

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current *1 [A]	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
					Material	Single sided	Double sided	Series operation	Parallel operation
GMA300F	Active filter	40 - 120	3.3	Thermistor	FR-4	-	Yes	Yes	No
	LLC resonant converters	90 - 180							

*1 The value of input current is at ACIN 115V and rated load.

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1 Function

1.1 Input voltage range

- The range is from AC85V to AC264V. (please see SPECIFICATIONS for details).
- In cases that conform with safety standard, input voltage range is AC100 - AC240V (50/60Hz).
- If input value doesn't fall within above range, a unit may not operate in accordance with specifications and/or start hunting or fail. If you need to apply a square waveform input voltage, which is commonly used in UPS and inverters, please contact us.
- When the input voltage changes suddenly, the output voltage accuracy might exceed the specification. please contact us.

1.2 Inrush current limiting

- An inrush current limiting circuit is built-in.
- If you need to use a switch on the input side, please select one that can withstand an input inrush current.
- Thermistor is used in the inrush current limiting circuit. When you turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that power supply cools down before being turned on.
- Surge current in the filter unit does not include (0.2ms or less).

1.3 Overcurrent protection

- An overcurrent protection circuit is built-in and activated over 105% of the rated current. A unit automatically recovers when a fault condition is removed. Please do not use a unit in short circuit and/or under an overcurrent condition.
- Hiccup Operation Mode
Hiccup operation for overcurrent protection is included in a part of series. When the overcurrent protection circuit is activated and the output voltage drops to a certain extent, the output becomes hiccup so that the average current will also decrease.
- Output voltage shuts down when the output voltage continuously drops due to overcurrent protection.
- Output voltage recovers from overcurrent protection by shutting down the input voltage and waiting more than 3 minutes then turning on AC input again.

1.4 Overvoltage protection

- An overvoltage protection circuit is built-in. If the overvoltage protection circuit is activated, shut down the input voltage, wait more than 3 minutes and turn on the AC input again to recover the output voltage. Recovery time varies depending on such factors as input voltage value at the time of the operation.

Remarks :

Please avoid applying a voltage exceeding the rated voltage to an output terminal. Doing so may cause a power supply to malfunction or fail. If you cannot avoid doing so, for example, if you need to operate a motor, etc., please install an external diode on the

output terminal to protect the unit.

1.5 Thermal protection

- Over Temperature Protection (OTP) is built-in. This protection circuit may be activated under the following conditions and shut down the output.
 - ① When a temperature continue to exceed the values determined by the derating curve.
 - ② When a current exceeding the rated current is applied.
 - ③ When convection stops.
 If the protection circuit is activated, shut off the input voltage and eliminate all the overheating conditions. To recover the output voltage, have enough time to cool down the unit before turning on the input voltage again.

Remarks :

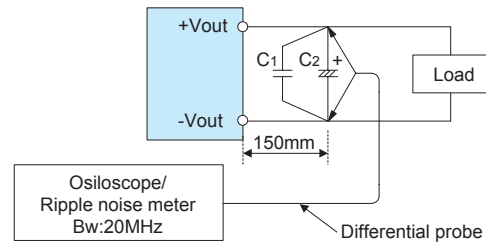
Please comply with recommended mounting method in section 3.

1.6 Output voltage adjustment range

- To increase an output voltage, turn a built-in potentiometer clockwise. To decrease the output voltage, turn it counterclockwise.

1.7 Output ripple and ripple noise

- Output ripple noise may be influenced by measurement environment, measuring method Fig.1.1 is recommended.



- C1 : Film capacitor 0.1 μ F
- C2 : Aluminum electrolytic capacitor 22 μ F

Fig.1.1 Measuring method of Ripple and Ripple Noise

Remarks :

When GND cable of probe with flux of magnetic force from power supply are crossing, ripple and ripple noise might not measure correctly. Please note the measuring environment.

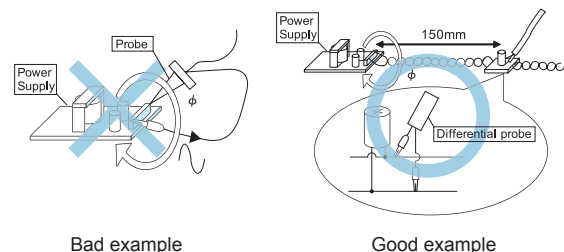


Fig.1.2 Example of measuring output ripple and ripple noise

1.8 Isolation

- For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for the start (shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.
- When you test a unit for isolation between the input and output, input and the terminal FG or between the output and the terminal FG, short-circuit between the output and the terminals RCG and AUXG.

