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9. SMD type (option S) package information
1 Connection for Standard Use

In order to use the power supply, it is necessary to wire as shown in Fig.1.1.

- Reference: 2 "Wiring Input/Output Pin"
- 8 "Temperature of measurement point"

Short the following pins to turn on the power supply.
- \(-\text{VIN}\), \(+\text{VOUT}\), \(+\text{S}\), \(-\text{VOUT}\), \(-\text{S}\)

The CHS series handle only the DC input. Avoid applying AC input directly. It will damage the power supply.

Table 1.1 Recommended External capacitor on the input side

<table>
<thead>
<tr>
<th>Model</th>
<th>CHS12024</th>
<th>CHS30024</th>
<th>CHS40024</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cin</td>
<td>220(\mu)F or more</td>
<td>660(\mu)F or more</td>
<td>660(\mu)F or more</td>
</tr>
<tr>
<td>Model</td>
<td>CHS6048</td>
<td>CHS8048</td>
<td>CHS12048</td>
</tr>
<tr>
<td>Cin</td>
<td>86(\mu)F or more</td>
<td>33(\mu)F or more</td>
<td>47(\mu)F or more</td>
</tr>
<tr>
<td>Model</td>
<td>CHS30048/CHS38048/CHS40048/CHS50048/CHS70048</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cin</td>
<td>200(\mu)F or more</td>
<td>400(\mu)F or more</td>
<td></td>
</tr>
</tbody>
</table>

2 Wiring Input/Output Pin

2.1 Wiring input pin

1) External fuse
- Fuse is not built-in on input side. In order to protect the unit, install the normal-blow type fuse on input side.
- When the input voltage from a front end unit is supplied to multiple units, install the normal-blow type fuse in each unit.

Table 2.1 Recommended fuse (Normal-blow type)

<table>
<thead>
<tr>
<th>Model</th>
<th>CHS60</th>
<th>CHS80</th>
<th>CHS120</th>
<th>CHS200</th>
<th>CHS300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage [V]</td>
<td>-</td>
<td>-</td>
<td>15A</td>
<td>-</td>
<td>20A (05/10/12/15)</td>
</tr>
<tr>
<td>24</td>
<td>5A</td>
<td>7A</td>
<td>10A</td>
<td>15A</td>
<td>15A</td>
</tr>
<tr>
<td>48</td>
<td>20A</td>
<td>20A</td>
<td>30A</td>
<td>30A</td>
<td></td>
</tr>
</tbody>
</table>

2) External capacitor on the input side
- Install an external capacitor Cin, between \(+\text{VIN}\) and \(-\text{VIN}\) input pins for low line-noise and for stable operation of the power supply.
- Capacitance: Refer to Table 1.1
- \(\text{Ta} = -20\text{ to } +85^{\circ}\)C Electrolytic or Ceramic capacitor
- \(\text{Ta} = -40\text{ to } +85^{\circ}\)C Ceramic capacitor
- Cin is within 50mm for pins. Make sure that ripple current of Cin is less than its rating.

3) Recommendation for noise-filter
- Install an external input filter as shown in Fig.2.1 in order to reduce conducted noise. For details refer to our website technical data.

4) Reverse input voltage protection
- Avoid the reverse polarity input voltage. It will damage the power supply.
- It is possible to protect the unit from the reverse input voltage by installing an external diode as shown in Fig.2.2.
2.2 Wiring output pin

■ When the CHS series supplies the pulse current for the pulse load, please install a capacitor Co between +VOUT and -VOUT pins.

Recommended capacitance of Co is shown in Table 2.2, 2.3.

■ If output current decreases rapidly, output voltage rises transiently and the overvoltage protection circuit may operate.

In this case, please install a capacitor Co.

■ Select a high frequency type capacitor. Output ripple and startup waveform may be influenced by ESR-ESL of the capacitor and the wiring impedance.

■ Make sure that ripple current of Co is less than its rating.

