# DC-DC Converter Application Manual
MPD6S022S

Features
・ 3.0-5.5V input voltage.
・ High efficiency (95% typ.@3.3V/1A) and small size and floor space saving.
・ Wide output voltage 1.1～3.6V range.
　(Output voltage is adjustable.)
・ Input and output voltage capacitor is built in.
・ Short circuit protection is built in.(Latch format)
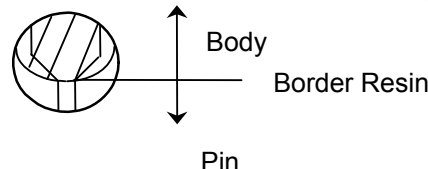
1. Appearance , Dimensions

21.0max.

MPD6S022S
Ⓜ　□□□

Body
21.0max.

Lead
3.0 min.

a 2a a a a a a a

Pin No. 1 · · · · · · · ·10
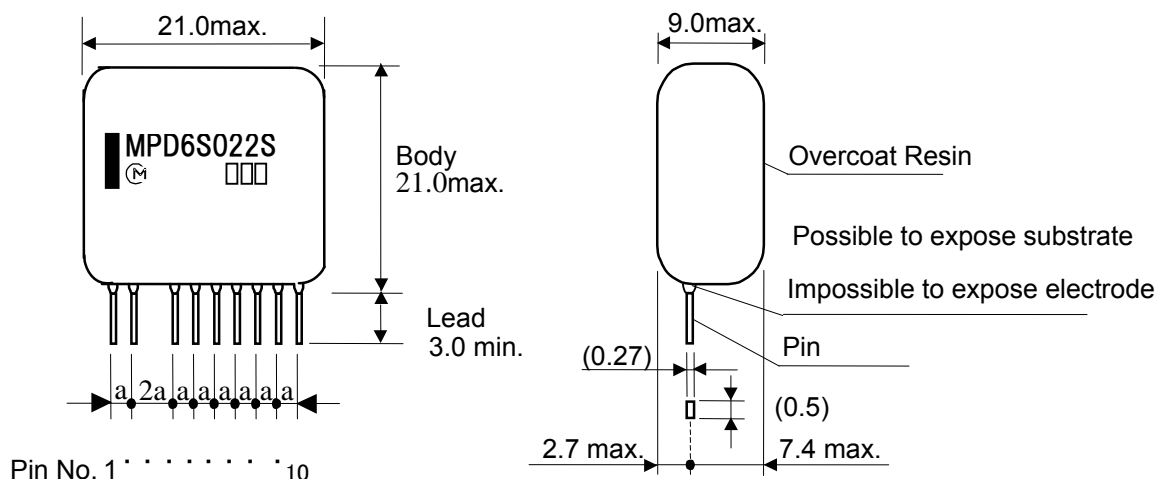
【Unit：mm】

(　)…reference value
Pin Pitch a= 1.8 ±0.3mm

Distance between the both roots of Pin.
Tolerance is not accumulated.

Pin plating　：SnCu

9.0max.

Overcoat Resin

Possible to expose substrate

Impossible to expose electrode

Pin

(0.27)

(0.5)

2.7 max.　　7.4 max.

Expanded Schematic of PinTerminal edge

Body

Border Resin

Pin

2. Pin Number and Function

Pin No.	Symbol	Function
1	VIN	Input
2	ON/OFF	Remote ON/OFF
3	NO PIN	
4	N.C.	Internal used
5	N.C	Internal used
6,7	GND	GND
8	ADJUST	Output voltage adjustment
9,10	VOUT	Output

GND terminals（Pin No.6 and No.7）should be connected to each other on your substrate in the shortest distance.
VOUT terminals（Pin No.9 and No.10）should be connected to each other on your substrate in the shortest distance.
N.C.（Pin No.4 and No.5）are used in the inside of this product. These pins should not be used in the outside.

