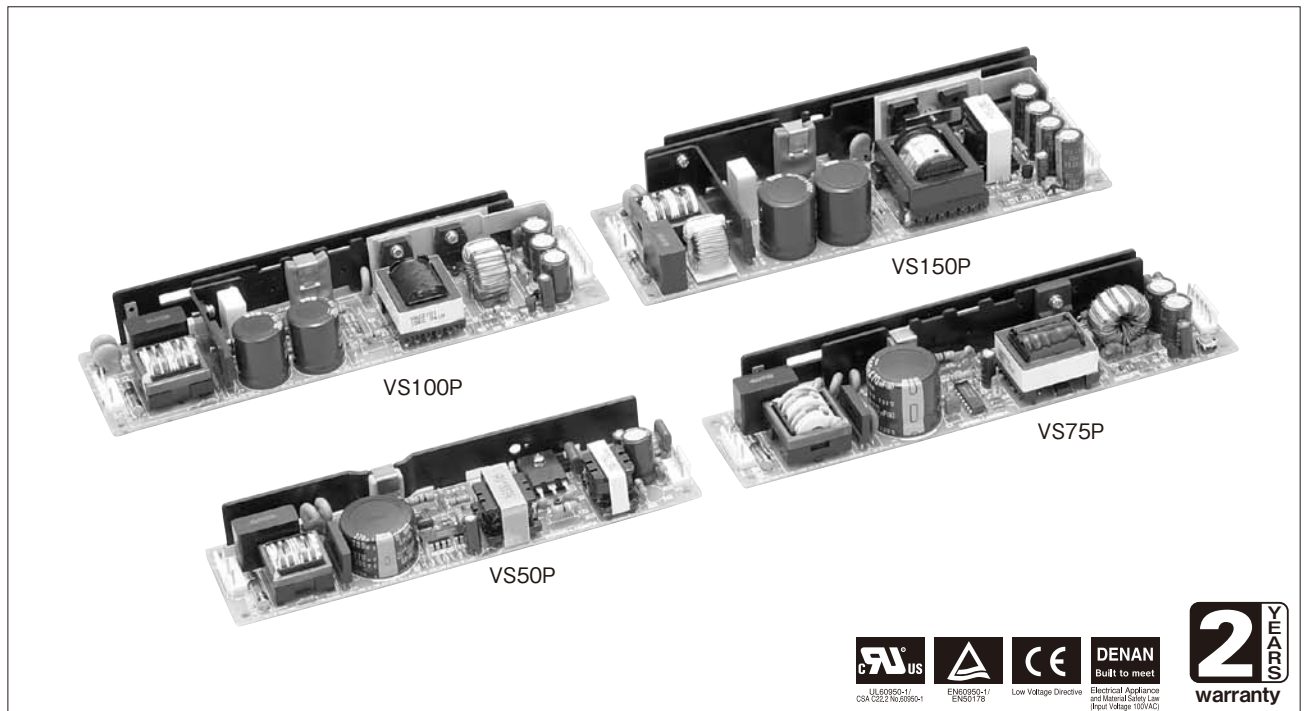


# VS-P SERIES

Single Output 50W - 150W



## ■ Features

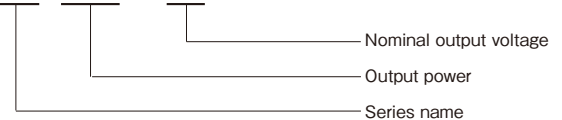
- Peak load double power: Approximately twice the value of average output current
- Operating ambient temperature range (-10C to +50C: 100%)
- Output voltage adjusting trimmer
- Low leakage current
- Complies with EMI/immunity standards
- Safety standard approved

## ■ Applications



## ■ Model naming method

**VS 50P - 24**



## ■ Conformity to RoHS Directive

This means that, in conformity with EU Directive 2002/95/EC, lead, cadmium, mercury, hexavalent chromium, and specific bromine-based flame retardants, PBB and PBDE, have not been used, except for exempted applications.

## ■ Product Line up

| Output Voltage | 50W                  |          | 75W                  |          | 100W                 |           | 150W                 |           |
|----------------|----------------------|----------|----------------------|----------|----------------------|-----------|----------------------|-----------|
|                | Output Current(Peak) | Model    | Output Current(Peak) | Model    | Output Current(Peak) | Model     | Output Current(Peak) | Model     |
| 24V            | 2.5A(4.2A)           | VS50P-24 | 3.2A(7.0A)           | VS75P-24 | 4.3A(10A)            | VS100P-24 | 6.3A(12A)            | VS150P-24 |

VS-P

## VS50P Specifications

| ITEMS/UNITS |                                         | MODEL    | VS50P-24                                                                                     |
|-------------|-----------------------------------------|----------|----------------------------------------------------------------------------------------------|
| Input       | Voltage Range                           | (*3) V   | AC85-132 or DC110-175                                                                        |
|             | Frequency                               | (*3) Hz  | 47-440                                                                                       |
|             | Efficiency (typ)                        | (*2) %   | 83.0                                                                                         |
|             | Current (typ)                           | (*2) A   | 1.3                                                                                          |
|             | Inrush Current (100VAC)(typ)(*4)        | A        | 30 at cold start, Ta=25°C                                                                    |
|             | Leakage Current                         | (*11) mA | Less than 0.75                                                                               |
| Output      | Nominal Voltage                         | V        | 24                                                                                           |
|             | Minimum Current                         | A        | 0                                                                                            |
|             | Average Current                         | A        | 2.5                                                                                          |
|             | Maximum Peak Current (*1)               | A        | 4.2                                                                                          |
|             | Average Power                           | W        | 60                                                                                           |
|             | Maximum Peak Power (*1)                 | W        | 100.8                                                                                        |
|             | Maximum Line Regulation (*5)(*6)        | mV       | 96                                                                                           |
|             | Maximum Load Regulation (*5)(*7)        | mV       | 150                                                                                          |
|             | Temperature Coefficient (*5)(*8)        | mV       | 240                                                                                          |
|             | Maximum Ripple & Noise (0≤Ta≤60°C)(*5)  | mVp-p    | 180                                                                                          |
|             | Maximum Ripple & Noise (-10≤Ta<0°C)(*5) | mVp-p    | 240                                                                                          |
|             | Hold-up Time (typ) (*2)(*13)            | ms       | 17                                                                                           |
|             | Voltage Adjustable Range                |          | 21.6% - 26.4%                                                                                |
| Function    | Over Current Protection (*9)            | A        | >4.3A at Ta:25°C                                                                             |
|             | Over Voltage Protection (*10)           |          | 115% - 135%                                                                                  |
|             | Parallel Operation                      |          | -                                                                                            |
|             | Series Opaeration                       |          | Possible                                                                                     |
| Environment | Operating Temperature (*12)             | °C       | Convection: -10 to 50: 100%, 60: 40%                                                         |
|             | Storage Temperature                     | °C       | -30 to +85                                                                                   |
|             | Operating Humidity                      | %RH      | 30 - 90 (No dewdrop)                                                                         |
|             | Storage Humidity                        | %RH      | 10 - 95 (No dewdrop)                                                                         |
|             | Vibration                               |          | At no operating, 10-55Hz (sweep for 1min) 19.6m/s <sup>2</sup> constant, X, Y, Z 1 hour each |
|             | Shock                                   |          | Less than 196.1m/s <sup>2</sup>                                                              |
|             | Cooling                                 |          | Convection cooling                                                                           |
| Isolation   | Withstand Voltage                       |          | Input-Output: 2kVAC (20mA), Input-FG: 2kVAC (20mA), Output-FG: 500VAC (100mA) 1min.          |
|             | Isolation Resistance                    |          | More than 100MΩ at Ta:25°C and 70%RH Output-FG 500VDC                                        |
| Standards   | Safety Standards                        |          | Approved by UL60950-1, CSA C22.2 No.60950-1, EN60950-1 & Built to meet DENAN                 |
|             | EMI (*13)                               |          | Built to meet VCCI-B & FCC class B                                                           |
| Mechanical  | Weight (typ)                            | g        | 200                                                                                          |
|             | Size (W x H x D)                        | mm       | 50 x 22 x 195                                                                                |

(\*1) Operating time at peak output current is less than 10 sec with average output power and current (Duty=0.35). Please refer to Fig.A.& instruction manual.

(\*2) At 100VAC and average output power, Ta=25°C.

(\*3) For cases where conformance to various safety specs are required to be described as 100-120VAC, 50/60Hz on name plate.

(\*4) Not applicable for the inrush current to noise filter for less than 0.2ms.

(\*5) Please refer to Fig B for measurement determination of line & load regulation and output ripple voltage.

(\*6) 85-132VAC, constant load.

(\*7) Min load - full load (average output power), constant input voltage.

(\*8) -10 to +50°C constant input voltage and load.

(\*9) Current limiting with automatic recovery. Avoid to operate at over load or dead short for more than 30 seconds.

(\*10) OVP circuit will shutdown output, manual reset (re power on).

(\*11) Measured by each measuring method of UL, CSA, EN and DENAN (at 60Hz).

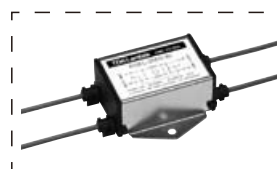
(\*12) At standard mounting method Fig C, refer to derating curve.

- Load(%) is percent of average output load.

Do not exceed derating in both average output power and current.

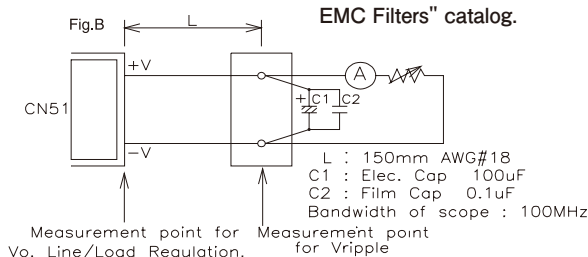
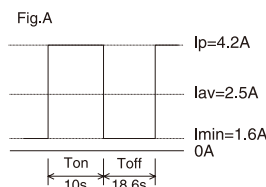
(\*13) At 2.5A continuous output current condition.

