CCG 1R5/3
Instruction Manual

BEFORE USING THE POWER SUPPLY

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 power supply 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.
- There are cases where high voltage charge remains inside the product. 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 case as you might get an electric shock or might damage the product. The product has been modified, changed or disassembled will be out of warranty.
- 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.

⚠CAUTION on MOUNTING

- Confirm connections to input terminals, output terminals and signal terminals are correct as indicated in the instruction manual before switching on.
- Input line and output line of mounting board, 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.
- The mounting parts on the bottom side of product are exposed. Take note that do not touch those components when handling.

⚠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.
- For products without built-in protection circuit (element, fuse, etc.), insert fuse at the input to prevent smoke, fire during abnormal operation.
- For externally mounted fuse do not use other fuses aside from our specified and recommended fuse.
- If the externally mounted fuse is blown, do not use the product even after replacing the fuse. There is risk of abnormality inside.
- 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, dust or liquid, 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.
- Take care not to apply external abnormal voltage to the output terminals and signal terminals. Especially, applying reverse voltage or overvoltage more than the rated voltage to the output might cause failure, electric shock or fire.
- Never operate the product under overcurrent or short circuit condition. Insulation failure, or other damages may occur.
- The application circuits and their parameters are for reference only. Be sure to verify effectiveness of these circuits and their parameters before finalizing the circuit design. Moreover, we will not be responsible on application patent or utility model.
- Excessive stress could cause damage. Therefore, please handle with care.
- Use recommended external fuse to each products to ensure safe operation and compliance with the Safety Standards to which it is approved.
- The input power source to this product must have reinforced or double insulation from the mains.
- The output of this product may reach ES3 under fault conditions. The output must be protected in the end equipment to maintain safety level.

⚠Note

- 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.
- If products are exported, please register the export license application etc. by the Government of Japan according to Foreign Exchange and Foreign Trade Control Law.
- The information in the catalog or the instruction manual is subject to change without prior notice. Please refer to the latest version of the catalog or the instruction manual.
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⚠ LONG-TERM STORAGE METHOD AND PERIOD

- Please keep the product in carton box.
- Please do not apply excessive vibration, shock or mechanical stress applied directly to the product.
- Consider storage of the product at normal temperature and humidity avoiding direct exposure to sunlight.
- For long-term storage temperature and humidity, the following conditions shall be used as a guideline :
  Temperature range : 5℃～30℃
  Humidity range : 40%～60%RH
  Please 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.
  For products that have been received for more than 1 year, please check lead oxidation and solderability.
  In addition, MSL (Moisture Sensitivity Level) of SMD type product is equivalent to 1.

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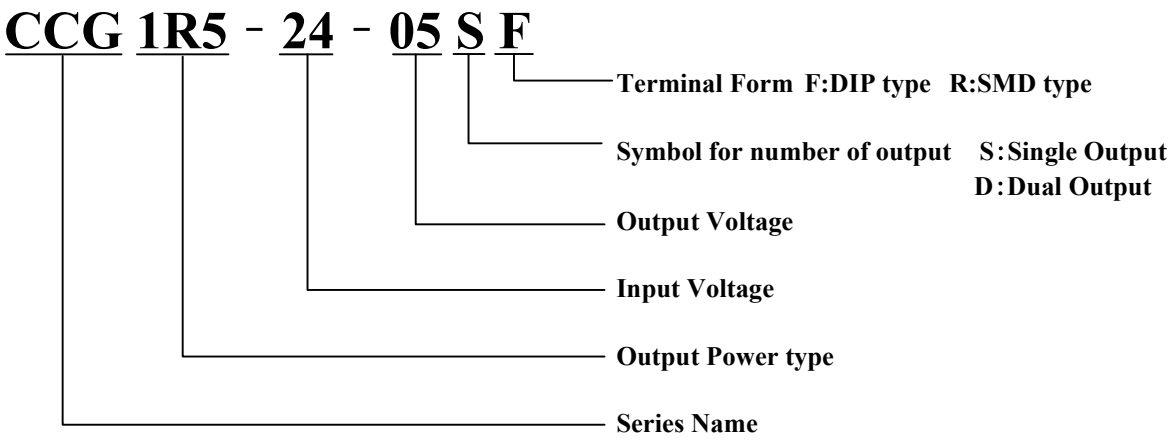
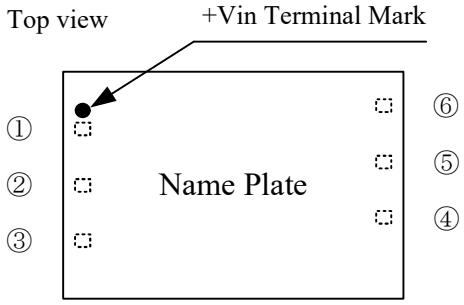
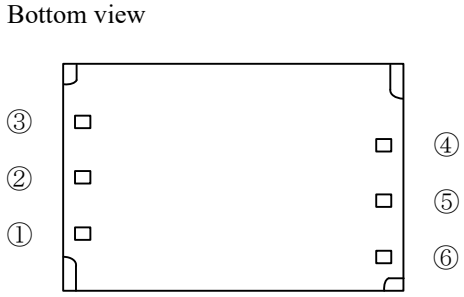
1. Model name identification method



2. Terminal Explanation





CCG-S

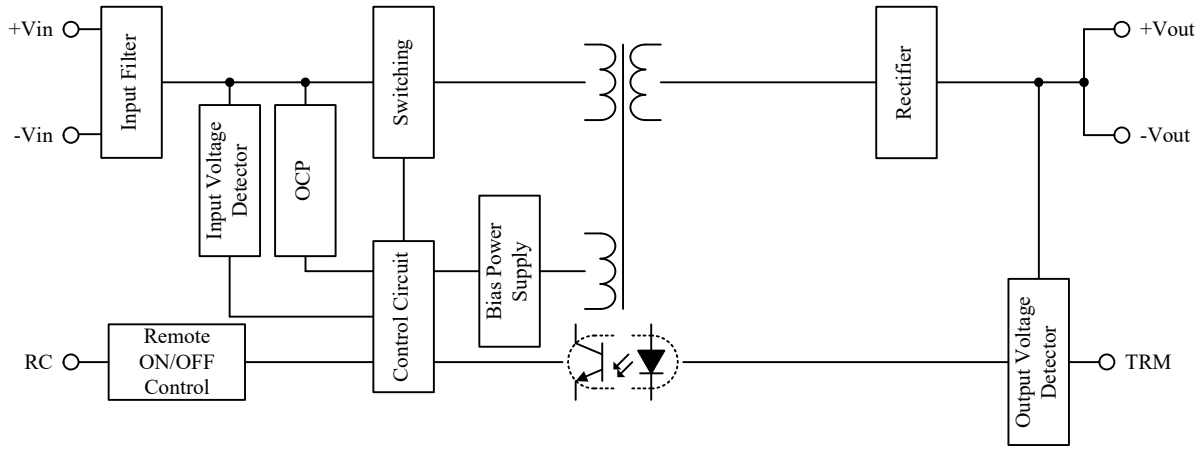
① +Vin : +Input Terminal
② RC : Remote ON/OFF Control Terminal
③ -Vin : -Input Terminal
④ -Vout : -Output Terminal
⑤ TRM : Output Voltage Trimming Terminal
⑥ +Vout : +Output Terminal

CCG-D

① +Vin : +Input Terminal
② RC : Remote ON/OFF Control Terminal
③ -Vin : -Input Terminal
④ -Vout : -Output Terminal
⑤ COM : Common Ground Terminal
⑥ +Vout : +Output Terminal

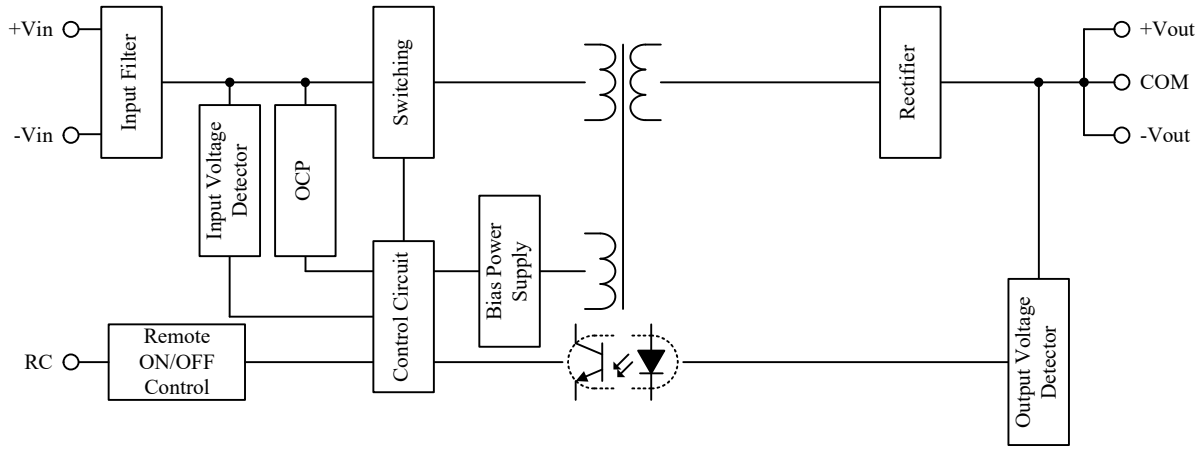
3. Block Diagram

CCG-S (Single Output)



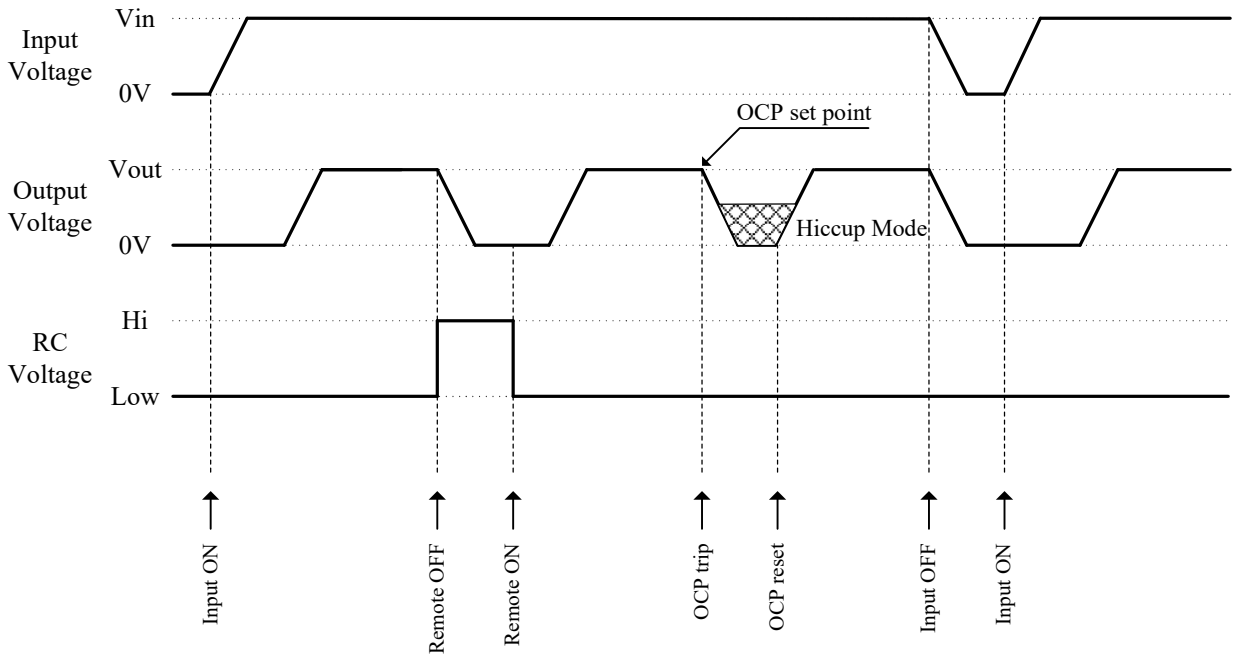
Switching Frequency(fixed) : 400kHz

CCG-D (Dual Output)



Switching Frequency(fixed) : 400kHz

4. Sequence Time Chart



5. Terminal Connecting Method

In order to use the CCG series, this power supply must be connected with external components according to Fig.5-1.
If it is connected to wrong terminal, the power supply will be damaged. Pay attention to each wiring.
External application should be connected in order to meet various EMI and EMS requirement.
Refer to Evaluation data, Reliability data and IEC61000 Test data of CCG1R5/3 (target model).

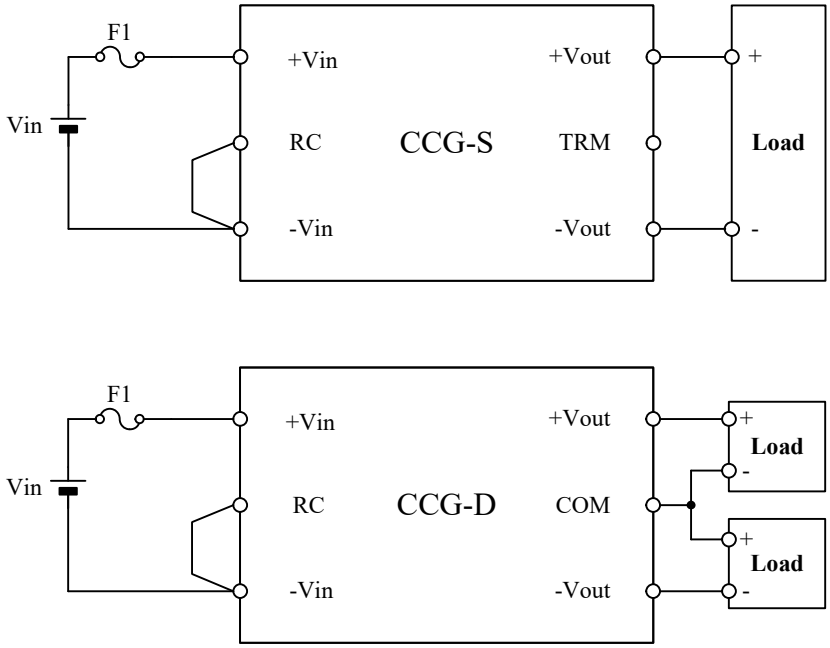


Fig.5-1 Basic connection

F1 : Input Fuse

CCG series has no internal fuse.
Use external fuse for each power supply to comply various Safety Standards and to improve safety.
Select a DC fuse, it must be connected to +Vin side if -Vin side is used as ground, or it must be connected to -Vin side if +Vin side is used as ground.
Consider margin over the maximum input voltage to be actually used when selecting fuse.
Moreover, consider I^2t fuse rating for surge current (inrush current) during line throw-in.
Select the following recommended item or equivalent, and evaluate enough on actual system.