⚠ **Note:**

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3. Electrical Characteristics (Ta=25 °C)
3.1 Electrical Characteristics (Test condition is specified at item 4.)

| Item	Symbol	Condition		Value			Unit
				Min.	Typ.	Max.	
Input Voltage	VIN	——————————		3.0	5.0	5.5	V
Output Voltage	VOUT	VIN=3.0～5.5V, (VIN-VOUT≧1.0V)	R1＝0Ω	1.067	1.100	1.133	V
			R1＝131.5 kΩ±0.5%	3.200	3.300	3.400	
			R1＝OPEN	—	3.600	—	
Load Current	IOUT	VIN= 3.0～5.5V		0.0	—	3.0	A
Ripple Voltage	VRIP	VIN= 5.0V, VOUT=3.3V, IOUT=3.0A		—	—	100	mV(p -p)
Efficiency	EFF1	VIN=5.0V, VOUT=3.3V, IOUT=1.0A		—	95	—	%
Remote Voltage	ON/OFF	VIN= 3.0～5.5V	ON	0.75 ×VIN	—	VIN	V
			OFF	0	—	0.25 ×VIN	
				OPEN			
Internal pull down resistance of Remote	RON/OFF	0≤VON/OFF≤VIN		—	220	—	KΩ
Frequency	FREQ.	VIN= 3.0～5.5V		—	250	—	k Hz
Protection Circuit	SCP	Short-circuit breaking. DC-DC Converter should be recover by opening the shorted output and RESET Remote.					

< Output Voltage Calc.>
VOUT1 = 5.782 / (1.606 + 20 / (5.479 + R1))   # R1 [kΩ]

3.2 Output Sequence Spec.
DC-DC Converter should be met below Sequence.

t1≥ 0ms , V1=VOUT* + 1.0V   (VOUT* : Set-Up Output Voltage)

VIN

V1

t1

REMOTE
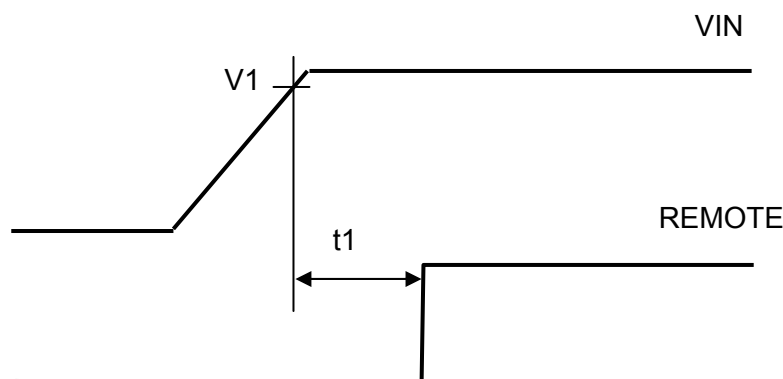
In order to make DC-DC Converter start certainly, please follow the above mentioned sequence.

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4. Test Circuit
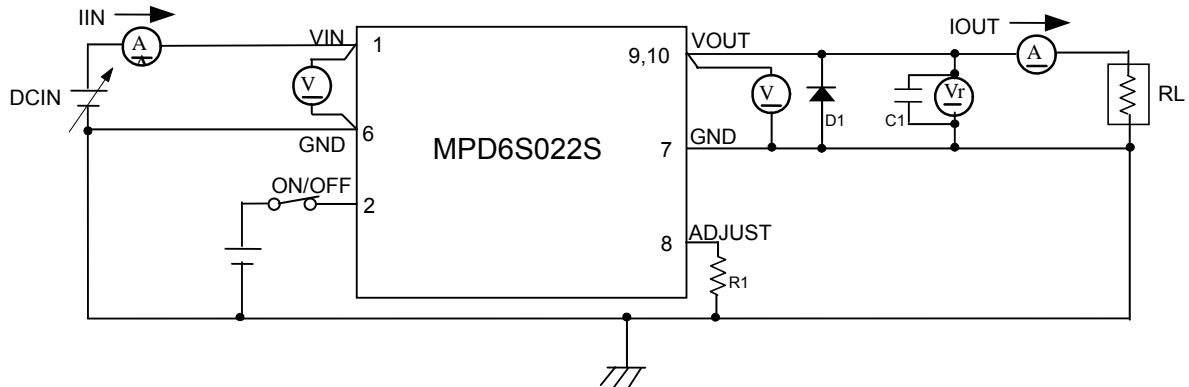
(V) (A)	: Digital Multi meter HP34401A equivalent (Agilent Technologies)
(Vr)	: Ripple Voltmeter RM－101 equivalent (Keisokugiken)
RL	: Electronic Load Device EUL－150αXL equivalent (Fujitsu access)
(capacitor symbol)	: DC Power Supply HP6621A equivalent (Agilent Technologies)