### Recommended EMC Filter



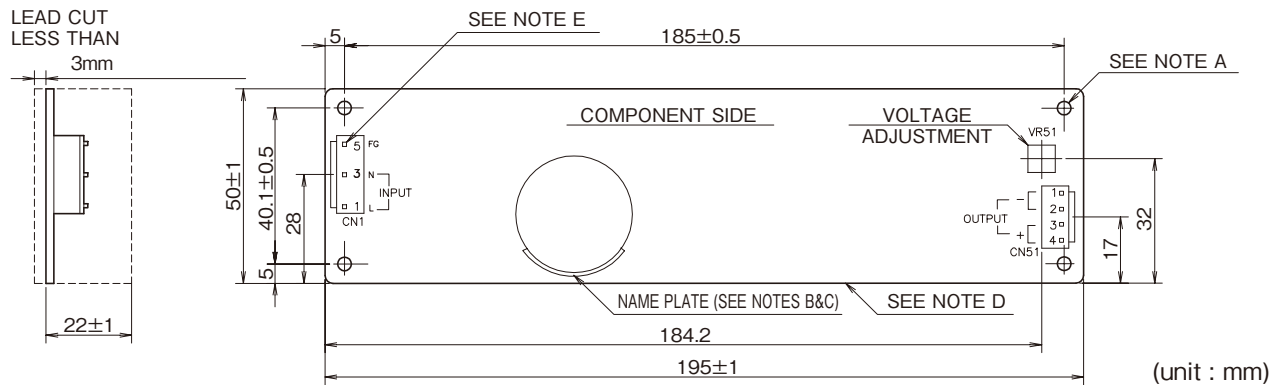
RSEL-2002W

Please refer to "TDK-Lambda EMC Filters" catalog.



## Outline Drawing

## [VS50P]



## CONNECTORS USED:

| PART DESCRIPTION              | PART NAME | MANUFACTURER | QTY |
|-------------------------------|-----------|--------------|-----|
| PIN HEADER (INPUT SIDE CN1)   | B3P-5-VH  | J.S.T        | 1   |
| PIN HEADER (OUTPUT SIDE CN51) | B4P-VH    | J.S.T        | 1   |

\* OUTPUT CURRENT OF EACH CONNECTOR PIN MUST BE LESS THAN 5A.

## MATCHING HOUSINGS &amp; PINS (NOT INCLUDED WITH PRODUCT):

|                        |              |       |   |
|------------------------|--------------|-------|---|
| SOCKET HOUSING (CN1)   | VHR-5N       | J.S.T | 1 |
| SOCKET HOUSING (CN51)  | VHR-4N       | J.S.T | 1 |
| TERMINAL PINS (CN1,51) | SVH-21T-P1.1 | J.S.T | 7 |

HAND CRIMPING TOOL: YC-160R MANUFACTURER: J.S.T

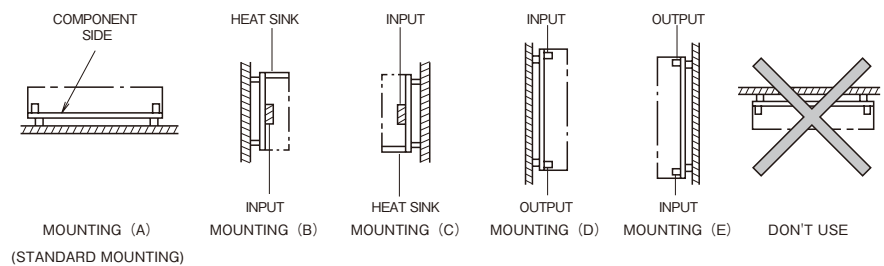
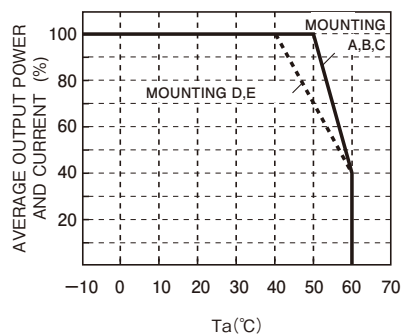
PCB MATERIAL  
GLASS COMPOSITE : CEM-3

## NOTES

- A : 4-φ3.5 HOLES ARE CUSTOMER'S CHASSIS MOUNTING HOLES. ALL MUST BE SCREWED IN ORDER TO CONFORM THE VIBRATION SPEC.
- B : MODEL NAME, NOMINAL OUTPUT VOLTAGE, AVERAGE OUTPUT CURRENT AND PEAK OUTPUT CURRENT ARE SHOWN HERE IN ACCORDANCE WITH THE SPECIFICATIONS.
- C : COUNTRY OF MANUFACTURE WILL BE SHOWN HERE.
- D : TO KEEP THE DISTANCE MORE THAN 2mm BETWEEN PC-BOARD EDGE AND CUSTOMER'S CHASSIS.
- C : FG IS FOR SAFETY GROUND CONNECTION.

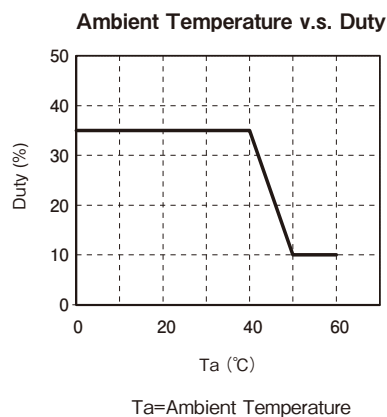
## Output Derating

## OUTPUT DERATING CURVE



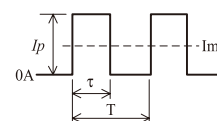
\*PEAK OUTPUT CURRENT DOES NOT NEED DERATING.

## Peak Output Current Condition

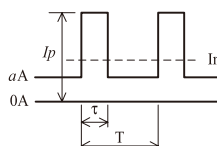


## Peak Output Current

Relation between average output current and peak output current must satisfy formulas below. Also operating time at peak output current should be less than 10 sec. When using pulse load, noise may be heard from power supply unit. Please evaluate and check before using.



$$I_{av} \geq I_m = \frac{I_p \times \tau}{T}$$



$$I_{av} \geq I_m = \frac{(I_p - a) \times \tau}{T} + a$$

$I_p$  : Peak output current (A)  
 $I_{av}$  : Average output current of specification (A)  
 $I_m$  : Average output current (A)  
 $\tau$  : Pulse width of peak output current (sec)  
 (Operating time at peak output)  
 $T$  : Period (sec)

## VS75P Specifications

| ITEMS/UNITS |                                         | MODEL        | VS75P-24                                                                                       |
|-------------|-----------------------------------------|--------------|------------------------------------------------------------------------------------------------|
| Input       | Voltage Range                           | (*3) V       | AC85-132 or DC110-175                                                                          |
|             | Frequency                               | (*3) Hz      | 47-440                                                                                         |
|             | Efficiency (typ)                        | (*2) %       | 83.0                                                                                           |
|             | Current (typ)                           | (*2) A       | 1.9                                                                                            |
|             | Inrush Current (100VAC)(typ)            | (*4) A       | 30 at cold start, Ta=25°C                                                                      |
|             | Leakage Current                         | (*11) mA     | Less than 0.75                                                                                 |
| Output      | Nominal Voltage                         | VDC          | 24                                                                                             |
|             | Minimum Current                         | A            | 0                                                                                              |
|             | Average Current                         | A            | 3.2                                                                                            |
|             | Maximum Peak Current                    | (*1) A       | 7.0                                                                                            |
|             | Average Power                           | W            | 76.8                                                                                           |
|             | Maximum Peak Power                      | (*1) W       | 168                                                                                            |
|             | Maximum Line Regulation                 | (*5)(*6) mV  | 96                                                                                             |
|             | Maximum Load Regulation                 | (*5)(*7) mV  | 150                                                                                            |
|             | Temperature Coefficient                 | (*5)(*8) mV  | 240                                                                                            |
|             | Maximum Ripple & Noise (0≤Ta≤60°C)(*5)  | mVp-p        | 180                                                                                            |
|             | Maximum Ripple & Noise (-10≤Ta<0°C)(*5) | mVp-p        | 240                                                                                            |
|             | Hold-up Time (typ)                      | (*2)(*13) ms | 17                                                                                             |
|             | Voltage Adjustable Range                | VDC          | 21.6 - 26.4                                                                                    |
| Function    | Over Current Protection                 | (*9) A       | >7.1 at Ta=25°C                                                                                |
|             | Over Voltage Protection                 | (*10)        | 115% - 135%                                                                                    |
|             | Parallel Operation                      |              | -                                                                                              |
|             | Series Operation                        |              | Possible                                                                                       |
| Environment | Operating Temperature                   | (*12) °C     | Convection: -10 to 50: 100%, 60: 70%                                                           |
|             | Storage Temperature                     | °C           | -30 to +85°C                                                                                   |
|             | Operating Humidity                      | %RH          | 30 ~ 90 (No dewdrop)                                                                           |
|             | Storage Humidity                        | %RH          | 10 ~ 95 (No dewdrop)                                                                           |
|             | Vibration                               |              | At no operating, 10-55Hz (sweep for 1min)<br>19.6m/s <sup>2</sup> constant, X, Y, Z 1hour each |
|             | Shock                                   |              | Less than 196.1m/s <sup>2</sup>                                                                |
|             | Cooling                                 |              | Convection cooling                                                                             |
| Isolation   | Withstand Voltage                       |              | Input-Output : 2kVAC (20mA), Input-FG : 2kVAC (20mA),<br>Output-FG : 500VAC (100mA) 1min.      |
|             | Isolation Resistance                    |              | More than 100MΩ at Ta: 25°C and 70%RH Output-FG 500VDC                                         |
| Standards   | Safety Standards                        |              | Approved by UL60950-1, CSA-C22.2 No.60950-1, EN60950-1. Built to meet DENAN.                   |
|             | EMI                                     | (*13)        | Built to meet FCCI-B, VCCI-B                                                                   |
| Mechanical  | Weight (typ)                            | g            | 280                                                                                            |
|             | Size (W x H x D)                        | mm           | 50 x 29 x 222                                                                                  |

(\*1) Operating time at peak output current is less than 10 sec. with average output power and current (Duty=0.35). Please refer to Fig.A.