2 Series Operation and Parallel Operation

2.1 Series Operation

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

Remarks :

Please be sure to have enough cooling in case one of the power supply stops due to activation of the protection circuitry. In case of malfunction (Failure of protection circuit activation), please stop the operation and replace the failed power supply.

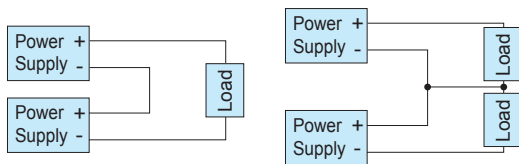


Fig.2.1 Examples of connecting in series operation

2.2 Parallel Operation

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

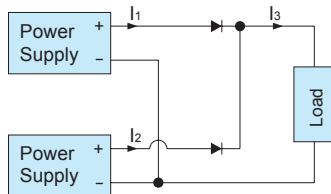


Fig.2.2 Example of redundancy operation

- 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 of a power supply.
 $I_3 \leq$ the rated current value
- Hot-swap or Hot-plug is not available.

3 Assembling and Installation Method

- Cooling method
Forced air cooling is available.
- For proper operation of the power supply, please note the following:
 - ① Heat dissipation (derating): Section 3.1 reference
 - The temperature rise and heat dissipation of the converter must be considered.
 - Conditions vary with environment and input voltage.
 - Mounting surface will be very hot during operation, so please be careful not to touch the surface.
 - ② Insulation distance: Please refer to Section 3.2
 - AC voltage exists on the primary side. Therefore, in order to prevent electric shock, or to meet the leakage current requirements of the safety standard, you need to ensure the proper insulation distance.

3.1 Heat dissipation (derating)

■ For reliable and safe operation, please make sure the maximum component temperatures rise given in table 3.1 is not exceeded. Please refer to Fig.3.2 - 3.3 for derating information based on standard cooling methods. Operating at the maximum temperature rating results in 3-Years life expectancy. The actual life expectancy can be extended by reducing the ambient temperature. Please refer to section 3.5 for more information.

- Test Measuring points
Be aware of the conductive parts during the measurements. Please contact us for more detail.

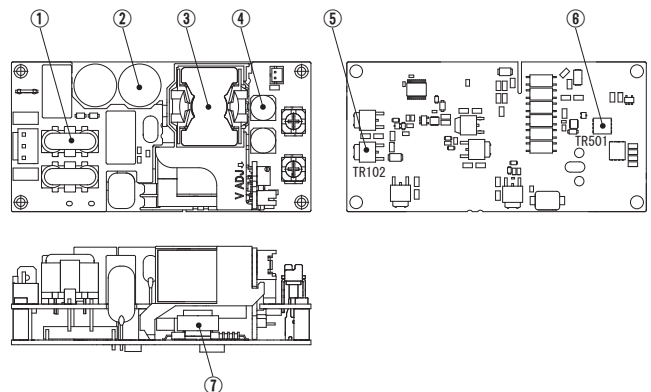


Fig.3.1 Temperature measurement points locations

Table 3.1 Maximum operating temperature

Point	Parts name	Symbol No.	Maximum temperature [°C]	Remarks
①	Line Filter	L101	100	
②	Input Capacitor	C114	89	
③	Transformer	T201	100	
④	Output Capacitor	C516	94	
⑤	Transistor	TR102	110	case temperature
⑥	Rectifier	TR501	110	case temperature
⑦	Transformer	T301	80	Applicable when -R3

