Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz] (reference)	Input current [A]	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
					Material	Single sided	Double sided	Series operation	Parallel operation
MG1R5	Flyback converter	200-1500 *3	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MGF1R5	Flyback converter	120-1500 *3	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MGX1R5	Flyback converter	60-1000 *3	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MG3	Flyback converter	200-1500 *3	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MGF3	Flyback converter	120-1500 *3	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MG6	Flyback converter	160-1500 *3	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MGF6	Flyback converter	120-1500 *3	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MGX6	Flyback converter	100-1000 *3	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MG10	Flyback converter	160-1500 *3	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MGF10	Flyback converter	120-1500 *3	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MG15	Flyback converter	445-495	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MGF15	Flyback converter	445-495	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MG30	Forward converter	380-460	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MGF30	Forward converter	380-460	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MGF40	Flyback converter	100-1500 *3	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MGF80	Flyback converter	100-1500 *3	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2

*1 Refer to Specification.
*2 Refer to Instruction Manual.
*3 The value changes depending on input and load.

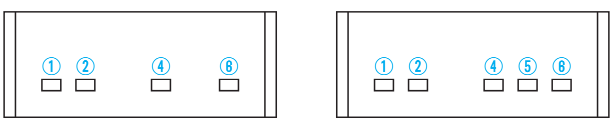
MG1R5, MG3, MG6, MG10

MG15, MG30, MG40, MG80

1 Pin Configuration

Table 1.1 Pin Configuration and Functions(MG1R5/MG3 Single Output)

Pin No.	Pin Name	Function
①	-Vin	-DC Input
②	+Vin	+DC Input
④	+Vout	+DC Output
⑤	NP	No Pin
	TRM	Output Voltage Adjustment (Option:Refer to 2.5)
⑥	-Vout	-DC Output



(a) Standard (b) Option : Y2

Fig.1.1 Pin Configuration(MG1R5/MG3 Single Output)

Table 1.2 Pin Configuration and Functions(MG1R5/MG3 Dual Output)

Pin No.	Pin Name	Function
①	-Vin	-DC Input
②	+Vin	+DC Input
④	+Vout	+DC Output
⑤	COM	GND of Output Voltage
⑥	-Vout	-DC Output

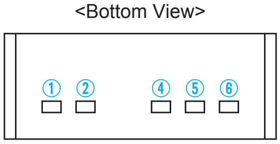
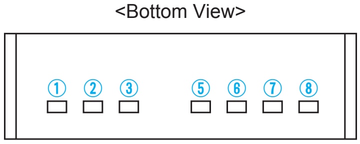


Fig.1.2 Pin Configuration(MG1R5/MG3 Dual Output)

Table 1.3 Pin Configuration and Functions(MG6/MG10)

Pin No.	Pin Name	Function
①	-Vin	-DC Input
②	+Vin	+DC Input
③	RC	Remote ON/OFF
⑤	NC	No Connect
	TRM	Output Voltage Adjustment (Option:Refer to 2.5)
⑥	+Vout	+DC Output
⑦	-Vout	-DC Output (for Single Output)
	COM	GND of Output Voltage (for Dual Output)
⑧	NC	No Connect (for Single Output)
	-Vout	-DC Output (for Dual Output)



(a) Single Output, Dual Output

Fig.1.3 Pin Configuration(MG6/MG10)

2 Function

2.1 Input Voltage Range

■If output voltage value doesn't fall within specifications, a unit may not operate in accordance with specifications and/or fail.

2.2 Overcurrent Protection

■Overcurrent protection is built-in and comes into effect at over 105% of the rated current.
Overcurrent protection prevents the unit from short circuit and overcurrent condition. The unit automatically recovers when the fault condition is cleared.

2.3 Isolation

■For a receiving inspection, such as Hi-Pot test, increase (decrease) the voltage gradually for a 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.

■In the case of use in locations exposed to constant voltage between primary and secondary is applied, please contact us.

2.4 Remote ON/OFF(MG6, MG10)

■You can turn the power supply ON or OFF without turning input power ON or OFF through the pin terminal RC.

■Please keep the voltage level of the pin terminal RC(V_{RC}) at 9.0V or below.

Table 2.1 Pin Specification of Remote ON/OFF

Voltage Level of the pin terminal RC (V_{RC})	MG6/MG10 Output
Open or Short or 0V $\leqq V_{RC} \leqq$ 0.3V	ON
2.0V $\leqq V_{RC} \leqq$ 9.0V	OFF

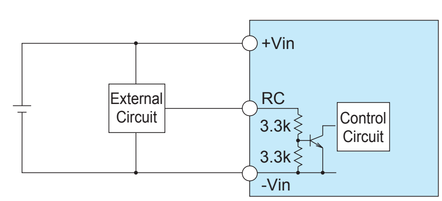


Fig.2.1 Internal Circuits of Remote ON/OFF

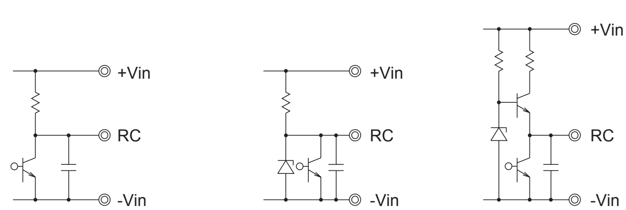


Fig.2.2 Examples of Using an External Remote ON/OFF Circuit

2.5 Output Voltage Adjustment Range

● -Y2 (Excluding MGW1R5/MGW3/MGFW1R5/MGFW3/MGXW1R5)

■The output voltage is adjustable through an external potentiometer. Adjust only within the range of +10%, -5% of the rated voltage.

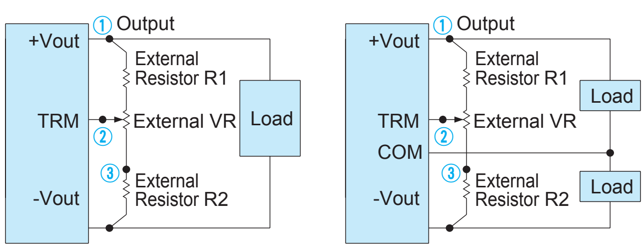
■To increase the output voltage, turn the potentiometer so that the resistance value between 2 and 3 becomes small.

■Please use a wire as short as possible to connect to the potentiometer and connect it from the pin on the power supply side. Temperature coefficient deteriorates when some types of resistors and potentiometers are used. Please use the following types.

Resistor	Metal Film Type, Temperature Coefficient of ±100ppm/℃ or below
Potentiometer	Cermet Type, Temperature Coefficient of ±300ppm/℃ or below

■In the case of dual output, ±voltages are adjusted simultaneously.

■When the output voltage adjustment is used, note that the output may be stopped when output voltage is set too high.



(a) Single Output (b) Dual Output

Fig.2.3 Connecting External Devices

Table 2.2 List of External Devices (MG1R5/MG3)

Output Voltage	Constant of External Device [Ω] (Adjustable within +10%, -5%)		
	VR	R1	R2
3.3V	1k	680	150
5V	1k	330	330
12V	5k	15k	2.4k
15V	5k	15k	1.2k
±12V			
±15V			

Table 2.3 List of External Devices (MG6/MG10)

Output Voltage	Constant of External Device [Ω] (Adjustable within +10%, -5%)		
	VR	R1	R2
3.3V	1k	680	150
5V	1k	2.7k	560
12V	5k	15k	2.4k
15V	5k	15k	1.2k
±12V	5k	22k	470
±15V	5k	27k	470

3 Wiring to Input/Output Pin

3.1 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 3.1 Recommended fuse (Normal-blow type)

Model / Vin	MG1R5	MG3	MG6	MG10
5	2.0A	3.15A	5.0A	6.3A
12	1.6A	2.0A	2.5A	3.15A
24	1.0A	1.6A	2.0A	2.5A
48	0.8A	1.0A	1.6A	2.0A
12-24 (MGF)	1.6A	2.0A	2.5A	3.15A
24-48 (MGF)	1.0A	1.6A	2.0A	2.5A
12-48 (MGX)	1.6A	—	3.15A	—

(2) External capacitor on the input side

■Basically, MG series does not need any external capacitor. Adding a capacitor Ci near the input pin terminal and reduce reflected input noise from a converter.
Please connect the capacitor as needed.

■When you use a capacitor Ci, please use the one with high frequency and good temperature characteristics.

■If the power supply is to be turned ON/OFF directly with a switch, inductance from the input line will induce a surge voltage several times that of the input voltage and it may damage the power supply. Make sure that the surge is absorbed, for example, by connecting an electrolytic capacitor between the input pins.

■If an external filter containing L (inductance) is added to the input line, or a wire from the input source to the DC-DC converter is long, not only the reflected input noise becomes large, but also the output of the converter may become unstable. In such case, connecting Ci to the input pin terminal is recommended.

■If you use an aluminum electrolytic capacitor, please pay attention to its ripple current rating.

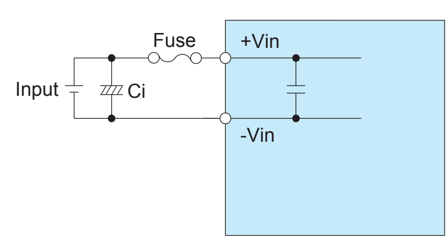


Fig3.1 Connecting Example of an External Capacitor to the Input Side

Table 3.2 Recommended Capacitance of an External Capacitor on the Input Side [μF]

Model / Vin	MG1R5	MG3	MG6	MG10
5	10 - 220	10 - 220	10 - 470	10 - 1000
12	10 - 100	10 - 100	10 - 220	10 - 470
24	10 - 47	10 - 47	10 - 100	10 - 220
48	10 - 22	10 - 22	10 - 47	10 - 100
12-24 (MGF)	10 - 47	10 - 47	10 - 100	10 - 220
24-48 (MGF)	10 - 22	10 - 22	10 - 47	10 - 100
12-48 (MGX)	10 - 100	—	10 - 220	—

＊Please adjust the capacitance in accordance with a degree of the effect you want to achieve.

(3) Reverse input voltage protection

■If a reverse polarity voltage is applied to the input pin terminal, the power supply will fail. If there is a possibility that a reverse polarity voltage is applied, connect a protection circuit externally as described below.

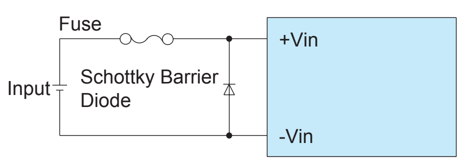
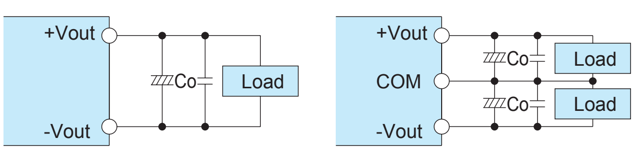


Fig3.2 Reverse Input Voltage Protection

3.2 Wiring Output Pin

■If you want to further reduce the output ripple noise, connect an electrolytic capacitor or a ceramic capacitor Co to the output pin terminal as shown below.



(a) MGS (b) MGW

Fig.3.3 Connecting Example of an External Capacitor to the Output Side

Table 3.3 Recommended Capacitance of External Capacitor on the Output Side [μF]

Model / Vout	MG1R5	MG3	MG6	MG10
3.3	0 - 220	0 - 220	0 - 220	0 - 220
5	0 - 220	0 - 220	0 - 220	0 - 220
12	0 - 100	0 - 100	0 - 100	0 - 100
15	0 - 100	0 - 100	0 - 100	0 - 100
±12	0 - 100	0 - 100	0 - 100	0 - 100
±15	0 - 100	0 - 100	0 - 100	0 - 100

＊If you use a ceramic capacitor, keep the capacitance within the rage between about 0.1 to 22uF.