(\*2) At 100VAC and average output power, Ta=25°C.

(\*3) For cases where conformance to various safety specs are required to be described as 100-120VAC, 50/60Hz on name plate.

(\*4) Not applicable for the inrush current to noise filter for less than 0.2ms.

(\*5) Please refer to Fig B for measurement determination of line & load regulation and output ripple voltage.

(\*6) 85-132VAC, constant load.

(\*7) Min load - full load (average output power), constant input voltage.

(\*8) -10 to +50°C constant input voltage and load.

(\*9) Current limiting with automatic recovery. Avoid to operate at over load or dead short for more than 30 seconds.

(\*10) OVP circuit will shutdown output, manual reset (re power on).

(\*11) Measured by each measuring method of UL, CSA, EN and DENAN (at 60Hz).

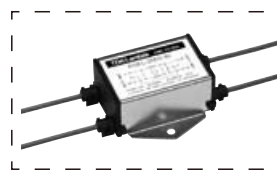
(\*12) At standard mounting method Fig C, refer to derating curve.

- Load(%) is percent of average output load.

Do not exceed derating in both average output power and current.

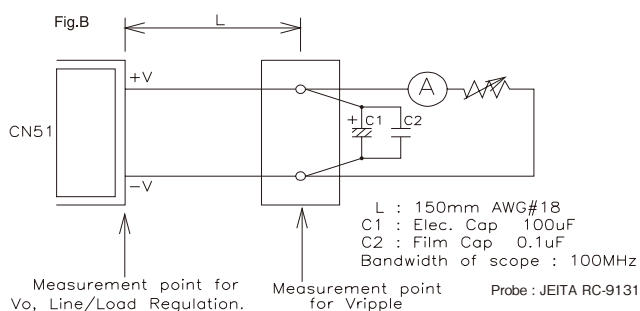
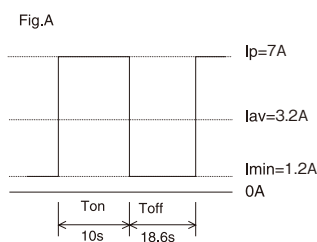
(\*13) At 3.2A continuous output current condition.

### Recommended EMC Filter



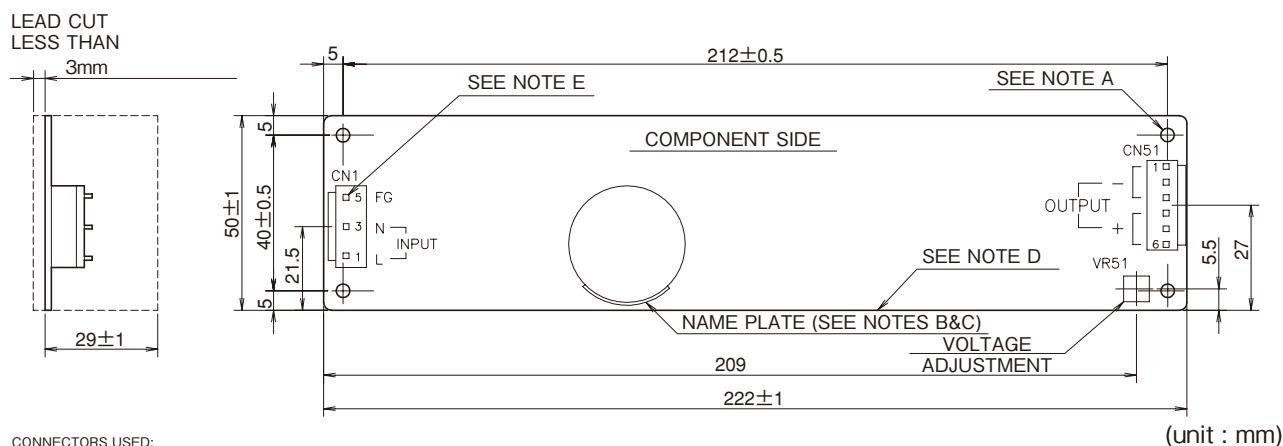
RSEL-2003W

Please refer to "TDK-Lambda EMC Filters" catalog.



## Outline Drawing

**【VS75P】**



CONNECTORS USED:

| PART DESCRIPTION              | PART NAME | MANUFACTURER | QTY |
|-------------------------------|-----------|--------------|-----|
| PIN HEADER (INPUT SIDE CN1)   | B3P-5-VH  | J.S.T        | 1   |
| PIN HEADER (OUTPUT SIDE CN51) | B6P-VH    | J.S.T        | 1   |

\*OUTPUT CURRENT OF EACH CONNECTOR PIN MUST BE LESS THAN 5A.

MATCHING HOUSINGS & PINS (NOT INCLUDED WITH PRODUCT):

|                        |              |       |   |
|------------------------|--------------|-------|---|
| SOCKET HOUSING (CN1)   | VHR-5N       | J.S.T | 1 |
| SOCKET HOUSING (CN51)  | VHR-6N       | J.S.T | 1 |
| TERMINAL PINS (CN1,51) | SVH-21T-P1.1 | J.S.T | 9 |

HAND CRIMPING TOOL: YC-160R      MANUFACTURER : J.S.T

## PCB MATERIAL

GLASS COMPOSITE : CEM-3

## NOTES

A: 4- $\phi$ 3.5 HOLES ARE CUSTOMER'S CHASSIS MOUNTING HOLES. ALL MUST BE SCREWED IN ORDER TO CONFORM THE VIBRATION SPEC.

B: MODEL NAME, NOMINAL OUTPUT VOLTAGE, AVERAGE OUTPUT CURRENT AND PEAK OUTPUT CURRENT ARE SHOWN HERE IN ACCORDANCE WITH THE SPECIFICATIONS

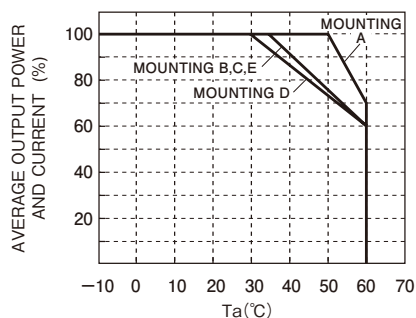
C : COUNTRY OF MANUFACTURE WILL BE SHOWN HERE.

D : TO KEEP THE DISTANCE MORE THAN 2mm BETWEEN PC-BOARD EDGE AND CUSTOMER'S CHASSIS

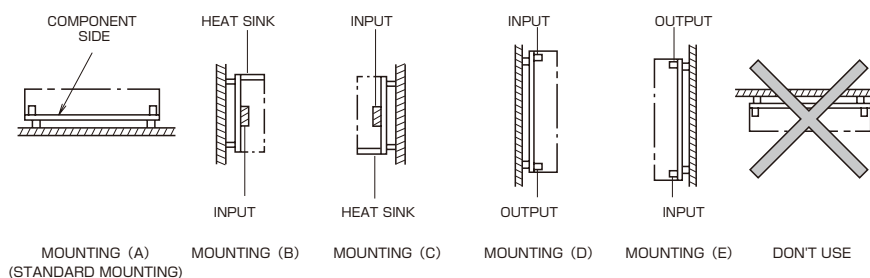
C : FG IS FOR SAFETY GROUND CONNECTION.

## Output Derating

### OUTPUT DERATING CURVE

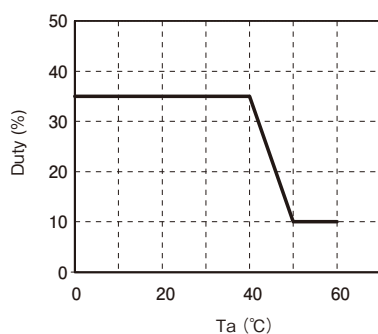


\*PEAK OUTPUT CURRENT DOES NOT NEED DERATING.



## Peak Output Current Condition

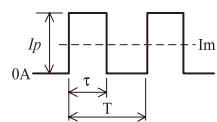
### Ambient Temperature v.s. Duty



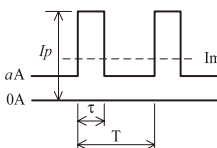
Ta=Ambient Temperature

### Peak Output Current

Relation between average output current and peak output current must satisfy formulas below. Also operating time at peak output current should be less than 10 sec. When using pulse load, noise may be heard from power supply unit. Please evaluate and check before using.



$$I_{av} \geq I_m = \frac{I_p \times \tau}{T}$$



$$I_{av} \geq I_m = \frac{(I_p - a) \times \tau}{T} + a$$

$I_p$  : Peak output current (A)

$I_{av}$  : Average output current of specification (A)

$I_m$  : Average output current (A)

$\tau$ : Pulse width of peak output current (sec)

(Operating time at peak output)

T : Period (sec)