Recommended item and current rating for input fuse

Recommended item DC86V11CT Series (SOC)

CCG1R5-12-xxS/D, CCG3-12-xxS/D : 3.15A or lower
CCG1R5-24-xxS/D, CCG3-24-xxS/D : 1.6A or lower
CCG1R5-48-xxS/D, CCG3-48-xxS/D : 1.25A or lower

● External Input Capacitor

This power supply is capable of operating without external input capacitor.
External capacitor can reduce input ripple voltage and conducted emission noise.
If necessary, add external input capacitor as shown in Fig.5-2.

Note) 1.The operation of power supply may become unstable if inductance of the input line is large when the input line is long or a choke coil is inserted in the line.
For this case, connect a capacitor with sufficiently large capacitance.
The capacitance of external input capacitor is influenced by the impedance characteristics of pattern on printed circuit board and choke coil etc. Please choose it by pre-evaluation sufficiently on actual system.
2.Connect an external capacitor as close to input terminal as possible.

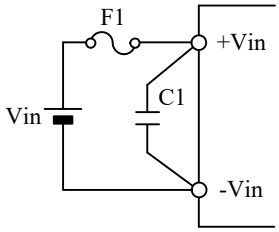


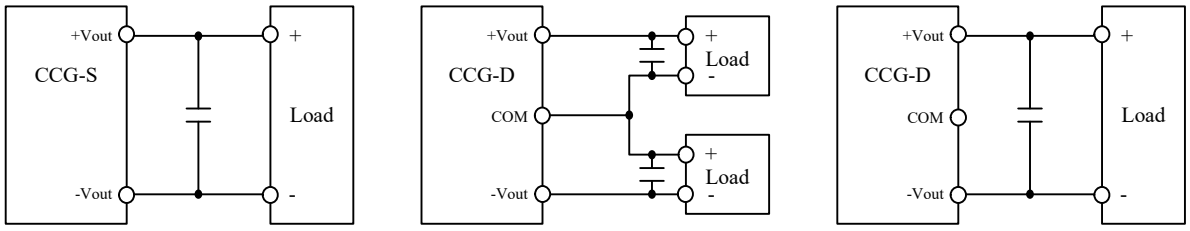
Fig.5-2 The way to connect external input capacitor

● External Output Capacitor

This power supply is capable of operating without external output capacitor.
External output capacitor can reduce output ripple noise and output voltage fluctuation due to sudden change in load current. If necessary, add external output capacitor as shown in Fig.5-3.
Maximum capacitance of external output capacitor is shown in Table 5-1.

Table 5-1 Maximum Capacitance of External Output Capacitor

Output Voltage \ Model	CCG1R5	CCG3	Connection Method
3.3V,5V	220µF	220µF	Fig.5-3(a)
12V,15V	100µF	100µF	
±12V,±15V	100µF	100µF	Fig.5-3(b)
±12V,±15V	47µF	47µF	Fig.5-3(c)



(a)Add to Single Output Model

(b)Add to Dual Output Model (Use as dual output)

(c)Add to Dual Output Model (Use as single output)

Fig.5-3 Adding method of external output capacitor

Note) The operation of power supply may become unstable when connecting external filter circuit with inductance such as choke coil to the output side. Please connect it by pre-evaluation sufficiently on actual system.

● Protection for Reversed Input Connection

Reverse input polarity would cause power supply damage. If there is a possibility of reverse connection, connect a protective diode and fuse as shown in Fig.5-4 or Fig.5-5. Use protective diode with higher voltage rating than the input voltage, and with higher surge current rating than fuse current rating.

The protection circuit as shown in Fig.5-5 can prevent fuse blow when reverse input polarity.

But, please take note that power loss will constantly occur due to conduction of the diode.

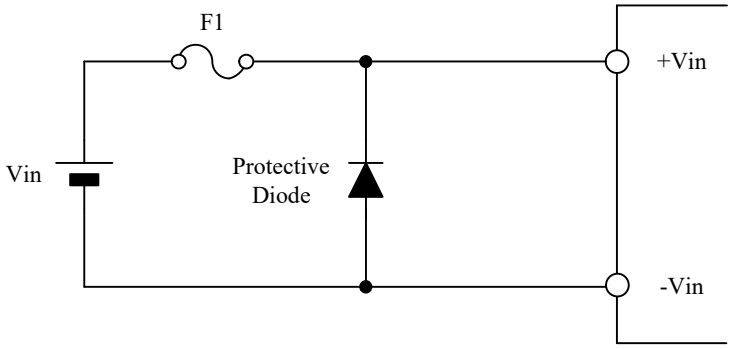


Fig.5-4 Protection for Reversed Input Connection (1)

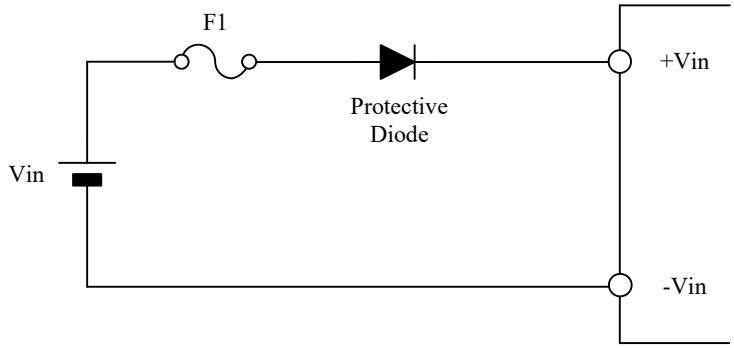


Fig.5-5 Protection for Reversed Input Connection (2)

● Protection of Instantaneous Input Voltage Drop

Note) When instantaneous drop of input voltage is occur, output voltage might become unstable.
In particular, in the case of input voltage recover before output voltage drops to 0V after the input voltage instantaneous drop, the output voltage may overshoot.
In this case, it is possible to stabilize the output voltage by attaching input voltage retention diode and capacitor C1 as shown in Fig.5-6.
The appropriate capacitance value of C1 is influenced by load factor used, capacitance of capacitor connected to output side and expected time that dips or short interruption.
Please choose it by pre-evaluation sufficiently on actual system.
Use input voltage retention diode with higher current rating than fuse current rating.

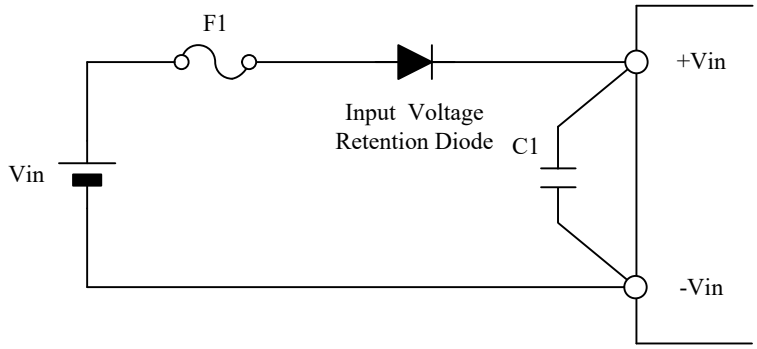


Fig.5-6 Protection of Instantaneous Input Voltage Drop

6. Explanation of Functions and Precautions

6-1.About Input Voltage

● Input Voltage Range

Input voltage range for CCG series is indicated below.

Input Voltage Range
CCGxxx-12-xxS/D : 4.5 ~ 18VDC
CCGxxx-24-xxS/D : 9 ~ 36VDC
CCGxxx-48-xxS/D : 18 ~ 76VDC

Take note that power supply might be damaged when applied input voltage which is out of specified range.
Take note that variation range of the input voltage and maximum and minimum values of ripple voltage do not out of above input voltage range.
Output ripple voltage may increase by level of ripple voltage or frequency about input voltage. So evaluate enough before using on actual system.
Take note that sudden change of input voltage may cause variation of output voltage transitionally.

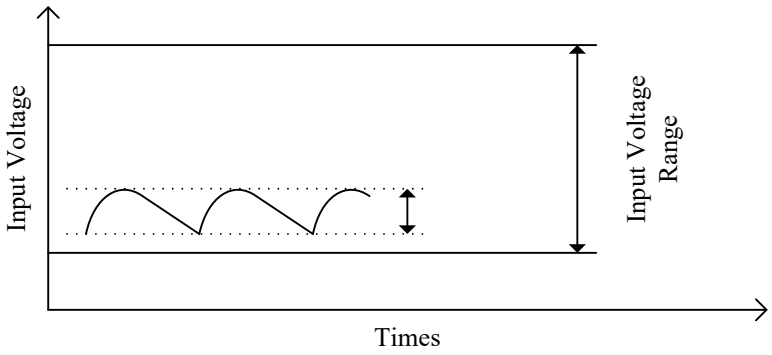


Fig.6-1 Input Ripple Voltage

● About Rise and Fall Slope of Input Voltage

If the input line is directly disconnected / connected by a switch component or other, this product may be damaged due to the generation of excessive surge voltage / current.
In this case, adjust such as adding an input capacitor so that the slope of the input voltage is 0.8V/μs or less or reduce switching speed of switching device.

6-2. Output Voltage Adjustable Range (Only CCG-S)

Output voltage could be adjusted within the range described below by connecting external resistor or variable resistor.
However, take note that power supply might be damaged when output voltage exceeds the range described below.

Output Voltage Adjustable Range : -5% ~ +10% of Nominal Output Voltage

● Output Voltage Adjustment by External Resistor or Variable Resistor

(1) In case of adjusting output voltage lower

(1-1) Maximum output current

Take note that when output voltage is decreased, do not over the maximum output current of specification.

ex)In case of CCG1R5-xx-05S

When setting 5V Model to 4.75V output, maximum output power = 4.75V×0.3A = 1.425W.

(1-2) External resister connecting method

Connect an external resistor or variable resister Ra between TRM and +Vout terminal as shown in Fig.6-2.
To prevent the effect of noise or other, wire as short as possible because TRM terminal is relatively high impedance.
Please refer to Table 6-1 when adjusting output voltage.

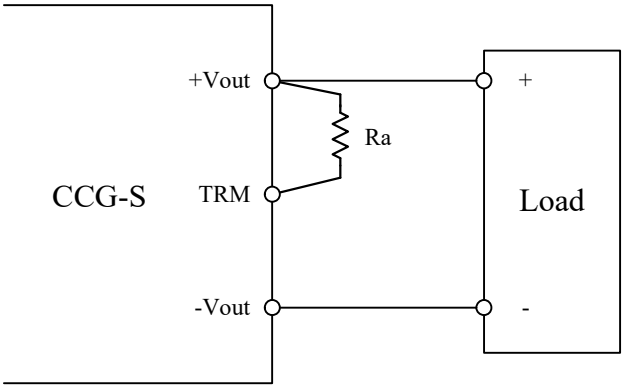


Fig.6-2 Basic Connection for Output Voltage Trim Down

Table 6-1 Equation of External Resistor and Output Voltage

Unit (Output Voltage : Vout [V], External Resistor : Ra [kΩ])

Model	Equation	
CCGxxx-xx-03S	$Vout = 3.31 - \frac{9.31}{16.50 + Ra}$	$Ra = \frac{9.31}{3.31 - Vout} - 16.50$
CCGxxx-xx-05S	$Vout = 5.02 - \frac{31.17}{23.22 + Ra}$	$Ra = \frac{31.17}{5.02 - Vout} - 23.22$
CCGxxx-xx-12S	$Vout = 12.1 - \frac{257.3}{41.7 + Ra}$	$Ra = \frac{257.3}{12.1 - Vout} - 41.7$
CCGxxx-xx-15S	$Vout = 15.2 - \frac{424.6}{48.4 + Ra}$	$Ra = \frac{424.6}{15.2 - Vout} - 48.4$

Output voltage could be adjusted within the -5% of nominal output voltage by external resistor Ra.

(2) In case of adjusting output voltage higher

(2-1) Maximum output current

When increasing the output voltage, reduce the output current accordingly so as not to exceed the maximum output power.

ex)In case of CCG1R5-xx-05S

When setting 5V Model to 5.5V output, maximum output current = 1.5W÷5.5V = 272.7mA.

(2-2) External resister connecting method

Connect an external resistor or variable resister Rb between TRM and -Vout terminal as shown in Fig.6-3.

To prevent the effect of noise or other, wire as short as possible because TRM terminal is relatively high impedance. Please refer to Table 6-2 when adjusting output voltage.

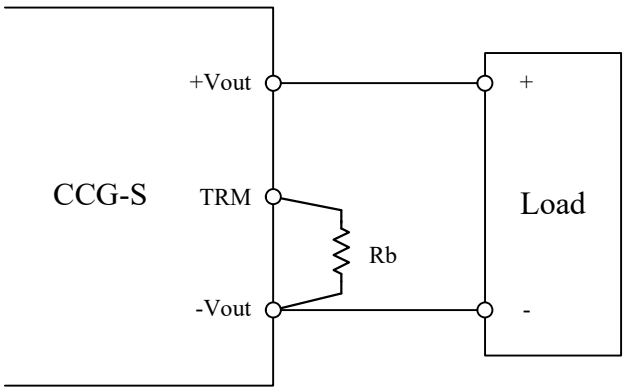


Fig.6-3 Basic Connection for Output Voltage Trim Up

Table 6-2 Equation of External Resistor and Output Voltage

Unit (Output Voltage : Vout [V], External Resistor : Rb [kΩ])

Model	Equation	
CCGxxx-xx-03S	$Vout = 3.31 + \frac{5.58}{12 + Rb}$	$Rb = \frac{5.58}{Vout - 3.31} - 12$
CCGxxx-xx-05S	$Vout = 5.02 + \frac{10.10}{15 + Rb}$	$Rb = \frac{10.10}{Vout - 5.02} - 15$
CCGxxx-xx-12S	$Vout = 12.1 + \frac{29.2}{18 + Rb}$	$Rb = \frac{29.2}{Vout - 12.1} - 18$
CCGxxx-xx-15S	$Vout = 15.2 + \frac{37.4}{18 + Rb}$	$Rb = \frac{37.4}{Vout - 15.2} - 18$

Output voltage could be adjusted within the +10% of nominal output voltage by external resistor Rb.

(3) In case of adjusting output voltage within adjustable range

(3-1) Maximum output current

Take note that when output voltage is decreased, do not over the maximum output current of specification.

When increasing the output voltage, reduce the output current accordingly so as not to exceed the maximum output power.

(3-2) External resister connecting method

Connect an external resistor Ra between +Vout and TRM terminal as shown in Fig.6-4, and connect an external resistor Rb and variable resister VR between TRM and -Vout terminal. To prevent the effect of noise or other, wire as short as possible because TRM terminal is relatively high impedance. Please refer to Table 6-3 when adjusting output voltage. Please refer to Table 6-4 when selecting external resistor.

