

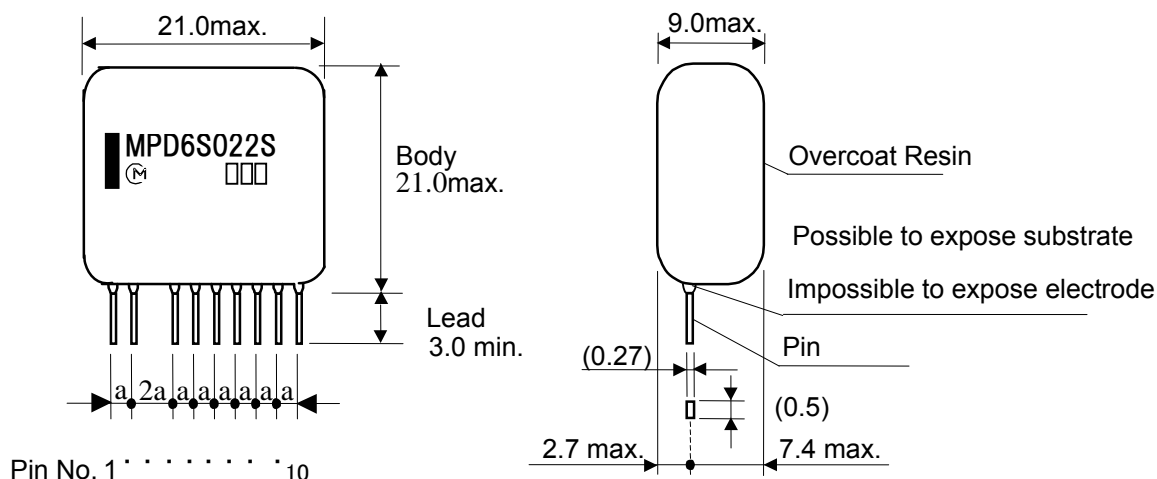
# DC-DC Converter Application Manual

## 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



Pin No. 1 . . . . . 10

【Unit : mm】

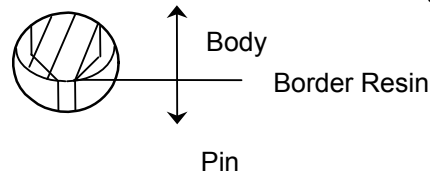
( )...reference value

Pin Pitch  $a = 1.8 \pm 0.3\text{mm}$

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

Pin plating : SnCu

Expanded Schematic of PinTerminal edge



### 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.

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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.					

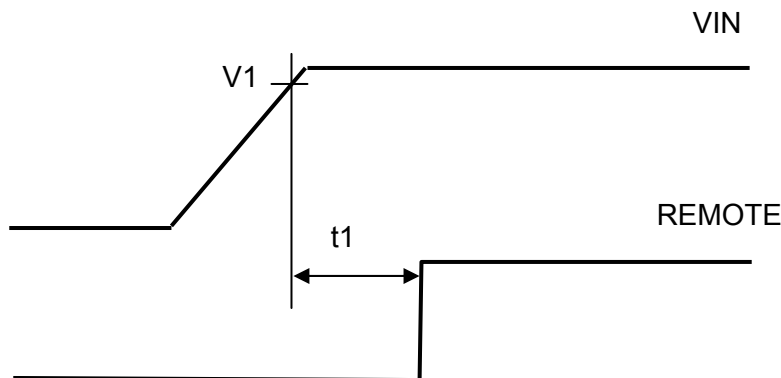
## &lt; Output Voltage Calc.&gt;

$$VOUT1 = 5.782 / ( 1.606 + 20 / ( 5.479 + R1 ) ) \quad \# R1 [k\Omega]$$

## 3.2 Output Sequence Spec.

DC-DC Converter should be met below Sequence.

$$t1 \geq 0ms, V1 = VOUT^* + 1.0V \quad (VOUT^* : \text{Set-Up Output Voltage})$$