## VS100P Specifications

| ITEMS/UNITS |                                         | MODEL        | VS100P-24                                                                                   |
|-------------|-----------------------------------------|--------------|---------------------------------------------------------------------------------------------|
| Input       | Voltage Range                           | (*3) V       | AC85-132 or DC110-175                                                                       |
|             | Frequency                               | (*3) Hz      | 47-440                                                                                      |
|             | Efficiency (typ)                        | (*2) %       | 85.0                                                                                        |
|             | Current (typ)                           | (*2) A       | 2.5                                                                                         |
|             | Inrush Current (100VAC)(typ)            | (*4) A       | 20A                                                                                         |
|             | Leakage Current                         | (*11) mA     | Less than 0.75                                                                              |
| Output      | Nominal Voltage                         | VDC          | 24                                                                                          |
|             | Minimum Current                         | A            | 0                                                                                           |
|             | Average Current                         | A            | 4.3                                                                                         |
|             | Maximum Peak Current                    | (*1) A       | 10                                                                                          |
|             | Average Power                           | W            | 103.2                                                                                       |
|             | Maximum Peak Power                      | (*1) W       | 240.0                                                                                       |
|             | Maximum Line Regulation                 | (*5)(*6) mV  | 96                                                                                          |
|             | Maximum Load Regulation                 | (*5)(*7) mV  | 150                                                                                         |
|             | Temperature Coefficient                 | (*5)(*8) mV  | 240                                                                                         |
|             | Maximum Ripple & Noise (0≤Ta≤60°C)(*5)  | mVp-p        | 180                                                                                         |
|             | Maximum Ripple & Noise (-10≤Ta<0°C)(*5) | mVp-p        | 240                                                                                         |
|             | Hold-up Time (typ)                      | (*2)(*13) ms | 17                                                                                          |
|             | Voltage Adjustable Range                | VDC          | 21.6 - 26.4                                                                                 |
| Function    | Over Current Protection                 | (*9) A       | >10.2 at Ta=25°C                                                                            |
|             | Over Voltage Protection                 | (*10)        | 115% - 135%                                                                                 |
|             | Parallel Operation                      |              | -                                                                                           |
|             | Series Operation                        |              | Possible                                                                                    |
| Environment | Operating Temperature                   | (*12) °C     | Convection: -10 to 50: 100%, 60: 70%                                                        |
|             | Storage Temperature                     | °C           | -30 to +85                                                                                  |
|             | Operating Humidity                      | %RH          | 30 - 90 (No dewdrop)                                                                        |
|             | Storage Humidity                        | %RH          | 10 - 95 (No dewdrop)                                                                        |
|             | Vibration                               |              | At no operating, 10-55Hz (sweep for 1min) 19.6m/s <sup>2</sup> constant, X, Y, Z 1hour each |
|             | Shock                                   |              | Less than 196.1m/s <sup>2</sup>                                                             |
|             | Cooling                                 |              | Convection cooling                                                                          |
| Isolation   | Withstand Voltage                       |              | Input-Output : 2kVAC (20mA), Input-FG : 2kVAC (20mA)<br>Output-FG : 500VAC (100mA) 1min.    |
|             | Isolation Resistance                    |              | More than 100MΩ at Ta=25°C and 70%RH Output-FG 500VDC                                       |
| Standards   | Safety Standards                        |              | Approved by UL60950-1, CSA C22.2 No.60950-1, EN60950-1. Built to meet DENAN.                |
|             | EMI                                     | (*13)        | Built to meet FCC-B, VCCI-B                                                                 |
| Mechanical  | Weight (typ)                            | g            | 350                                                                                         |
|             | Size (W x H x D)                        | mm           | 62 x 29 x 222                                                                               |

(\*1) Operating time at peak output current is less than 10 sec. with average output power and current (Duty=0.35). Please refer to Fig.A.

(\*2) At 100VAC and average output power, Ta=25°C.

(\*3) For cases where conformance to various safety specs are required to be described as 100-120VAC, 50/60Hz on name plate.

(\*4) Not applicable for the inrush current to noise filter for less than 0.2ms.

(\*5) Please refer to Fig B for measurement determination of line & load regulation and output ripple voltage.

(\*6) 85-132VAC, constant load.

(\*7) Min load - full load (average output power), constant input voltage.

(\*8) -10 to +50°C constant input voltage and load.

(\*9) Current limiting with automatic recovery. Avoid to operate at over load or dead short for more than 30 seconds.

(\*10) OVP circuit will shutdown output, manual reset (re power on).

(\*11) Measured by each measuring method of UL, CSA, EN and DENAN (at 60Hz).

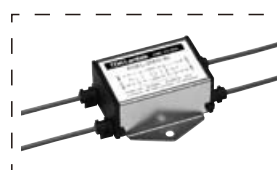
(\*12) At standard mounting method Fig C, Refer to derating curve.

- Load(%) is percent of average output load.

Do not exceed derating in both average output power and current.

(\*13) At 4.3A continuous output current condition.

### Recommended EMC Filter



RSEL-2003W

Please refer to "TDK-Lambda EMC Filters" catalog.

Fig.A

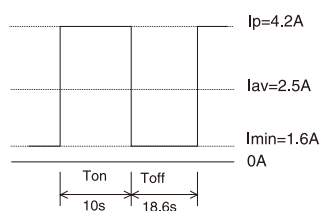


Fig.B

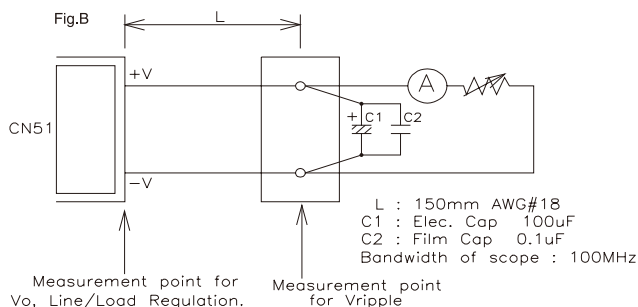
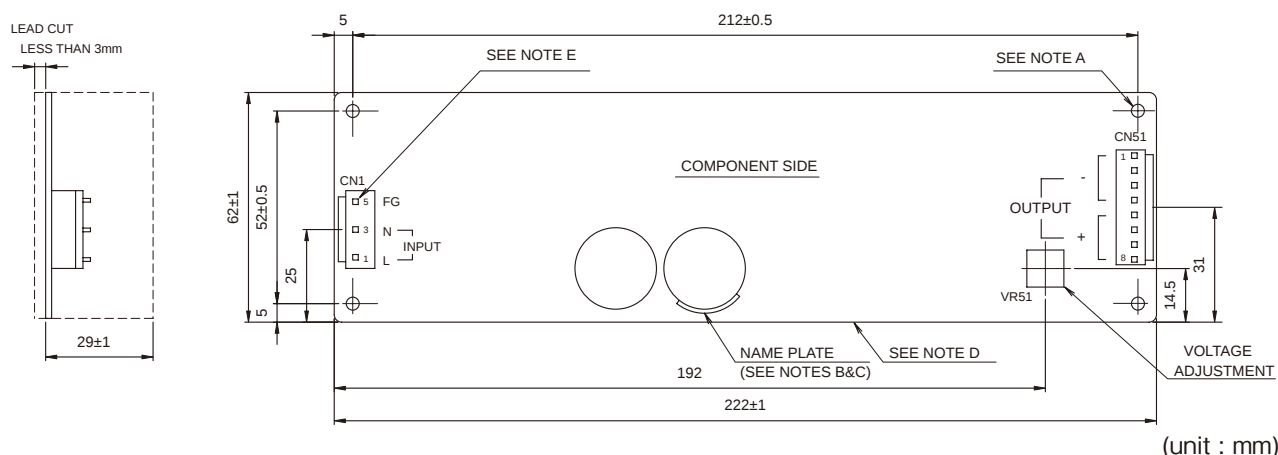


Fig.C



## Outline Drawing

## [VS100P]



CONNECTORS USED:

| PART DESCRIPTION              | PART NAME | MANUFACTURER | QTY |
|-------------------------------|-----------|--------------|-----|
| PIN HEADER (INPUT SIDE CN1)   | B3P-5-VH  | J.S.T        | 1   |
| PIN HEADER (OUTPUT SIDE CN51) | B8P-VH    | J.S.T        | 1   |

\* OUTPUT CURRENT OF EACH CONNECTOR PIN MUST BE LESS THAN 5A.

MATCHING HOUSINGS &amp; PINS (NOT INCLUDED WITH PRODUCT):

|                        |              |       |    |
|------------------------|--------------|-------|----|
| SOCKET HOUSING (CN1)   | VHR-5N       | J.S.T | 1  |
| SOCKET HOUSING (CN51)  | VHR-8N       | J.S.T | 1  |
| TERMINAL PINS (CN1,51) | SVH-21T-P1.1 | J.S.T | 11 |

HAND CRIMPING TOOL: YC-160R MANUFACTURER: J.S.T

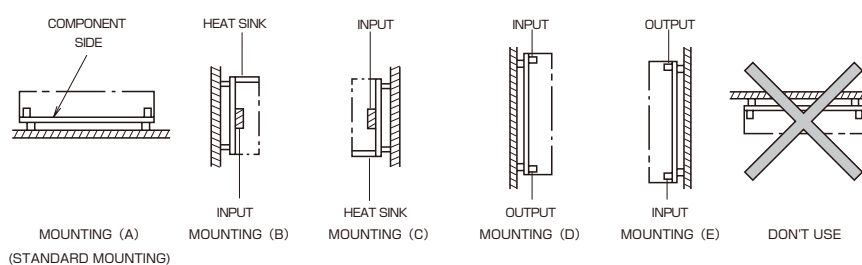
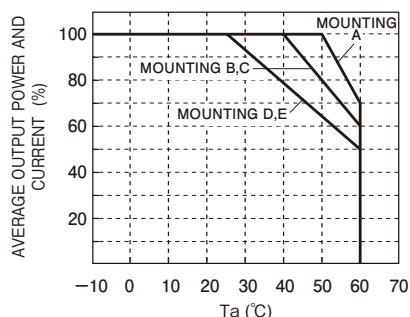
PCB MATERIAL  
GLASS COMPOSITE : CEM-3

## NOTES

- A : 4- $\phi$ 3.5 HOLES ARE CUSTOMER'S CHASSIS MOUNTING HOLES. ALL MUST BE SCREWED IN ORDER TO CONFORM THE VIBRATION SPEC.  
 B : MODEL NAME, NOMINAL OUTPUT VOLTAGE, AVERAGE OUTPUT CURRENT AND PEAK OUTPUT CURRENT ARE SHOWN HERE IN ACCORDANCE WITH THE SPECIFICATIONS.  
 C : COUNTRY OF MANUFACTURE WILL BE SHOWN HERE.  
 D : TO KEEP THE DISTANCE MORE THAN 2mm BETWEEN PC-BOARD EDGE AND CUSTOMER'S CHASSIS.  
 E : FG IS FOR SAFETY GROUND CONNECTION.

## Output Derating

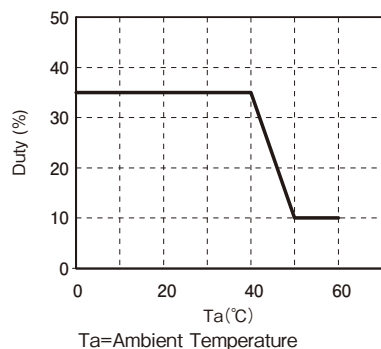
## OUTPUT DERATING CURVE



\*PEAK OUTPUT CURRENT DOES NOT NEED DERATING.