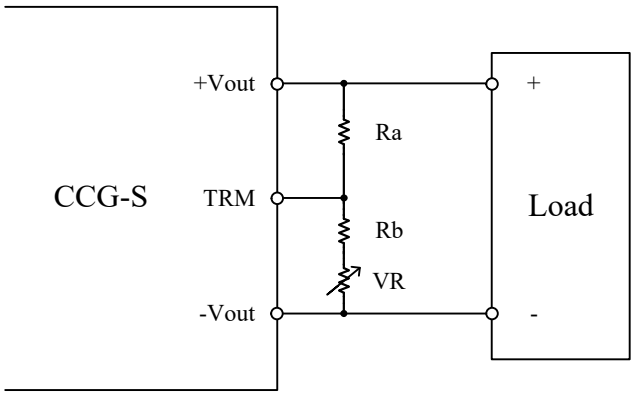


Fig.6-4 Basic connection for adjusting output voltage within adjustable range

Table 6-3 Equation of External Resistor and Output Voltage

Unit (Output Voltage : Vout [V], External Resistor : Ra Rb VR [kΩ])

Model	Equation
CCGxxx-xx-03S	$Vout = 3.31 + \frac{5.58 \times Ra - 9.32 (VR + Rb)}{(Ra + 16.50) (VR + Rb) + 12 \times Ra}$
CCGxxx-xx-05S	$Vout = 5.02 + \frac{10.10 \times Ra - 31.06(VR + Rb)}{(Ra + 23.22) (VR + Rb) + 15 \times Ra}$
CCGxxx-xx-12S	$Vout = 12.1 + \frac{29.2 \times Ra - 257.2 (VR + Rb)}{(Ra + 41.7) (VR + Rb) + 18 \times Ra}$
CCGxxx-xx-15S	$Vout = 15.2 + \frac{37.4 \times Ra - 424.5 (VR + Rb)}{(Ra + 48.4) (VR + Rb) + 18 \times Ra}$

Output voltage could be adjusted within the -5% ~ +10% of nominal output voltage by external resistor Ra, Rb, VR.

Table 6-4 External Resistor (Reference Value)

Model	Ra(kΩ)	Rb(kΩ)	VR(kΩ)
CCGxxx-xx-03S	6.8	0.100	10
CCGxxx-xx-05S	15	0.470	10
CCGxxx-xx-12S	47	0.560	10
CCGxxx-xx-15S	33	0.470	5

6-3. Measurement Method of Output Ripple and Noise

Measurement method of output ripple and noise voltage is shown in Fig.6-5.
Connect ceramic capacitor (C2, C3 : 1μF) at 50mm distance from the output terminal.
Measure at C2 and C3 terminals as shown in Fig.6-5 using coaxial cable with JEITA attachment.
Use oscilloscope with 100MHz frequency bandwidth or equivalent.

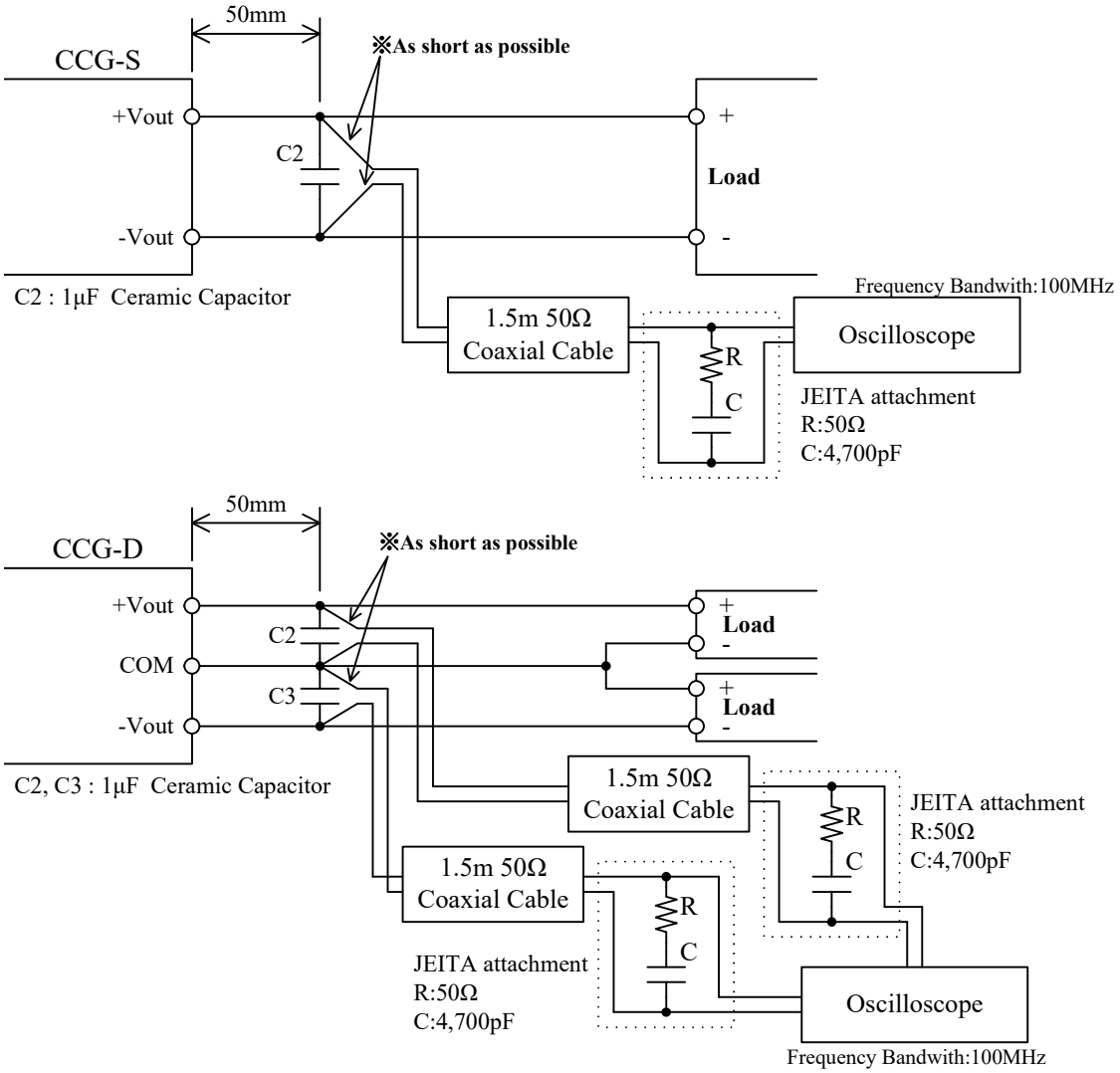


Fig.6-5 Measurement Method of Maximum Output Ripple and Noise

Take note that PCB wiring design might influence output ripple voltage and spike noise voltage.
Generally, increasing capacitance value of external capacitor can reduce output ripple voltage and connecting ceramic capacitor can reduce output spike noise voltage.

6-4. Line Regulation

Line regulation of specification is the variation value of output voltage when input voltage is gradually varied (steady state) within specified input voltage range.
Please consider to connect the protection circuit as shown in Fig.5-6 if there is a possibility that instantaneous drop of input voltage might happen.
A thorough pre-evaluation must be performed before using this power supply.

6-5. Load Regulation

Load regulation of specification is the variation value of output voltage when output current is gradually varied (steady state) within specified output current range.
When using at dynamic load mode, output voltage fluctuation might increase.
Also, when CCG-D is used with unbalanced load, the output voltage with the higher load factor decreases and the output voltage with the lower load factor increases.
A thorough pre-evaluation must be performed before using this power supply.

6-6. Over Current Protection (OCP)

This power supply has built-in OCP function.
When short circuit or output current is in overload condition, it becomes intermittent operation.
Output will recover when short circuit or overload conditions are released.
Take note that power supply might be damaged at continuous overload conditions depending on thermal conditions.

6-7. Remote ON/OFF Control (RC terminal)

The output can be enabled/disabled by RC terminal without turning the input supply on and off.
This function is Negative Logic.
In order to use remote ON/OFF control function, attach transistor, relay or equivalent switch between RC and -Vin terminal as shown in Fig.6-6.
For secondary control, isolation can be achieved through the use of a opto-coupler or equivalent as shown in Fig.6-7.

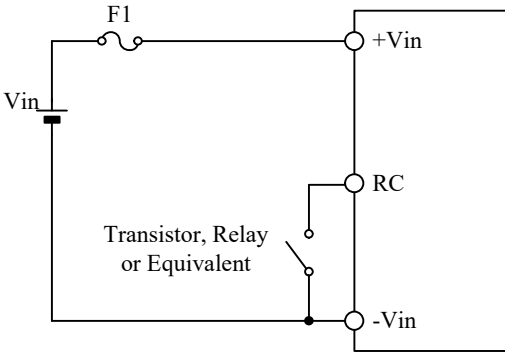


Fig.6-6 RC Connection (1)

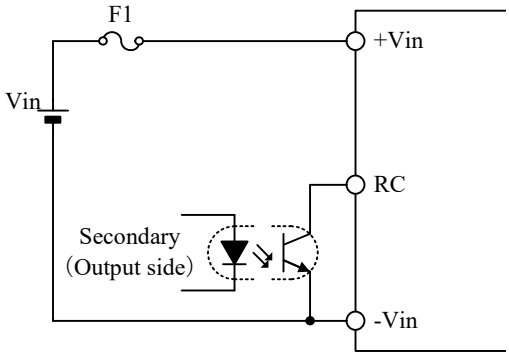


Fig.6-7 RC Connection (2)

Table 6-5 Specification of Remote ON/OFF Control

Connection of RC and -Vin terminal	RC Voltage Range	Output Status
Short	$0V \leqq V_{RC} \leqq 0.5V$	ON
Open	-	OFF

Note) 1. When remote ON/OFF control function is not used, between RC and -Vin terminals should be shorted.
2. In case of applying external voltage into RC terminal, please contact us.
3. When the wiring from RC terminal to -Vin terminal is long or it is affected by noise, attach capacitor between RC terminal and -Vin terminal. The maximum capacitance of it is 1,000pF.
4. When selecting external component for using ON/OFF circuit, refer to Table 6-6.
5. When using opto-coupler for ON/OFF circuit, select one with a small dark current.
Select opto-coupler with a dark current 50uA or less at 25℃ (ambient temperature)
or 100uA or less at 100℃ (ambient temperature).
6. Take note that if control ON operation applied before output voltage drops to 0V after control OFF operation, over shoot may occur in the output voltage.

Table6-6 The Maximum Value of Open Voltage of RC Terminal
and Source Current (when RC Terminal and -Vin Terminal are Shorted).

model	Open Voltage	Source Current
CCGxxx-12-xxS/D	11V	1.5mA
CCGxxx-24-xxS/D CCGxxx-48-xxS/D	6.5V	

6-8. Redundant Operation

Redundant operation is possible for loads that are within the maximum output power of one power supply. When one power supply is shut-down by the power failure etc., another one can continue to provide power.

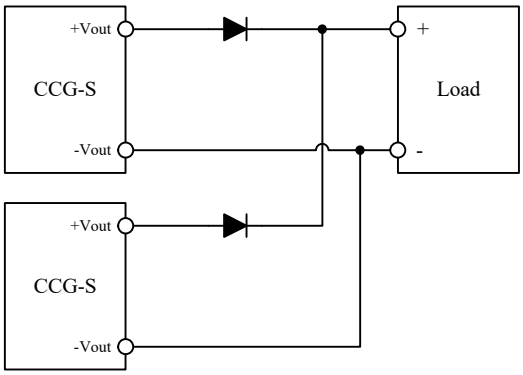


Fig.6-8 Redundant Operation Connection (CCG-S)

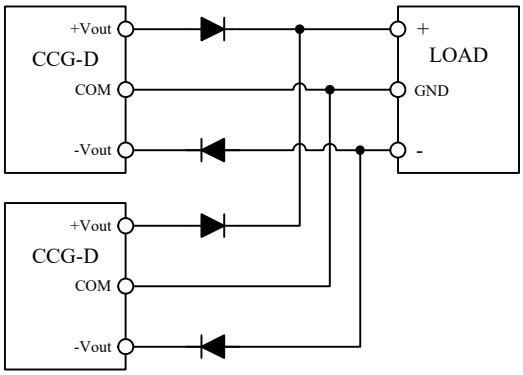


Fig.6-9 Redundant Operation Connection (CCG-D)

6-9. Parallel Operation

Parallel operation cannot be used.

6-10. Series Operation

Series operation is possible for CCG series.
Connections shown in Fig.6-10 and Fig.6-11 are possible.

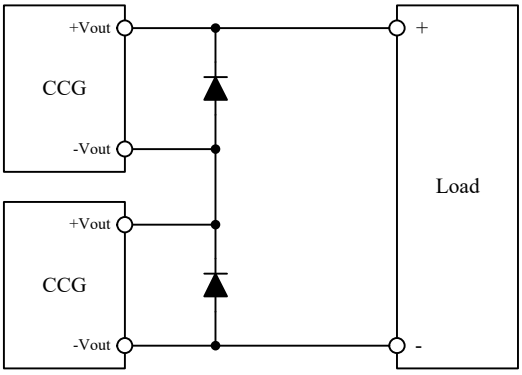


Fig.6-10 Series Operation for High Output Voltage

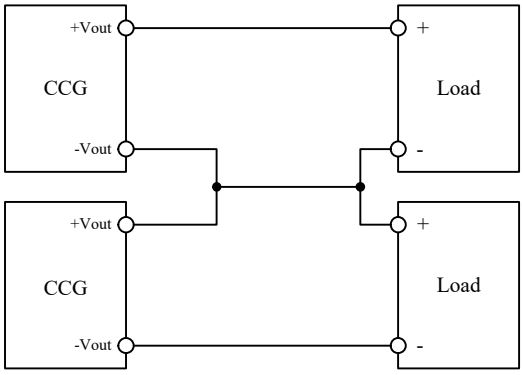


Fig.6-11 ±Output Series Operation

＜Reference＞

CCG-D can be used as 24V or 30V single output by connecting + Vout and -Vout to the load.

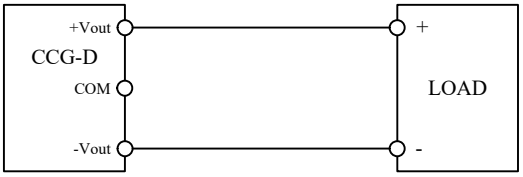


Fig.6-12 Connection when CCG-D single output is used

6-11. Operating Ambient Temperature

Output load needs to be derated depending on the ambient temperature. There is no restriction on mounting direction but there should be enough consideration for airflow so that heat does not accumulate around the power supply vicinity. Determine external components configuration and mounting direction on PCB such that air could flow around the power supply at forced cooling and convection cooling. For better improvement of power supply reliability, derating of ambient temperature is recommended. For details, refer to "7.Output Derating" section.

6-12. Operating Ambient Humidity

Take note that condensation could lead to power supply abnormal operation or damage.

6-13. Storage Ambient Temperature

Take note that sudden temperature change can cause dew condensation.

6-14. Storage Ambient Humidity

Take note that rust would occurred on terminals when stored in high temperature and high humidity environment.