■ Recommended cooling condition

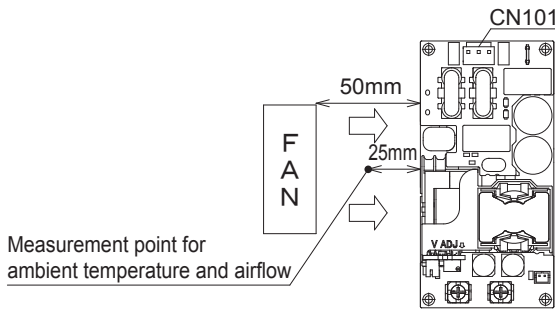


Fig.3.2 Recommended cooling condition

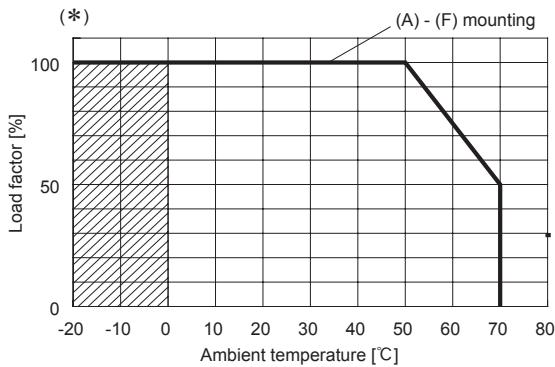


Fig.3.3 Forced air cooling derating curve (Reference value)

■ Specifications for ripple and ripple noise changes in the shaded area.

*Maximum power with Forced air (Fig.3.4)

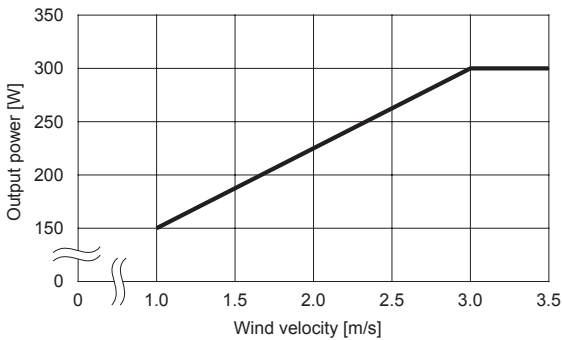


Fig.3.4 The maximum output power by wind speed conditions

■ Input voltage derating curve

Derating curve depending on input voltage is Fig.3.5.

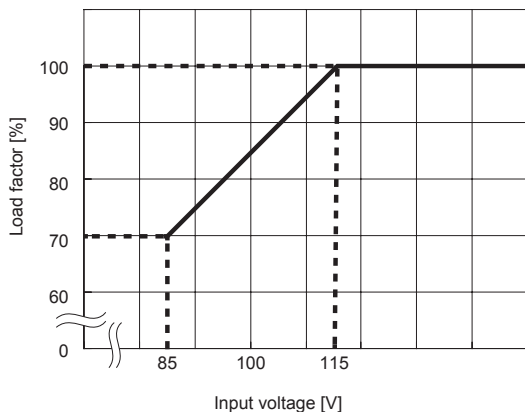


Fig.3.5 Input voltage derating curve

■ Mounting method

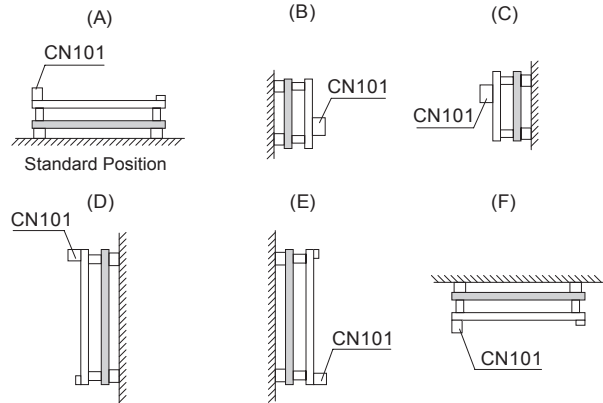


Fig.3.6 Mounting method

3.2 Installation method

■ In case of metal chassis, keep the distance shown as Fig.3.7 between component and metal chassis for insulation, use the spacer of 8mm or more between bottom of power supply and metal chassis.

If it is less than required distance, insert the insulation sheet between power supply and metal chassis.

The following distance is not satisfactory for cooling condition. Please refer to section 3.1 for cooling method.

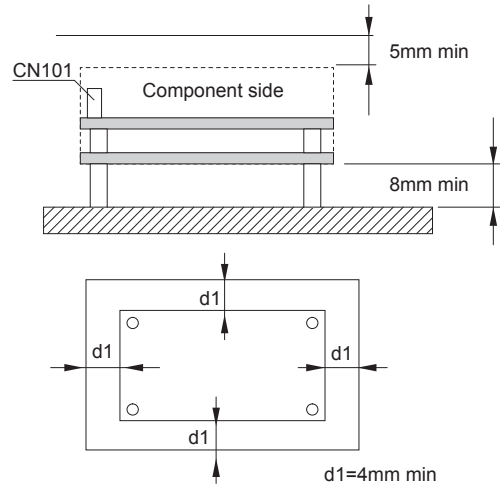


Fig.3.7 Installation method

3.3 Mounting screw

■ The mounting screw should be M3. The hatched area shows the allowance of metal parts for mounting.