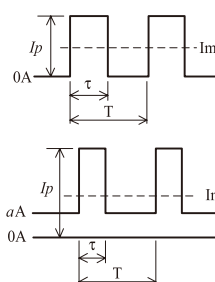
## Peak Output Current Condition

## Ambient Temperature v.s. Duty



## Peak Output Current

Relation between average output current and peak output current must satisfy formulas below. Also operating time at peak output current should be less than 10 sec. When using pulse load, noise may be heard from power supply unit. Please evaluate and check before using.



$$I_{av} \geq I_m = \frac{I_p \times \tau}{T}$$

$$I_{av} \geq I_m = \frac{(I_p - a) \times \tau}{T} + a$$

$I_p$  : Peak output current (A)  
 $I_{av}$  : Average output current of specification (A)  
 $I_m$  : Average output current (A)  
 $\tau$  : Pulse width of peak output current (sec)  
 (Operating time at peak output)  
 T : Period (sec)

## VS150P Specifications

| ITEMS/UNITS |                                         | MODEL        | VS150P-24                                                                             |
|-------------|-----------------------------------------|--------------|---------------------------------------------------------------------------------------|
| Input       | Voltage Range                           | (*3) V       | AC85-132 or DC110-175                                                                 |
|             | Frequency                               | (*3) Hz      | 47 - 440                                                                              |
|             | Efficiency (typ)                        | (*2) %       | 86.0                                                                                  |
|             | Current (typ)                           | (*2) A       | 3.6                                                                                   |
|             | Inrush Current (100VAC)(typ)            | (*4) A       | 20A                                                                                   |
|             | Leakage Current                         | (*11) mA     | Less than 0.75                                                                        |
| Output      | Nominal Voltage                         | VDC          | 24                                                                                    |
|             | Minimum Current                         | A            | 0                                                                                     |
|             | Average Current                         | A            | 6.3                                                                                   |
|             | Maximum Peak Current                    | (*1) A       | 12                                                                                    |
|             | Average Power                           | W            | 151.2                                                                                 |
|             | Maximum Peak Power                      | (*1) W       | 288                                                                                   |
|             | Maximum Line Regulation                 | (*5)(*6) mV  | 96                                                                                    |
|             | Maximum Load Regulation                 | (*5)(*7) mV  | 150                                                                                   |
|             | Temperature Coefficient                 | (*5)(*8) mV  | 240                                                                                   |
|             | Maximum Ripple & Noise (0≤Ta≤60°C)(*5)  | mVp-p        | 180                                                                                   |
|             | Maximum Ripple & Noise (-10≤Ta<0°C)(*5) | mVp-p        | 240                                                                                   |
|             | Hold-up Time (typ)                      | (*2)(*13) ms | 17                                                                                    |
|             | Voltage Adjustable Range                | VDC          | 21.6 - 26.4                                                                           |
| Function    | Over Current Protection                 | (*9) A       | >12.3 at Ta=25°C                                                                      |
|             | Over Voltage Protection                 | (*10)        | 115% - 135%                                                                           |
|             | Parallel Operation                      |              | -                                                                                     |
|             | Series Operation                        |              | Possible                                                                              |
| Environment | Operating Temperature                   | (*12) °C     | Convection: -10 to 50: 100%, 60: 50%<br>Forced Air: -10 to 50: 100%, 60: 70%          |
|             | Storage Temperature                     | °C           | -30 to +85                                                                            |
|             | Operating Humidity                      | %RH          | 30 - 90 (No dewdrop)                                                                  |
|             | Storage Humidity                        | %RH          | 10 - 95 (No dewdrop)                                                                  |
|             | Vibration                               |              | At no operating, 10-55Hz (sweep for 1min) 19.6m/s² constant, X,Y,Z<br>1hour each      |
|             | Shock                                   |              | Less than 196.1m/s²                                                                   |
| Isolation   | Cooling                                 |              | Convection & forced air cooling (depends on o/p loading)                              |
|             | Withstand Voltage                       |              | Input-Output : 2kVAC(20mA), Input-FG : 2kVAC(20mA)<br>Output-FG : 500VAC(100mA) 1min. |
|             | Isolation Resistance                    |              | More than 100MΩ at Ta:25°C and 70%RH Output-FG 500VDC                                 |
| Standards   | Safety Standards                        |              | Approved by UL60950-1, CSA C22.2 No.60950-1, EN60950-1. Built to meet DENAN.          |
|             | EMI                                     | (*13)        | Built to meet FCC-B, VCCI-B                                                           |
| Mechanical  | Weight (typ)                            | g            | 480                                                                                   |
|             | Size (W x H x D)                        | mm           | 75 x 33 x 222                                                                         |

(\*1) Operating time at peak output current is less than 10 sec. with average output power and current (Duty=0.35). Please refer to Fig.A.

(\*2) At 100VAC and average output power, Ta=25°C.

(\*3) For cases where conformance to various safety specs are required to be described as 100-120VAC, 50/60Hz on name plate.

(\*4) Not applicable for the inrush current to noise filter for less than 0.2ms.

(\*5) Please refer to Fig B for measurement determination of line & load regulation and output ripple voltage.

(\*6) 85-132VAC, constant load.

(\*7) Min load - full load (average output power), constant input voltage.

(\*8) -10 to +50°C constant input voltage and load.

(\*9) Current limiting with automatic recovery. Avoid to operate at over load or dead short for more than 30 seconds.

(\*10) OVP circuit will shutdown output, manual reset (re power on).

(\*11) Measured by each measuring method of UL, CSA, EN and DENAN (at 60Hz).

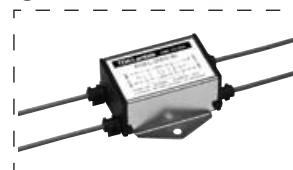
(\*12) At standard mounting method Fig C. Refer to derating curve.

- Load(%) is percent of average output load.

Do not exceed derating in both average output power and current.

(\*13) At 6.3A continuous output current condition.

### Recommended EMC Filter



RSEL-2006W

Please refer to "TDK-Lambda EMC Filters" catalog.

Fig.A

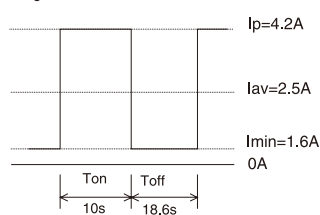


Fig.B

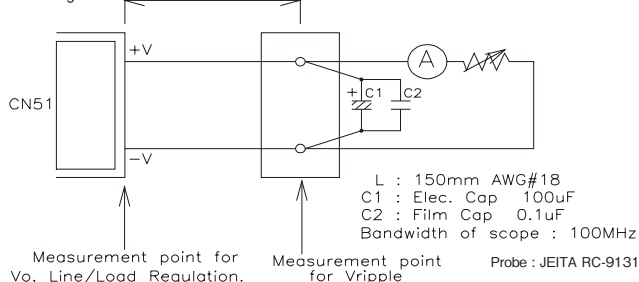
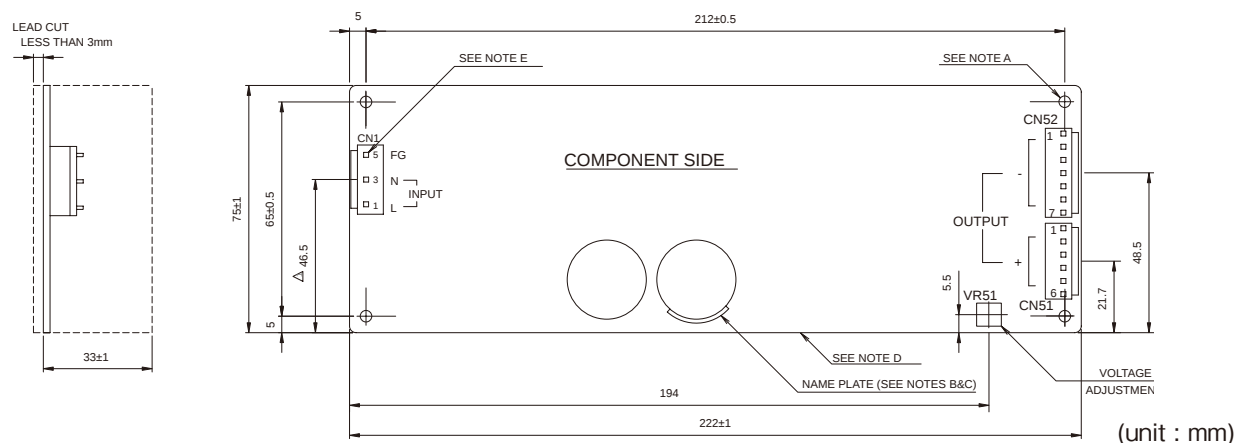


Fig.C



## Outline Drawing

## [VS150P]



## CONNECTORS USED:

| PART DESCRIPTION              | PART NAME | MANUFACTURER | QTY |
|-------------------------------|-----------|--------------|-----|
| PIN HEADER (INPUT SIDE CN1)   | B3P-5-VH  | J.S.T        | 1   |
| PIN HEADER (OUTPUT SIDE CN51) | B6P-VH    | J.S.T        | 1   |
| PIN HEADER (OUTPUT SIDE CN52) | B7P-VH    | J.S.T        | 1   |

\* OUTPUT CURRENT OF EACH CONNECTOR PIN MUST BE LESS THAN 5A.

## MATCHING HOUSINGS &amp; PINS (NOT INCLUDED WITH PRODUCT):

|                             |              |       |    |
|-----------------------------|--------------|-------|----|
| SOCKET HOUSING (CN1)        | VHR-5N       | J.S.T | 1  |
| SOCKET HOUSING (CN51)       | VHR-6N       | J.S.T | 1  |
| SOCKET HOUSING (CN52)       | VHR-7N       | J.S.T | 1  |
| TERMINAL PINS (CN1, 51, 52) | SVH-21T-P1.1 | J.S.T | 16 |

HAND CRIMPING TOOL: YC-160R MANUFACTURER: J.S.T

## PCB MATERIAL

GLASS COMPOSITE : CEM-3

## NOTES

A : 4-φ3.5 HOLES ARE CUSTOMER'S CHASSIS MOUNTING HOLES. ALL MUST BE SCREWED IN ORDER TO CONFORM THE VIBRATION SPEC.