6-15. Withstand Voltage

This power supply is designed to have a withstand voltage of 1.5kVDC or 1.0kVAC between input and output for 1 minute. When conducting withstand voltage test during incoming inspection, set the current limit value of the withstand voltage testing equipment to 20mA. Furthermore, avoid throw in or shut off of the testing equipment when applying or when shutting down the voltage. Instead, gradually increase or decrease the applied voltage. Take note especially when using the timer of the test equipment because when the timer switches the applied voltage off, impulse voltage which has several times the magnitude of the applied voltage is generated causing damage to the power supply. Connect the terminals as shown in Fig.6-13.

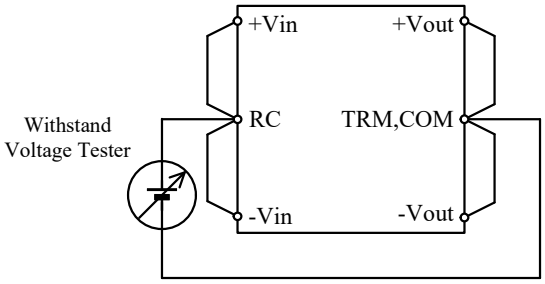


Fig.6-13 Withstand Voltage Test

6-16. Isolation Resistance

Isolation resistance value is 100MΩ and above at 500VDC applied voltage.
Make sure that during testing, the isolation testers do not generate a high pulse when the applied voltage is varied. Ensure that the tester is fully discharged after the test.
Connect the terminals as shown in Fig.6-14.

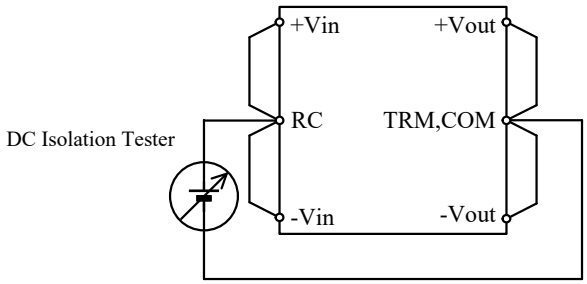


Fig.6-14 Isolation Resistance Test

7. Output Derating

7-1. Output Derating Measurement Method

There is no restriction on mounting direction but there should be enough consideration for airflow so that heat dose not accumulate around the power supply vicinity. Determine external components configuration and mounting direction on PCB such that air could flow around the power supply at forced cooling and conventional cooling. The derating of the output current is necessary when the ambient temperature is high. (See「7-2. Output Derating Curve」.)
Measurement method of Output Current vs. Ambient Temperature is according to Fig.7-1 and Fig.7-2.

When mounting on actual system, do actual measurement based on measurement points shown in Fig.7-1 and Fig.7-2. Moreover take note that component temperature shown in Fig.7-3 not to exceed the criterion value.

(1) Output Current vs. Ambient Temperature Measurement Method (for convection cooling)

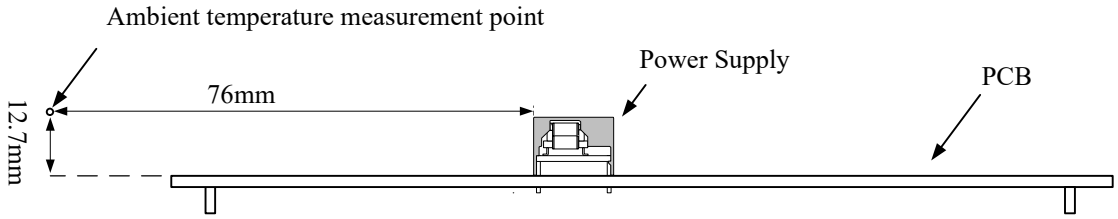


Fig.7-1 Output Current vs. Ambient Temperature Measurement Method (for convection cooling)

(2) Output Current vs. Ambient Temperature Measurement Method (for forced cooling)

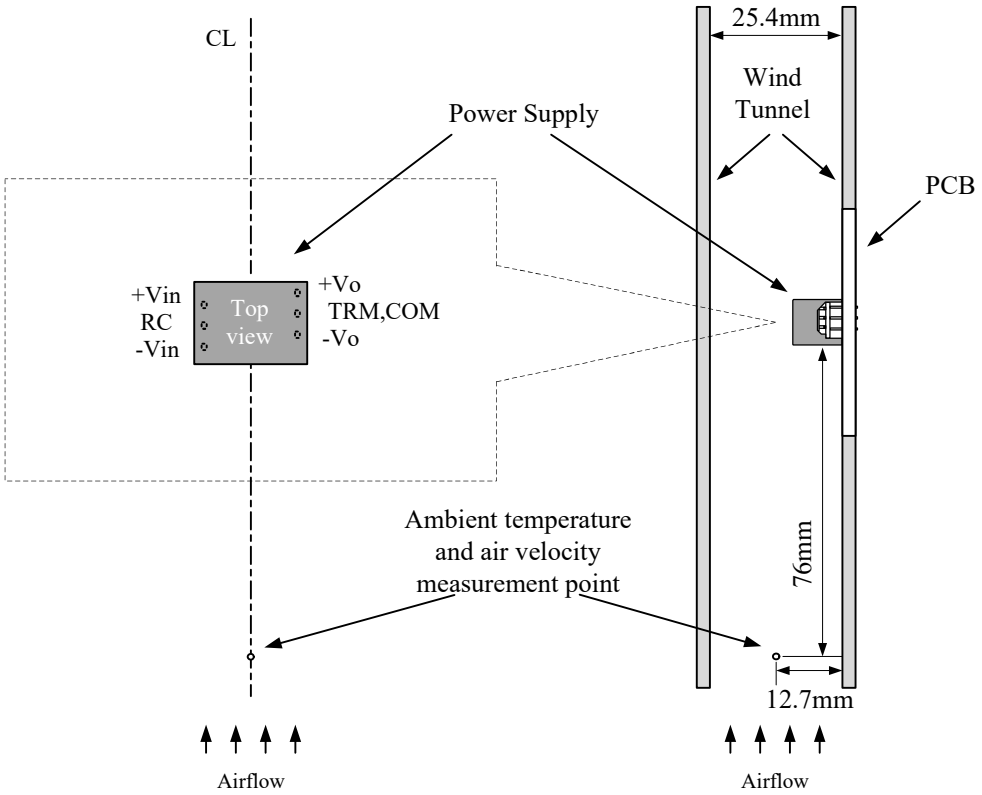


Fig.7-2 Output Current vs. Ambient Temperature Measurement Method (for forced cooling)

(3) Temperature Measurement Points of Component

Confirm the temperature of measurement points (Tc) shown in Fig.7-3 (Center at both sides of transformer core) is below derating curve shown in「7-2. Output Derating Curve」.

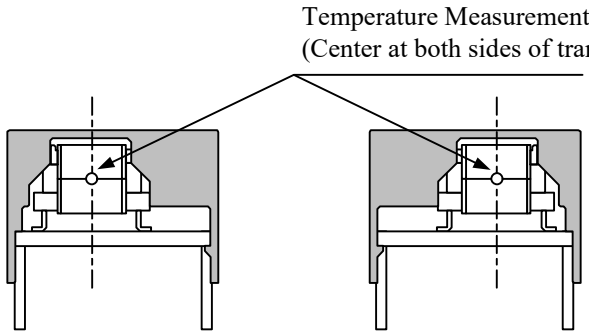


Fig.7-3 Temperature Measurement Point of Component

7-2. Output Derating Curve

Output derating curve described (next page and after) is a measurement data when mounting on our evaluation PCB.

The output derating curve is affected by the mounting board, the external components, and the ambient conditions. Therefore, use it after confirming the temperature that center at both sides of transformer when the power supply operates on actual system does not exceed following derating curve. Moreover, take note that ambient temperature does not exceed following derating curve.

＊Evaluation PCB Specification

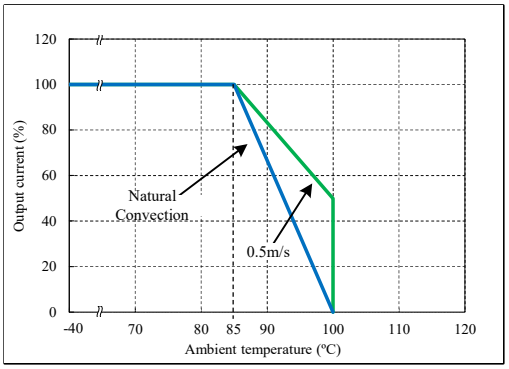
Size	135mm×50mm t = 1.6mm
Material	FR-4 （Double sided）
Copper	18μm

(1) Output Derating Curve

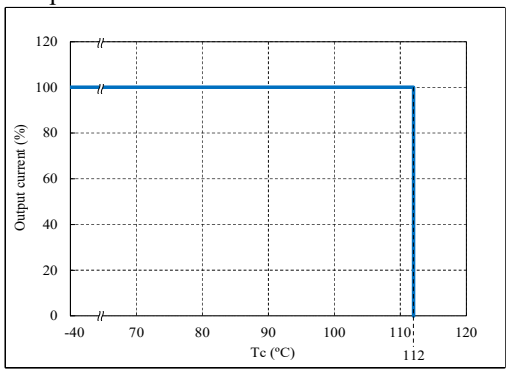
※Data which input voltage range is not described correspond to the full input range.

