

# *VS-E Series*

## *VS50E · 75E · 100E · 150E*

### *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.

#### **⚠ INSTALLATION WARNING**

- When installing, ensure that work is done in accordance with the instruction manual. When installation is improper, there is risk of electric shock and fire.
- Installation shall be done by Service personnel with necessary and appropriate technical training and experience. There is a risk of electric shock and fire.
- Do not cover the product with cloth or paper etc. Do not place anything flammable around. This might cause damage, electric shock or fire.

#### **⚠ WARNING on USE**

- Do not touch this product or its internal components while circuit in operation, or shortly after shutdown. You may receive a burn.
- While this product is operating, keep your hands and face away from it as you may be injured by an unexpected situation.
- For products with no cover, do not touch them as there are high-voltage and high temperature parts inside. Touching them might cause injury such as electric shock or burn.
- There are cases where high voltage charge remains inside the product immediately after the input is cut off. Therefore, do not touch even if they are not in operation as you might get injured due to high voltage and high temperature. You might also get electric shock or burn.
- Do not make unauthorized changes to this product nor remove the cover as you might get an electric shock or might damage the product. We will not be held responsible after the product has been modified, changed or dis-assembled.
- Do not use this product under unusual condition such as emission of smoke or abnormal smell and sound etc. Please stop using it immediately and shut off the product. 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 and store these products in environments where condensation occurs due to moisture and humidity. It might lead fire and electric shock.
- Do not drop or apply shock to this product. It might cause failure. Do not operate these products mechanical stress is applied.
- When necessary, this products is to be repaired only by us or our authorized agents. It is important that this product cannot be used in hazardous environments (facilities such as nuclear power control system or life support equipment) without our written consent.

### **⚠ CAUTION on MOUNTING**

- 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.
- Input line, please use the wires as short and thick as possible.
- Do not use this product in special environment with strong electromagnetic field, corrosive gas or conductive substances and direct sunlight, or places where product is exposed to water or rain.
- Mount this product properly in accordance with the instruction manual, mounting direction and shall be properly be ventilated.
- Please shut down the input when connecting input and output of the product.
- When installing in environment where conductive foreign, dust and liquid may be present, please consider penetration of above foreign material in the power supply by installing filter, to prevent trouble or malfunction.

### **⚠ CAUTION on USE**

- Product individual notes are shown in the instruction manual. If there is any difference with common notes individual notes shall have priority.
- Before using this product, be sure to read the catalog and instruction manual. There is risk of electric shock or damage to the product or fire due to improper use.
- Input voltage, Output current, Output power, ambient temperature and ambient humidity should be kept within specifications, otherwise the product will be damaged, or cause electric shock or fire.
- If the built-in fuse is blown, do not use the product even after replacing the fuse, as there is risk of abnormality inside. Be sure to request repair to our company.
- For products without built-in protection circuit (element, fuse, etc.), insert fuse at the input to prevent smoke, fire during abnormal operation. As for products with built-in protection circuit, depending on usage conditions, built-in protection circuit might not work. It is recommended to provide separate proper protection circuit.
- For externally mounted fuse do not use other fuses aside from our specified and recommended fuse.
- This product was made for general purpose electronic equipment use and is not designed for applications requiring high safety (such as extremely high reliability and safety requirements. Even though high reliability and safety are not required, this product should not be used directly for applications that have serious risk for life and physical safety. Take sufficient consideration in fail-safe design (such as providing protective circuit or protective device inside the system, providing redundant circuit to ensure no instability when single device failure occurs).
- When used in environments with strong electromagnetic field, there is possibility of product damage due to malfunction.
- When used in environment with corrosive gas (hydrogen sulfide, sulfur dioxide, etc.), there is possibility that they might penetrate the product and lead to failure.
- When used in environments where there is conductive foreign matter or dust, there is possibility of product failure or malfunction.
- Provide countermeasure for prevention of lightning surge voltage as there is risk of damage due to abnormal voltage.
- Connect together the frame ground terminal of the product and the ground terminal of the equipment for safety and noise reduction. If these ground is not connected together, there is risk of electric shock.
- Parts with lifetime specifications (built-in fan electrolytic capacitor) are required to be replaced periodically. Set the overhaul period depending on the environment of usage and perform maintenance. Also, note that there are cases when EOL products cannot be overhauled.
- Take care not to apply external abnormal voltage to the output. Especially, applying reverse voltage or overvoltage more than the rated voltage to the output might cause failure, electric shock or fire.
- This product is designed under condition Material group IIIb, Pollution Degree (PD): PD2, Over Voltage category (OVC): OVC II and Class of equipment: Class I. This product is designed to be accessible only to service technicians as part of indoor use device.
- 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.
- 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.
- 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 might cause damage to internal components because of generating surge current.
- Please refer to the latest version of the data sheet, etc., for the most up-to date specifications of the product.