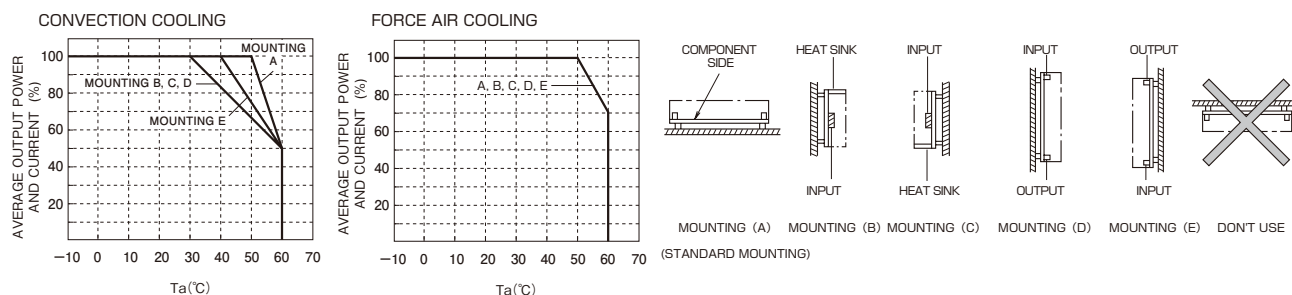
B : MODEL NAME, NOMINAL OUTPUT VOLTAGE, AVERAGE OUTPUT CURRENT AND PEAK OUTPUT CURRENT ARE SHOWN HERE IN ACCORDANCE WITH THE SPECIFICATIONS.

C : COUNTRY OF MANUFACTURE WILL BE SHOWN HERE.

D : TO KEEP THE DISTANCE MORE THAN 2mm BETWEEN PC-BOARD EDGE AND CUSTOMER'S CHASSIS.

E : FG IS FOR SAFETY GROUND CONNECTION.

## Output Derating



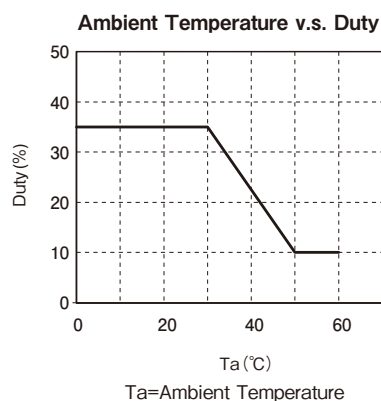
\*Peak output current does not need derating.

\*Peak output current does not need derating

\*Air must flow through component side. (The air velocity is measured at component side of P.C.B)

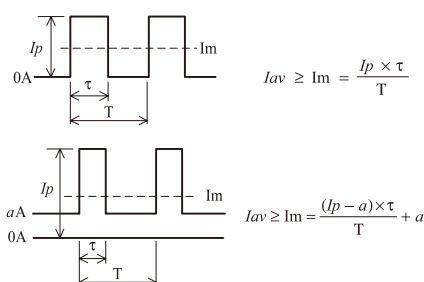
Recommended air velocity : 0.7m/s

## Peak Output Current Condition



## Peak Output Current

Relation between average output current and peak output current must satisfy formulas below. Also operating time at peak output current should be less than 10 sec. When using pulse load, noise may be heard from power supply unit. Please evaluate and check before using.



$I_p$  : Peak output current (A)  
 $I_{av}$  : Average output current of specification (A)  
 $I_m$  : Average output current (A)  
 $\tau$  : Pulse width of peak output current (sec)  
 (Operating time at peak output)  
 $T$  : Period (sec)

## VS-P Series Instruction Manual

## BEFORE USING THE POWER SUPPLY UNIT

Pay attention to all warnings and cautions before using the unit. Incorrect usage could lead to an electric shock, damage to the unit or a fire hazard.

**⚠ WARNING**

- Do not touch the internal components as they may have high voltage or high temperature. You may get electric shock or burned.
- When the unit is operating, keep your hands and face away from it as an accident may injure you.

**⚠ CAUTION**

- This power supply is primarily designed and manufactured to be used and enclosed in other equipment.
- Do not operate overload or dead short condition for more than 30 seconds. Doing so may cause damage or insulation failure. There is no possibility for fire or burning.
- Confirm connections to input/output terminals are correct as indicated in the instruction manual.
- This power supply is PC board type unit. PCB stress such as bending, twisting could cause damage. Therefore, please handle with care.
- When handling, hold the board edge and take care not to touch component side. When mounting power supply unit on

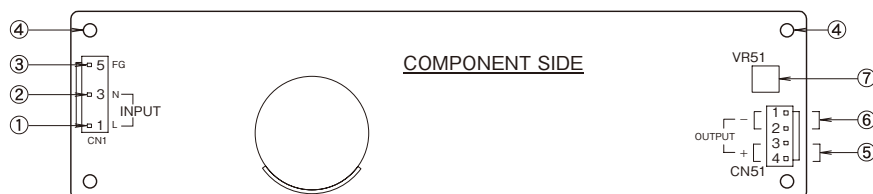
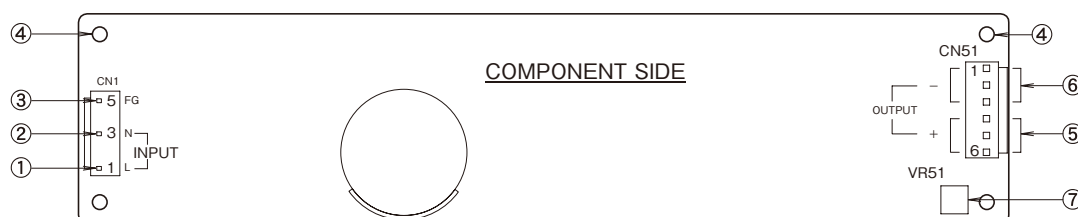
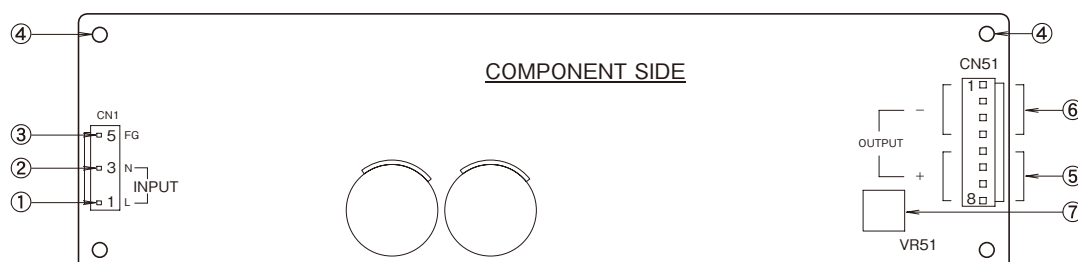
apparatus or equipment, lift the power supply with spacer.

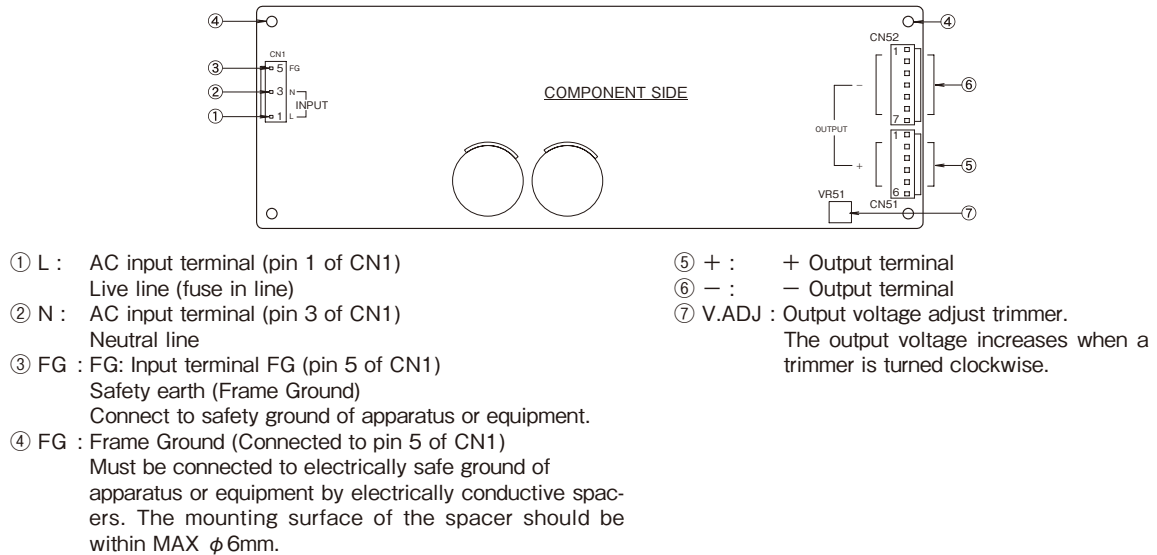
- Do not drop or apply shock to power supply unit.
- Avoid places where the products are subjected to penetration of liquid, foreign substance, or corrosive gas.
- Since the output voltages of VS100P and VS150P are regarded as dangerous energy level (output voltage: more than 2V, output power: more than 240VA), this should not be accessible to end-user. The unit incorporating this product must be protected so that service engineer itself or the tool, which fell at the time of repair, may not accidentally contact the output terminal of this product.
- This power supply has a possibility that hazardous voltage may occur in output terminal depending on failure mode. The outputs of these products must be earthed in the end use equipment to maintain SELV. If the outputs are not earthed, they must be considered hazardous and must not be made user accessible.

**Note: CE MARKING**

CE Marking, when applied to a product covered by this handbook, indicates compliance with the low voltage directive (73/23/EEC) as modified by the CE Marking Directive (93/68/EEC) which complies with EN60950.