Table 2.2 Recommended capacitance Co
(CHS60/CHS80/CHS120/CHS200/CHS300/CHS380)

<table>
<thead>
<tr>
<th>No.</th>
<th>Output voltage</th>
<th>CHS60</th>
<th>CHS80</th>
<th>CHS120</th>
<th>CHS200/ CHS300/ CHS380</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.3V</td>
<td>0 - 20,000μF</td>
<td>0 - 20,000μF</td>
<td>0 - 20,000μF</td>
<td>0 - 40,000μF</td>
</tr>
<tr>
<td>2</td>
<td>5V</td>
<td>0 - 10,000μF</td>
<td>0 - 10,000μF</td>
<td>0 - 10,000μF</td>
<td>0 - 20,000μF</td>
</tr>
<tr>
<td>3</td>
<td>10V</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0 - 2,000μF</td>
</tr>
<tr>
<td>4</td>
<td>12V</td>
<td>0 - 2,200μF</td>
<td>0 - 1,000μF</td>
<td>0 - 2,200μF</td>
<td>0 - 2,200μF</td>
</tr>
<tr>
<td>5</td>
<td>15V</td>
<td>-</td>
<td>-</td>
<td>0 - 2,200μF</td>
<td>0 - 2,200μF</td>
</tr>
<tr>
<td>6</td>
<td>24V</td>
<td>-</td>
<td>-</td>
<td>0 - 1,000μF</td>
<td>0 - 2,200μF</td>
</tr>
<tr>
<td>7</td>
<td>28V</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0 - 2,200μF</td>
</tr>
<tr>
<td>8</td>
<td>32V</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0 - 2,200μF</td>
</tr>
<tr>
<td>9</td>
<td>48V</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0 - 1,000μF</td>
</tr>
</tbody>
</table>

Table 2.3 Recommended capacitance Co
(CHS300/CHS400/CHS500/CHS700)

<table>
<thead>
<tr>
<th>No.</th>
<th>Output voltage</th>
<th>CHS300</th>
<th>CHS400</th>
<th>CHS400/ CHS500</th>
<th>CHS700</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10V</td>
<td>0 - 2,200μF</td>
<td>-</td>
<td>0 - 4,000μF</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>12V</td>
<td>0 - 2,200μF</td>
<td>0 - 4,000μF</td>
<td>0 - 4,000μF</td>
<td>0 - 10,000μF</td>
</tr>
<tr>
<td>3</td>
<td>15V</td>
<td>0 - 2,200μF</td>
<td>0 - 4,000μF</td>
<td>0 - 4,000μF</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>24V</td>
<td>0 - 2,200μF</td>
<td>0 - 3,300μF</td>
<td>0 - 3,300μF</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>28V</td>
<td>0 - 1,000μF</td>
<td>0 - 3,300μF</td>
<td>0 - 3,300μF</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>32V</td>
<td>0 - 1,000μF</td>
<td>0 - 3,300μF</td>
<td>0 - 3,300μF</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>48V</td>
<td>0 - 1,000μF</td>
<td>0 - 2,200μF</td>
<td>0 - 1,000μF</td>
<td>-</td>
</tr>
</tbody>
</table>

Ripple and Ripple Noise are measured, as shown in the Fig.2.3. Cin is shown in Table 1.1.

Fig.2.3 Measuring method of Ripple and Ripple Noise

3 Function

3.1 Overcurrent protection

■ Over Current Protection (OCP) is built-in and works over 105% of the rated current or higher. However, use in an overcurrent situation must be avoided whenever possible.

The output voltage of the power module will recover automatically when the fault causing overcurrent is corrected.

When the output voltage drops after OCP works, the power module enters a “hiccup mode” where it repeatedly turns on and off at a certain frequency.

3.2 Overvoltage protection

■ The overvoltage protection circuit is built-in. The DC input will be shut down if overvoltage protection is in operation.

The output voltage of the power module will recover automatically when the fault causing over voltage is corrected.

Remarks:

Please avoid applying a voltage exceeding the rated voltage to an output pin.

Doing so may cause power supply to malfunction or fail. This could happen when the customer tests the overvoltage performance of the unit.

If this is unavoidable, for example, if you need to operate a motor, etc., please install an external diode on the output pin to protect the unit.

3.3 Thermal protection

■ When the power supply temperature is kept above 120°C, the thermal protection will be activated and simultaneously shut down the output.

The output voltage of the power supply will recover automatically when the unit is cool down.

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When the remote sensing function is not in use, it is necessary to confirm that pins are shorted between +S & +VOUT and between -S & -VOUT.

Wire between +S & +VOUT and between -S & -VOUT as short as possible.

Loop wiring should be avoided. This power supply might become unstable by the noise coming from poor wiring.

(2)When the remote sensing function is in use

+VOUT +S -S -VOUT

Wire as close as possible

When RC is "Low" level, fan out current is 0.1mA typ. When Vcc is applied, use 2.0≤Vcc≤7.0V.

When RC is "Low" level, fan out current is 0.1mA typ. When Vcc is applied, use 4.0≤Vcc≤7.0V.