◆CCG1R5-12-03S

Output Current vs. Ambient Temperature

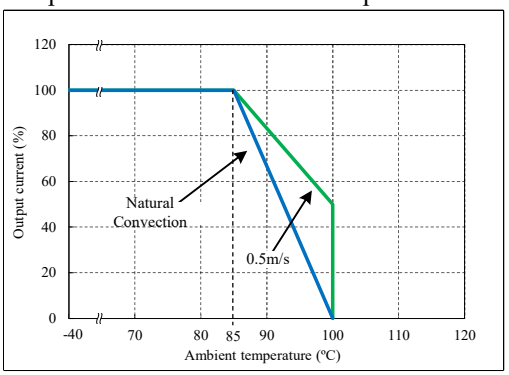


Output Current vs. Tc

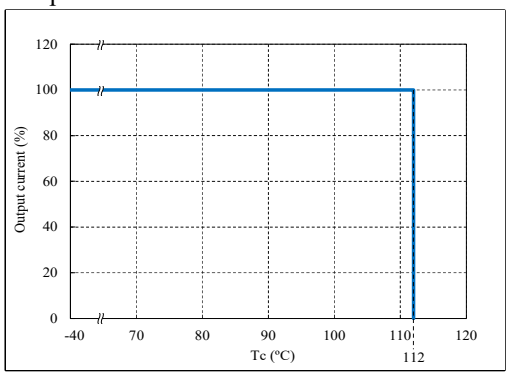


◆CCG1R5-12-05S

Output Current vs. Ambient Temperature

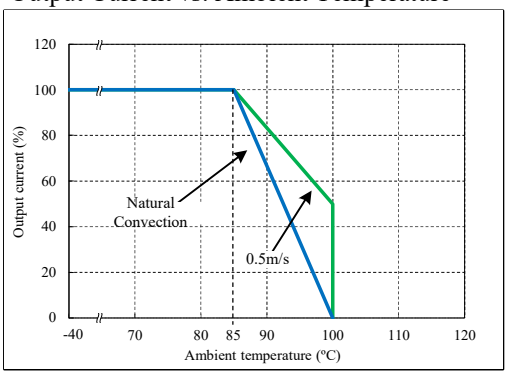


Output Current vs. Tc

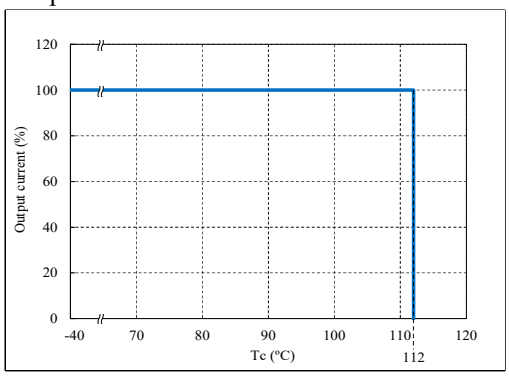


◆CCG1R5-12-12S

Output Current vs. Ambient Temperature

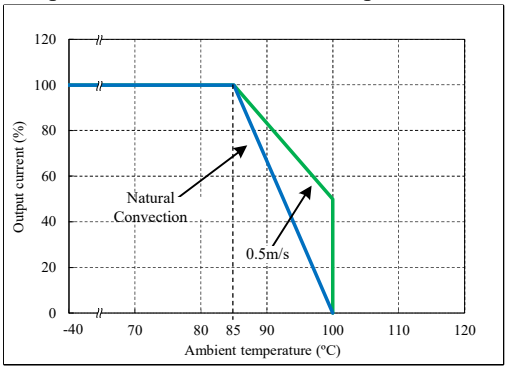


Output Current vs. Tc

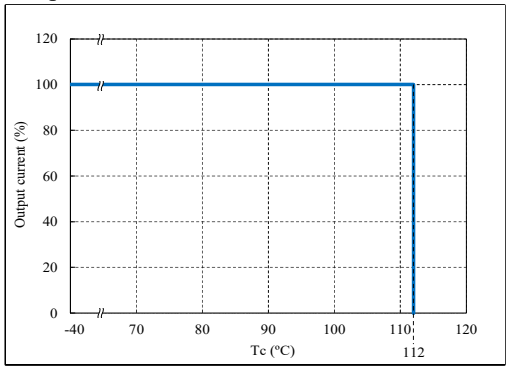


◆CCG1R5-12-15S

Output Current vs. Ambient Temperature

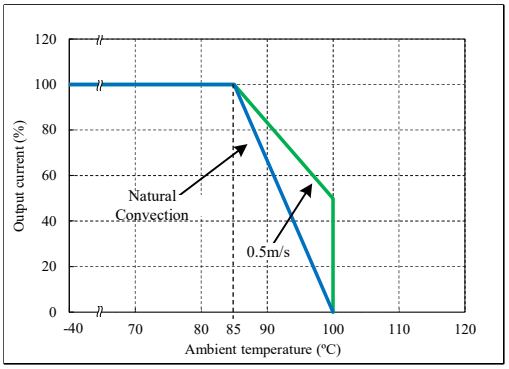


Output Current vs. Tc

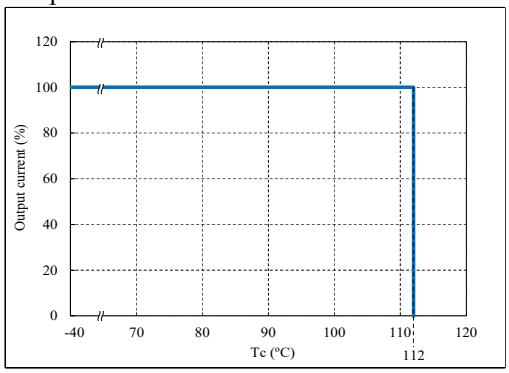


◆CCG1R5-12-12D

Output Current vs. Ambient Temperature

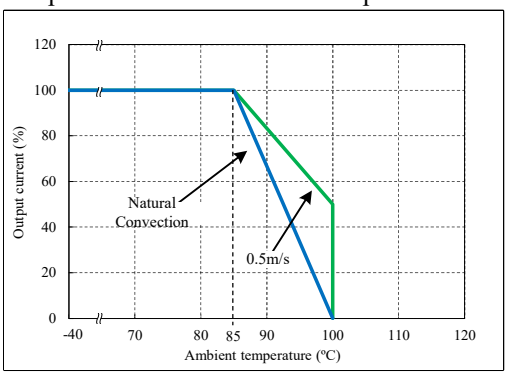


Output Current vs. Tc

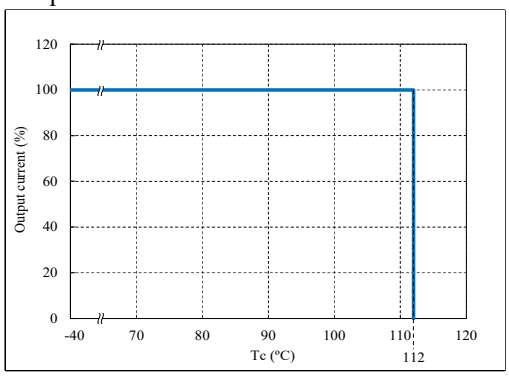


◆CCG1R5-12-15D

Output Current vs. Ambient Temperature

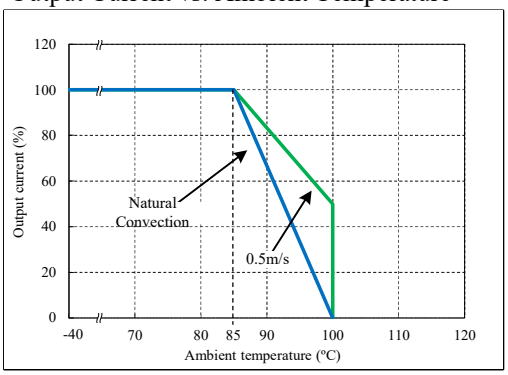


Output Current vs. Tc

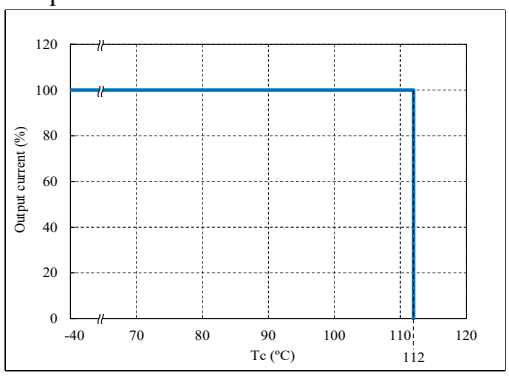


◆CCG1R5-24-03S

Output Current vs. Ambient Temperature

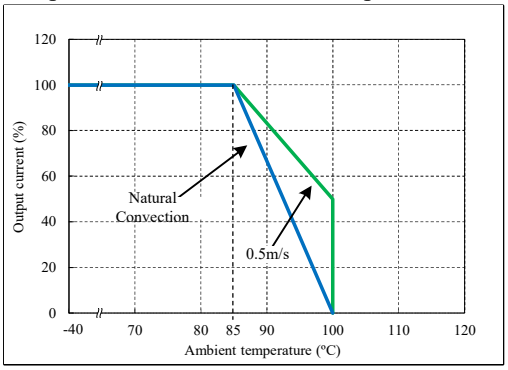


Output Current vs. Tc

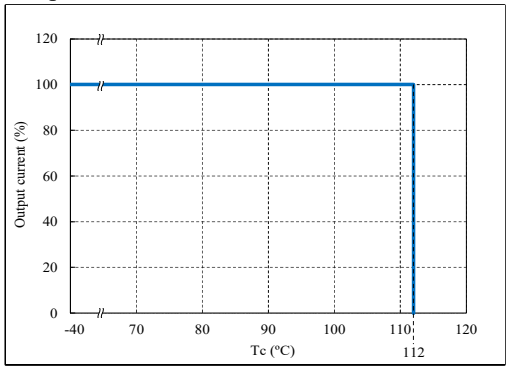


◆CCG1R5-24-05S

Output Current vs. Ambient Temperature

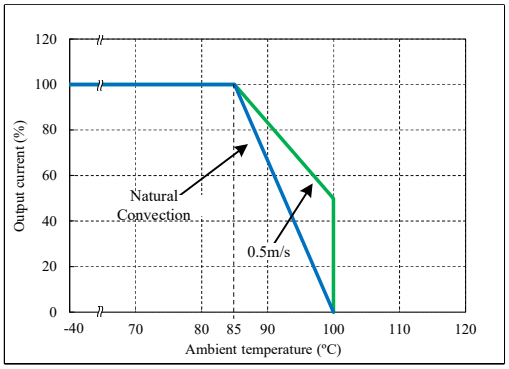


Output Current vs. Tc

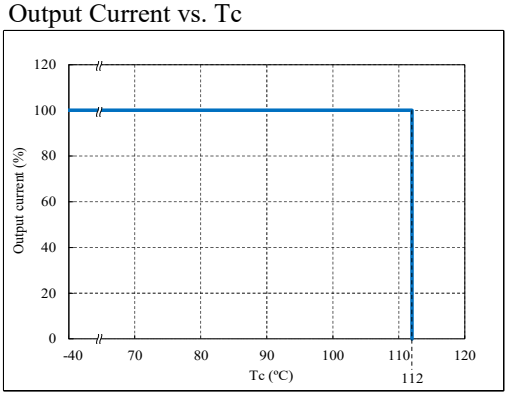


◆CCG1R5-24-12S

Output Current vs. Ambient Temperature

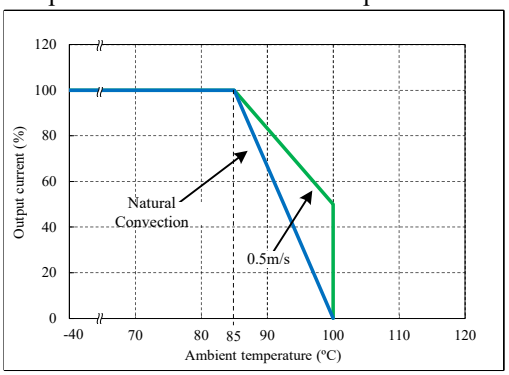


Output Current vs. Tc

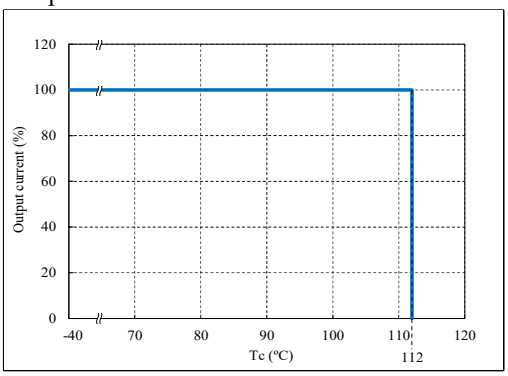


◆CCG1R5-24-15S

Output Current vs. Ambient Temperature

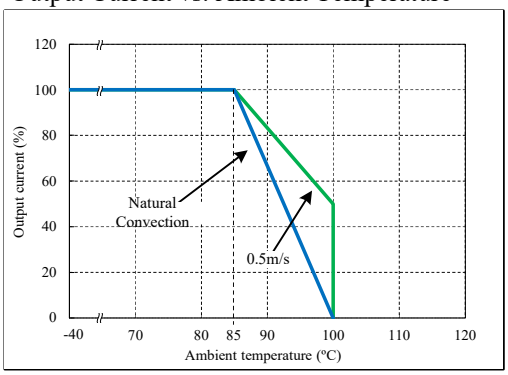


Output Current vs. Tc

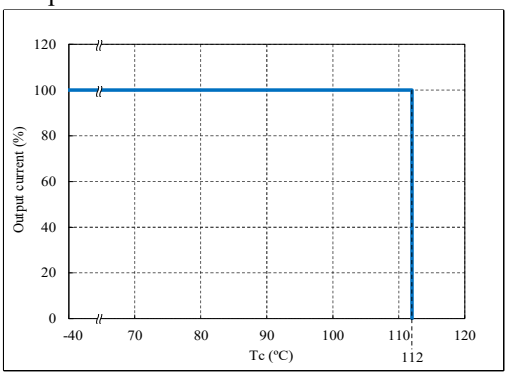


◆CCG1R5-24-12D

Output Current vs. Ambient Temperature

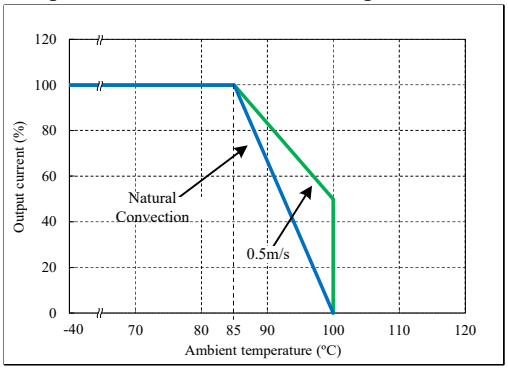


Output Current vs. Tc

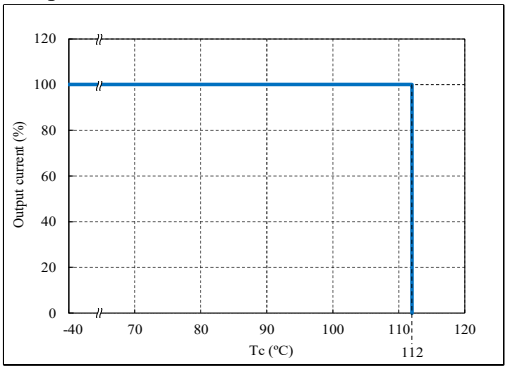