#### Note

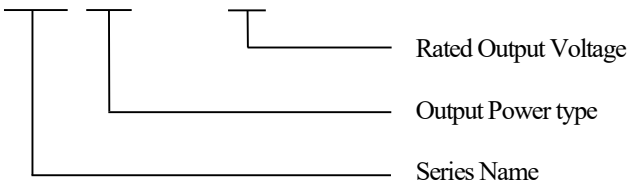
- Take note that traces of sheet metal processing be left in our power supplies.
- When disposing product, follow disposal laws of each municipality.
- Published EMI (CE, RE) or immunity is the result when measured in our standard measurement conditions and might not satisfy specification when mounted and wired inside end-user equipment. Use the product after sufficiently evaluating at actual end-user equipment.
- When exporting our products, apply for necessary permissions as required by rules and regulations of Foreign Exchange and Foreign Trade Control Act.
- Catalogue, contents of the instruction manual may be changed without a prior notice. Refer to latest catalogue or instruction manual.
- Reproduction or reprinting the instruction manual or its portion is forbidden without our permission.

#### LONG-TERM STORAGE METHOD AND LONG-TERM STORAGE PERIOD

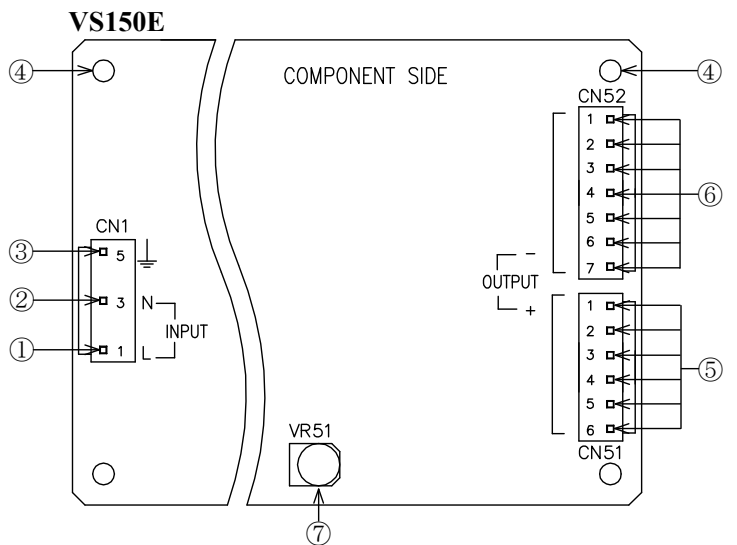
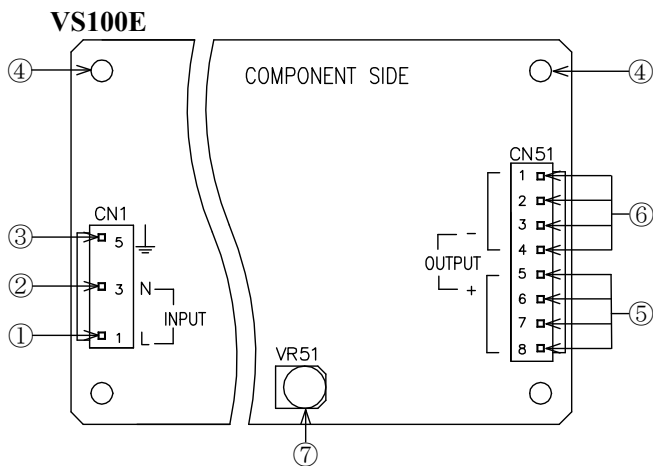
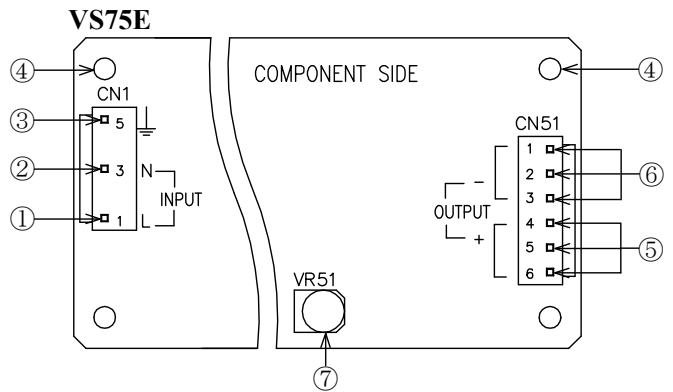
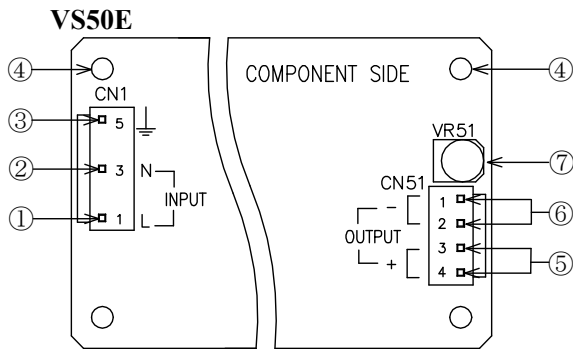
- Please keep the product in carton box.
  - Please do not apply excessive vibration, shock or mechanical stress applied directly to the product.
  - Please keep away from direct sunlight.
  - For long-term storage temperature and humidity, the following conditions shall be used as a guideline :
    - Temperature range : 5°C ~ 30°C
    - Humidity range : 40% ~ 60%RHPlease keep away from the places where temperature and humidity can change drastically. It can cause condensation on the product or deterioration.
  - For long-term storage period, we recommend to use within 2 years after receiving the product.
    - There is tendency that the leakage current of an aluminum electrolytic capacitor may increase when stored without using for a long time.
    - This phenomenon can be improved by applying voltage to the aluminum electrolytic capacitor to reduce the increased leakage current through the self-recovery effect of the electrolyte.
    - For reference, before using products that have been stored for a very long time, please warm-up first for 30 minutes or more without taking load.
- < Criterion of warm up voltage condition >
- (1)Implementation period : 1 year or above after the delivery
  - (2)Electrical continuity condition
    - Input voltage : Rating
    - Load : 0A
    - Ambient temperature : Normal temperature
    - Time : 30 minutes or more