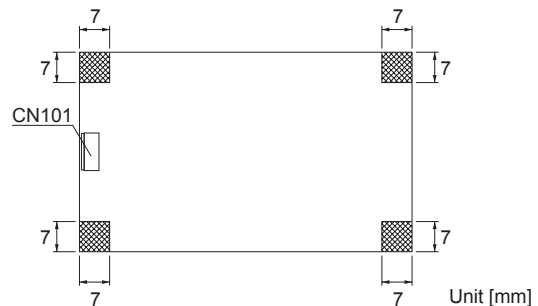


Fig.3.8 Allowance of metal for mounting

- If metallic fittings are used on the component side of the board, ensure there is no contact with surface mounted components.
- This product uses SMD technology.
Please avoid the PCB installation method which includes the twisting stress or the bending stress.

3.4 Ground

- When installing the power supply with your unit, ensure that the input FG terminal or mounting hole FG is connected to safety ground of the unit. However when applying the safety agency, connect the input FG terminal to safety ground of the unit.

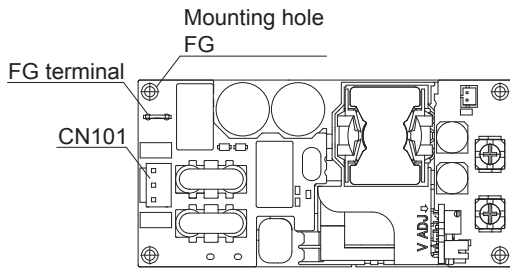


Fig.3.9 Location of FG

* It is recommended to electrically connect FG to metal chassis for reducing noise.

3.5 Life Expectancy and Warranty

■ Life Expectancy

Table 3.2 Life Expectancy

Cooling Method	Mounting Method	Average ambient temperature (year)	Life Expectancy	
			$l_o \leq 75\%$	$75\% < l_o \leq 100\%$
Forced air	A,B,C,D,E,F	Ta = 40°C or less	Over 10years	Over 10years
		Ta = 50°C	Over 10years	Over 10years

Remarks:

The above life expectancy is the value at recommended cooling condition (3m/s).
Estimated life expectancy can be calculated by point temperature ②, ④ shown in section 3.1. Please contact us for details.

■ Warranty.

Table 3.3 Warranty

Cooling Method	Mounting Method	Average ambient temperature (year)	Warranty	
			$l_o \leq 75\%$	$75\% < l_o \leq 100\%$
Forced air	A,B,C,D,E,F	Ta = 40°C or less	5years	4years
		Ta = 50°C	5years	3years

3.6 External capacitor on the output side

- When the load current changes rapidly, for output stability improvement we recommend that you connect the capacitor to the output terminal.

Table 3.6 External capacity on the output recommended capacity [μF]

Model	Output voltage [V]	Recommended capacitance [μF]
GMA300F-12	$11.4 \leq V_o \leq 13.2$	0 to 15,000
GMA300F-24	$22.8 \leq V_o \leq 26.4$	0 to 8,800
GMA300F-48	$45.6 \leq V_o \leq 52.8$	0 to 220
GMA300F-56	$52.0 \leq V_o \leq 56.0$	0 to 120

Remarks:

When load current changes rapidly, some specifications may not

meet the spec.

Please mount power supply after enough evaluation and comply with recommended amount of capacitors. If you exceed the rated amount of capacitor, output for power supply may be stopped or power supply may be unstable.

4 Option and Others

4.1 Outline of options

● -C

- Option -C models have coated internal PCB for better moisture resistance.

● -J1

- Option -J1 models, the Input connector is VH connectors (Mfr. J.S.T.).

● -J3

- The input connector is VH connectors (Mfr. J.S.T.) and the connector is oriented horizontally.
- Please contact us for details about appearance.