＊Please adjust the capacitance in light of the effect you want to achieve.

＊If you need to use an external capacitor whose capacitance exceeds the range provided in Table 3.3, please contact us.

■If the distance between the output and the load is long and therefore noise is created on the load side, connect a capacitor externally to the load as shown below.

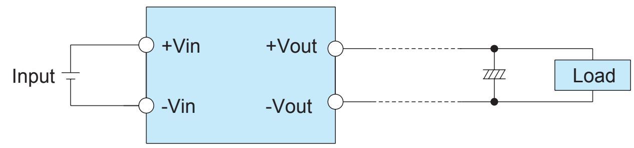


Fig3.4 Connecting Example

4 Series/Redundancy 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.

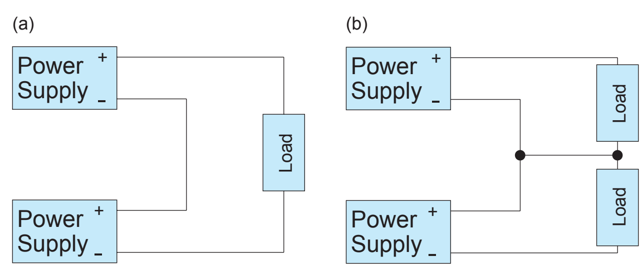


Fig.4.1 Examples of series operation

4.2 Redundancy Operation

■Parallel operation is not possible.

■Redundancy operation is available by wiring as shown below.

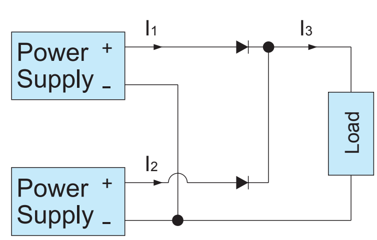


Fig.4.2 Redundancy operation

■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 for each power supply.

$I_3 \leqq$ Rated Current Value

5 Input Voltage/Current Range

■If you use a non-regulated power source for input, please check and make sure that its voltage fluctuation range and ripple voltage do not exceed the input voltage range shown in specifications.
■Please select an input power source with enough capacity, taking into consideration of the start-up current (Ip), which flows when a DC-DC converter starts up.

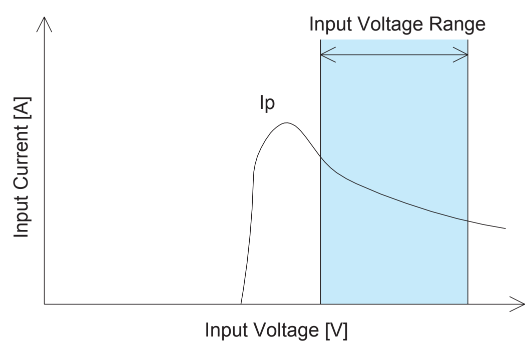


Fig.5.1 Input Current Characteristics

6 Assembling and Installation

6.1 Installation

■When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Ambient temperature around each power supply should not exceed the temperature range shown in derating curve.

6.2 Soldering Conditions

(1) Flow Soldering : 260℃ 15 seconds or less
(2) Soldering Iron : maximum 360℃ 5 seconds or less

6.3 Stress to Pin

■Applying excessive stress to the input or output pins of the power module may damage internal connections. Avoid applying stress in excess of that shown in Fig. 6.1.
■Input/output pin are soldered to the PCB internally.
Do not pull or bend a lead powerfully.

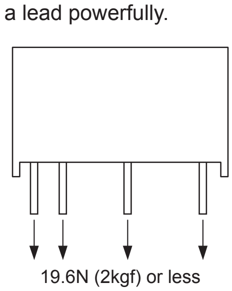


Fig.6.1 Stress onto Pins

■If it is expected that stress is applied to the input/output pin due to vibration or impact, reduce the stress to the pin by taking such measures as fixing the unit to the PCB by silicone rubber, etc.
■Due to prevent failure, PS should not be pulled after soldering with PCB.

6.4 Cleaning

■If you need to clean the unit, please clean it under the following conditions.
Cleaning Method: Varnishing, Ultrasonic or Vapor Cleaning
Cleaning agent: IPA (Solvent type)
Cleaning Time: Within total 2 minutes for varnishing, ultrasonic and vapor cleaning
■Please dry the unit sufficiently after cleaning.
■If you do ultrasonic cleaning, please keep the ultrasonic output at 15W/ℓ or below.

7 Safety Standards

■To apply for a safety standard approval using the power supply, please meet the following conditions. Please contact us for details.
●Please use the unit as a component of an end device.
●The area between the input and the output of the unit is isolated functionally. Depending upon the input voltage, basic insulation, dual insulation or enhanced insulation may be needed. In such case, please take care of it within the structure of your end-device. Please contact us for details.
●Safety approved fuse must be externally installed on input side.

8 Output Derating

■Please have sufficient ventilation to keep the temperature of point A in Fig.8.1 at Table8.1 or below. Please also make sure that the ambient temperature does not exceed 85℃.

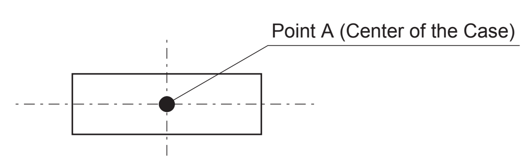


Fig.8.1 Temperature Measuring Point on the case (Top View)

Table 8.1 Point A Temperature

Model	MG1R5	MG3	MG6	MG10
Point A	110℃	110℃	105℃	105℃

8.1 MGS1R5/MGW1R5 Derating Curve

■If you derate the output current, you can use the unit in the temperature range from -40℃ to the maximum temperature shown below.

(1) In the case of Convection Cooling (Reference)

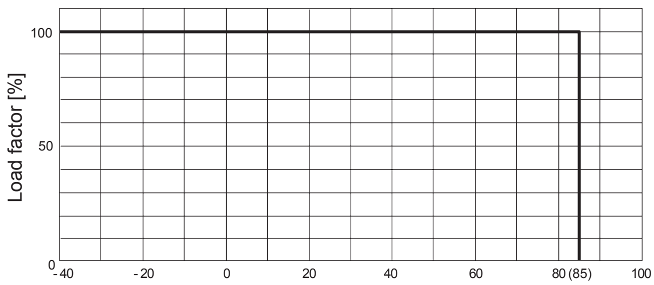


Fig.8.2 Derating Curve for Convection Cooling (Rated Input Voltage)

(2) In the case of Forced Air Cooling (1.0m/s) (Reference)

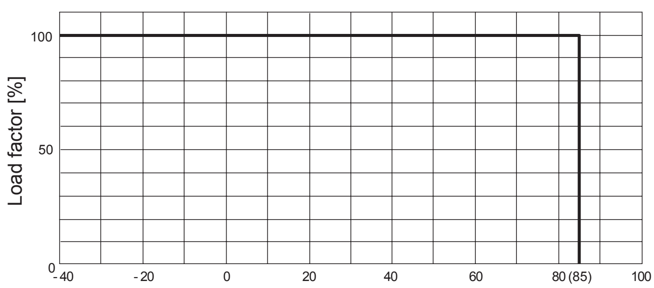
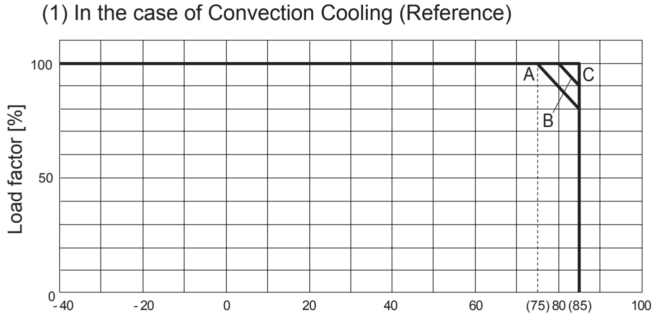


Fig.8.3 Derating Curve for Forced Air Cooling (1.0m/s) (Rated Input Voltage)

8.2 MGS3/MGW3 Derating Curve

■If you derate the output current, you can use the unit in the temperature range from -40℃ to the maximum temperature shown below.

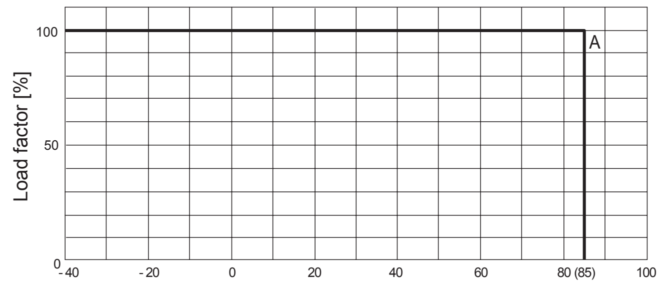
(1) In the case of Convection Cooling (Reference)



Output Voltage / Input Voltage	3.3	5	12	15	±12	±15
5	B	B	C	C	B	B
12	B	C	C	C	B	C
24	B	C	C	C	B	C
48	A	A	C	C	B	C

Fig.8.4 Derating Curve for Convection Cooling (Rated Input Voltage)

(2) In the case of Forced Air Cooling (1.0m/s) (Reference)



Output Voltage / Input Voltage	3.3	5	12	15	±12	±15
5	A	A	A	A	A	A
12	A	A	A	A	A	A
24	A	A	A	A	A	A
48	A	A	A	A	A	A

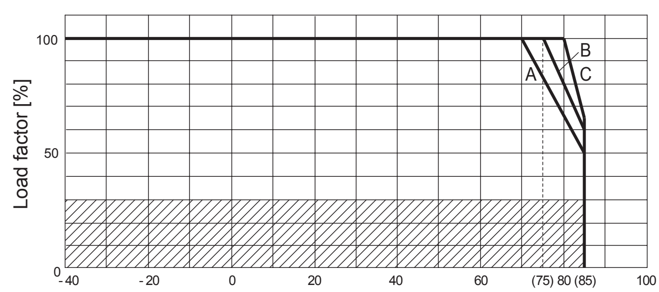
Fig.8.5 Derating Curve for Forced Air Cooling (Rated input Voltage)

8.3 MGS6/MGW6 Derating Curve

■If you derate the output current, you can use the unit in the temperature range from -40℃ to the maximum temperature shown below.