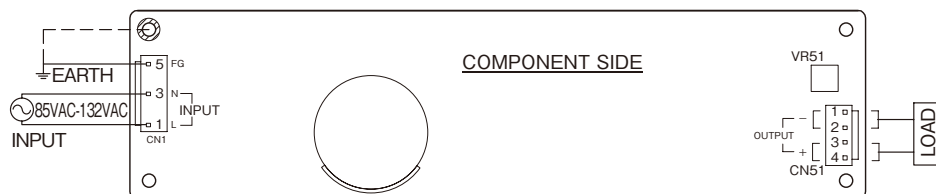
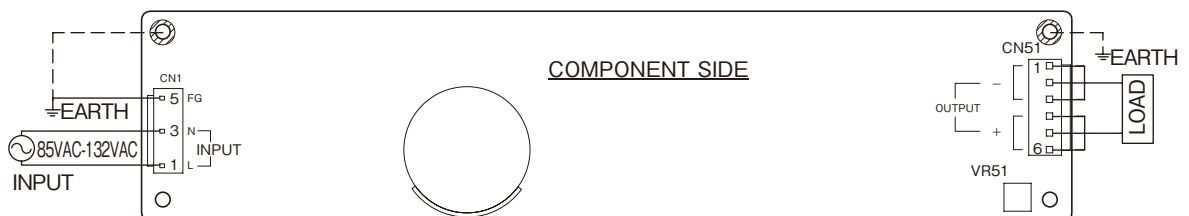
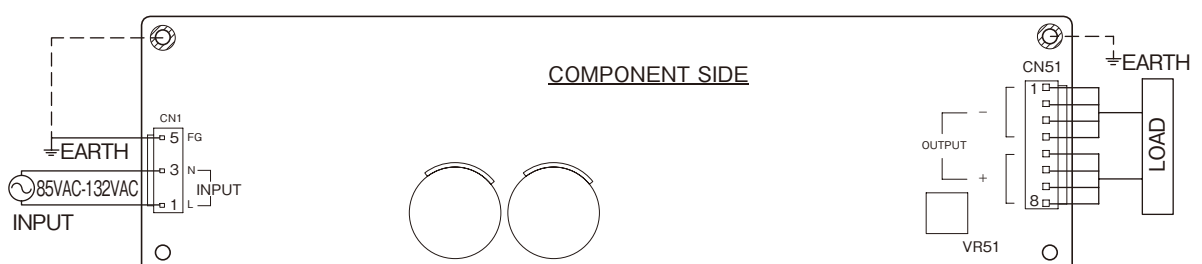
## 1. Terminal Explanation

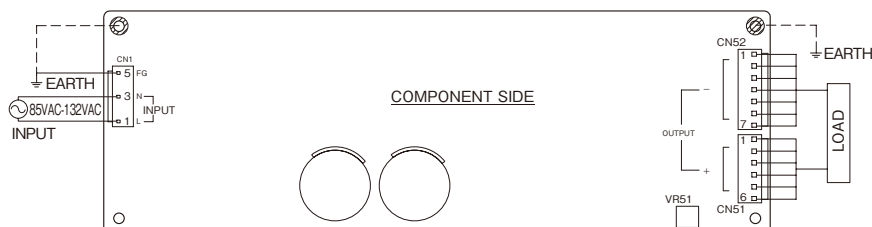
**1 VS50P****2 VS75P****3 VS100P**

**4 VS150P****2. Terminal Connection Method**

Pay attention to the input wiring. If it is connected with 200VAC or other wrong terminal, the power supply will be damaged.

- Input must be off when making connection.
  - Connect FG terminal to ground terminal of the equipment.
  - Output current of each terminal pin must be less than 5A.
  - The output load line and input line shall be separated and twisted to improve noise sensitivity.
  - In connecting or removing connector, do not apply stress to PCB.
  - Use the input/output connector specified in outline drawing. Also, use recommended crimping tool.
- Connector is not included with this product.

**1 VS50P****2 VS75P****3 VS100P**

**4 VS150P**

\* VS-P series input & output connector (J.S.T)

|               | VS50P     |         |              | VS75P     |         |              |
|---------------|-----------|---------|--------------|-----------|---------|--------------|
| Input : CN1   | Connector | Housing | Terminal Pin | Connector | Housing | Terminal Pin |
|               | B3P-5-VH  | VHR-5N  | SVH-21T-P1.1 | B3P-5-VH  | VHR-5N  | SVH-21T-P1.1 |
| Output : CN51 | Connector | Housing | Terminal Pin | Connector | Housing | Terminal Pin |
|               | B4P-VH    | VHR-4N  | SVH-21T-P1.1 | B6P-VH    | VHR-6N  | SVH-21T-P1.1 |

|                       | VS100P    |         |              | VS150P    |         |              |
|-----------------------|-----------|---------|--------------|-----------|---------|--------------|
| Input : CN1           | Connector | Housing | Terminal Pin | Connector | Housing | Terminal Pin |
|                       | B3P-5-VH  | VHR-5N  | SVH-21T-P1.1 | B3P-5-VH  | VHR-5N  | SVH-21T-P1.1 |
| Output : CN51<br>CN52 | Connector | Housing | Terminal Pin | Connector | Housing | Terminal Pin |
|                       | B8P-VH    | VHR-8N  | SVH-21T-P1.1 | B6P-VH    | VHR-6N  | SVH-21T-P1.1 |
|                       | -         | -       | -            | B7P-VH    | VHR-7N  | SVH-21T-P1.1 |

CN52 is used only for VS150P  
Hand Crimping Tool : YC-160R (J.S.T)

## 3. Explanation of Functions and Precautions

### 1 Input Voltage Range

Input voltage range is single phase 85~132VAC (47~440Hz) or 110~175VDC. Input voltage, which is out of specification, may cause unit damage. Rated input voltage range when applying for various safety specs (UL, CSA, EN) will be 100~120VAC (50/60Hz).

### 2 Output Voltage Range

Output voltage can be adjusted within the rated range by V.ADJ trimmer (VR51) located near the output connector. Output voltage range is within  $\pm 10\%$  of rated output voltage. By turning the trimmer clockwise, the output voltage can be increased. Please be careful not to increase output voltage excessively as over voltage protection (OVP) function might be activated.

### 3 Inrush Current

This series has built-in inrush current protection circuit. Since VS50P, VS75P employ power thermistor inrush current protection circuit, inrush current becomes large at high temperature or during re-input after the operation. VS100P, VS150P employ Triac as protection circuit. Please be careful when selecting the input switch and the external fuse.

### 4 Over Voltage Protection (OVP)

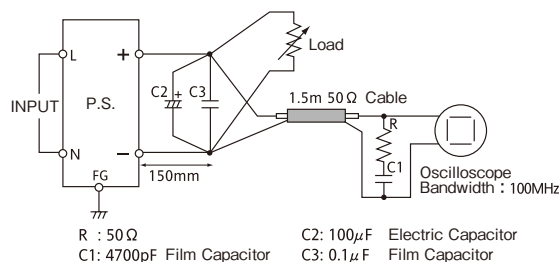
The OVP function (inverter shut down method, manual reset type) is provided. OVP function operates within 115-135 % of rated output voltage. When OVP operated, the output voltage will be shut down. After cutting input voltage for a few minutes, please re-input for recovery of the output voltage. OVP setting can not be changed, since it is fixed.

### 5 Over Current Protection (OCP)

Constant current limiting, automatic recovery. OCP function operates when the output current exceeds 102% of peak output current of specification. The output voltage will be automatically recovered when the overload condition is removed. Do not operate in overload or dead short conditions for more than 30 seconds. It could result in damage.

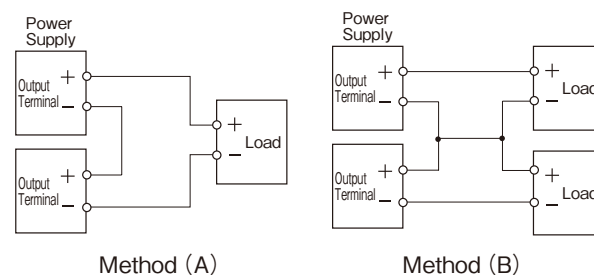
### 6 Output Ripple & Noise

The maximum ripple value of a specification standard is measured according to measurement circuit specified by JEITA-RC9131. When load lines are longer, ripple becomes larger. In this case, it is better to connect electrolytic capacitor, film capacitor, etc., across the load terminal. The output ripple can not be measured accurately if the probe ground of oscilloscope is too long.



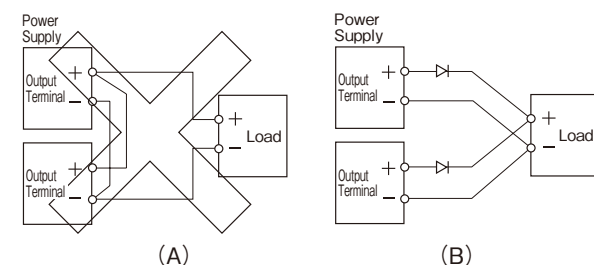
### 7 Series Operation

Following series operation (A) or (B) is possible.



### 8 Parallel Operation

- (A) Increasing the output current by parallel operation is not possible.
- (B) Using as Back-up Power Supply is possible.
  - Set power supply output voltage higher for the forward voltage drop ( $V_F$ ) of diode.
  - Adjust the output voltage of each power supply to be the same.
  - Use output voltage and average output power within the specifications.



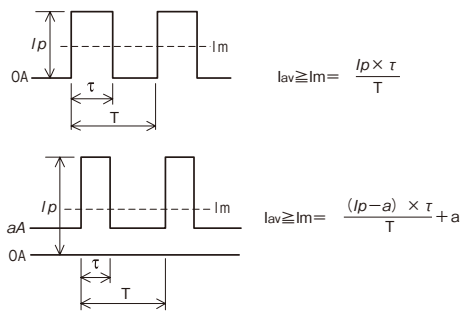
### 9 Peak Output Current

Output current can cope with peak current loads. Specified maximum average output current and peak output current must satisfy formulas below. During peak current operations, maximum allowable average current value must not be exceeded. Allowable peak output operating duration is less than 10sec.

Moreover, please use according to following peak output current duty derating.

When using pulse load, noise may be heard from power supply unit. Please evaluate and check before using.

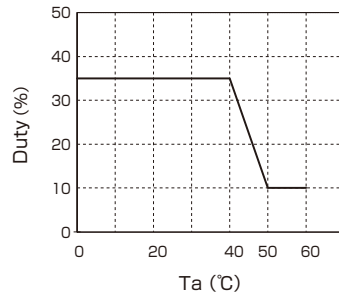
• All specifications are subject to change without notice.