## 1. Model name identification method

**VS 50 E - 5**

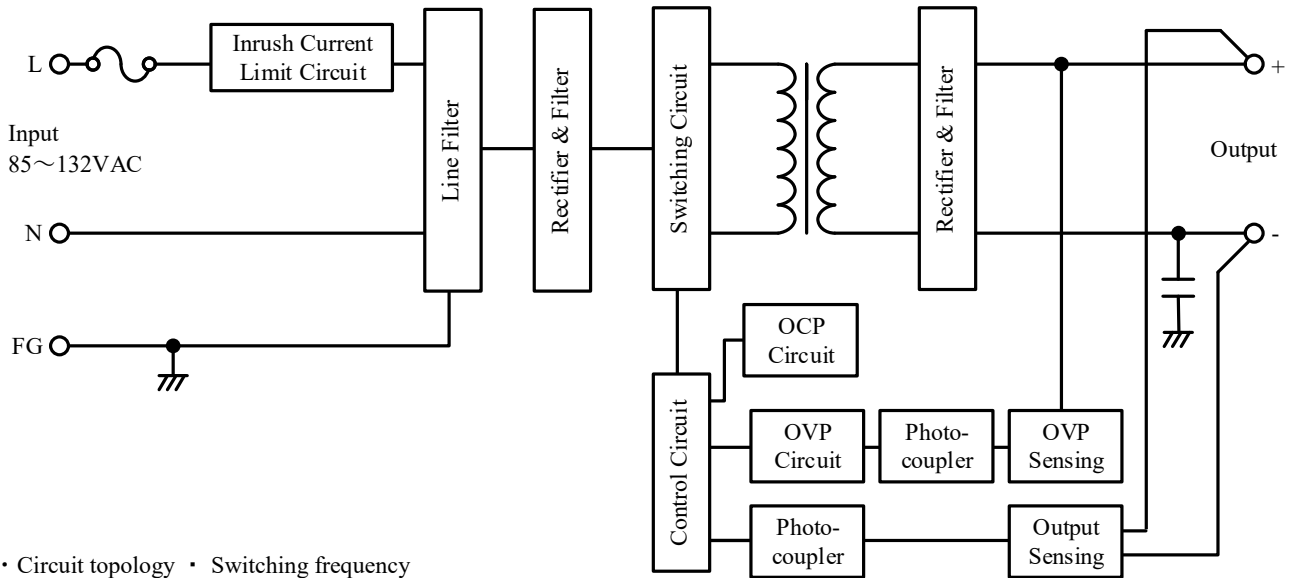


## 2. Terminal Explanation



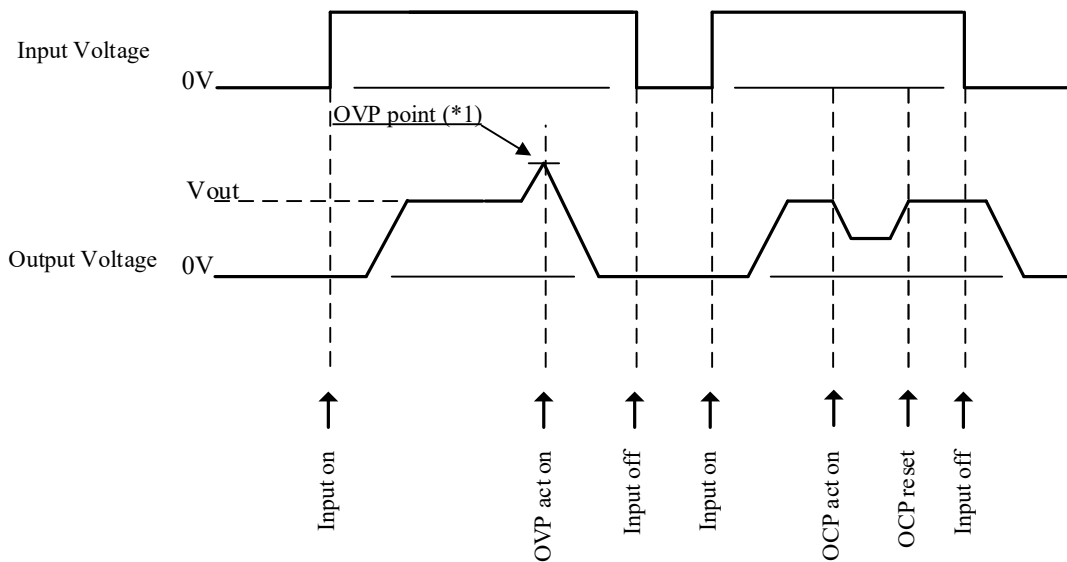
- ① L : AC Input terminal Live line (Fuse in line.)
- ② N : AC Input terminal Neutral line
- ③  $\perp$  :  $\perp$  Terminal (Protective earth)
- ④ Mounting hole (hole diameter :  $\phi$  3.5mm) : This hole is connected to Protective Earth of CN1.  
 Must be connected to electrically conductive spacer. The mounting surface of the spacer should be within Max  $\phi$  8mm.
- ⑤ + : + Output Terminal
- ⑥ - : - Output Terminal
- ⑦ V.ADJ : Output voltage adjust trimmer. The output voltage rises when a trimmer is turned clockwise.

### 3. Block Diagram



- Circuit topology    • Switching frequency
  - V50E : Flyback topology    100kHz (Fixed)
  - V75E, VS100E : Forward topology    140kHz (Fixed)
  - V150E : Forward topology    135kHz (Fixed)
- Fuse rating
  - VS50E : 4A
  - VS75E, VS100E : 5A
  - VS150E : 6.3A