In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

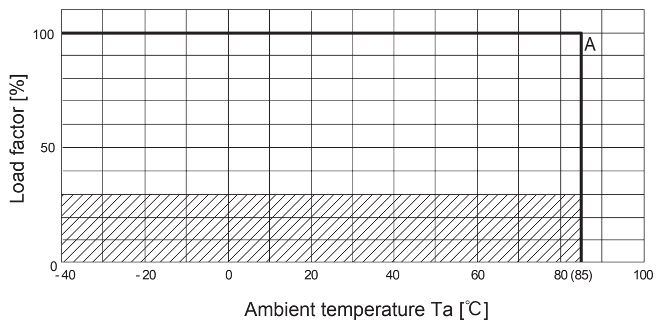
(1) In the case of Convection Cooling (Reference)



Output Voltage / Input Voltage	3.3	5	12	15	±12	±15
5	A	B	B	C	C	C
12	A	B	C	C	C	C
24	A	B	C	C	C	C
48	A	A	C	C	C	C

Fig.8.6 Derating Curve for Convection Cooling (Rated Input Voltage)

(2) In the case of Forced Air Cooling (1.0m/s) (Reference)



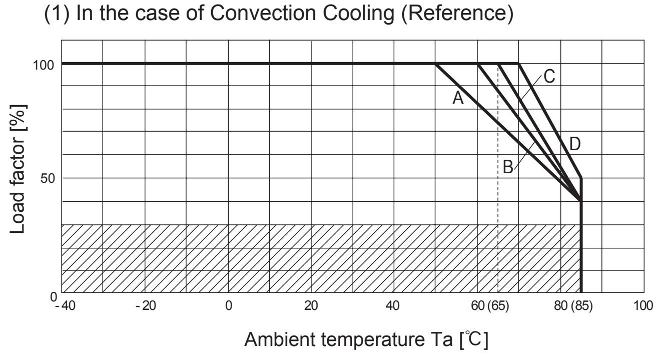
Output Voltage / Input Voltage	3.3	5	12	15	±12	±15
5	A	A	A	A	A	A
12	A	A	A	A	A	A
24	A	A	A	A	A	A
48	A	A	A	A	A	A

Fig.8.7 Derating Curve for Forced Air Cooling (Rated input Voltage)

8.4 MGS10/MGW10 Derating Curve

■If you derate the output current, you can use the unit in the temperature range from -40℃ to the maximum temperature shown below.
In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

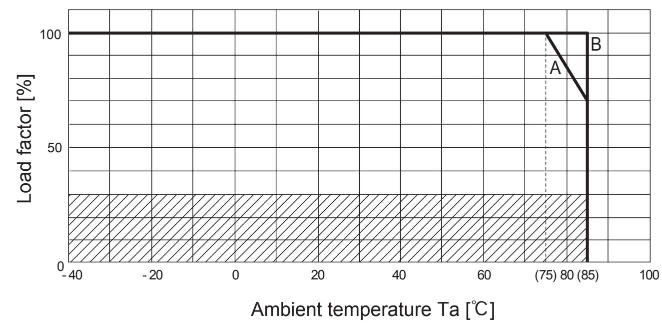
(1) In the case of Convection Cooling (Reference)



Output Voltage / Input Voltage	3.3	5	12	15	±12	±15
5	A	A	A	A	A	A
12	C	C	C	D	B	B
24	B	C	C	D	B	C
48	B	C	C	D	B	C

Fig.8.8 Derating Curve for Convection Cooling (Rated Input Voltage)

(2) In the case of Forced Air Cooling (1.0m/s) (Reference)



Output Voltage / Input Voltage	3.3	5	12	15	±12	±15
5	A	A	A	A	A	A
12	B	B	B	B	B	B
24	B	B	B	B	B	B
48	B	B	B	B	B	B

Fig.8.9 Derating Curve for Forced Air Cooling (Rated input Voltage)

8.5 MGFS1R5/MGFW1R5 Derating Curve

■If you derate the output current, you can use the unit in the temperature range from -40℃ to the maximum temperature shown below.

(1) In the case of Convection Cooling (Reference)

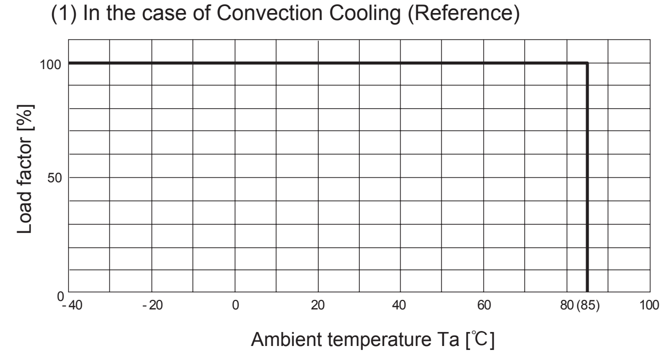


Fig.8.10 Derating Curve for Convection Cooling (Rated Input Voltage)

(2) In the case of Forced Air Cooling (1.0m/s) (Reference)

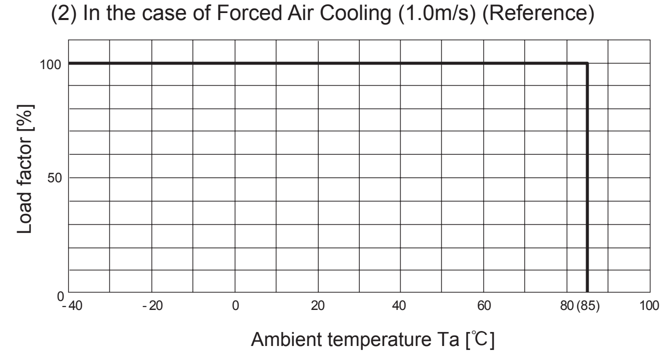
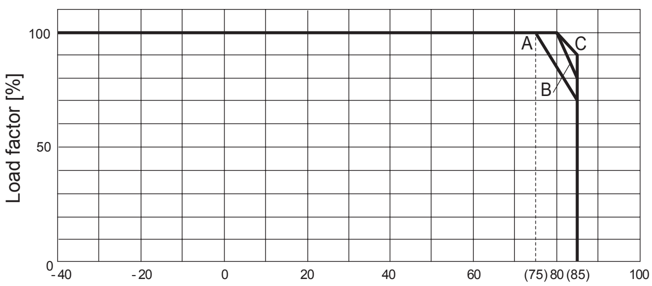


Fig.8.11 Derating Curve for Forced Air Cooling (1.0m/s) (Rated Input Voltage)

8.6 MGFS3/MGFW3 Derating Curve

■If you derate the output current, you can use the unit in the temperature range from -40℃ to the maximum temperature shown below.

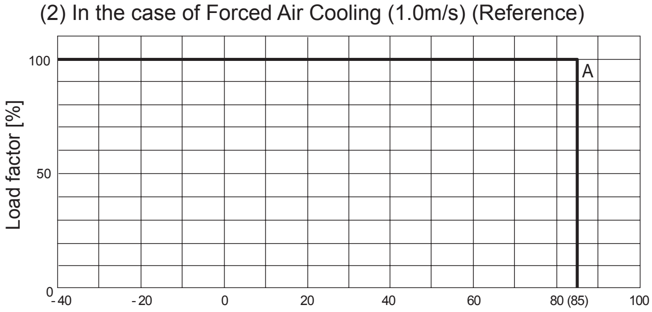
(1) In the case of Convection Cooling (Reference)



Output Voltage / Input Voltage	3.3	5	12	15	±12	±15
12-24	A	A	C	C	C	C
24-48	A	A	B	B	B	B

Fig.8.12 Derating Curve for Convection Cooling (Rated Input Voltage)

(2) In the case of Forced Air Cooling (1.0m/s) (Reference)



Output Voltage / Input Voltage	3.3	5	12	15	±12	±15
12-24	A	A	A	A	A	A
24-48	A	A	A	A	A	A

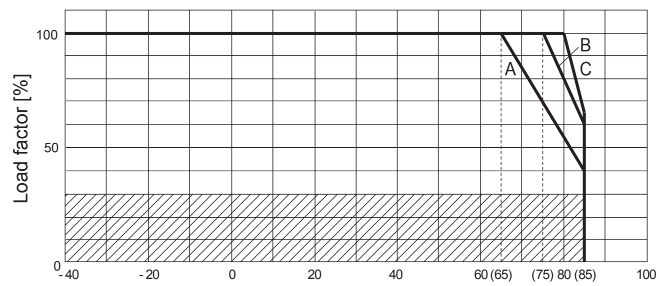
Fig.8.13 Derating Curve for Forced Air Cooling (Rated input Voltage)

8.7 MGFS6/MGFW6 Derating Curve

■If you derate the output current, you can use the unit in the temperature range from -40℃ to the maximum temperature shown below.

In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

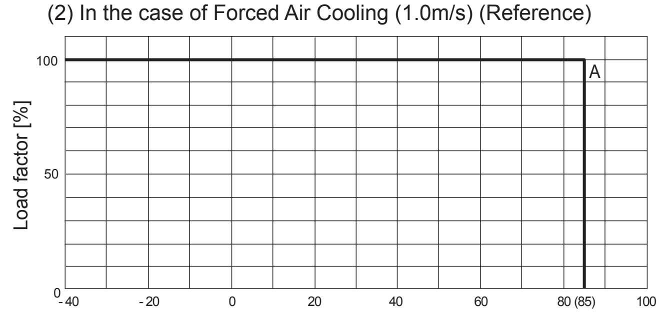
(1) In the case of Convection Cooling (Reference)



Output Voltage / Input Voltage	3.3	5	12	15	±12	±15
12-24	A	A	C	C	C	C
24-48	A	A	C	C	B	B

Fig.8.14 Derating Curve for Convection Cooling (Rated Input Voltage)

(2) In the case of Forced Air Cooling (1.0m/s) (Reference)



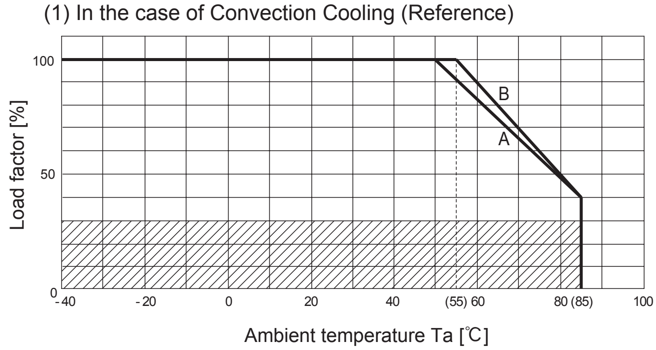
Output Voltage / Input Voltage	3.3	5	12	15	±12	±15
12-24	A	A	A	A	A	A
24-48	A	A	A	A	A	A

Fig.8.15 Derating Curve for Forced Air Cooling (Rated input Voltage)

8.8 MGFS10/MGFW10 Derating Curve

■If you derate the output current, you can use the unit in the temperature range from -40℃ to the maximum temperature shown below.
In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

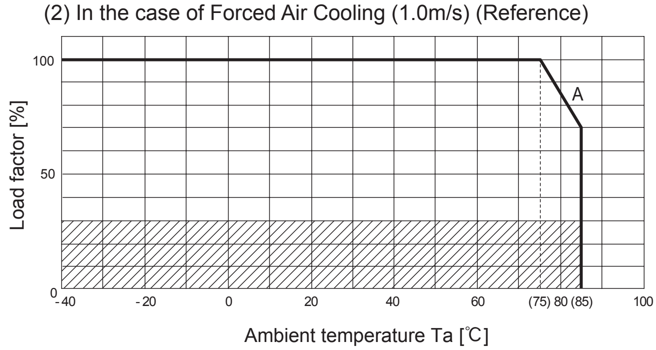
(1) In the case of Convection Cooling (Reference)



Output Voltage / Input Voltage	3.3	5	12	15	±12	±15
12-24	B	B	B	B	A	A
24-48	B	B	B	B	B	B

Fig.8.16 Derating Curve for Convection Cooling (Rated Input Voltage)

(2) In the case of Forced Air Cooling (1.0m/s) (Reference)



Output Voltage / Input Voltage	3.3	5	12	15	±12	±15
12-24	A	A	A	A	A	A
24-48	A	A	A	A	A	A

Fig.8.17 Derating Curve for Forced Air Cooling (Rated input Voltage)

8.9 MGXS1R5/MGXW1R5 Derating Curve

■If you derate the output current, you can use the unit in the temperature range from -40℃ to the maximum temperature shown below.