◆CCG1R5-24-15D

Output Current vs. Ambient Temperature

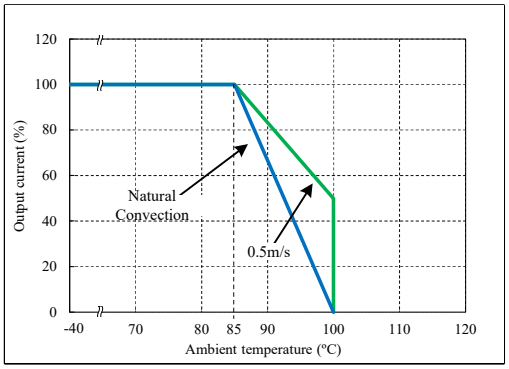


Output Current vs. Tc

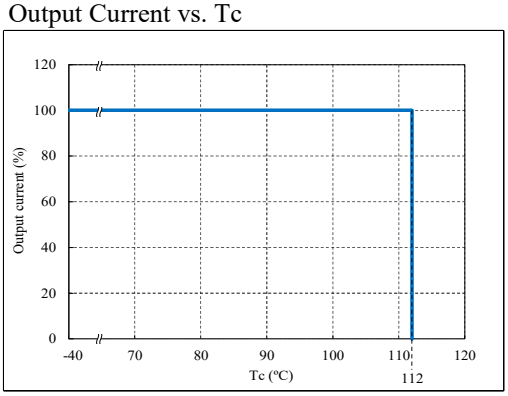


◆CCG1R5-48-03S

Output Current vs. Ambient Temperature

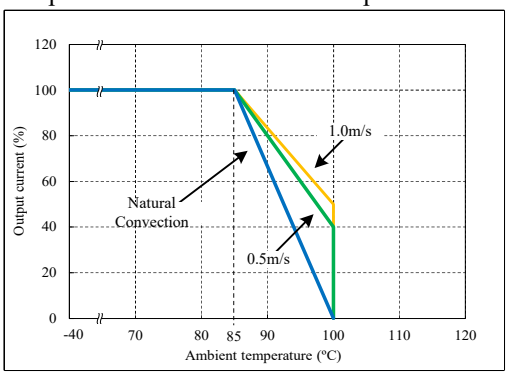


Output Current vs. Tc

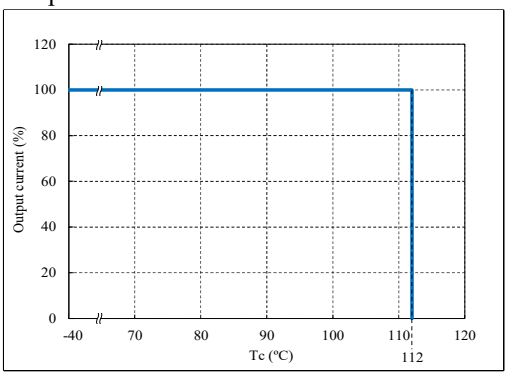


◆CCG1R5-48-05S

Output Current vs. Ambient Temperature

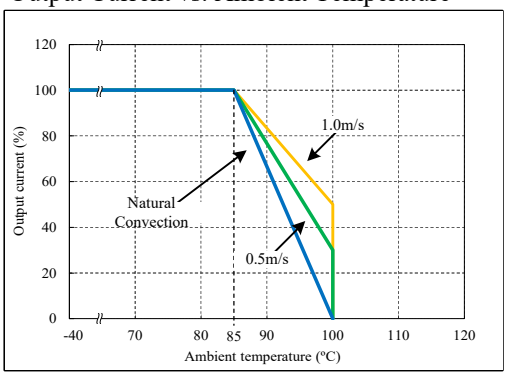


Output Current vs. Tc

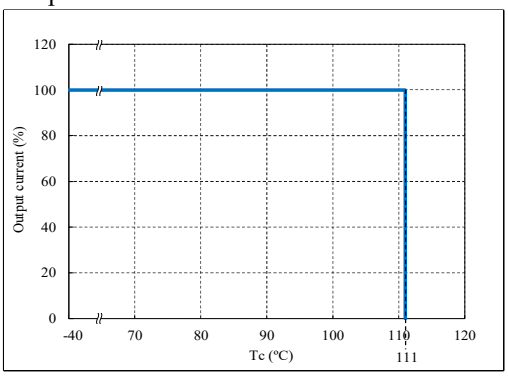


◆CCG1R5-48-12S

Output Current vs. Ambient Temperature

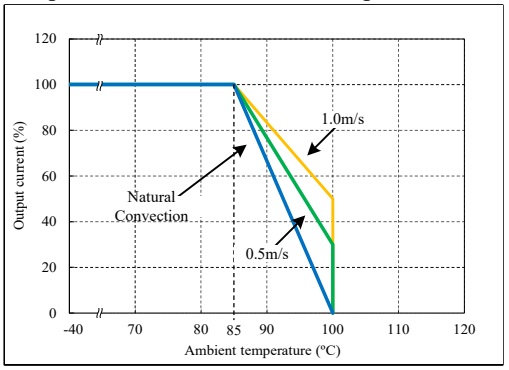


Output Current vs. Tc

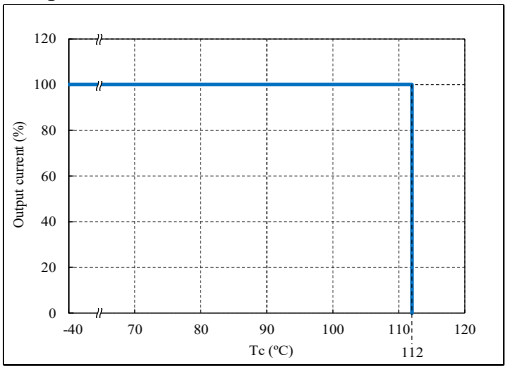


◆CCG1R5-48-15S

Output Current vs. Ambient Temperature

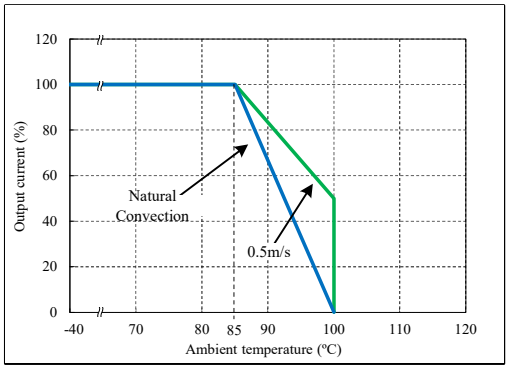


Output Current vs. Tc

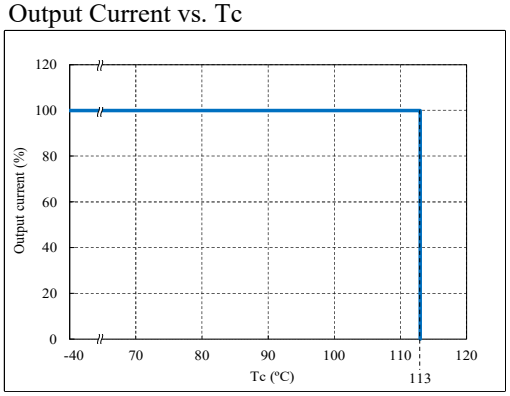


◆CCG1R5-48-12D

Output Current vs. Ambient Temperature

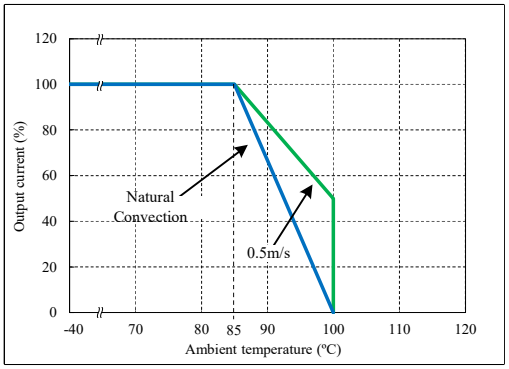


Output Current vs. Tc

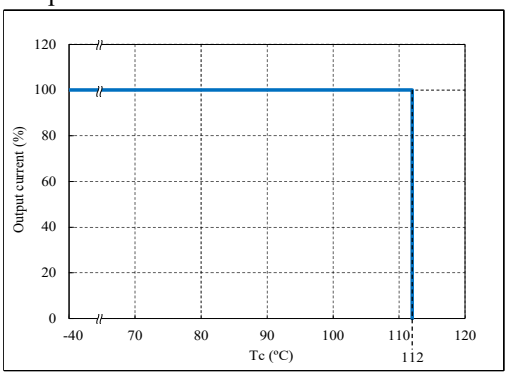


◆CCG1R5-48-15D

Output Current vs. Ambient Temperature

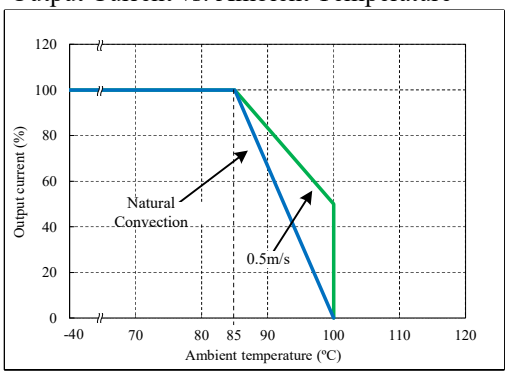


Output Current vs. Tc

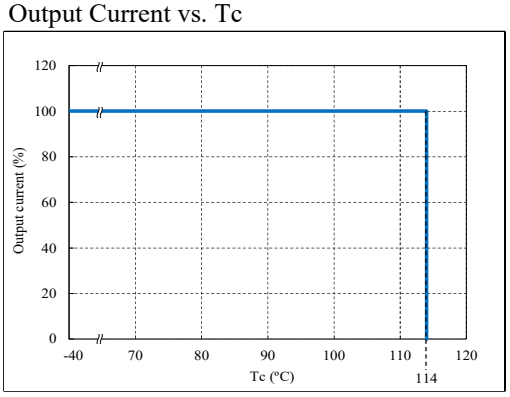


◆CCG3-12-03S

Output Current vs. Ambient Temperature

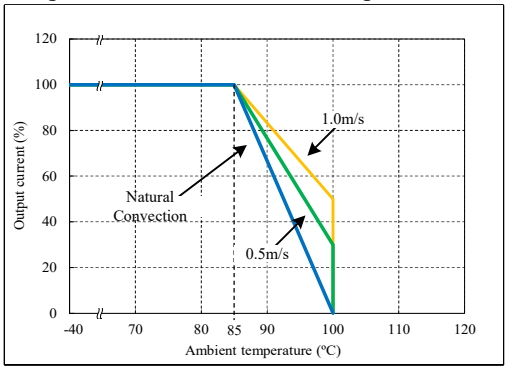


Output Current vs. Tc

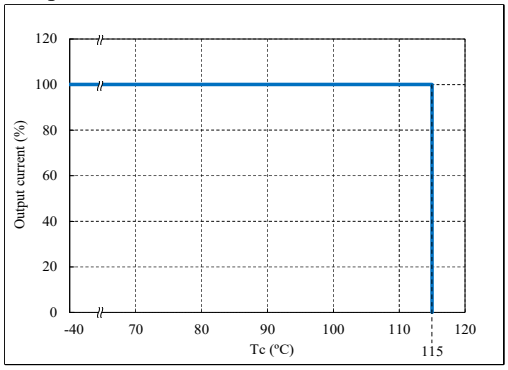


◆CCG3-12-05S

Output Current vs. Ambient Temperature

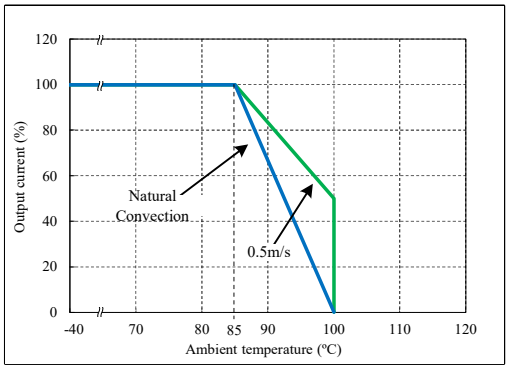


Output Current vs. Tc

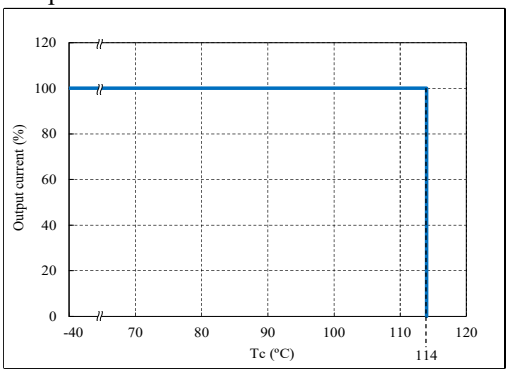


◆CCG3-12-12S

Output Current vs. Ambient Temperature

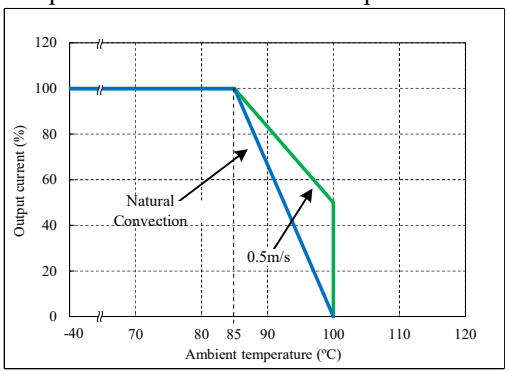


Output Current vs. Tc

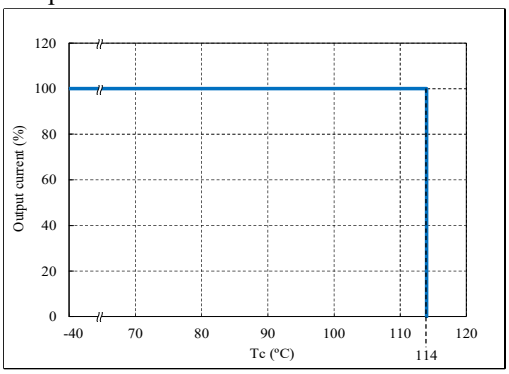


◆CCG3-12-15S

Output Current vs. Ambient Temperature

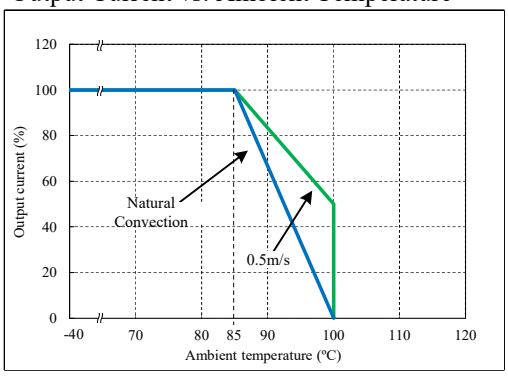


Output Current vs. Tc

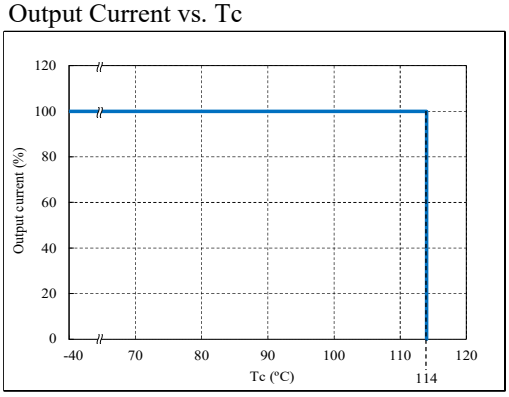


◆CCG3-12-12D