C1   : Ceramic Capacitor   0.1μF

D1   : Shottoky Diode

Please do not connect a mass capacitor to the output line of the DC-DC Converter.
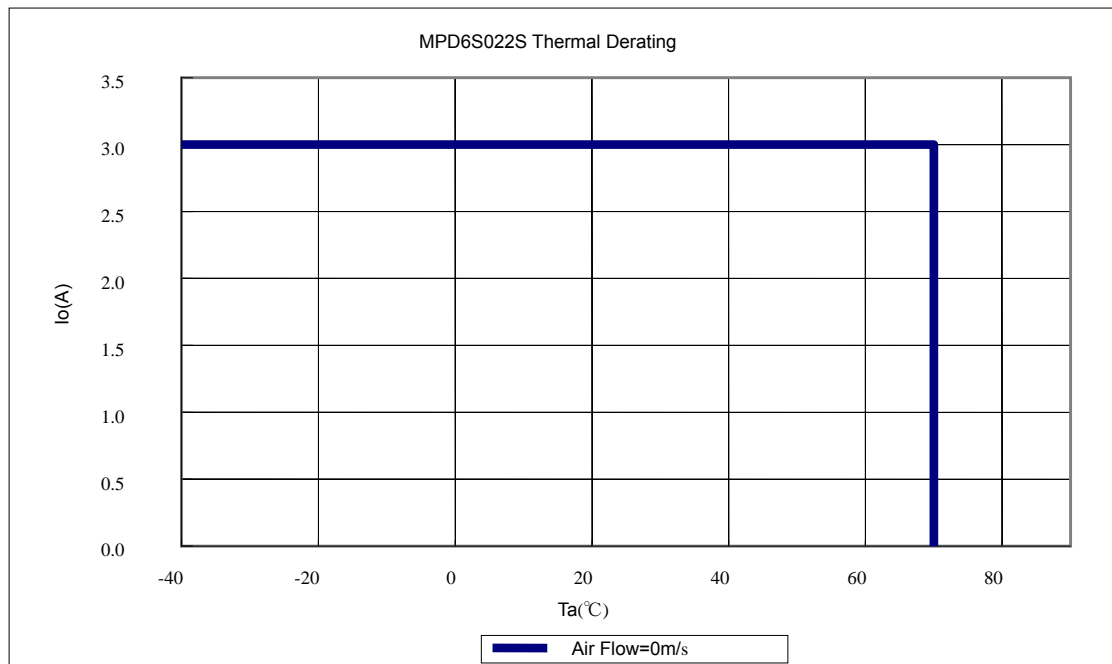
※Ripple Noise Test
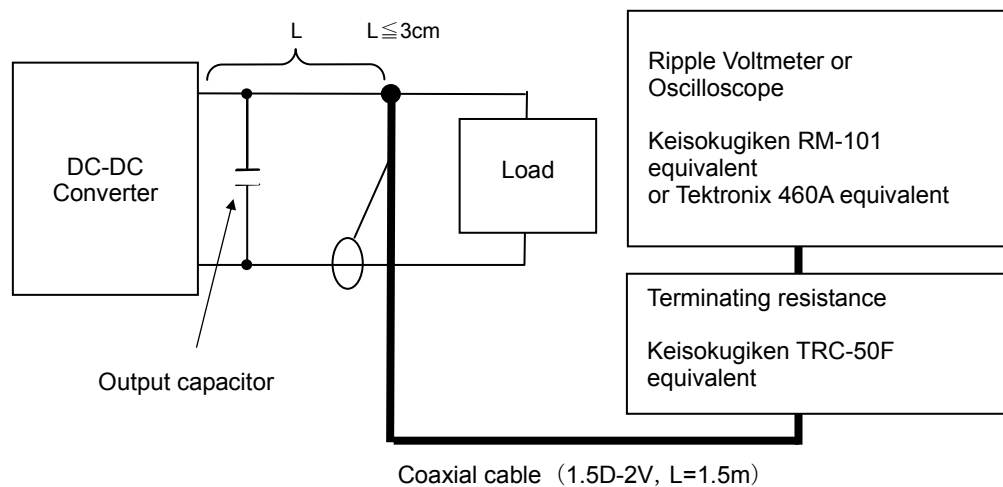
Output capacitor