(1) In the case of Convection Cooling (Reference)

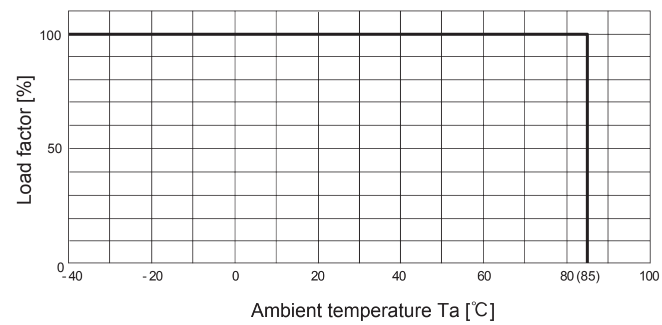


Fig.8.18 Derating Curve for Convection Cooling (Rated Input Voltage)

(2) In the case of Forced Air Cooling (1.0m/s) (Reference)

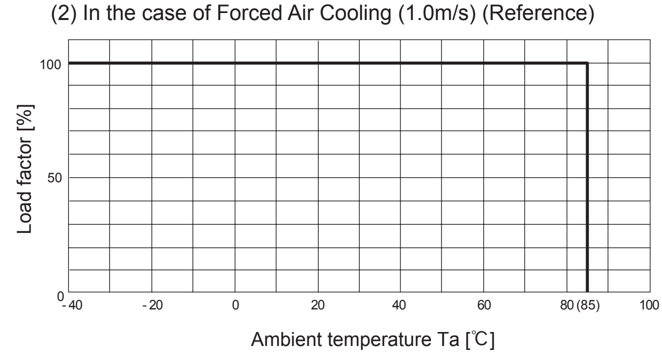
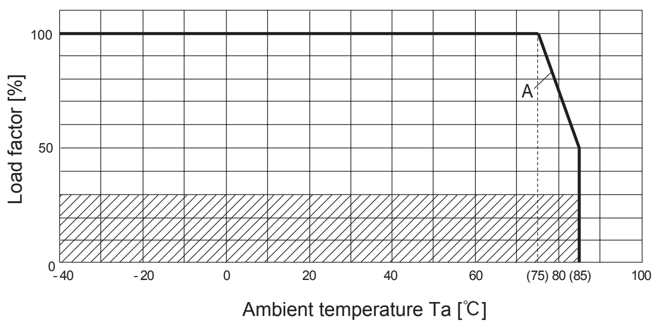


Fig.8.19 Derating Curve for Forced Air Cooling (1.0m/s) (Rated Input Voltage)

8.10 MGXS6/MGXW6 Derating Curve

■If you derate the output current, you can use the unit in the temperature range from -40℃ to the maximum temperature shown below.
In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

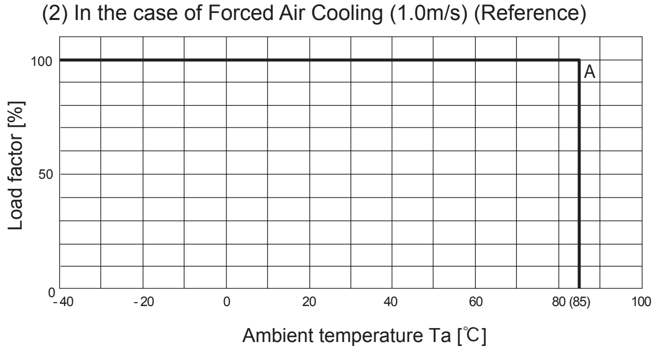
(1) In the case of Convection Cooling (Reference)



Output Voltage / Input Voltage	3.3	5	12	15	±12	±15
12-48	A	A	A	A	A	A

Fig.8.20 Derating Curve for Convection Cooling (Rated Input Voltage)

(2) In the case of Forced Air Cooling (1.0m/s) (Reference)



Output Voltage / Input Voltage	3.3	5	12	15	±12	±15
12-48	A	A	A	A	A	A

Fig.8.21 Derating Curve for Forced Air Cooling (Rated input Voltage)

9 Input Derating

9.1 MGF3/MGF10 Input Derating

■MGFS3, MGFW3, MGFS10 and MGFW10 has derating by input voltage is required. shown Fig.9.1.

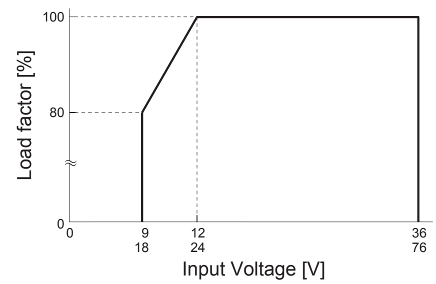


Fig.9.1 Input voltage derating curve
(MGFS3, MGFW3, MGFS10, MGFW10)

9.2 MGX1R5/MGX6 Input Derating

■MGXS1R5, MGXW1R5, MGXS6 and MGXW6 has derating by input voltage is required shown Fig.9.2.

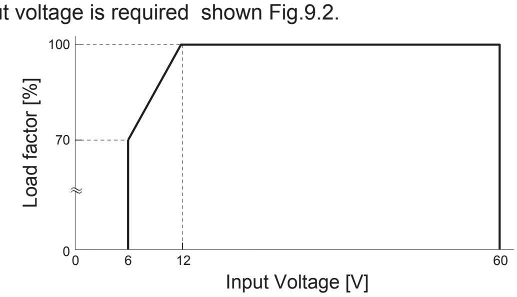


Fig.9.2 Input voltage derating curve
(MGXS1R5, MGXW1R5, MGXS6, MGXW6)

10 Lifetime expectancy depends on stress by temperature difference

■Regarding lifetime expectancy design of solder joint, following contents must be considered. Be careful that the soldering joint is not stressed by temperature rise and down which occures by self-heating and ambient temperature change. The stress is accelerated by thermal-cycling, therefore the temperature difference should be minimized as much as possible if temperature rise and down occures frequently.

10.1 MG1R5/MG3 Lifetime expectancy depends on stress by temperature difference

■Product lifetime expectancy depends on case temperature difference (Tc) and number of cycling in a day is shown in Fig.10.1, Fig.10.2 (It is calculated based on our accelerated process test result.) If case temperature changes frequently by changing output load factor etc., the above the lifetime expectancy design should be applied as well. And point A which is shown in Fig.10.3 must keep below 110℃.

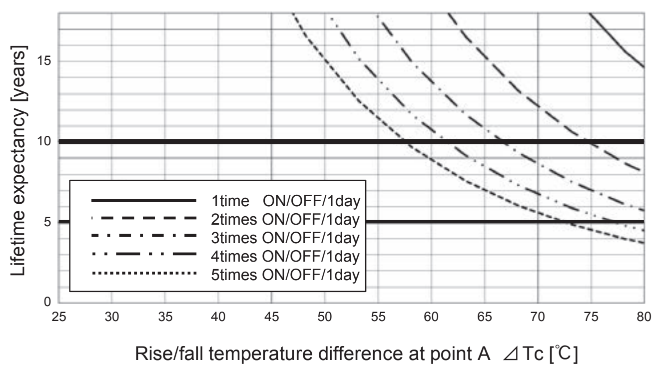


Fig.10.1 Lifetime expectancy against rise/fall temperature difference (MG1R5)

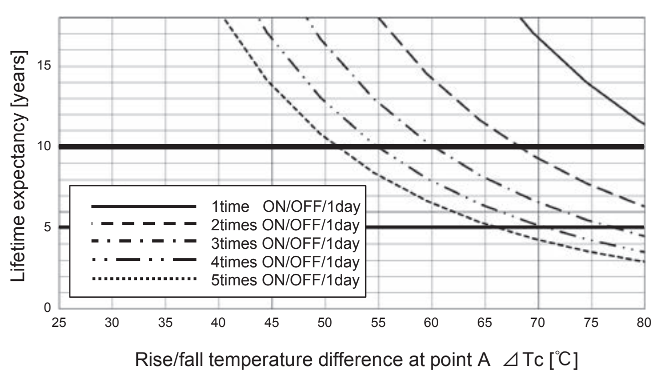


Fig.10.2 Lifetime expectancy against rise/fall temperature difference (MG3)

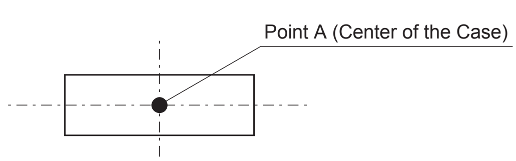


Fig.10.3 Temperature Measuring Point on the case (Top View)

■The warranty period is basically 10 years, however it depends on the lifetime expectancy which is shown in Fig.10.1, Fig.10.2 if it is less than 10 years.

10.2 MG6/MG10 Lifetime expectancy depends on stress by temperature difference

■Product lifetime expectancy depends on case temperature difference (Tc) and number of cycling in a day is shown in Fig.10.4, Fig.10.5 (It is calculated based on our accelerated process test result.) If case temperature changes frequently by changing output load factor etc., the above the lifetime expectancy design should be applied as well. And point A which is shown in Fig.10.6 must keep below 105℃.

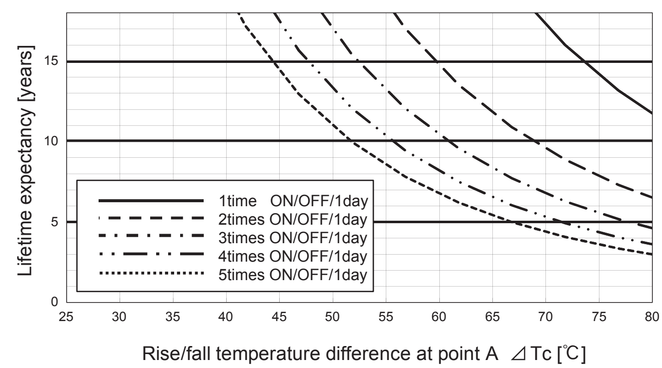


Fig.10.4 Lifetime expectancy against rise/fall temperature difference (MG6)

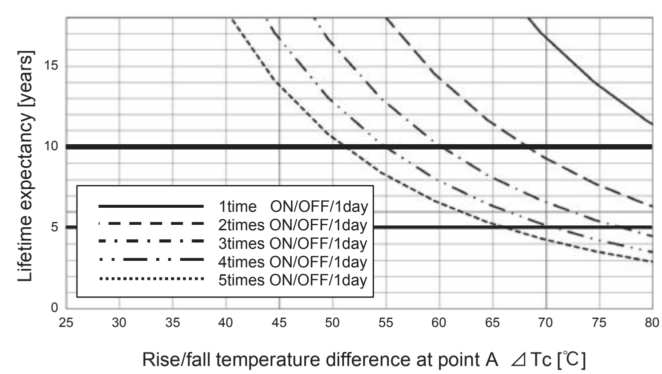


Fig.10.5 Lifetime expectancy against rise/fall temperature difference (MG10)

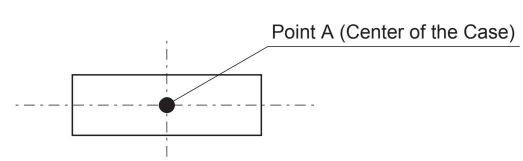


Fig.10.6 Temperature Measuring Point on the case (Top View)

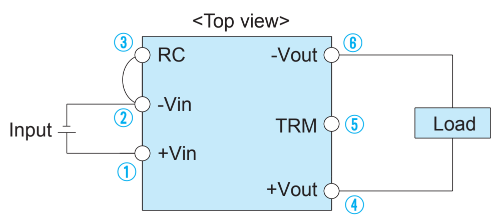
■The warranty period is basically 10 years, however it depends on the lifetime expectancy which is shown in Fig.10.4, Fig.10.5 if it is less than 10 years.