Output Current vs. Ambient Temperature

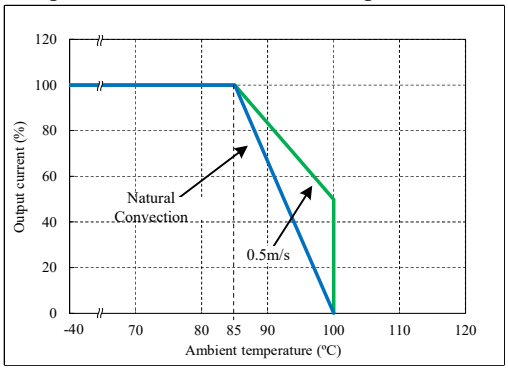


Output Current vs. Tc

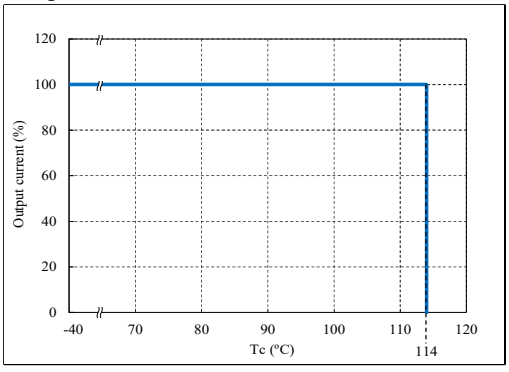


◆CCG3-12-15D

Output Current vs. Ambient Temperature

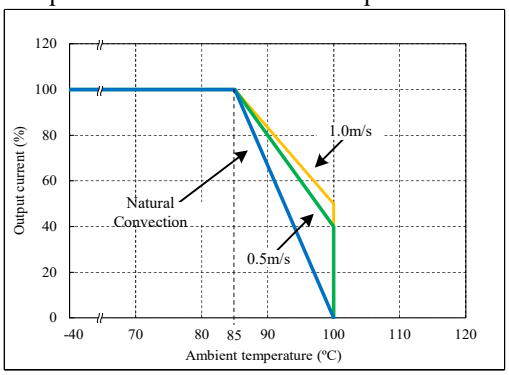


Output Current vs. Tc

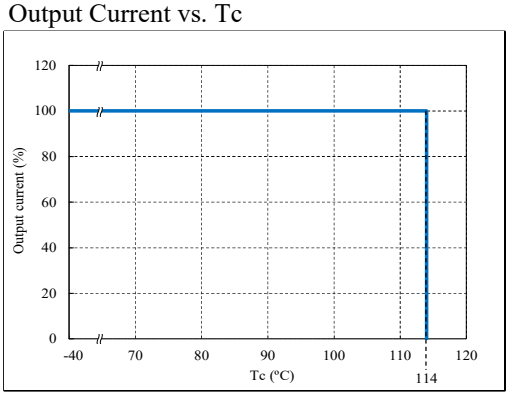


◆CCG3-24-03S

Output Current vs. Ambient Temperature

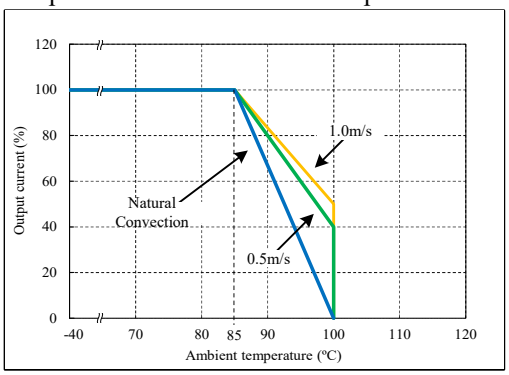


Output Current vs. Tc

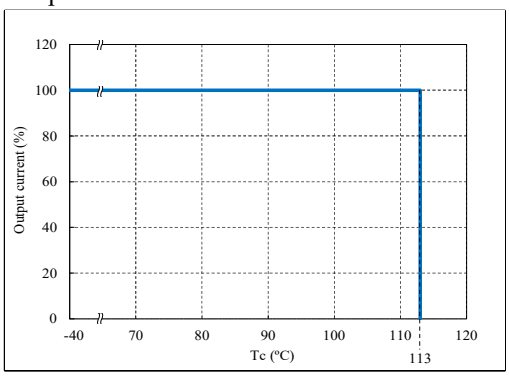


◆CCG3-24-05S

Output Current vs. Ambient Temperature

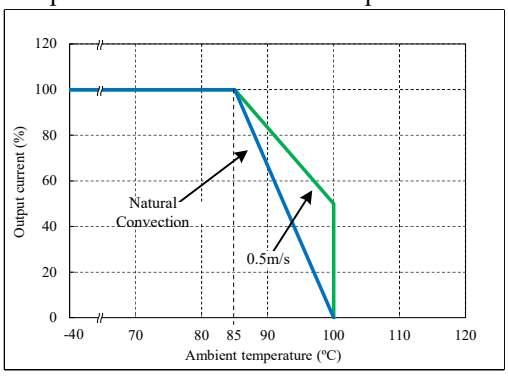


Output Current vs. Tc

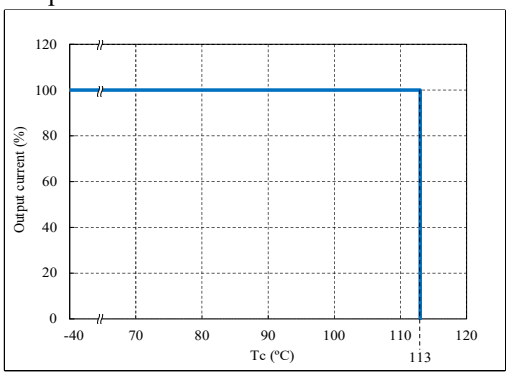


◆CCG3-24-12S

Output Current vs. Ambient Temperature

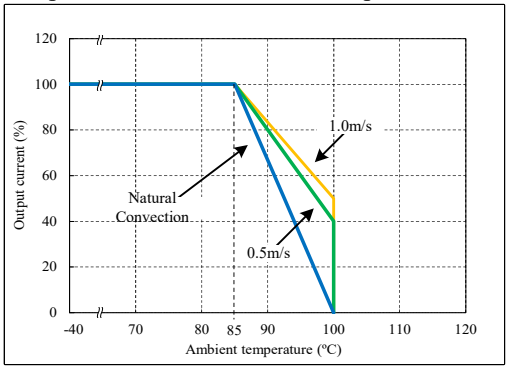


Output Current vs. Tc

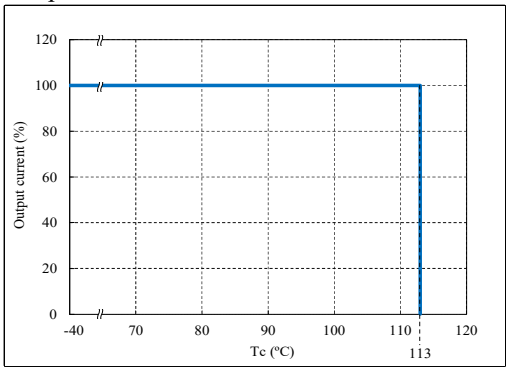


◆CCG3-24-15S

Output Current vs. Ambient Temperature

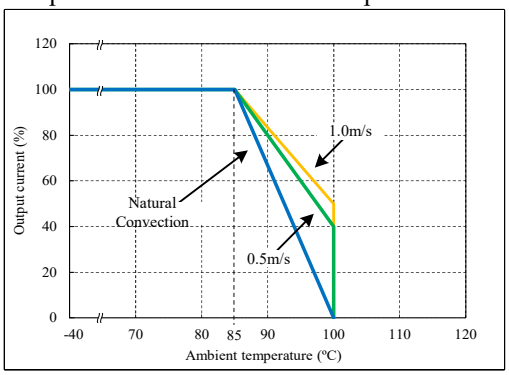


Output Current vs. Tc

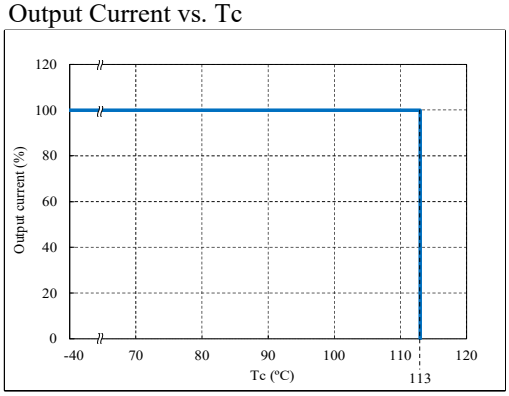


◆CCG3-24-12D

Output Current vs. Ambient Temperature

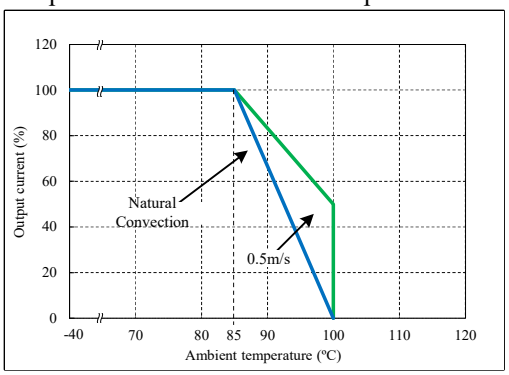


Output Current vs. Tc

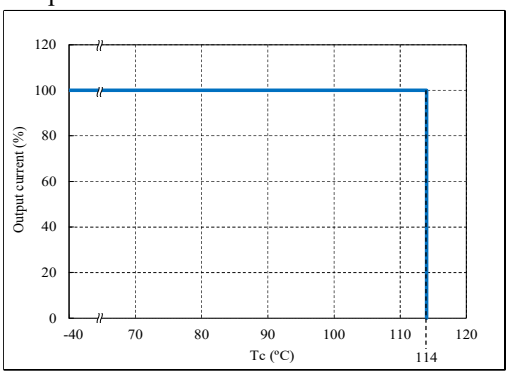


◆CCG3-24-15D

Output Current vs. Ambient Temperature

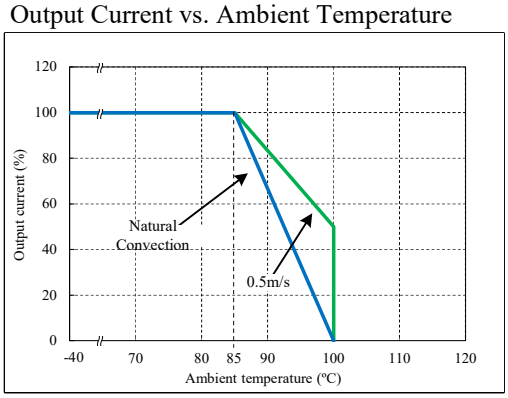


Output Current vs. Tc

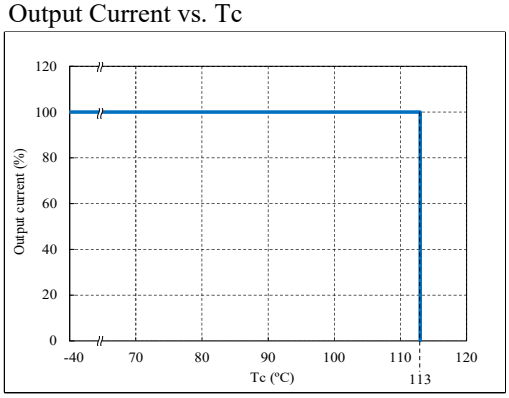


◆CCG3-48-03S (18V≦Vin≦36V)

Output Current vs. Ambient Temperature

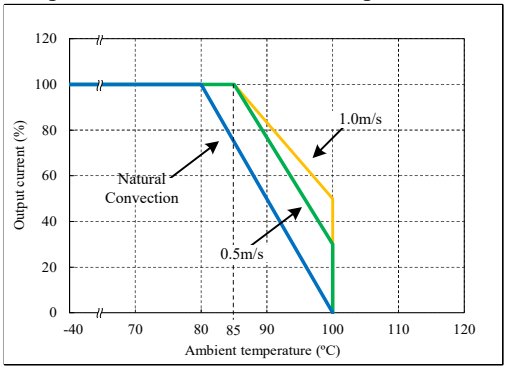


Output Current vs. Tc

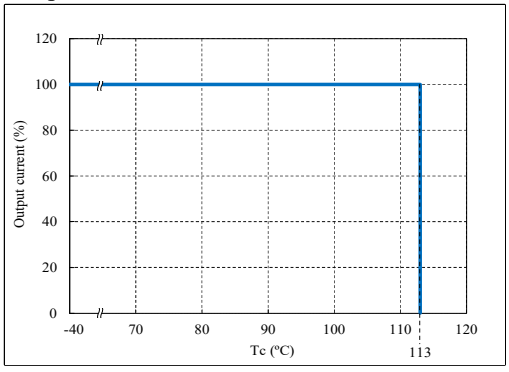


(36V<Vin≦76V)

Output Current vs. Ambient Temperature

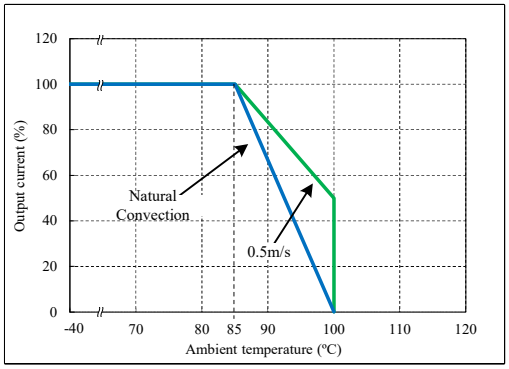


Output Current vs. Tc

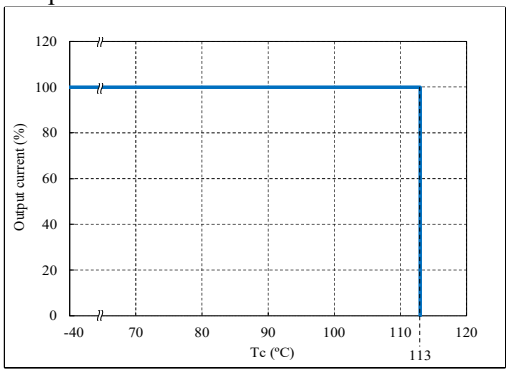


◆CCG3-48-05S (18V≦Vin≦36V)

Output Current vs. Ambient Temperature

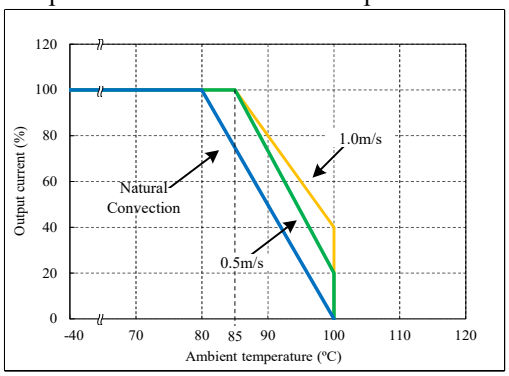


Output Current vs. Tc

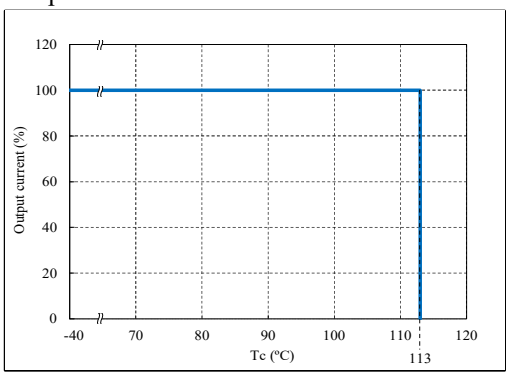


(36V<Vin≦76V)