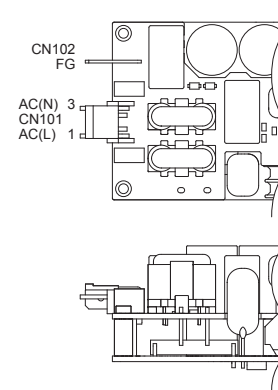


Fig.4.1 Example of option -J3

● -R3

- The following features are included.
- Please refer to the optional parts for the dedicated harness.
- AUX1 (12V 1A)
 - This power supply is equipped with an auxiliary low power 12V output AUX1 (12V±10% 1.0A) which is available from CN701.
 - AUX has been isolated from other circuit (input, output, FG, RC).
 - Do not exceed the current rating, it may cause malfunction or failure of the internal circuitry.
- AUX2 (5V 1A)
 - Output AUX2 will be generated from CN601. AUX2 (5V±5% 1.0A) can be used to power up remote control or other circuits.
 - AUX has been isolated from other circuit (input, output, FG, RC).

- Do not exceed the current rating, it may causes malfunction or failure of the internal circuitry.

Table 4.1 External capacity on the output recommended capacity of AUX2

Output Voltage	Recommended capacitance [μ F]
5V (AUX2)	0 to 330

Remarks:

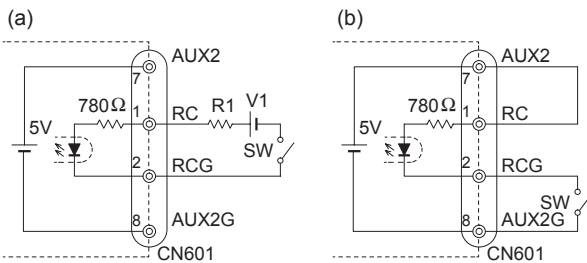
When the load current changes rapidly, for output stability improvement. Please contact us for details.

■ Remote ON/OFF

- You can operate the remote ON/OFF function by sending signals to CN601. Please see Table 4.2 for specifications and Fig.4.2 for connecting examples.
- Remote ON/OFF circuits (RC and RCG) are isolated from input, output FG and AUX.
- Please note the following when using the remote ON/OFF function.
 - Turns on by drawing current to RC.
 - The current flow to RC is a 5mA typ (maximum 25mA).
 - If the output voltage is turned off through the remote ON/OFF circuit, 12V AUX stops.
 - If voltage or current of a value not listed in Table 4.2 is applied between RC and RCG, the output voltage may not be generated normally.
 - Please wire carefully. If you wire wrongly, the internal components of a unit may be damaged.

Table 4.2 Specifications of remote ON/OFF

Fig.4.2 RC circuit example		-R3
SW Logic	Output on	SW close (3mA min)
	Output off	SW open (0.1mA max)
Optional harness		H-SN-38



(Example V1 : 15V R1 : 2k Ω)

Fig.4.2 RC circuit example

- * If the output of an external power supply is within the range of 4.5 - 12.5V, you do not need a current limiting resistor R1. If the output exceeds 12.5V, however, please connect the current limiting resistor R1.

■ To calculate a current limiting resistance value, please use the following equation.

R1 Recommended resister [Ω]	Ri : 780[Ω]
$\frac{V1 - (1.1 + Ri \times 0.005)}{0.005}$	

4.2 Medical Isolation Grade

■ GMA series fit 2MOPP

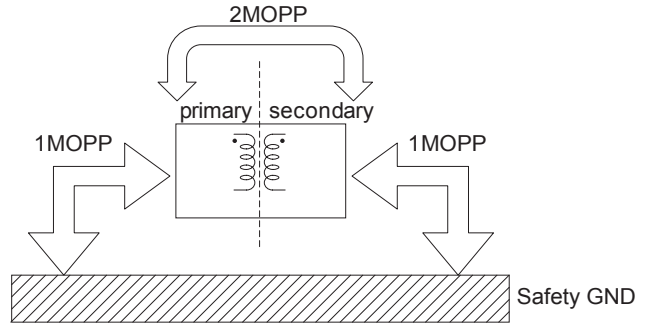


Fig.4.3 Medical Isolation Grade

4.3 Others

- High voltage exists in the power supply for a few minutes after input voltage is stopped. Please pay attention to this during maintenance.
- This power supply is manufactured by SMD technology. The stress to PCB like twisting or bending causes the defect of the unit, so handle the unit with care.
 - Notes for mounting
 - All Mounting holes should be tight and secured.
 - Power supply should be mounted parallel to the mounting surface.
 - Avoid applying mechanical stress or shock to the power supply.
- When power supply is energized or immediately after power supply stops working, power supply is still very hot, so please handle it with care.