1 Pin Configuration

Table 1.1 Pin Configuration and Functions (MG15/MG40)

Pin No.	Pin Name	Function
1	+Vin	+DC Input
2	-Vin	-DC Input
3	RC	Remote ON/OFF
4	+Vout	+DC Output
5	TRM	Output Voltage Adjustment (please see 2.5)
	COM	GND of Output Voltage (for Dual Output)
6	-Vout	-DC Output

●Single Output



●Dual(±)Output

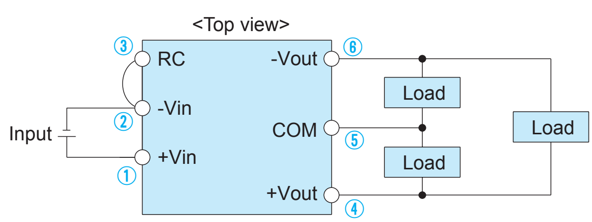
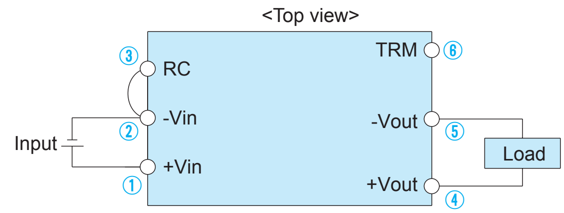


Fig.1.1 Pin Configuration (MG15/MG40)

Table 1.2 Pin Configuration and Functions (MG30/MG80)

Pin No.	Pin Name	Function
1	+Vin	+DC Input
2	-Vin	-DC Input
3	RC	Remote ON/OFF
4	+Vout	+DC Output
5	-Vout	-DC Output (for Single Output)
	COM	GND of Output Voltage (for Dual Output)
6	TRM	Output Voltage Adjustment (please see 2.5)
	-Vout	-DC Output (for Dual Output)

●Single Output



●Dual(±)Output

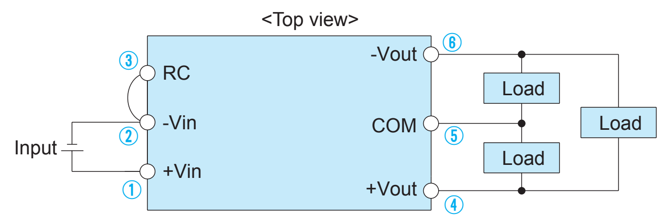


Fig.1.2 Pin Configuration (MG30/MG80)

2 Function

2.1 Input Voltage Range

■If output voltage value doesn't fall within specifications, a unit may not operate in accordance with specifications and/or fail.

2.2 Overcurrent Protection

■Overcurrent Operation

An overcurrent protection circuit is built-in and activated over 105% of the rated current or above. It prevents the unit from short circuit and overcurrent. The output voltage of the power supply will recover automatically if the fault causing over current is corrected.

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

2.3 Overvoltage Protection (Excluding MG15)

■Over Voltage Protection (OVP) is built in. When OVP works, output voltage can be recovered by shutting down DC input for at least one second or by turning off the remote control switch for one second without shutting down the DC input. The recovery time varies according to input voltage and input capacitance.

Remarks :

Note that devices inside the power supply may fail when a voltage greater than the rated output voltage is applied from an external power supply to the output terminal of the power supply. This could happen in in-coming inspections that include OVP function test or when voltage is applied from the load circuit.

2.4 Isolation

■When you run a Hi-Pot test as receiving inspection, gradually increase the voltage to start. When you shut down, decrease the voltage gradually by using a dial. Please avoid a Hi-Pot tester with a timer because, when the timer is turned ON or OFF, it may generate a voltage a few times higher than the applied voltage.

2.5 Output Voltage Adjustment Range(MGS/MGFS Only)

■The output voltage is adjustable through an external potentiometer. Adjust only within the range of ±10% of the rated voltage.

■To increase the output voltage, turn the potentiometer so that the resistance value between 2 and 3 becomes small.

■Please use a wire as short as possible to connect to the potentiometer and connect it from the pin on the power supply side. Temperature coefficient deteriorates when some types of resistors and potentiometers are used. Please use the following types.

Resistor············ Metal Film Type, Temperature Coefficient of ±100ppm/℃ or below

Potentiometer··· Cermet Type, Temperature Coefficient of ±300ppm/℃ or below

■If output voltage adjustment is not required, open the TRM pin.

■Output voltage adjustment may increase to overvoltage protection activation range based on determined external resister values.

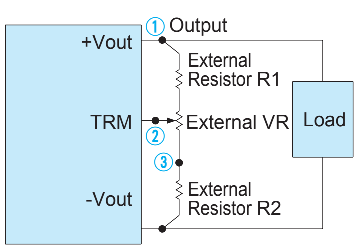


Fig.2.1 Connecting External Devices

Table 2.1 List of External Devices

Item #	Output Voltage	Constant of External Device [Ω] (Adjustable within ±10%)		
		VR	R1	R2
1	3.3V	1k	100	100
2	5V	1k	100	270
3	12V	5k	10k	1.5k
4	15V	5k	10k	1k
5	±5V			
6	±12V			
7	±15V			

2.6 Remote ON/ OFF

■The remote ON/OFF function is incorporated in the input circuit and operated with RC and -Vin. If positive logic control is required, order the power supply with "-R" option.

Table 2.2 Remote ON/OFF Specifications (MG15/MG30)

Model	ON/OFF logic	Between RC and -Vin	Output Voltage
Standard	Negative	Llebel (0 - 1.2V) or short	ON
		Hlebel (3 - 12V) or open	OFF
Option-R	Positive	Llebel (0 - 1.2V) or short	OFF
		Hlebel (3 - 12V) or open	ON

Table 2.3 Remote ON/OFF Specifications (MG40/MG80)

Model		ON/OFF logic	Between RC and -Vin	Output Voltage
MGF□□05□	Standard	Negative	L lebel (0 - 0.4V) or short	ON
			Hlebel (3 - 12V) or open	OFF
	Option-R	Positive	Llebel (0 - 0.4V) or short	OFF
			Hlebel (3 - 12V) or open	ON
MGF□□24□/ MGF□□48□	Standard	Negative	Llebel (0 - 0.8V) or short	ON
			Hlebel (3 - 12V) or open	OFF
	Option-R	Positive	Llebel (0 - 0.8V) or short	OFF
			Hlebel (3 - 12V) or open	ON

■When RC is at low level, a current of 0.5mA typ will follow out. (MG15/MG30)

■When RC is at low level, a current of 0.05mA typ will follow out. (MG40/MG80)

■When remote ON/OFF is not used, short RC and -Vin.

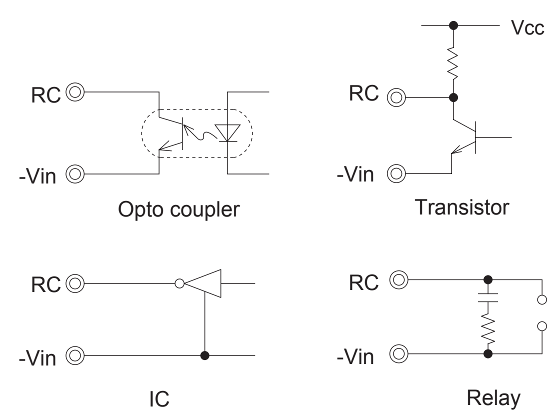


Fig.2.2 RC Connection Example

2.7 Thermal protection (MG40/MG80)

■When the power supply temperature is kept above the values determined by the derating curve, the thermal protection will be activated and simultaneously shut down the output.

In this case, the unit should be cool down, and then recovery from thermal protection is accomplished by cycling the DC input power off for at least 1 second, or toggling Remote ON/OFF signal.

3 Wiring to Input/Output Pin

3.1 Wiring input pin

(1) External fuse

● MG15, MG30

■Fuse is built-in on input side.

● MG40, MG80

■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.

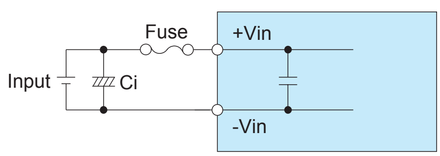


Fig.3.1 Connecting Example of an External Capacitor to the Input Side

Table 3.1 Recommended fuse (normal-blow type)

Model / Input Voltage[V]	MG40	MG80
5-12 (MGF)	15A	
12-24 (MGF)	10A	15A
24-48 (MGF)	5A	10A

(2) External capacitor on the input side

■MG series has Pi-shaped filter internally.

You can add a capacitor Ci near the input pin termilal and reduce reflected input noise from the converter. Please connect the capacitor as needed.

■When you use a capacitor Ci, please use the one with high frequency and good temperature characteristics.

■If the power supply is to be turned ON/OFF directly with a switch, inductance from the input line will induce a surge voltage several times that of the input voltage and it may damage the power supply. Make sure that the surge is absorbed, for example, by connecting an electrolytic capacitor between the input pins.

■If an external filter containing L (inductance) is added to the input line or a wire from the input source to the MG series is long, not only the reflected input noise becomes large, but also the output of the converter may become unstable. In such case, connecting Ci to the input pin is recommended.

■If you use an aluminum electrolytic capacitor, please pay attention to the ripple current rating.

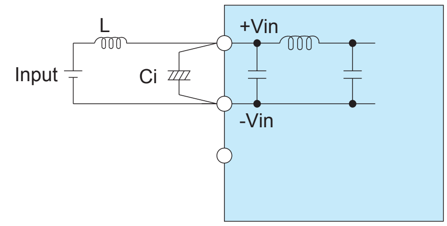


Fig.3.2 Connecting an External Capacitor to the Input Side

Table 3.2 Recommended Capacitance of an External Capacitor on the Input Side [μF]

Model / Input Voltage[V]	MG15	MG30	MG40	MG80
12	220	220		
24	100	100		
48	47	47		
5-12 (MGF)			220	
12-24 (MGF)	100	100	100	100
24-48 (MGF)	47	47	47	47

*Please adjust the capacitance in accordance with a degree of the effect you want to achieve.

■If a reverse polarity voltage is applied to the input pin, the power supply will fail.

If there is a possibility that a reverse polarity voltage is applied, connect a protection circuit externally as described below.

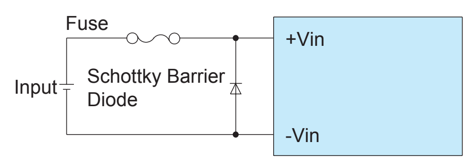
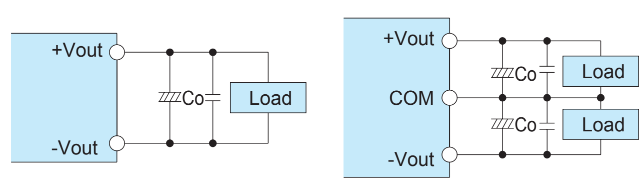


Fig.3.3 Connecting a Reverse Voltage Protection Circuit

3.2 Wiring output pin

■If you want to further reduce the output ripple noise, connect an electrolytic capacitor or a ceramic capacitor Co to the output pin as shown below.



MGS/MGFS MGW/MGFW

Fig.3.4 Connecting Example of an External Capacitor to the Output Side

Table 3.3 Recommended Capacitance of External Capacitor on the Output Side [μF]

Model / Output Voltage[V]	MG15	MG30	MG40	MG80
3.3	470	470	470	470
5	470	470	470	470
12	150	150	150	150
15	100	100	100	100
±5	330	330		
±12	100	100	100	100
±15	47	47	47	47

＊If you use a ceramic capacitor, keep the capacitance within the rage between about 0.1 to 22μF.

＊Please adjust the capacitance in light of the effect you want to achieve.

＊If you need to use an unproven external capacitor which capacitance moreover the range provided in Table 3.3, please contact us for the assistance.

■If the distance between the output and the load is long and therefore the noise is generated on the load side, connect a capacitor externally to the load as shown below.

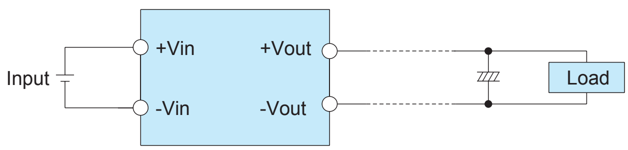


Fig.3.5 Connecting Example

4 Series/Redundancy Operation

4.1 Series Operation

■You can use the power supplies in series operation by wiring as shown below. In the case of (a) below, the output current should be lower than the rated current for each power supply with the lowest rated current among power supplies that are serially connected. Please make sure that no current exceeding the rated current flows into a power supply.