When remote ON/OFF function is not used, please short between RC and -VIN (-R: open between RC and -VIN).

Table 3.1.1 Specification of Remote ON/OFF(CHS80,CHS200)

<table>
<thead>
<tr>
<th>ON/OFF logic</th>
<th>Between RC and -VIN</th>
<th>Output voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>L level(0 - 0.8V) or short</td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td>H level(2.0 - 7.0V) or open</td>
<td>OFF</td>
</tr>
<tr>
<td>Optional -R</td>
<td>L level(0 - 0.8V) or short</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td>H level(2.0 - 7.0V) or open</td>
<td>ON</td>
</tr>
</tbody>
</table>

When RC is "Low" level, fan out current is 0.1mA typ. When Vcc is applied, use 4.0≤Vcc≤7.0V.

Table 3.1.2 Specification of Remote ON/OFF (CHS60,CHS120,CHS300,CHS380,CHS400,CHS500,CHS700)

<table>
<thead>
<tr>
<th>ON/OFF logic</th>
<th>Between RC and -VIN</th>
<th>Output voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>L level(0 - 0.8V) or short</td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td>H level(4.0 - 7.0V) or open</td>
<td>OFF</td>
</tr>
<tr>
<td>Optional -R</td>
<td>L level(0 - 0.8V) or short</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td>H level(4.0 - 7.0V) or open</td>
<td>ON</td>
</tr>
</tbody>
</table>

When RC is "Low" level, fan out current is 0.1mA typ. When Vcc is applied, use 4.0≤Vcc≤7.0V.

When remote ON/OFF function is not used, please short between RC and -VIN (-R: open between RC and -VIN).

3.5 Remote sensing

(1) When the remote sensing function is not in use

+VOUT +S -S -VOUT

Short at pin root

3.6 Adjustable voltage range

(1) To adjust output voltage

■ Output voltage is adjustable by the external potentiometer.

■ When the output voltage adjustment is used, note that the over voltage protection circuit operates when the output voltage is set too high.

■ If the output voltage drops under the output voltage adjustment range, the Low voltage protection operates.

■ By connecting the external potentiometer (VR1) and resistors (R1, R2), output voltage becomes adjustable, as shown in Fig.3.4. Recommended external parts are shown in Table 3.2.

■ The wiring to the potentiometer should be as short as possible. The temperature coefficient could become worse, depending on the type of a resistor and potentiometer. Following parts are recommended for the power supply.

Resistor---------Metal film type, coefficient of less than ±100ppm/°C

Potentiometer-------Cermet type, coefficient of less than ±300ppm/°C

■ When the output voltage adjustment is not used, open the TRM pin respectively.

■ The change speed of the TRM voltage should be less than 0.15V/ms.

- -U

■ Option "-U" means output is shut down when the abovementioned protection circuit is activated.

If this happens, protection circuit can be inactivated by cycling the DC input power off for at least 1 second or toggling Remote ON/OFF signal.
(2) To decrease output voltage  
By connecting the external resistor (RD), output voltage becomes adjustable to decrease. 

The external resistor (RD) is calculated by the following equation.

(a) Rated output voltage: 3.3 - 15V  
$$RD = \frac{5.11 \Delta}{10.22} \text{[kΩ]}$$

(b) Rated output voltage: 24 - 48V  
$$RD = \frac{1 \Delta}{2} \text{[kΩ]}$$

$$\Delta = \frac{V_{OR} - V_{OD}}{V_{OR}}$$  
$$V_{OR} : \text{Rated output voltage [V]}$$  
$$V_{OD} : \text{Output voltage needed to set up [V]}$$

(3) To increase output voltage  
By connecting the external resistor (RU), output voltage becomes adjustable to increase. 

The external resistor (RU) is calculated by the following equation.

(a) Rated output voltage: 3.3 - 15V  
$$RU = \frac{5.11 \times V_{OR} \times (1+\Delta)}{1.225 \times \Delta} \times \frac{5.11}{10.22} \text{[kΩ]}$$

(b) Rated output voltage: 24 - 48V  
$$RU = \frac{V_{OR} \times (1+\Delta)}{1.225 \times \Delta} \times \frac{1+2 \times \Delta}{\Delta} \text{[kΩ]}$$

$$\Delta = \frac{V_{OU} - V_{OR}}{V_{OR}}$$  
$$V_{OR} : \text{Rated output voltage [V]}$$  
$$V_{OU} : \text{Output voltage needed to set up [V]}$$
Input voltage derating

When input voltage is 18-21.5V DC or 36-44VDC, the output voltage adjustment range becomes as shown in Fig.3.7.