Coaxial cable （1.5D-2V, L=1.5m）

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5. Block Diagram
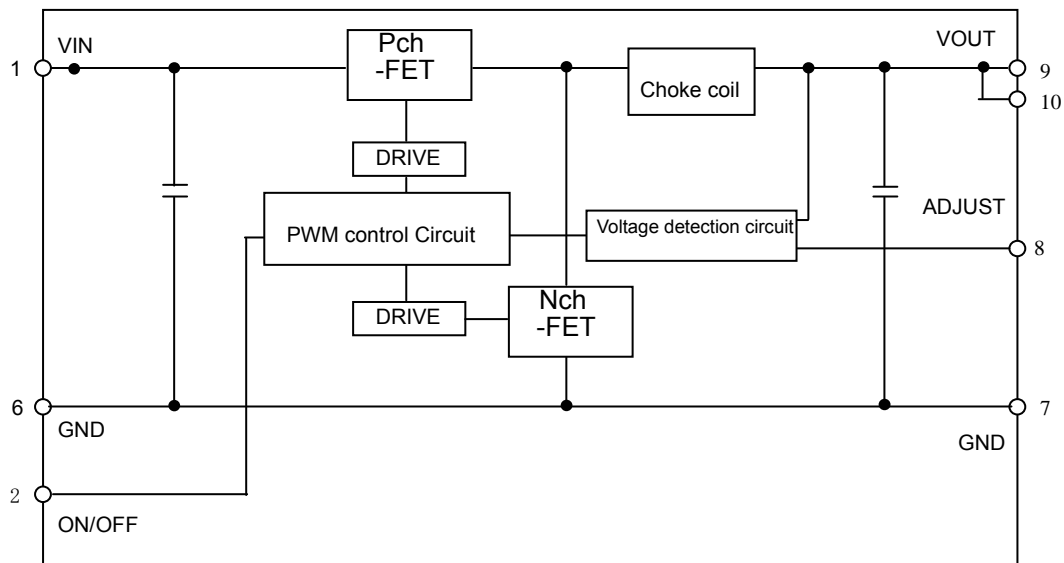
6 Thermal Derating

MPD6S022S Thermal Derating

Io(A)

Ta(℃)

Air Flow=0m/s

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7. Output Voltage Adjustment
・ Resistors connected between Adjust-pin(8pin) to GND-pin (6,7pin) will adjust the output voltage
   $1.1V \leqq VOUT \leqq 3.3V$
・ The following equations give the required external-resistor value to adjust the output voltage to Voadj.
   When you change the output voltage, it is necessary to evaluate the characteristics of DC-DC Converter
   at your board conditions.
・ If you need VOUT control, keep the input the voltage Vin > Vout + 1.0V.

$$VOUT = \frac{5.782}{1.606 + 20/(R1 + 5.479)}$$

$$R1 = \frac{20}{5.782/VOUT - 1.606} - 5.479$$

UNIT:[V] [kΩ]

＜R1 calculation example＞

VOUT [V]	R1 [kΩ]	Voadj	R1 [kΩ]
3.6	Open	1.8	6.8+0.18
3.3	130+1.5	1.5	3.3+0.12
2.5	22+0.82	1.2	0.68+0.068
2.0	10+0.082	1.1	0

8. ON/OFF Control
・ ON/OFF function
   The DC-DC Converter can be inactive by using ON/OFF function.
   This function is effective when the sequence of a power supply system is constituted.

・ ON/OFF control method
   Between ON/OFF-pin(2pin) to VIN-pin(1Pin)
   Open……Output Voltage= OFF
   Short……Output Voltage= ON
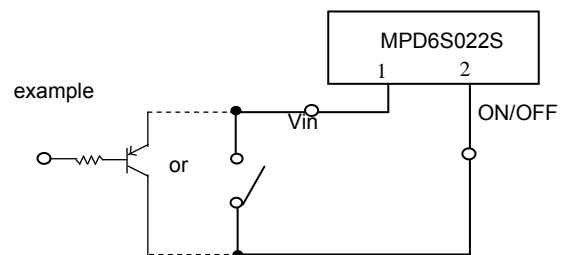
9. Characteristics Data

Fig.9-1 Efficiency vs Output Current (VIN=5.0V)

Efficiency [%]