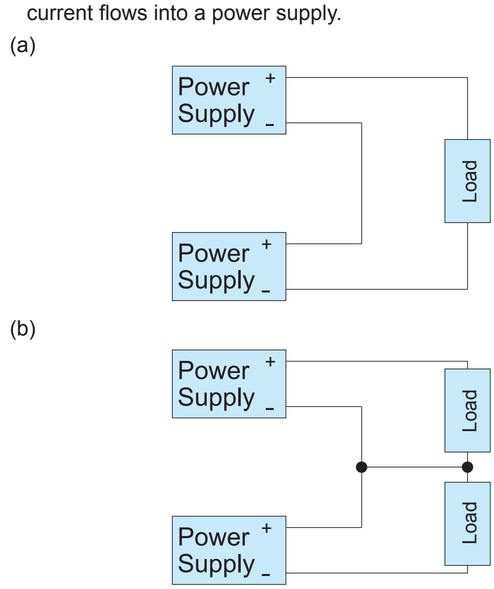


Fig.4.1 Series Operation

4.2 Redundancy Operation

■You can use the power supplies in redundancy operation by wiring as shown below.

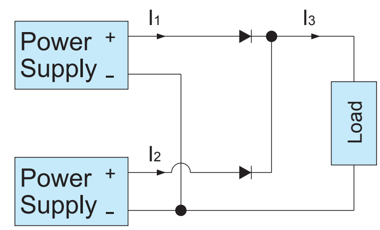


Fig.4.2 Redundancy Operation

■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 for each power supply.

$I_3 \leqq$ Rated Current Value

5 Input Voltage/ Current Range

■If you use a non-regulated power source for input, please check and make sure that its voltage fluctuation range and ripple voltage do not exceed the input voltage range shown in specifications.

■Please select an input power source with enough capacity, taking into consideration of the start-up current (Ip), which flows when a DC-DC converter starts up.

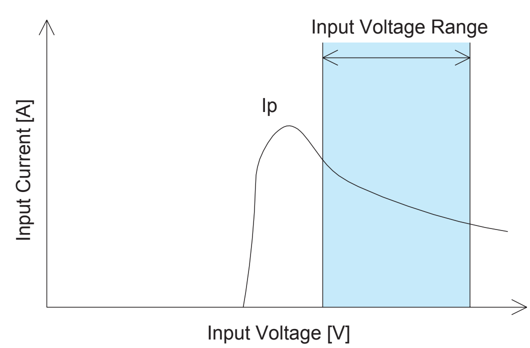


Fig.5.1 Input Current Characteristics

6 Assembling and Installation

6.1 Installation

■When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Ambient temperature around each power supply should not exceed the temperature range shown in derating curve.

6.2 Soldering Conditions

(1) Flow Soldering	: 260℃	15 seconds or less
(2) Soldering Iron	: maximum 360℃	5 seconds or less

6.3 Stress to Pin

■Applying excessive stress to the input or output pins of the power module may damage internal connections. Avoid applying stress in excess of that shown in Fig. 6.1.

■Input/output pin are soldered to the PCB internally. Do not pull or bend a lead powerfully.

■If it is expected that stress is applied to the input/output pin due to vibration or impact, reduce the stress to the pin by taking such measures as fixing the unit to the PCB by silicone rubber, etc.

■Due to prevent failure, PS should not be pull after soldering with PCB.

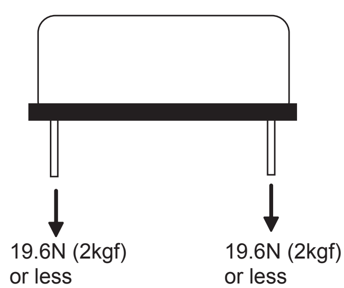


Fig.6.1 Stress onto Pins

6.4 Cleaning

■If you need to clean the unit, please clean it under the following conditions.
Cleaning Method: Varnishing, Ultrasonic or Vapor Cleaning
Cleaning agent: IPA (Solvent type)
Cleaning Time: Within total 2 minutes for varnishing, ultrasonic and vapor cleaning

■Do not apply pressure to the lead and name plate with a brush or scratch it during the cleaning.

■Please dry the unit sufficiently after cleaning.

■If you do ultrasonic cleaning, please keep the ultrasonic output at 15W/ℓ or below.

7 Safety Standards

■To apply for a safety standard approval using the power supply, please meet the following conditions. Please contact us for details.

●Please use the unit as a component of an end device.

●The area between the input and the output of the unit is isolated functionally. Depending upon the input voltage, basic insulation, dual insulation or enhanced insulation may be needed. In such case, please take care of it within the structure of your end-device. Please contact us for details.

8 Output Derating

8.1 MG15 / MGF15 Derating Curve

■Please have sufficient ventilation to keep the temperature of point A in Fig.8.1 at 105℃ or below.
Please also make sure that the ambient temperature does not exceed 85℃.

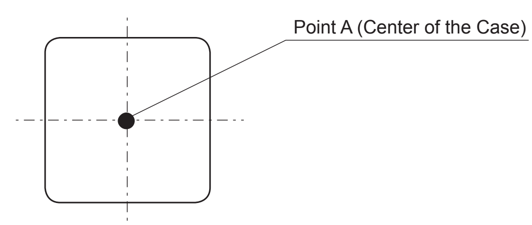


Fig.8.1 Temperature Measuring Point on the case (Top View)

■If you derate the output current, you can use the unit in the temperature range from -40℃ to the maximum temperature shown below.

(1) In the case of Convection Cooling

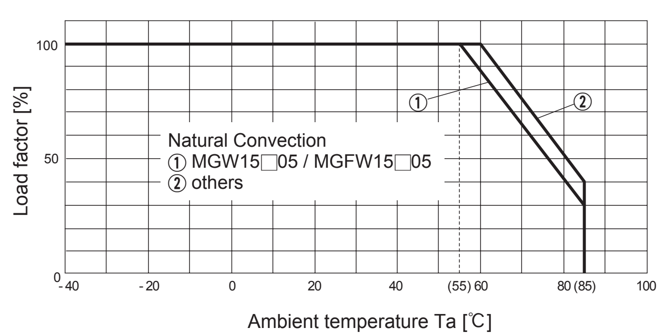


Fig.8.2 Derating Curve for Convection Cooling (Rated Input Voltage)

(2) In the case of Forced Air Cooling (1.0m/s)(Excluding MG-W15□05/MGFW15□05)

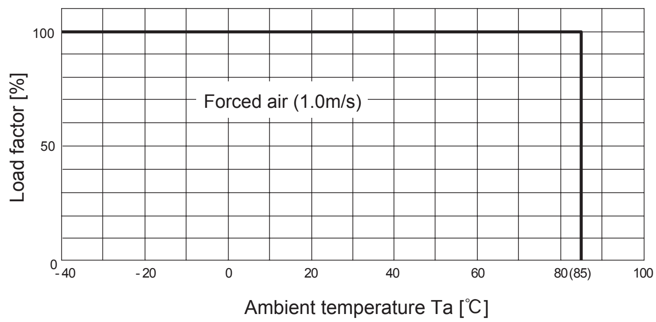


Fig.8.3 Derating Curve for Forced Air Cooling (1.0m/s) (Rated Input Voltage)

(3) In the case of Forced Air Cooling (1.0m/s, 2.5m/s)(MGW15□05/MGFW15□05)

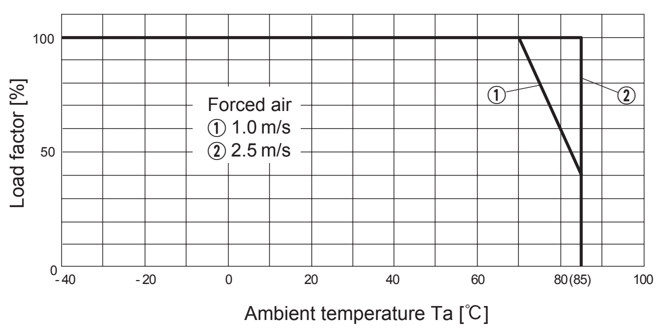


Fig.8.4 Derating Curve for Forced Air Cooling (1.0m/s,2.5m/s) (Rated Input Voltage)

8.2 MG30 / MGF30 Derating Curve

■In case of forced air cooling, please have sufficient ventilation to keep the temperature of point A in Fig.8.5 at 110℃ or below.
Please also make sure that the ambient temperature does not exceed 85℃.

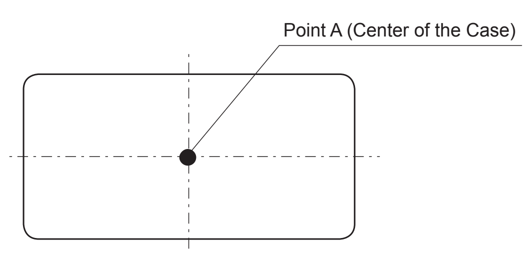


Fig.8.5 Temperature Measuring Point on the case (Top View)

■If you derate the output current, you can use the unit in the temperature range from -40℃ to the maximum temperature shown below.

(1) In the case of Convection Cooling

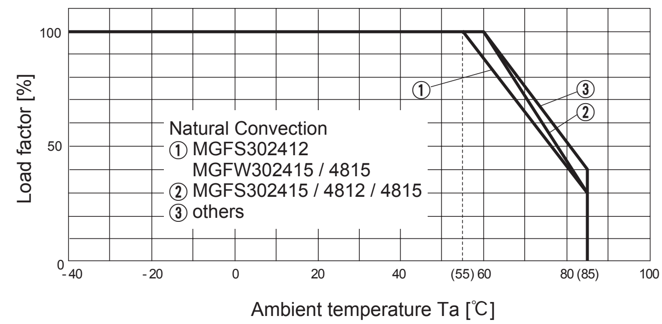


Fig.8.6 Derating Curve for Convection Cooling (Rated Input Voltage)

(2) In the case of Forced Air Cooling (1.0m/s)(Excluding MG-W30□05 and MGFW30□12/15)

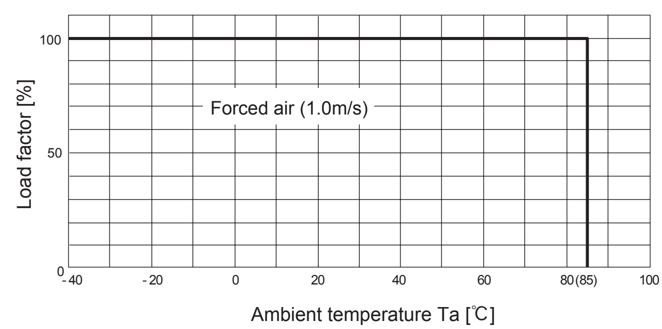


Fig.8.7 Derating Curve for Forced Air Cooling (1.0m/s) (Rated Input Voltage)

(3) In the case of Forced Air Cooling (1.0m/s, 1.5m/s)(MGW30□05 and MGFW30□12/15)

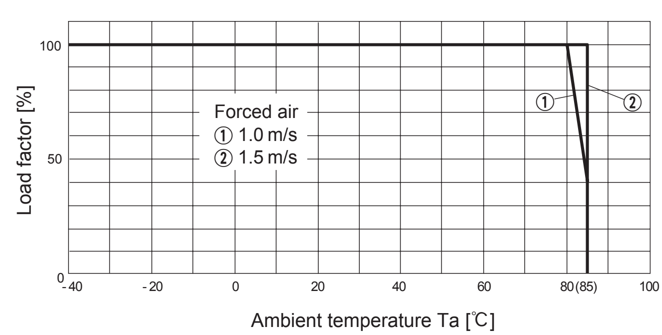


Fig.8.8 Derating Curve for Forced Air Cooling (1.0m/s,1.5m/s) (Rated Input Voltage)

8.3 MGF40 Derating Curve

■Please have sufficient ventilation to keep the temperature of point A in Fig 8.9 at Table 8.1 or below.