3.7 Isolation

For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage to start (shut down). Avoid using Hi-Pot tester with timer because it may generate voltage a few times higher than the applied voltage at ON/OFF of a timer.

3.8 PMBus interface

•-I (CHS300, CHS400, CHS500)

This option is equipped with a digital PMBus interface. Please contact us about for details.

4 Series and Parallel Operation

4.1 Series operation

Series operation is available by connecting the outputs of two or more power supplies, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

4.2 Parallel operation

•-P (CHS400, CHS500)

This option is for parallel operation.

Sensing and adjustment of the output voltage are not possible at the time of the use with this option.

As variance of output current drew from each power supply is maximum 10%, the total output current must not exceed the value determined by the following equation.

\[
\text{(Output current in parallel operation)} = (\text{the rated current per unit}) \times (\text{number of unit}) \times 0.9
\]

When the number of units in parallel operation increases, input current increases at the same time. Adequate wiring design for input circuitry is required, such as circuit pattern, wiring and current capacity for equipment.

1. Total number of units should be no more than 3 pieces.
2. Thick wire should be used for wiring between the power supply and load, and line drop should be less than 0.3V.
3. Connect each input pin for the lowest possible impedance.
4. When the number of the units in parallel operation increases, input current increases. Adequate wiring design for input circuitry such as circuit pattern, wiring and current for equipment is required.
4.3 Redundancy operation

- Parallel operation is not possible.
- Redundancy operation is available by wiring as shown below.

Even a slight difference in output voltage can affect the balance between the values of $I_1$ and $I_2$.
Please make sure that the value of $I_3$ does not exceed the rated current of the power supply.

$\text{I}_3 \leq \text{the rated current value}$

5 Cleaning

- When cleaning is necessary, clean under the following conditions.
  Method : Varnishing, ultrasonic wave and vapor
  Cleaning agents : IPA (Solvent type)
  Total time : 2 minutes or less
- Do not apply pressure to the lead and name plate with a brush or scratch it during the cleaning.
- After cleaning, dry them enough.

6 Storage method
(CHS series: option S)

- To stock unpacked products in your inventory, it is recommended to keep them under controlled condition, 5-30°C, 60%RH and use them within a year.
- 24-hour baking is recommended at 125°C, if unpacked products were kept under uncontrolled condition, which is 30°C, 60%RH or higher.

Original trays are not heat-resistant. Please move them to heat-resistant trays in preparation to bake.
To check moisture condition in the pack. Silica gel packet has some moisture condition indicator particles.
Indicated blue means good. Pink means alarm to bake it.
- Notification. The tray will be deformed and the power supply might be damaged, if the vacuum pressure is too much to reseal.

7 Safety Considerations

- To apply for safety standard approval using this power supply, the following conditions must be met.
  - This unit must be used as a component of the end-use equipment.
  - The equipment must contain basic insulation between input and output. If double or reinforced insulation is required, it has to be provided by the end-use equipment in accordance with the final build-in condition.
  - Safety approved fuse must be externally installed on input side.

8 Temperature Measurement Location

- It is necessary to note thermal fatigue life by power cycle.
  Please reduce the temperature fluctuation range as much as possible when the up and down of temperature are frequently generated.
- Use with the convection cooling or the forced air cooling.
  Make sure the temperatures at temperature measurement locations shown from Fig.8.2.1 to Fig.8.2.14 below are on or under the derating curve in Fig.8.1.
  Ambient temperature must be kept at 85°C or under.
Fig. 8.1 Derating curve
For option “B” which is used with the convection cooling, forced air cooling or conduction cooling, use the temperature measurement location as shown in Fig.8.2.12 to Fig.8.2.14.

- **Fig.8.2.12 Measurement point (CHS120 option “B” and “BC”)**

- **Fig.8.2.13 Measurement point (CHS200/CHS300/CHS380 option “B” and “BC”)**

- **Fig.8.2.14 Measurement point (CHS400/CHS500/CHS700 option “B” and “BC”)**

- Shown the measurement point for ambient temperature as shown in Fig.8.3.

![Diagram showing measurement points for ambient temperature and airflow](image-url)
These are packed in a tray (Fig.9.1 to Fig.9.3).
Please order “CHS60□□-S”, “CHS80□□-S”, “CHS120□□-S” for tray type packaging.
Capacity of the tray is 15max.
In case of fractions, the units are stored in numerical order.
Fig. 9.3 Delivery package information (CHS120)

Dimensions in mm
Material: Conductive PS

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