100%
95%
90%
85%
80%
75%
70%
65%
60%

0.0 0.5 1.0 1.5 2.0 2.5 3.0

●— Vo=3.3V ◆— Vo=2.5V ■— Vo=1.8V ●— Vo=1.2V
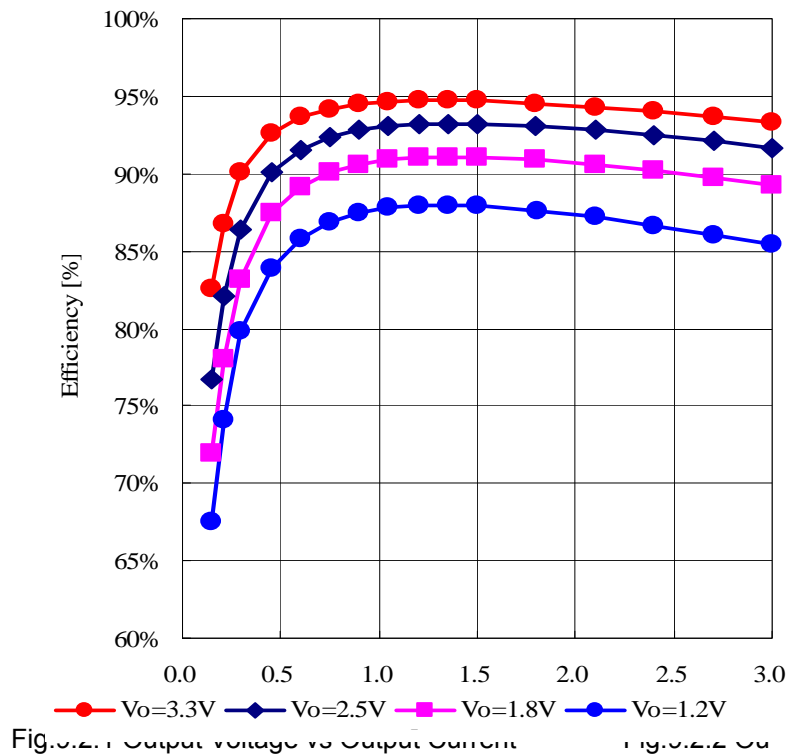
Fig.9.2.1 Output Voltage vs Output Current   Fig.9.2.2 Ou

Fig.9-2 Efficiency vs Output Current (VIN=3.3V)
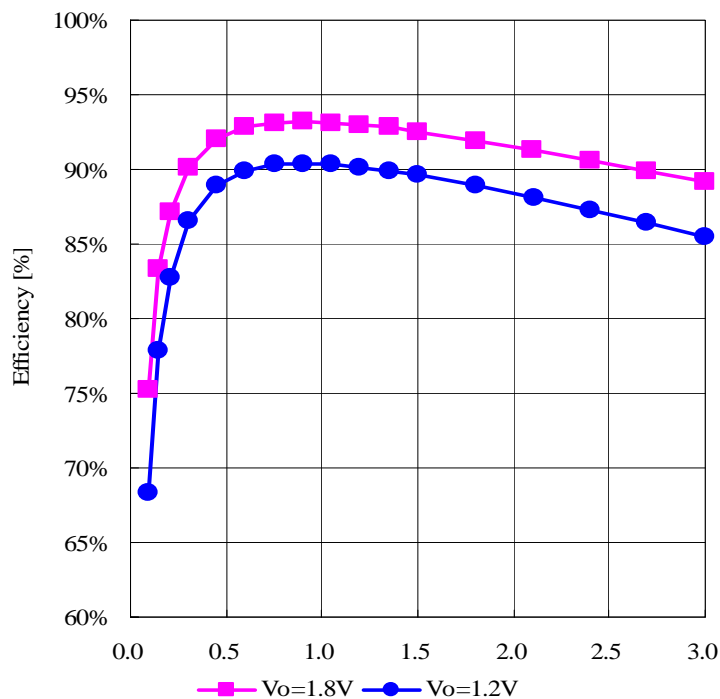
Efficiency [%]