Please also make sure that the ambient temperature does not exceed 85℃.

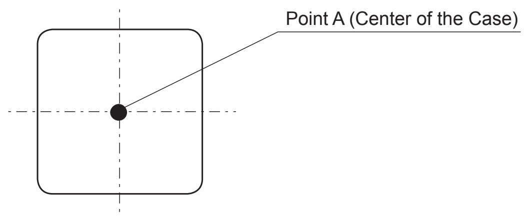


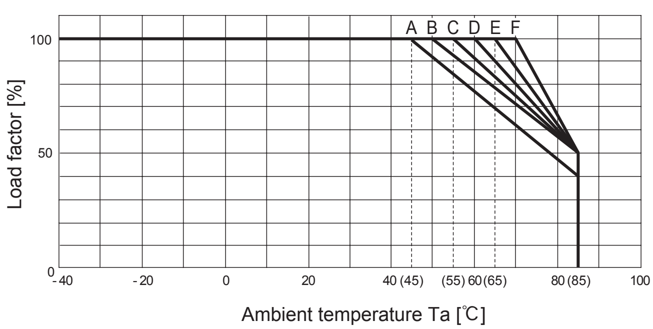
Fig.8.9 Temperature Measuring Point on the case (Top View)

Table 8.1 The temperature of pointA

Model	point A
MGF□4005□	105℃
MGF□4024□	110℃
MGF□4048□	110℃

■If you derate the output current, you can use the unit in the temperature range from -40℃ to the maximum temperature shown below.

(1) In the case of Convection Cooling



Input Voltage[V]	Output Voltage[V]					
	3.3	5	12	15	±12	±15
5	B	A	B	C	B	B
24	E	D	E	F	E	E
48	F	D	F	E	E	E

Fig.8.10 Derating Curve for Convection Cooling (Rated Input voltage)

(2) In the case of Force Air Cooling (1.0m/s)

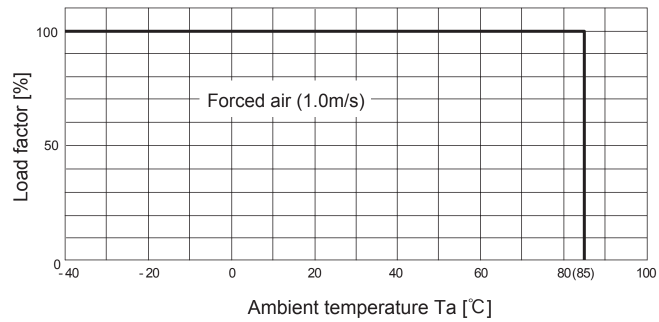


Fig.8.11 Deratingt Curve for Force Air Cooling (1m/s) (Rated Input voltage)

8.4 MGF80 Derating Curve

■Please have sufficient ventilation to keep the temperature of point A in Fig.8.12 at Fig.8.13 or below.

Please also make sure that the ambient temperature does not exceed 85℃.

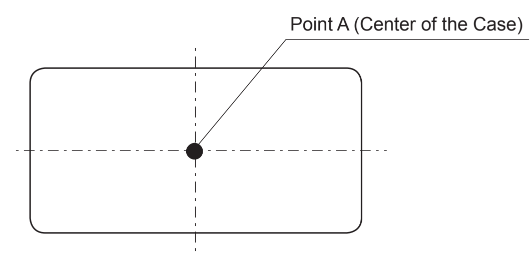


Fig.8.12 Temperature Measuring Point on the case (Top View)

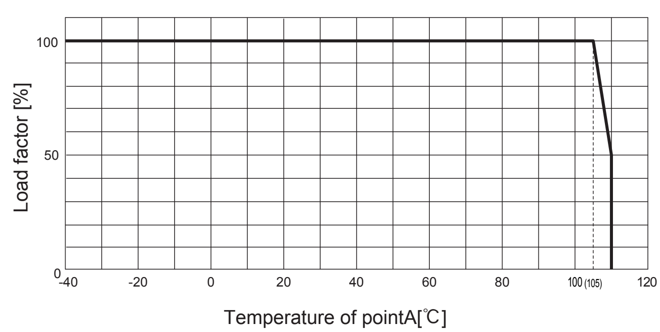
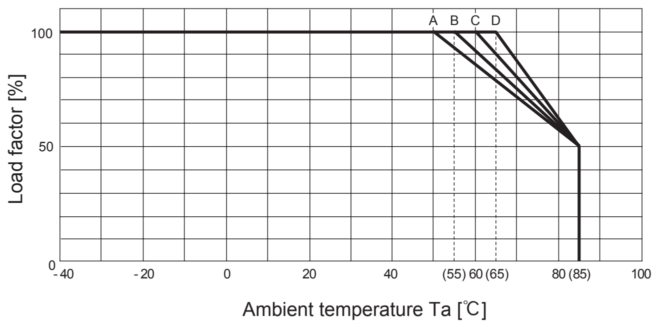


Fig.8.13 The temperature of PointA

■If you derate the output current, you can use the unit in the temperature range from -40℃ to the maximum temperature shown below.

(1) In case of Convection Cooling



Input Voltage[V]	Output Voltage[V]					
	3.3	5	12	15	±12	±15
24	B	A	C	C	C	C
48	C	B	C	D	C	C

Fig.8.14 Derating Curve for Convection Cooling (Rated input voltage)

(2) In the case of Forced Air Cooling (1.0m/s)

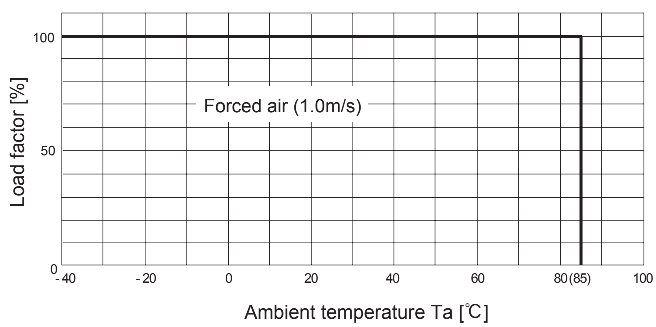


Fig.8.15 Derating Curve for Force Air Cooling (1.0m/s) (Rated Input voltage)

9 Input Derating

9.1 MGF40/MGF80 Input Derating

■MGF40/MGF80 has derating by input voltage is required shown Fig.9.1. and Fig.9.2.

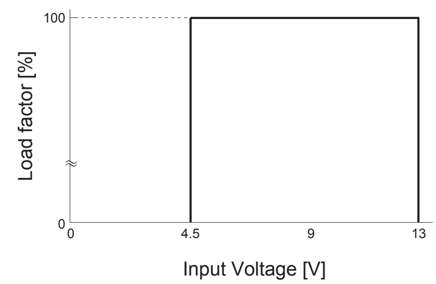


Fig.9.1. Input voltage derating curve (MGF□4005□)

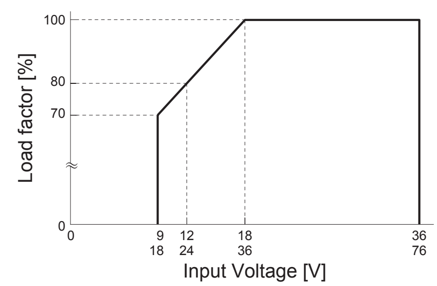
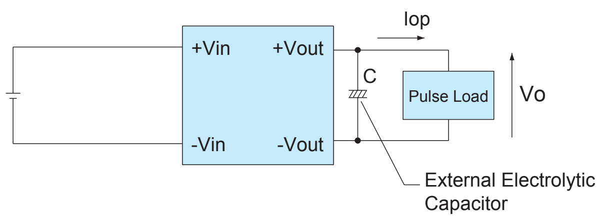
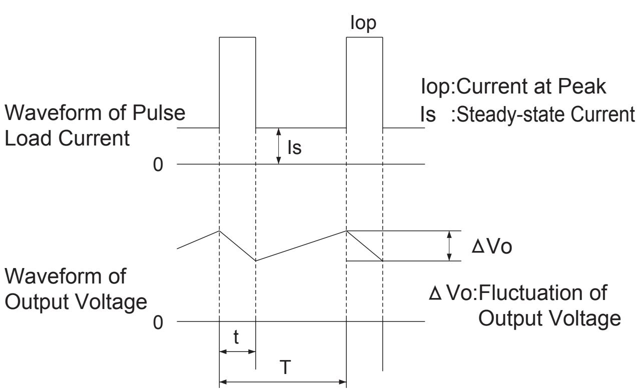


Fig.9.2. Input voltage derating curve (MGF□□24□, MGF□□48□)

10 Peak Current (Pulse Load)

■If a load connected to a converter is a pulse load, you can provide a pulse current by connecting an electrolytic capacitor externally to the output side.





■The average output current Iav is expressed in the following formula.

$$Iav = Is + \frac{(Iop - Is) \times t}{T}$$

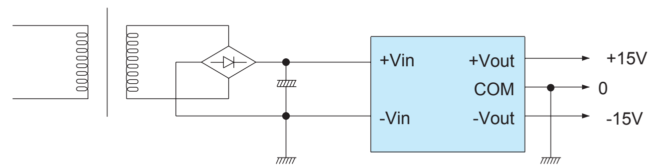
■Required electrolytic capacitor C can be obtained from the following formula.

$$C = \frac{(Iop - Iav) \times t}{\Delta Vo}$$

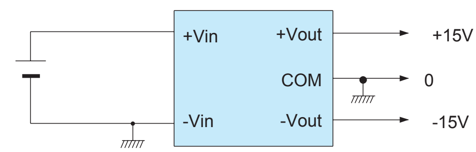
■Depending on the conditions, output may be stopped by the internal protection circuit.

11 Using DC-DC Converters

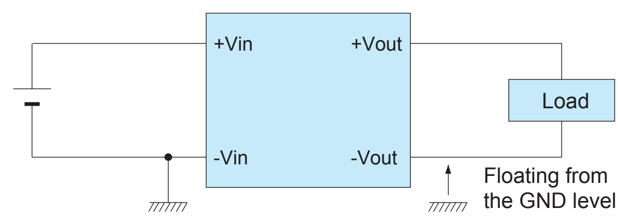
■When using AC power source



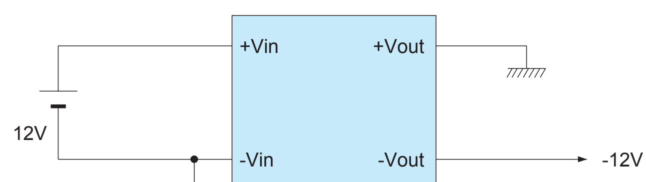
■When using a battery-operated device



■When a floating mechanism is required for the output circuit

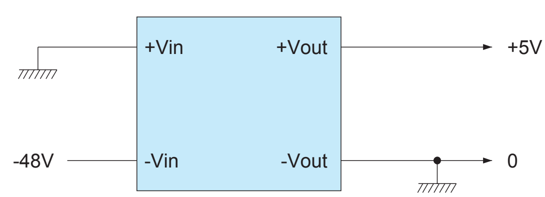


■To draw a reverse polarity output



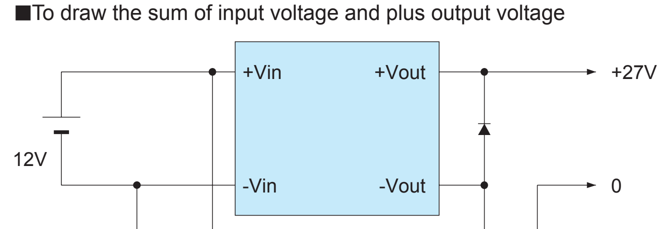
Example MGS151212

■To provide a negative voltage to -Vin by using +Vin side of the converter as GND potential (0V)



Example MGS154805

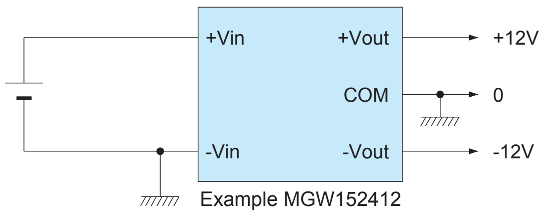
■To draw the sum of input voltage and plus output voltage



Example MGS151215

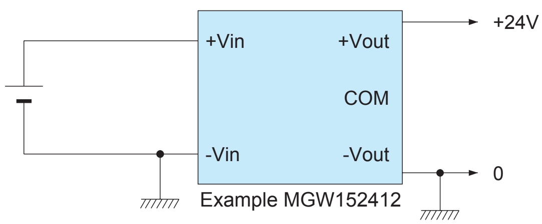
*Output current should be the same as the rated output current of the converter.
*Output current fluctuation is the sum of the input voltage fluctuation and the output voltage fluctuation of the converter.