### 4. Sequence time chart

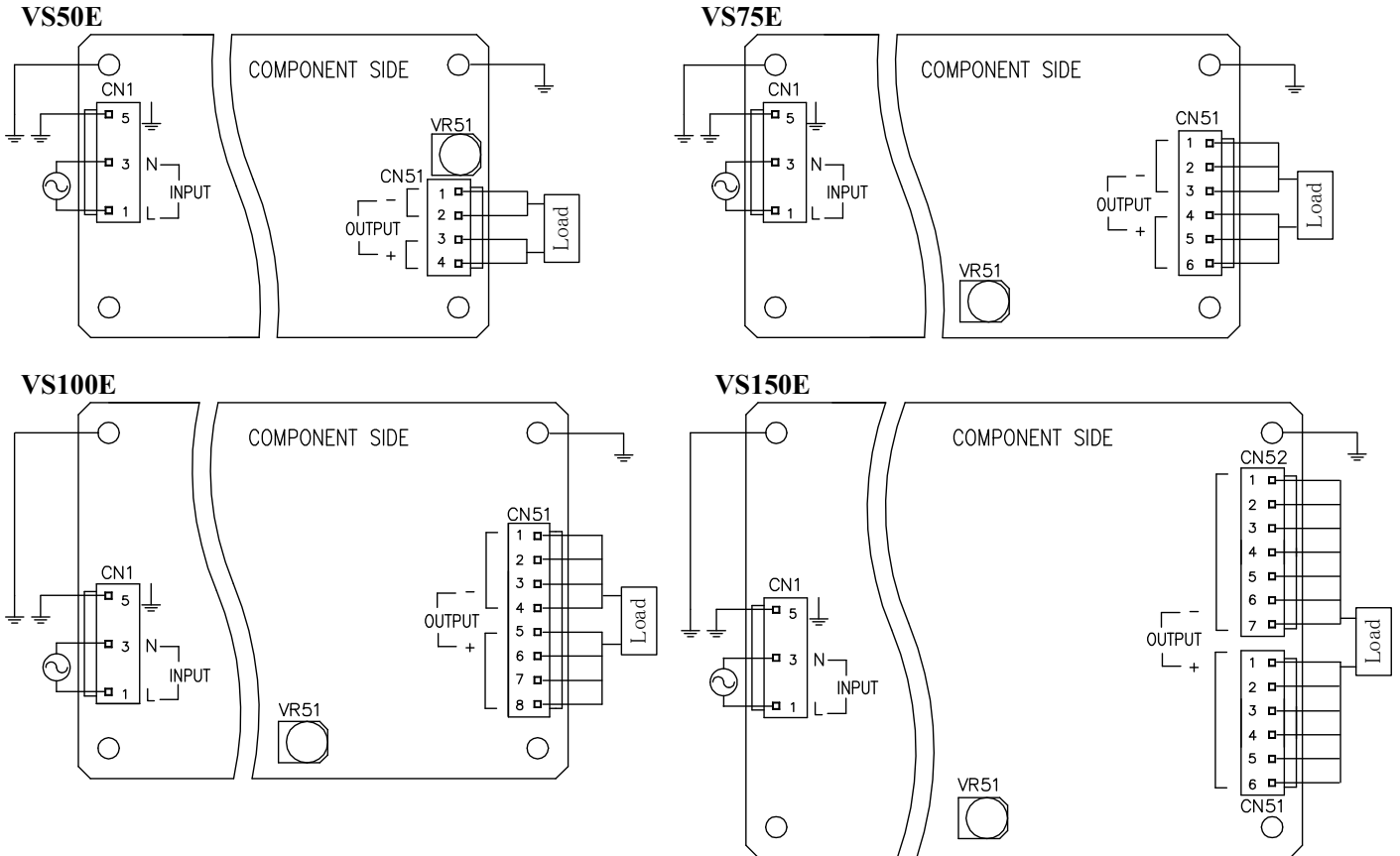


(\*1) OVP Point  
3V-48V : 115% - 135%

## 5. 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.
- Connect  $\perp$  terminal of input connector and mounting hole to protective earth of the equipment.
- Output current of each terminal pin must be less than 5A.
- 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 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)	B3P-VH(LF)(SN)	VHR-5N	SVH-21T-P1.1 BVH-21T-P1.1	J.S.T.
Output (CN51)	VS50E	B4P-VH(LF)(SN)	VHR-4N		
	VS75E	B6P-VH(LF)(SN)	VHR-6N		
	VS100E	B8P-VH(LF)(SN)	VHR-8N		
	VS150E	B6P-VH(LF)(SN)	VHR-6N		
Output (CN52)	VS150E	B7P-VH(LF)(SN)	VHR-7N		

Hand Crimping Tool : YC-160R (J.S.T.)

## 6. Explanation of Function and Precautions

### 6-1. Input Voltage Range

Input voltage range is single phase 85-132VAC(47-63Hz). Input voltage, which is out of specification, might cause unit damage. For cases where conformance to various safeties required, described as 100-120VAC (50/60Hz). Also, 110-175VDC is possible for VS100E and VS150E. As for VS50E and VS75E, please contact us.

### 6-2. 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 is within  $\pm 10\%$  of nominal output voltage. 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 trigger 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.

### 6-3. Inrush Current

This series 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.