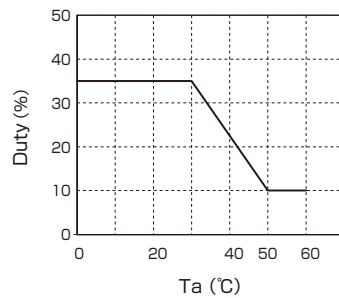
$I_p$  : Peak output current (A)  
 $I_{av}$  : Average output current (A)  
 (Average output current of specification)  
 $I_m$  : Average output current (A)  
 $\tau$  : Pulse width of peak output current (sec)  
 (Operating time at peak output)  
 $T$  : Period (sec)

#### Peak Duty Derating

##### [VS50P]

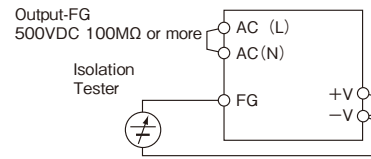


##### [VS75P, VS100P, VS150P]



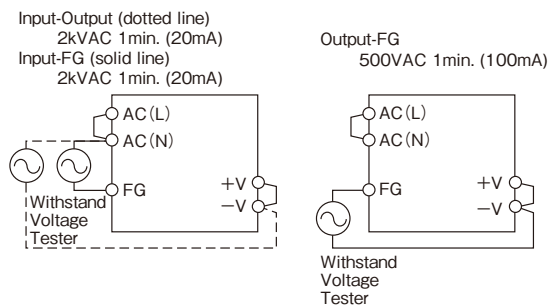
## 10 Isolation Test

Isolation resistance between output and FG shall be more than 100M $\Omega$  at 500VDC. For safety operation, voltage setting of DC isolation tester must be done before the test. Additionally, make sure you discharge sufficiently by resistance etc., after the test.



## 11 Withstand Voltage

This series can withstand 2.0kVAC between input and output, 2.0kVAC between input and FG, and 500VAC between output and FG, each for 1 minute. When testing withstand voltage, set current limit of withstand voltage test equipment at 20mA. The test voltage must be gradually increased from zero to testing value. And gradually decrease also for shut down. When timer is used, the power supply may be damaged by high impulse voltage generated during applying or shutting off voltage. Connect input side and output side as follows. When output is left open during tests, output voltage might appear momentarily.

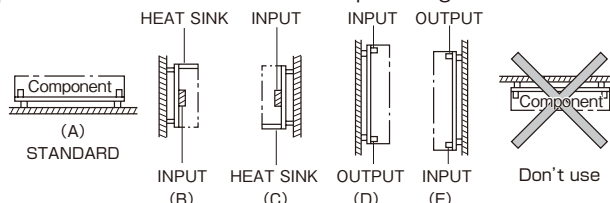


## 4. Mounting Directions

### 1 Output Derating according to the Mounting Directions

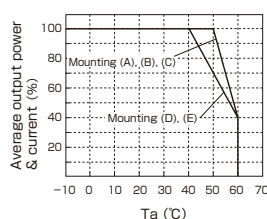
Recommended standard mounting method is (A). Method (B), (C), (D), and (E) are also possible. Refer to the derating below. Please do not use installation method (F).

The following derating values are maximum average output power and current values at rated output voltage as 100%.



#### Output Derating (Convection cooling)

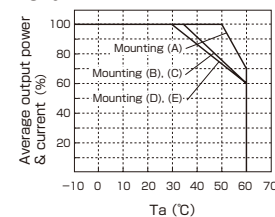
##### VS50P



##### VS50P Output Derating

|              |       | Average output power & current (%) |     |     |     |     |
|--------------|-------|------------------------------------|-----|-----|-----|-----|
| Mounting     | $T_a$ | A                                  | B   | C   | D   | E   |
| -10 to +40°C |       | 100                                | 100 | 100 | 100 | 100 |
| +50°C        |       | 100                                | 100 | 100 | 70  | 70  |
| +60°C        |       | 40                                 | 40  | 40  | 40  | 40  |

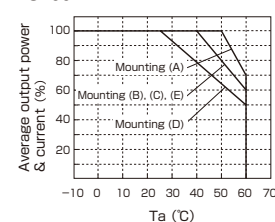
##### VS75P



##### VS75P Output Derating

|              |       | Average output power & current (%) |     |     |      |     |
|--------------|-------|------------------------------------|-----|-----|------|-----|
| Mounting     | $T_a$ | A                                  | B   | C   | D    | E   |
| -10 to +30°C |       | 100                                | 100 | 100 | 100  | 100 |
| +35°C        |       | 100                                | 100 | 100 | 93.3 | 100 |
| +50°C        |       | 100                                | 76  | 76  | 73.3 | 76  |
| +60°C        |       | 70                                 | 60  | 60  | 60   | 60  |

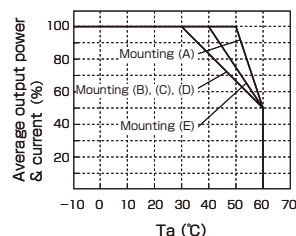
##### VS100P



##### VS100P Output Derating

|              |       | Average output power & current (%) |     |     |      |      |
|--------------|-------|------------------------------------|-----|-----|------|------|
| Mounting     | $T_a$ | A                                  | B   | C   | D    | E    |
| -10 to +25°C |       | 100                                | 100 | 100 | 100  | 100  |
| +40°C        |       | 100                                | 100 | 100 | 78.6 | 78.6 |
| +50°C        |       | 100                                | 80  | 80  | 64.3 | 64.3 |
| +60°C        |       | 70                                 | 60  | 60  | 50   | 50   |

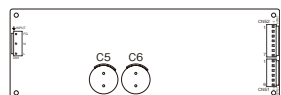
VS150P



VS150P Output Derating

| Mounting<br>Ta | Average output<br>power & current (%) |      |      |      |     |
|----------------|---------------------------------------|------|------|------|-----|
|                | A                                     | B    | C    | D    | E   |
| -10 to +30°C   | 100                                   | 100  | 100  | 100  | 100 |
| +40°C          | 100                                   | 83.4 | 83.4 | 83.4 | 100 |
| +50°C          | 100                                   | 66.7 | 66.7 | 66.7 | 75  |
| +60°C          | 50                                    | 50   | 50   | 50   | 50  |

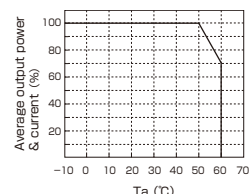
### Output Derating (Forced air cooling)



For forced air cooling, airflow of more than 0.7m/s is needed for component side.

As reference, air-cool such that E-cap. (C6) temperature becomes lower than 75°C.

VS150P



VS150P Output Derating

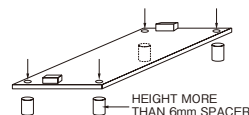
| Mounting<br>Ta | Average output<br>power & current (%) |  |
|----------------|---------------------------------------|--|
|                | A,B,C,D,E                             |  |
| -10 to +50°C   | 100                                   |  |
| +55°C          | 85                                    |  |
| +60°C          | 75                                    |  |

## 2 Mounting Method

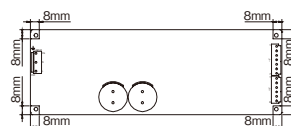
Please use the mounting hole as:

VS50P - VS150P: 4 holes of  $\phi 3.5$

Insert the spacer (MAX  $\phi 6$ mm) of height over 6mm to lift the unit. Also use all 4 mounting holes for the unit installation. The vibration specification is the value taken when the unit is raised by 6mm spacers.

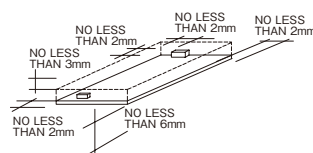


Also, allowable area for metal pieces is 8mm from each PCB corners. Refer to figure below.

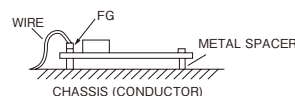


When mounting this unit (PCB), please allot space to satisfy isolation and withstand voltage specifications. Furthermore, for convection cooling, component side ventilation is necessary.

Please allot more than 2mm space from the surfaces and the sides of PCB. Additionally, 6mm space is necessary from the solder surface. If the space is not enough, the specification of insulation and withstand will not be satisfied.



FG should be connected to the earth terminal of the apparatus. If not, the returned noise of input, and output noise will increase.



## 5. Wiring Method

- The input and output lines should be separated and twisted to reduce noise sensitivity.
- The input and output lines should be as thick and short as possible to reduce impedance.
- Noise can be eliminated by attaching a capacitor to the load terminals.

- For safety and EMI, FG terminal must be connected to ground terminal of equipment using thick wires.
- Recommended screw torque is 0.49N·m (5kg.cm).
- Select wire materials suitable for connector as follows.  
INPUT: VS50P-150P---AWG#22-#18  
OUTPUT: VS50P-150P---AWG#22-#18

## 6. External Fuse Rating

Please refer to the following fuse rating when selecting the external fuses that is used on input line. Surge current flows when input voltage is applied to line. Therefore, use slow-blow fuse or time-lag fuse. Do not use fast-blow fuse. Fuse rating is specified by in-rush current value by applying input voltage. Do not select the fuse from input current (rms.) values of the

actual load condition.

VS50P: 4.0A  
VS75P: 5.0A  
VS100P: 5.0A  
VS150P: 6.3A

## 7. Before concluding that the unit is at fault...

Before concluding that the unit is at fault, make the following checks.

- Check if the rated input voltage is connected.
- Check if the wiring of input and output is correct.
- Check if the wire material is not too thin.
- Check if the output voltage trimmer (V.ADJ) is properly adjusted.
- Check if the output current and output power are not used over specification.

- Audible noise may be heard during dynamic-load operation.
- Ensure that a large capacitor is not connected on the output side.

Please use within maximum capacitance shown below.

VS50P: 10,000  $\mu$ F  
VS75P: 30,000  $\mu$ F  
VS100P: 30,000  $\mu$ F  
VS150P: 30,000  $\mu$ F

## 8. Notes

1. Overvoltage Category II

2. Radio Interference Suppression Test is not performed.