■To use a dual output type
*Dual output type is typically used in the following manner.



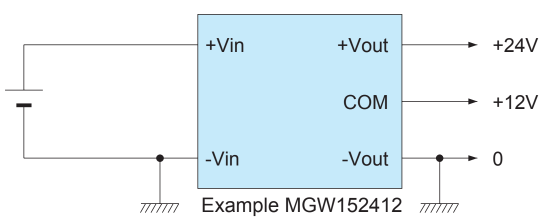
Example MGW152412

*The unit can be used as a 24V type single output power supply as follows.



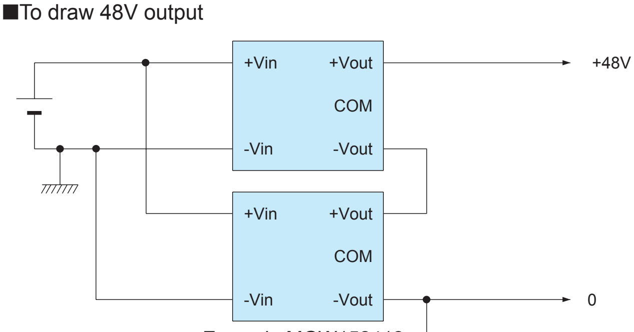
Example MGW152412

*Another way to use the unit is described below.
*The sum of +12V and +24V flows to the 0V line. Please make sure that this value does not exceed the rated output current of the converter.



Example MGW152412

■To draw 48V output



Example MGW152412

12 Note to use ±5V output

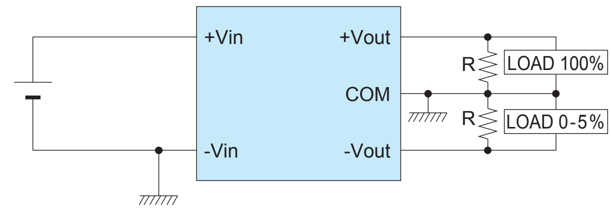


Fig.12.1 Example of decreasing the fluctuation of output voltage.

■If an output current is 0% to 5% of the rated current, the output is influenced by the other output load condition.
20% output voltage fluctuation may occer.
To avoid the fluctuation, external bleeding resister is required to draw sufficient current.

13 Lifetime expectancy depends on stress by temperature difference

■Regarding lifetime expectancy design of solder joint, following contents must be considered.
It must be careful that the soldering joint is stressed by temperature rise and down which is occurred by self-heating and ambient temperature change.
The stress is accelerated by thermal-cycling, therefore the temperature difference should be minimized as much as possible if temperature rise and down is occurred frequently.

13.1 MG15 / MGF15 Lifetime expectancy depends on stress by temperature difference

■Product lifetime expectancy depends on case temperature difference (⊿Tc) and number of cycling in a day is shown in Fig.13.1 (It is calculated based on our accelerated process test result.)
If case temperature changes frequently by changing output load factor etc., the above the lifetime expectancy design should be applied as well. And point A which is shown in Fig.13.2 must keep below 105℃.

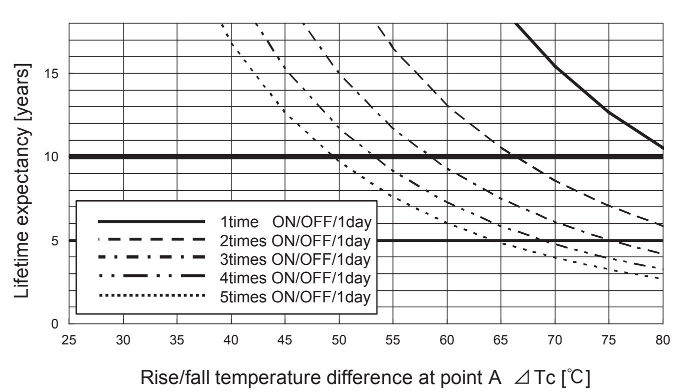


Fig.13.1 Lifetime expectancy against rise/fall temperature difference

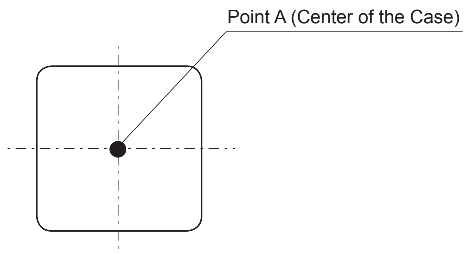


Fig.13.2 Temperature measuring point (Top View)

■The warranty period is basically 10 years, however it depends on the lifetime expectancy which is shown in Fig.13.1 if it is less than 10 years.

13.2 MG30 / MGF30 Lifetime expectancy depends on stress by temperature difference

■Product lifetime expectancy depends on case temperature difference (⊿Tc) and number of cycling in a day is shown in Fig.13.3 (It is calculated based on our accelerated process test result.)
If case temperature changes frequently by changing output load factor etc., the above the lifetime expectancy design should be applied as well. And point A which is shown in Fig.13.4 must keep below 110℃.

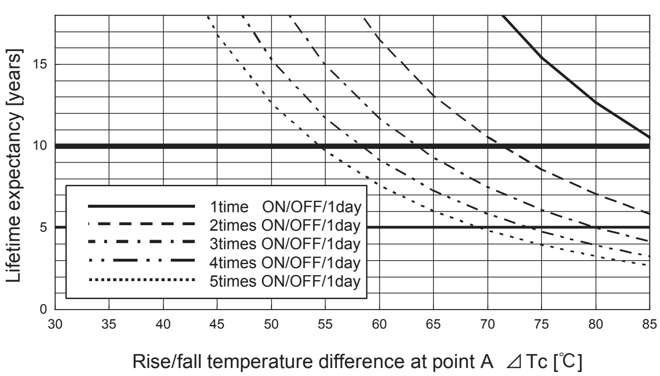


Fig.13.3 Lifetime expectancy against rise/fall temperature difference

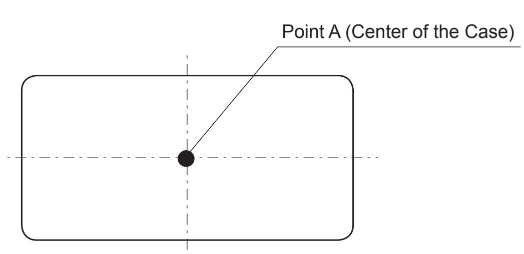


Fig.13.4 Temperature measuring point (Top View)

■The warranty period is basically 10 years, however it depends on the lifetime expectancy which is shown in Fig.13.3 if it is less than 10 years.

13.3 MGF40 Lifetime expectancy depends on stress by temperature difference

■Product lifetime expectancy depends on case temperature difference (⊿Tc) and number of cycling in a day is shown in Fig.13.5 (It is calculated based on our accelerated process test result.)
If case temperature changes frequently by changing output load factor etc., the above the lifetime expectancy design should be applied as well. And point A which is shown in Fig.13.6 must keep below the values determined by the derating curve.

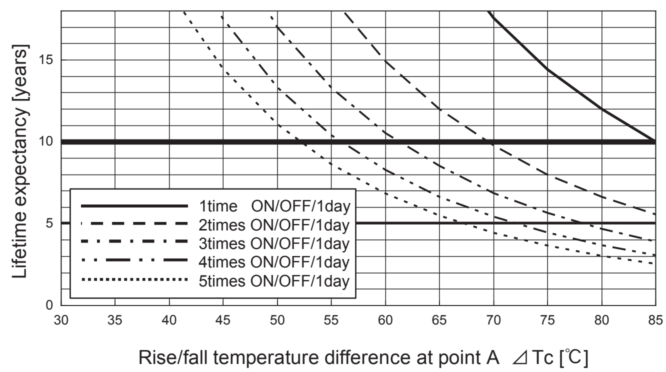


Fig.13.5 Lifetime expectancy against rise/fall temperature difference

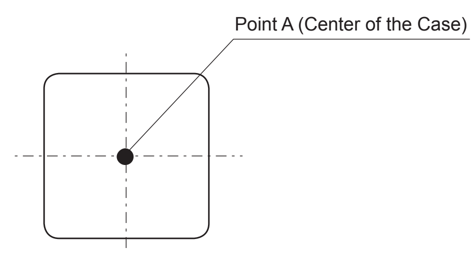


Fig.13.6 Temperature measuring point (Top View)

■The warranty period is basically 10 years, however it depends on the lifetime expectancy which is shown in Fig.13.5 if it is less than 10 years.

13.4 MGF80 Lifetime expectancy depends on stress by temperature difference

■Product lifetime expectancy depends on case temperature difference (⊿Tc) and number of cycling in a day is shown in Fig.13.7 (It is calculated based on our accelerated process test result.)
If case temperature changes frequently by changing output load factor etc., the above the lifetime expectancy design should be applied as well. And point A which is shown in Fig.13.8 must keep below the values determined by the derating curve.

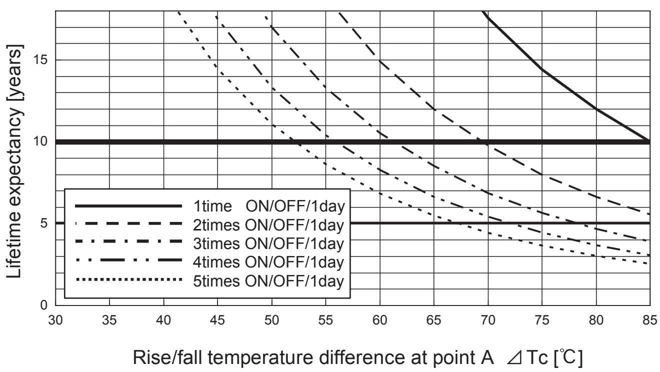


Fig.13.7 Lifetime expectancy against rise/fall temperature difference

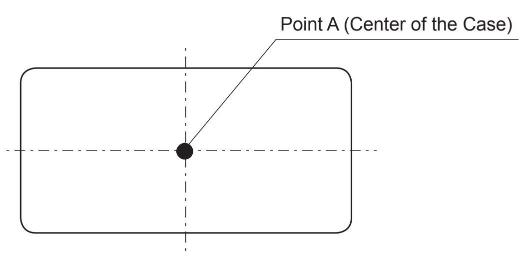


Fig.13.8 Temperature measuring point (Top View)

■The warranty period is basically 10 years, however it depends on the lifetime expectancy which is shown in Fig.13.7 if it is less than 10 years.