### 6-4. Over Voltage Protection (OVP)

The OVP function (Inverter shut down method, manual reset type) is provided. OVP function operates within 115-135% of nominal output voltage. 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.

### 6-5. Over Current Protection (OCP)

VS50E : Down & back limiting and Hiccup mode near shorted conditions, automatic recovery.

VS75E - VS150E : 3V, 5V Constant current limiting and Hiccup mode near shorted conditions, automatic recovery.

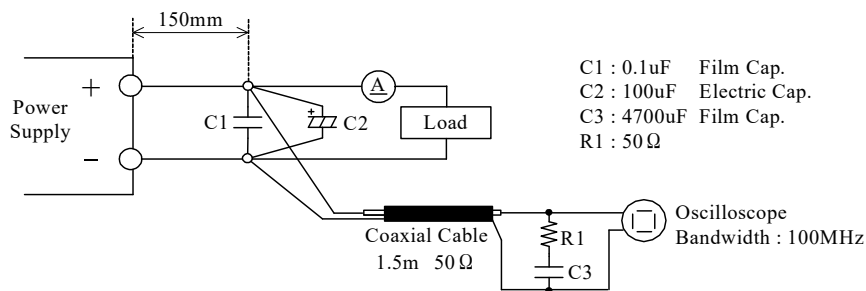
VS75E - VS150E : 12V – 48V Constant current limiting, automatic recovery.

OCP function operates when the output current exceeds 105% of maximum DC output current of specification. The outputs will recover 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. OCP setting is fixed and not to be adjusted externally. Do not operate overload or dead short conditions for more than 30 seconds, which could result in damage or insulation failure.

### 6-6. Output Ripple & Noise

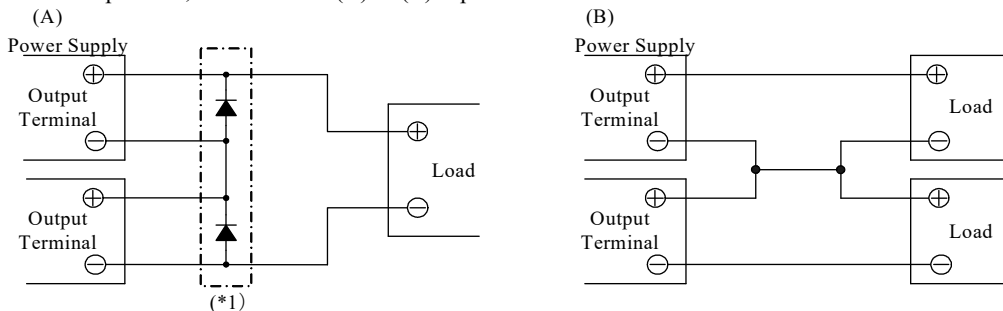
The standard specification for maximum ripple value is measured according to measurement circuit specified by JEITA-RC9131A. When load lines are longer, ripple will becomes larger. In this case, electrolytic capacitor, film capacitor, etc. might be necessary to use across the load terminal. The output ripple cannot be measure accurately if the probe ground lead of oscilloscope is too long.