Output Current vs. Ambient Temperature

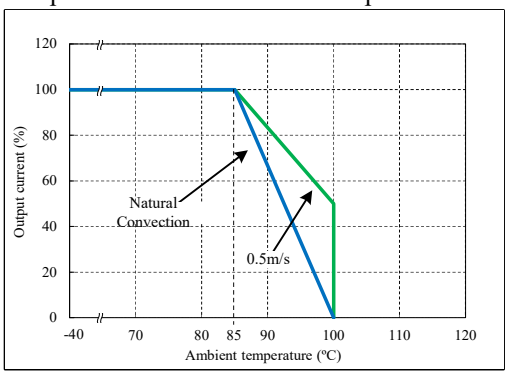


Output Current vs. Tc

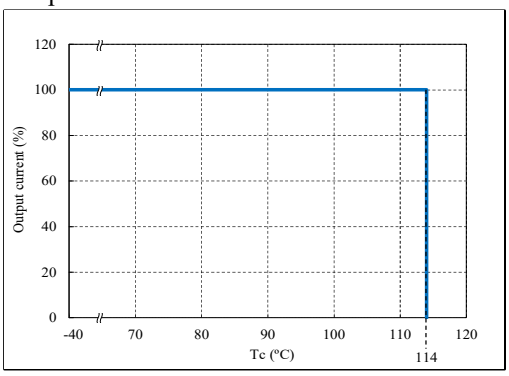


◆CCG3-48-12S

Output Current vs. Ambient Temperature

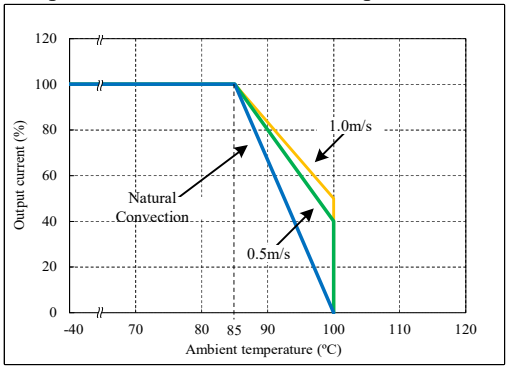


Output Current vs. Tc

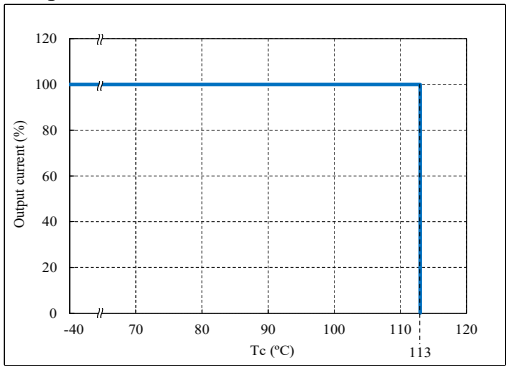


◆CCG3-48-15S

Output Current vs. Ambient Temperature

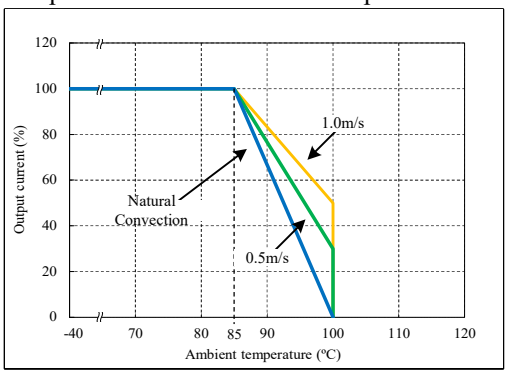


Output Current vs. Tc

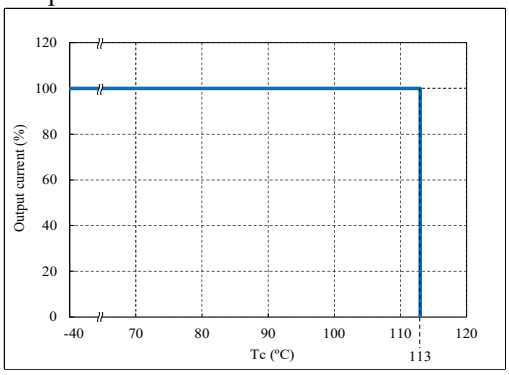


◆CCG3-48-12D

Output Current vs. Ambient Temperature

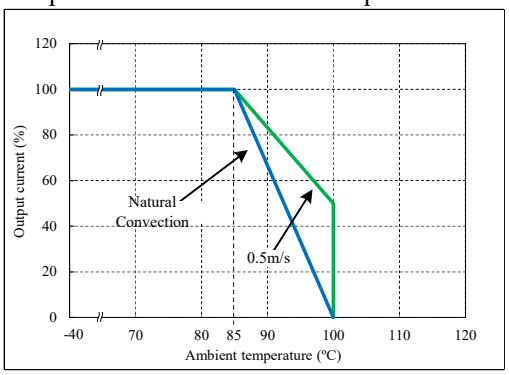


Output Current vs. Tc

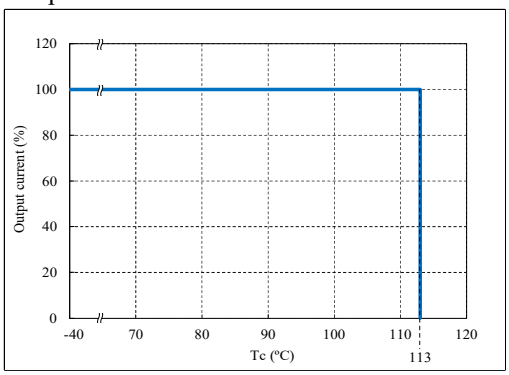


◆CCG3-48-15D

Output Current vs. Ambient Temperature



Output Current vs. Tc



8. Mounting Method, Soldering and Cleaning Condition

8-1. Mounting Method

(1) Mounting Dimension

[DIP type]

Below is the recommended size of hole and land of PCB in Table 8-1.
The mounting hole position is shown in Fig.8-1.

Table 8-1 Recommended Diameter of Hole and Land

Terminal pin size	0.7×0.5mm
Hole diameter	ϕ 1.2mm
Land diameter	ϕ 2.0mm

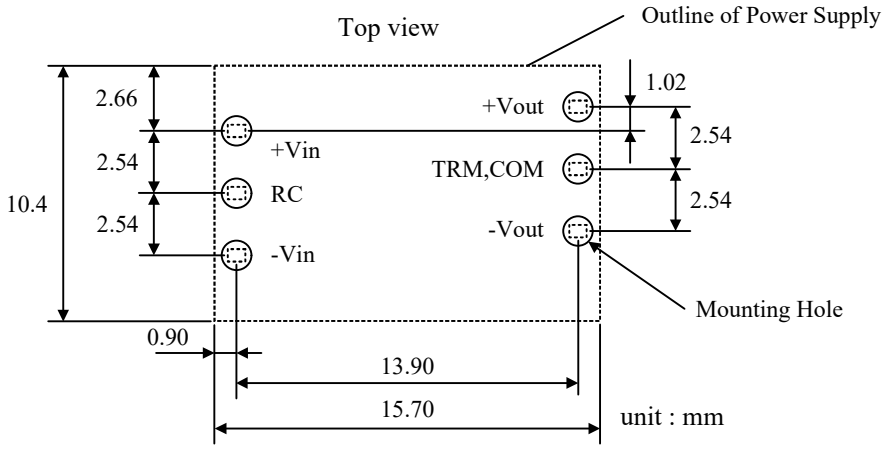


Fig.8-1 Recommended Mounting Dimension (DIP type)

[SMD type]

There is the recommended pad size of PCB in Table 8-2.
The mounting pad position is shown in Fig.8-2.

Table 8-2 Recommended Pad

Terminal pin size	2.25×0.5mm
Pad size	3.60×1.30mm

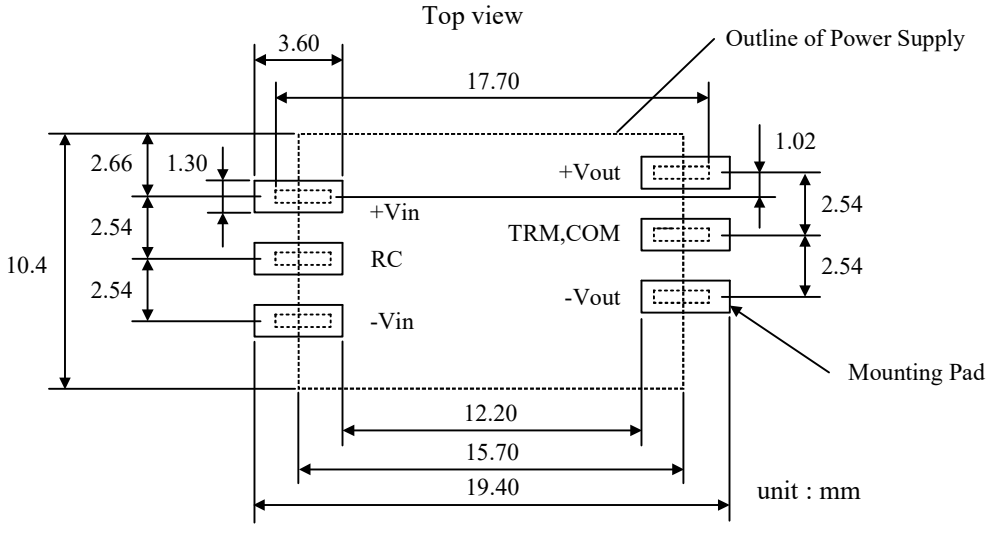


Fig.8-2 Recommended Mounting Dimension (SMD type)

※See outline drawing for outline of the power supply.

(2) Prohibition Area of Pattern Wiring

When power supply mount on PCB, avoid wiring pattern to prohibition area as shown in Fig.8-3.
Because there is a possibility to occur insulation failure.
When wiring signal pattern under the power supply even in non-prohibition area,
evaluate enough on actual system because it is susceptible to noise.

① : Wiring prohibition area of secondary circuit pattern
② : Wiring prohibition area of primary circuit pattern

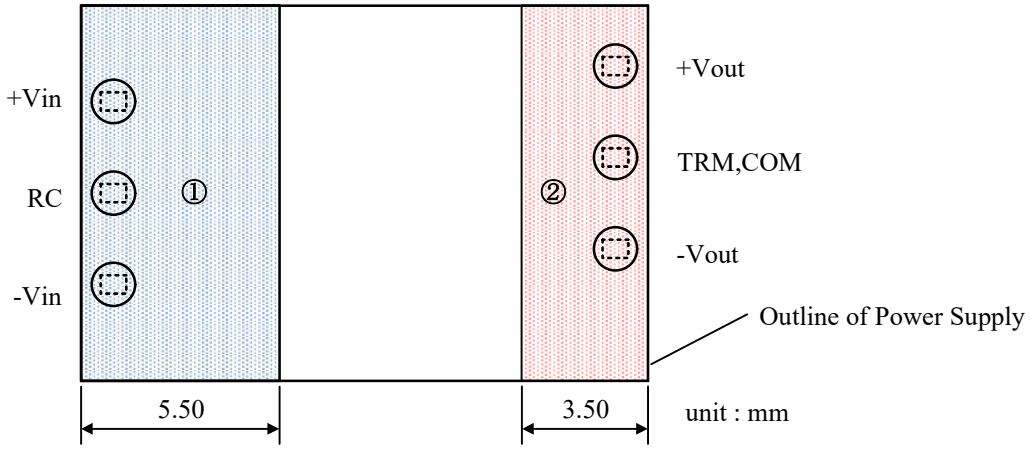


Fig.8-3 Prohibition Area of Pattern Wiring

(3) Recommended Material of PCB

Recommended materials of the printed circuit board is double sided glass epoxy with through holes.
(thickness : 1.6mm, copper : 18µm or more)

(4) Input / Output Pattern Width

Large current flows through input and output pattern. If pattern width is too narrow, heat on pattern will increase because of voltage drop of pattern. Relationship between allowable current and pattern width varies depending on materials of printed circuit board, thickness of conductor and allowable temperature rise of pattern, etc. It is definitely necessary to confirm on manufactures of printed circuit board for designing pattern.

(5) Method of Connecting Terminals

Connect +Vin, -Vin, RC, +Vout, -Vout, TRIM/COM with consideration of contact resistance.
On CCG1R5 and CCG3, there is a possibility of reverse mounting (it means that input and output terminals are opposite orientation) might happen as shown in Fig.8-4.
Power supply would be damaged when input voltage was applied it of reverse mounting situation.
Prevent reverse mounting by confirming +Vin terminal marking and orientation of words printed on case as shown in Fig.8-5.

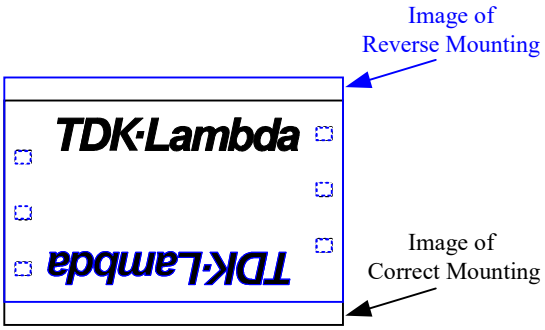


Fig.8-4 Image of Reverse Mounting

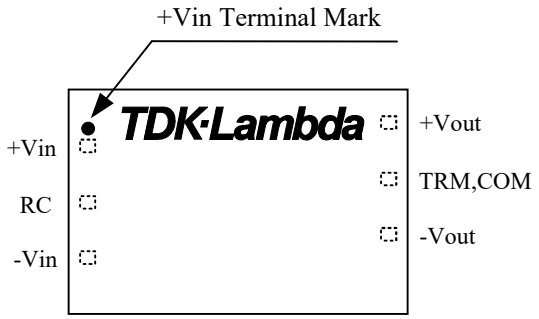


Fig.8-5 Printed Image of +Vin Terminal Marking and words

8-2. Recommended Soldering Condition

Recommended soldering conditions are as follows.

(1) Soldering Dip

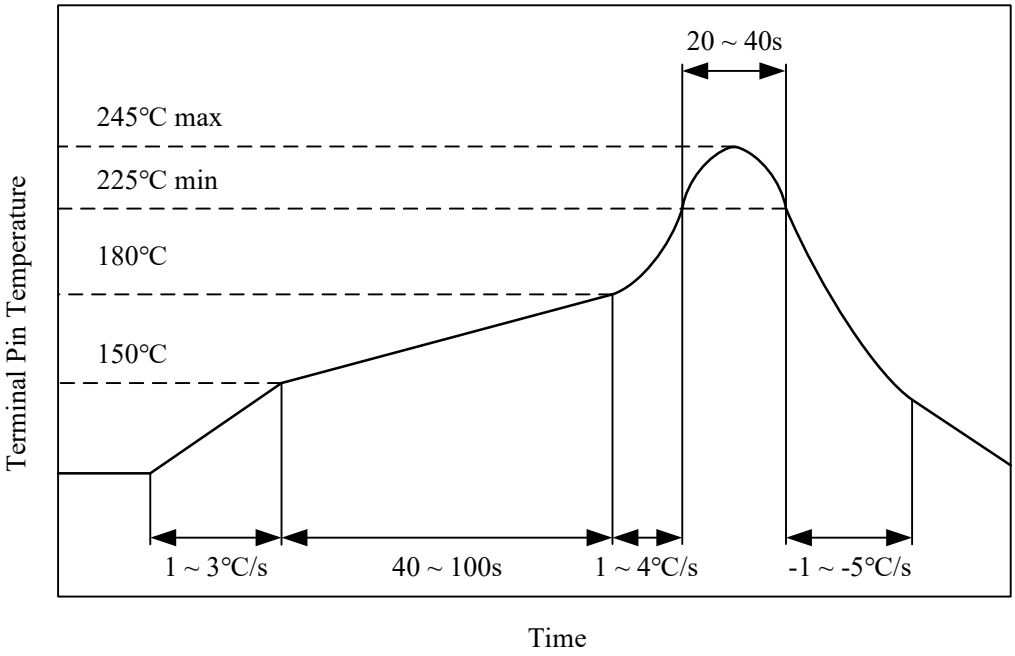
Dip condition : 260ºC within 10 seconds

Pre-heat condition : 110ºC for 30 ~ 40 seconds

(2) Soldering SMD

Allowable number of Reflow: 1 time

MSL(Moisture Sensitivity Level) : Equivalent to 1



(3) Soldering Iron

350ºC within 3 seconds

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

8-3. About Cleaning

Cleaning is not recommended.

9. Before Concluding Power Module Damage

Verify following items before concluding power supply damage.

(1) No output voltage

- Is specified input voltage applied?
- Are the remote ON/OFF control terminal (RC), output voltage trimming terminal (TRM) correctly connected?
- For case where output voltage adjustment is used, is resistor or variable resister setting, connections correctly done?
- Are there no abnormalities in the output load used?
- Is the temperature of measurement point (Tc) as shown in Fig.7-3 within the specified temperature range?
- Is the ambient temperature within the specified temperature range?

(2) Output voltage is high

- For case where output voltage adjustment is used, is resistor or variable resister setting, connections correctly done?
- Is the ambient temperature within the specified temperature range?

(3) Output voltage is low

- Is specified input voltage applied?
- For cases where output voltage adjustment is used, is resistor or variable resistor setting, connections correctly done?
- Are there no abnormalities in the output load used?

(4) Load regulation or line regulation is large

- Is specified input voltage applied?
- Are the input terminals and the output terminals firmly connected?
- Is the input or output wire too thin?
- Is the input or output wire too long?

(5) Output ripple voltage is large

- Is the measurement done according to methods described in the Instruction Manual or is it an equivalent method?
- Is the input ripple voltage value within the specified value?

10. Warranty Period

Warranty period is 5 years.
For damages occurring at normal operation within this warranty period, exchange is free of charge.
Please read the General Safety Instruction before using the products.

11. CE MARKING / UKCA MARKING

CE MARKING
CE Marking, when applied to a product or packing material for a product covered by this handbook, CCGxxx-12-xxS/D, CCGxxx-24-xxS/D indicates compliance with RoHS Directive, CCGxxx-48-xxS/D indicates compliance with 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.