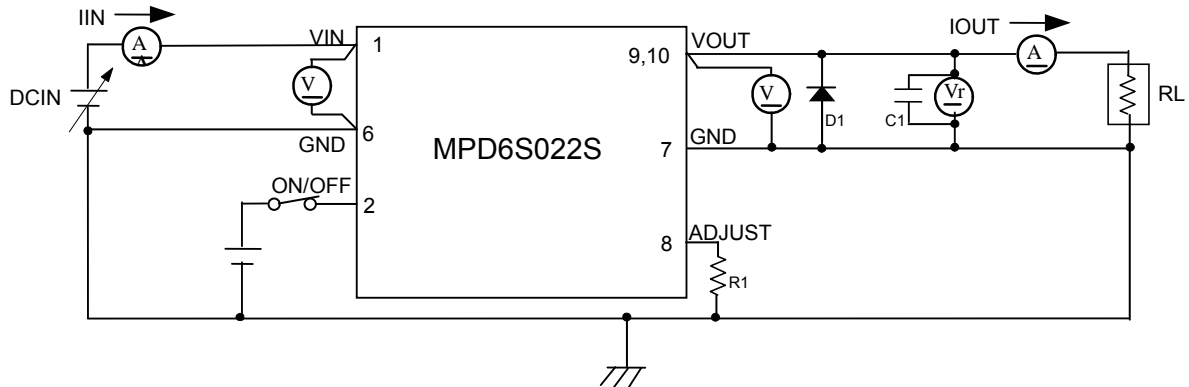


In order to make DC-DC Converter start certainly, please follow the above mentioned sequence.

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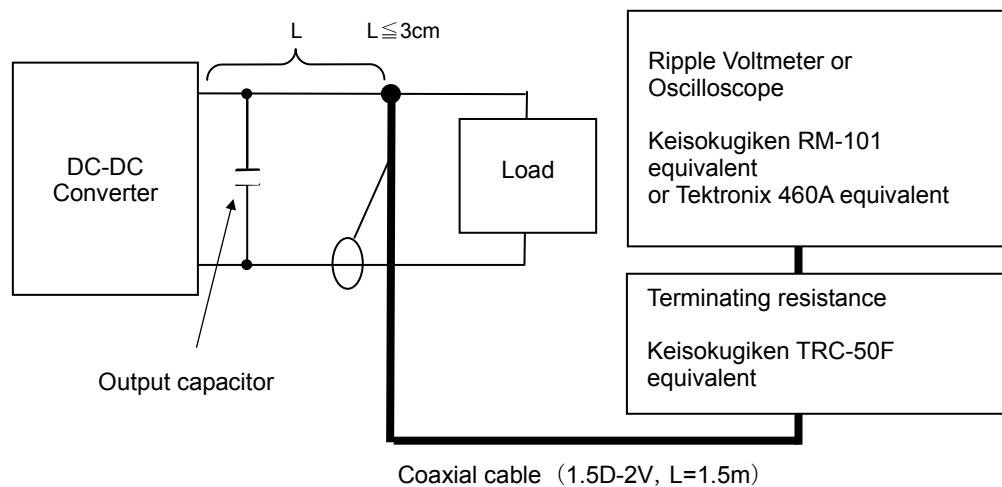
## 4. Test Circuit



- : Digital Multi meter HP34401A equivalent (Agilent Technologies)  
 : Ripple Voltmeter RM-101 equivalent (Keisokugiken)  
 : Electronic Load Device EUL-150αXL equivalent (Fujitsu access)  
 : 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.