For start up at low ambient temperature and low voltage, output ripple noise of VS75E, VS100E and VS150E might not meet specification. However, there is no overshoot at start up and output ripple noise specification can be met after one second.



### 6-7. Series Operation

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

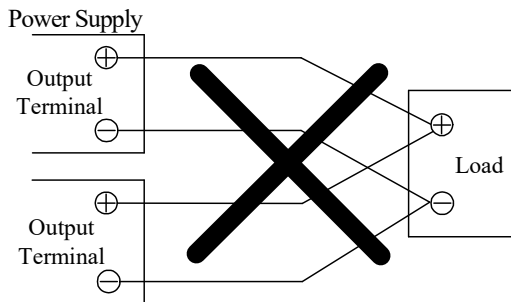


(\*1) For VS50E only in case of (A), please connect bypass diodes to prevent reverse voltage. Please select a bypass diode with maximum forward current rating more than output load current. And maximum reverses voltage must withstand each power supply output voltage.

### 6-8. Parallel Operation

For parallel operation, method (B) is possible.

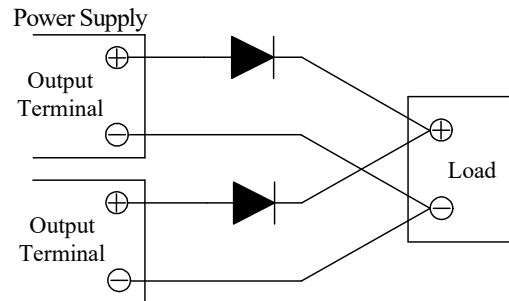
(A) To increase the output current is not possible.



(B) To use as Back-up Power Supply

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

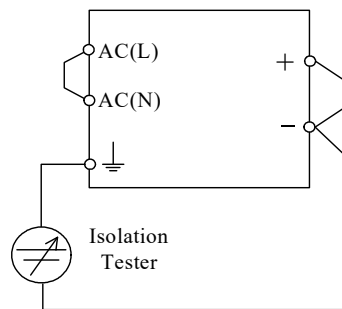
Use within the specification for output voltage and output power.



### 6-9. Isolation Test

Isolation resistance between Output -  $\perp$  (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  $100M\Omega$

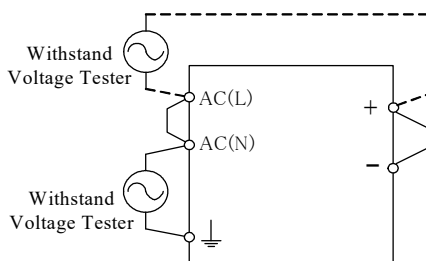


### 6-10. Withstand Voltage

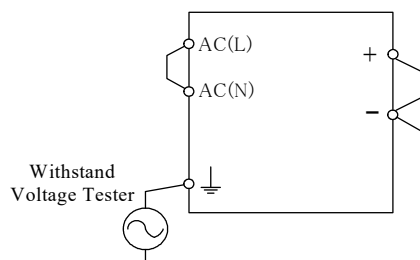
This series is designed to withstand 2.0kVAC between input and output, 2.0kVAC between input and  $\perp$  (Protective Earth) and 500VAC between output and  $\perp$  (Protective Earth) each for 1 minute. When testing withstand voltage, set current limit of the withstand voltage test equipment to 10mA (output -  $\perp$  (Protective Earth): 20mA). 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) : 2.0kVAC 1min ( 10mA)

Input -  $\perp$  (Protective Earth) (Solid line) :  
2.0kVAC 1min ( 10mA )



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

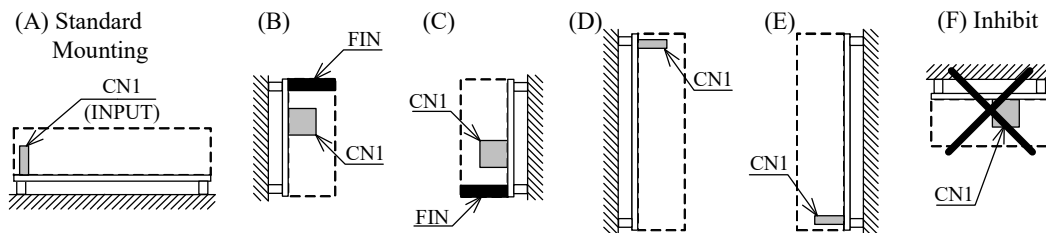




## 7. Mounting Directions

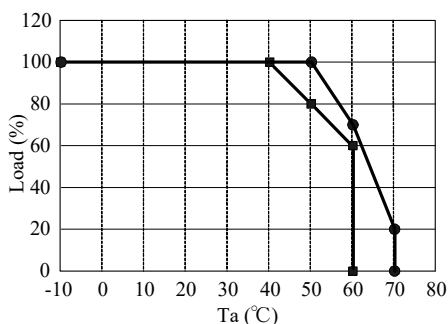
### 7-1. Output Derating according to the Mounting Directions.