100%
95%
90%
85%
80%
75%
70%
65%
60%

0.0 0.5 1.0 1.5 2.0 2.5 3.0

■— Vo=1.8V ●— Vo=1.2V

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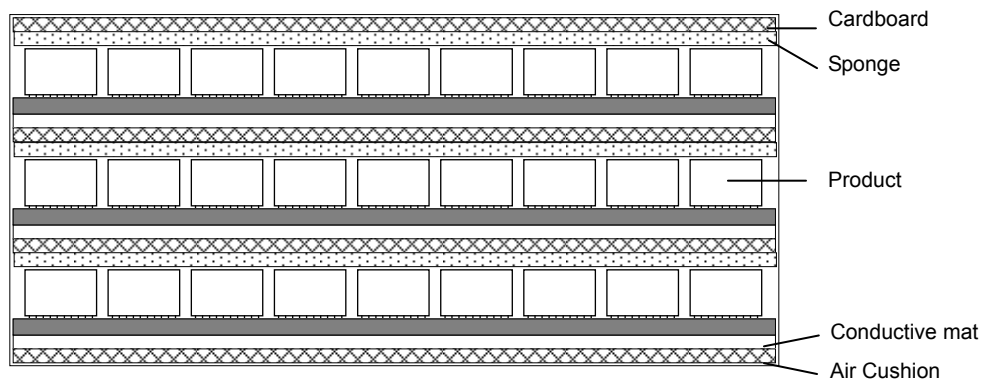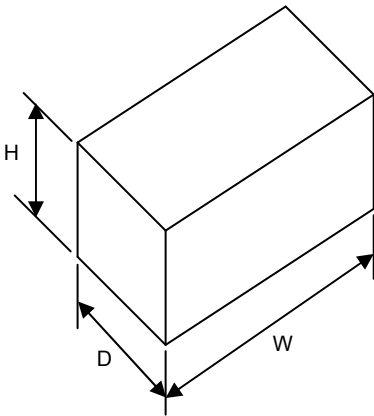
10. Packaging Specification
10. 1 Packing form
①The products are putted on the conductive mat in a row as below.   (9lines×5pcs.)

Product

Conductive mat
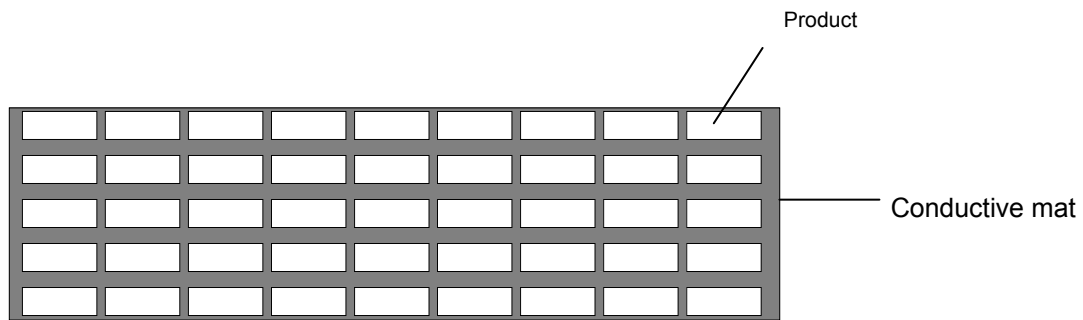
②Above packed products are them piled up three-tier.

Cardboard

Sponge

Product

Conductive mat

Air Cushion

10. 2 Packaging Form

Item	Specification
Packaging form typical classification	Box
Dimensions of packaging form	W = 245 (mm) D = 78 (mm) H = 104 (mm)
The number of products in packaging form	135 (p c s)
Mass of one product	4.3typ. (g)
Remark ・ If the products have fraction, may not follow this specification.	

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11. Soldering
  11. 1 Soldering
    11.1.1 Flux
      Please solder the products with no-cleaning type Rosin Flux which leaves little residue and low activity.
      Do not use cleaning type flux, in case that you wash the products afrer using cleaning type flux, they
      may damage mounting parts on the products and may cause defective or low quality products.

  11. 1.2 Solder
    11.1.2.1 Lead Free Solder
      Please use the solder Sn-3Ag-0.5Cu.

    11.1.2.2 Eutectic Solder
      Please use the solder H60, H63 (in JIS Z 3282) or the equivalent type.

  11. 1.3 Condition of soldering
    11.1.3.1 Lead Free Solder
   Please solder under the following condition.
      ・ Flow soldering Preheating   : 120±10 ^{o}C 60～120 seconds
        Soldering   : 260±5 ^{o}C
        Time within   : 10 seconds
      ・ Condition of iron soldering   : under 350 ^{o}C, 5 seconds at maximum
                                             (Only iron less than 30W should be used.)
    11.1.3.2 Lead Free Solder
      ・ Flow soldering Preheating   : 120±10 ^{o}C 60～120 seconds
        Soldering   : 230±5 ^{o}C
        Time within   : 5 seconds
      ・ Condition of iron soldering   : under 300 ^{o}C, 3 seconds at maximum
                                             (Only iron less than 30W should be used.)

