the bottom.

The mounting holes on the metal plate are for power supply fixing. The M3 stud near the input connector is used to connect to the protective earth.

Refer to the CUS75EB/B model outline drawings for the detailed dimensions.



#### ■ Mounting Holes

A: 3-  $\phi$  3.5 holes for mounting screws to fix the power supply from top.

B: 3-M3 tapped, embossed and countersink holes for mounting screws to fix the power supply from bottom

Ground: M3 stud for protective earth

#### ■ Condition to meet EMI, EMC, Isolation, Withstand Voltage and Cooling.

Keep more than 4mm space from the top of components and the sides of PCB to meet safety requirement. If the space is not enough, the specification of isolation and withstand voltage will not be satisfied.

More space may be required in the surrounding of power supply and the upper area of components for effective cooling depends on the application conditions.

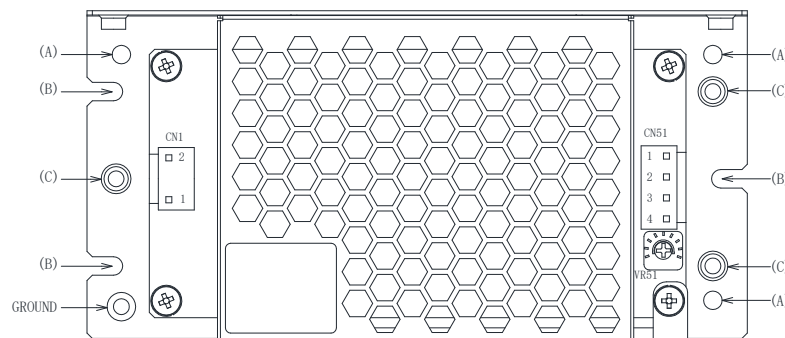
All equipment ideally should be mounted inside an earthed shielded metal box. Alternatively an earthed metal plate can be used to mount the power supply and load to ensure the EMI and EMC performance.

### 5-3-3. Mounting method for CUS75EB/A

CUS75EB/A model is optional model with metal chassis and cover.

The mounting holes on the bottom of the chassis are for power supply fixing. The M3 stud near the input connector can be used to connect to the protective earth.

Refer to the CUS75EB/A model outline drawings for the detailed dimensions.



#### ■ Mounting Holes

A: 3-  $\phi$  3.5 holes for mounting screws to fix the power supply from top.

B: 3-  $\phi$  3.5 holes for mounting screws to fix the power supply from top.

C: 3-M3 tapped, embossed and countersink holes for mounting screws to fix the power supply from bottom.

Ground: M3 stud for protective earth

▪ **Condition to meet EMI, EMC, Isolation, Withstand Voltage and Cooling.**

- (1) This series is convection cooling type. In consideration of the heat radiation and safety, please keep a distance of more than 15mm between the power supply and the peripheral parts. When lining up multiple units, please make sure to place them 15mm or more apart from each other.
- (2) Recommended torque for mounting screws of M3 screw : 0.49 N·m (5.0 kgf·cm).
- (3) All equipment ideally should be mounted inside an earthed shielded metal box. Alternatively an earthed metal plate can be used to mount the power supply and load to ensure the EMI and EMC performance.

## 6. EMC and Wiring Method

This power supply is primarily designed and manufactured to be used and enclosed in other equipment. The installation, wiring, grounding and end application of the switching power supply in the equipment system may influence its EMC characteristics. Therefore, the EMC performance has to be tested on end system level. Additional filtering may be required depends on application and installation methods.

Please refer to following application notes which may help to improve EMC performance.

- (1) The output load line and input line shall be separated each other and twisted individually to improve noise.
- (2) Use all lines as thick and short as possible to made lower impedance.
- (3) Noise can be reduced by attaching a capacitor to the load terminals.
- (4) For safety and EMI considerations, connect  $\perp$  (Protective Earth) terminal and Frame Ground terminal of equipment firmly.

## 7. 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

CUS75EB: 3.15A

## 8. 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 power does not over specification.
- (5) Check if the output voltage adjust trimmer (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 across the output terminals. Please use within maximum capacitance shown below.

	Maximum External Capacitance				
MODEL	5V	12V	15V	24V	48V
CUS75EB	10000uF	10000uF	5600uF	4500uF	2000uF

## 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.

- (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.