Recommended standard mounting method is (A). Method (B)-(E) are also possible. Refer to the output derating below.



### 7-2. Output Derating CONVECTION COOLING

#### VS50E

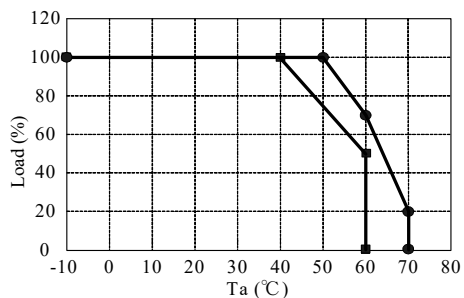


(\*1) Output Derating is different depending on the output voltage.

● Mounting : (A)-(D) 3V-24V      ■ Mounting : (E) 3V-24V  
: (A)-(C) 48V                                  : (D),(E) 48V

Ta (°C)	Load (%)	
	(*1) Mounting (A)-(D) Mounting (A)-(C)	(*1) Mounting (E) Mounting (D),(E)
-10 - +40	100	
+50	100	80
+60	70	60
+70	20	-

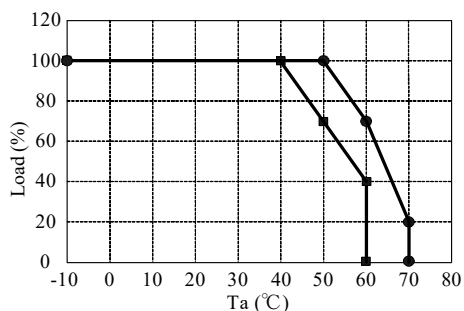
#### VS75E



● Mounting (A),(B)  
■ Mounting (C) - (E)

Ta (°C)	Load (%)	
	Mounting (A),(B)	Mounting (C) - (E)
-10 - +40	100	
+50	100	-
+60	70	50
+70	20	-

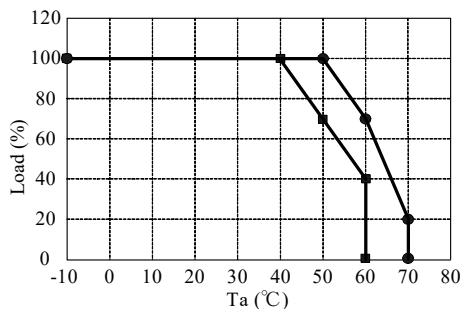
#### VS100E



● Mounting (A),(B)  
■ Mounting (C) - (E)

Ta (°C)	Load (%)	
	Mounting (A),(B)	Mounting (C) - (E)
-10 - +40	100	
+50	100	70
+60	70	40
+70	20	-

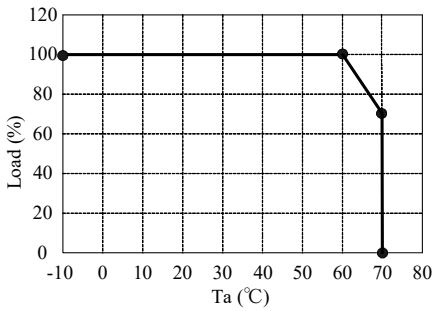
#### VS150E



● Mounting (A)  
■ Mounting (B) - (E)

Ta (°C)	Load (%)	
	Mounting (A)	Mounting (B) - (E)
-10 - +40	100	
+50	100	70
+60	70	40
+70	20	-

**FORCED AIR COOLING**  
**VS50E·75E·100E·150E**



—●— MOUNTING (A) - (E)

Ta (°C)	Load (%)
	MOUNTING (A) - (E)
-10 - +60	100
+70	70

The entire component must be cooled.

Electrolytic capacitor upper bound temperature

MODEL	Load (%)	
	(*1) $I_o \leq 80$	(*2) $80 < I_o \leq 100$
VS50E	75°C	80°C
VS75E·100E·150E	80°C	85°C

(\*1) Condition to apply 5 years warranty.

(\*2) Condition to apply 3 years warranty.

The maximum temperature of the electrolytic capacitor C51 or C52 (VS50E-3 and 5 are C53) must become lower than “Electrolytic capacitor upper bound temperature” in the above table. Please let air 0.5m<sup>3</sup>/min (17.7CFM) flow into the component side as a standard.

**7-3. Mounting Method**

Insert the spacer (Max  $\phi$  8.0) of height more than 6mm to lift the unit. Also use all mounting holes for the unit installation. The vibration spec is that the unit mounted by 6mm spacers.