  11. 2 Cleaning
      Please do not wash the products.
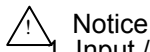
⚠ Notice
1. Input / output capacitor
   When a inductance or a switch devise are connected to the input line, or when you use a power supply with
   output inductance as the input voltage source, the input voltage of the DC-DC Converter will be fluctuated.
   By this input voltage fluctuation, the transient load response of the DC-DC Converter may be deteriorated or
   abnormal oscillation may occur. So please confirm normal operation on each application.
   Please use external input capacitor in order to decrease inductance of input line.
   In case you use external output capacitor in order to improve transient load response, please use input
   capacitor to prevent abnormal oscillation.

2 Wiring of input / output capacitor
   In the case of input / output capacitor connection, in order to reduce electrical noise , please design PCBs
   with consideration of the following item.

①. Please be sure to check normal operation on your system.
②. Please use low impedance capacitors with good high frequency characteristic.
③. Please shorten those leads of each capacitor as much as possible, and make sure the lead inductance low.
④. Both input-side and output side, please make the wiring loop between plus and minus as small as possible.
   The influence of leakage inductance can be reduced.
⑤. Please design the print pattern of the main circuit as wide and short as possible.. Input / output capacitor
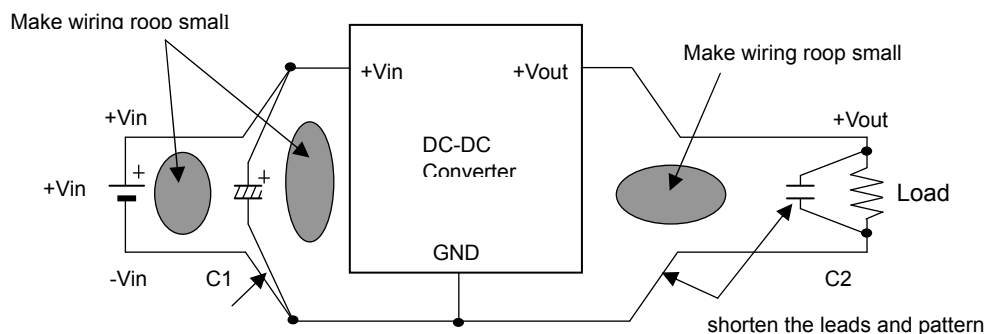
⚠ **Note:**   shorten the leads and pattern

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3 This product could not be operated parallel or series.

4 Please do not use a connector or a socket for connection with your board of this product.
Electrical performance may be deteriorated the influence of contact resistance.
Please be sure to mount this product with solder.

5 Be sure to provide an appropriate fail-safe function on your product to prevent a second damage that may be caused by the abnormal function or the failure of our product.

6 Please connect the input terminal with proper polarity.   If you connect wrong polarity, the DC-DC Converter may be broken. In the case of the DC-DC Converter is damaged, abnormal input current may flow in, and abnormal overheat of the DC-DC Converter, or some damage of your products may occur. Please use a diode and a fuse to as following figure.
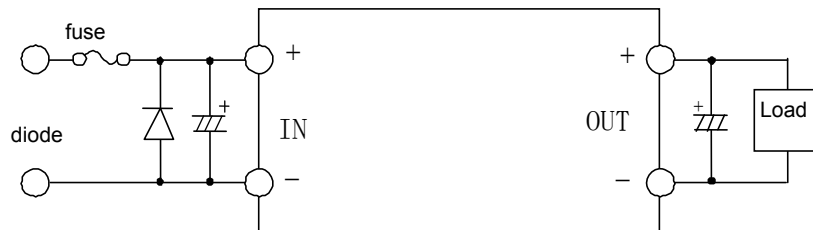
Standard of fuse : current rating   5   [A]

※Please select diode and fuse after confirming the operation.

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1. Please contact our main sales office or nearby sales office before using our products for the applications listed below which require especially high reliability for the prevention of defects which might directly cause damage to the third party's life, body or property or this products for any other applications that described in the above.

①Aircraft equipment
②Aerospace equipment
③Undersea equipment
④Power plant control equipment
⑤Medical equipment
⑥Transportation equipment (vehicles, trains, ships, etc.)
⑦Traffic signal equipment
⑧Disaster prevention /crime prevention equipment
⑨Data-processing equipment
⑩Application of similar complexity and/or reliability requirements to the applications listed in the above.

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