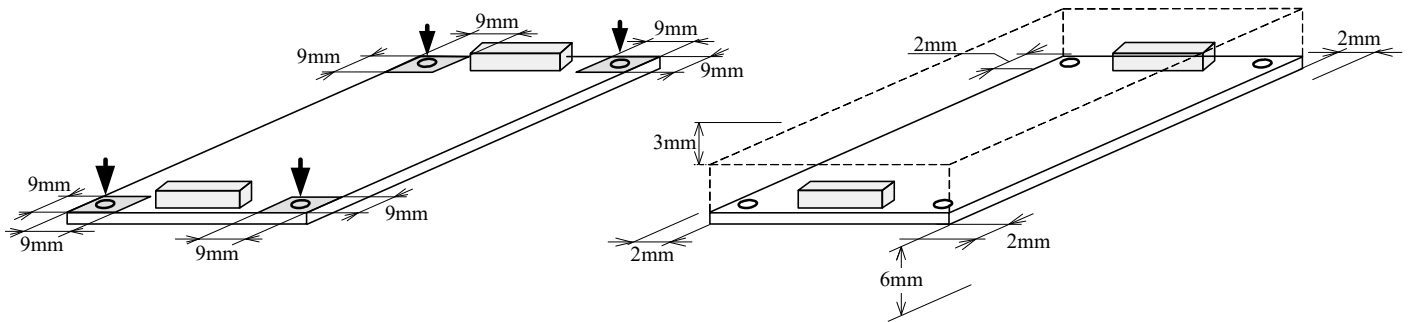
**Mounting Holes size**

4 holes  $\phi$  3.5mm.

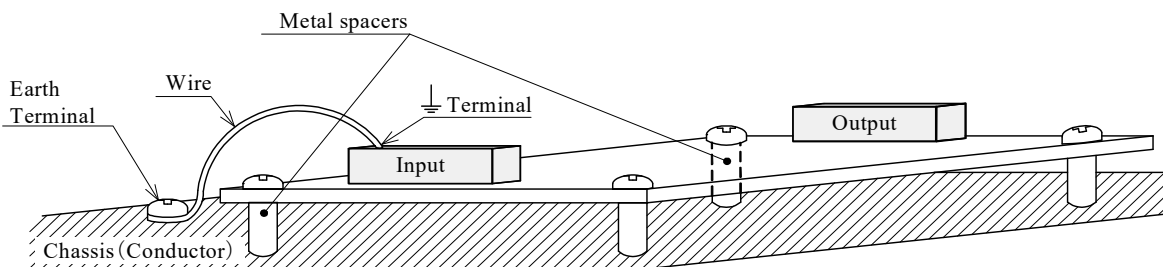
Allowable area by metal pieces are 9mm from each PCB corners.

**Condition to meet Insulation & Withstand Voltage standard.**

- Leave 3mm space from the power supply surface.
- Leave 6mm space from the solder side surface.
- Leave 2mm space from the sides of PCB.



⏏ (Protective Earth) should be connected to the earth terminal of the equipment. Also 2 mounting holes should be connected to the Chassis by metal spacer. If not, the conducted noise, radiation noise and output noise will increase.



Consider the heat radiation and safety when the power supply is used in convection cooling. Please take a distance more than 15mm between the power supply and the peripheral parts. When lay out multiple units, please make sure to place 15mm or more space from each other.

## 8. Wiring Method

- (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  $\perp$  terminal of input connector and mountable Frame Ground of VS-E series to ground terminal equipment firmly.

## 9. 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. Please use slow-blow or time-lag type fuse, not fast-blow fuse. Fuse rating is specified 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

VS50E : 4.0A  
 VS75E : 5.0A  
 VS100E : 5.0A  
 VS150E : 6.3A

## 10. 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.
- (7) 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	48V
VS50E	10,000uF		5,000uF		2,000uF	500uF
VS75E · VS100E · VS150E	5,000uF		30,000uF			

## 11. The life expectancy

The life of the power supply depends on the life of the built-in aluminum electrolytic capacitor.

The life is described in reliability data.

The life of the aluminum electrolytic capacitor varies depending on the method of mounting the power supply, the load current, and the ambient temperature.

Please refer to "Electrolytic Capacitor Lifetime".

Please do not use the product which passed over the life expectancy.

There is a risk of unexpected output shutdown and specifications may not be satisfied.

Please contact us for maintenance or exchange the product which passed over the life expectancy.

## 12. Warranty Period

This product is warranted for a period of 5 years from the date of shipment.

For damages occurring at normal operation within this warranty period, repair is free of charge.

## 13. CE MARKING/UKCA MARKING

### CE MARKING

CE Marking, when applied to a product or packing material for a product covered by this handbook, indicates compliance with the Low Voltage Directive and RoHS Directive.

### UKCA MARKING

UKCA Marking, when applied to a product or packing material for a product covered by this handbook, indicates compliance with the Electrical Equipment (Safety) Regulations and Restriction of the Use of Certain Hazardous Substances in Electrical & Electronic Equipment Regulations.