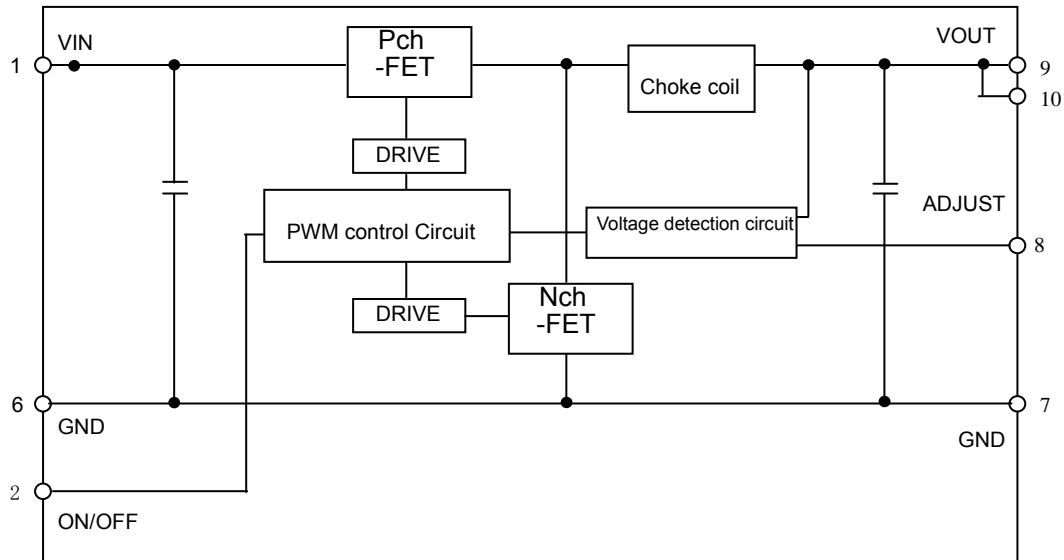
## ※Ripple Noise Test



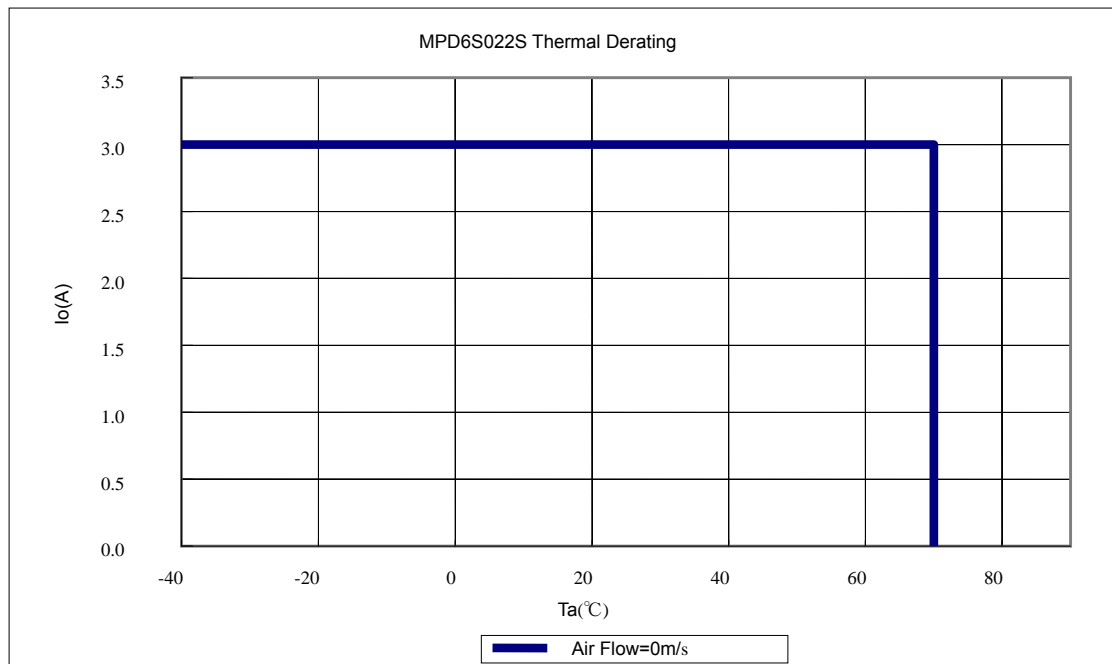
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## 5. Block Diagram



## 6 Thermal Derating



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### 7. Output Voltage Adjustment

- Resistors connected between Adjust-pin(8pin) to GND-pin (6,7pin) will adjust the output voltage  
 $1.1V \leq VOUT \leq 3.3V$
- The following equations give the required external-resistor value to adjust the output voltage to  $V_{oadj}$ .  
 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  $V_{in} > V_{out} + 1.0V$ .

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

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

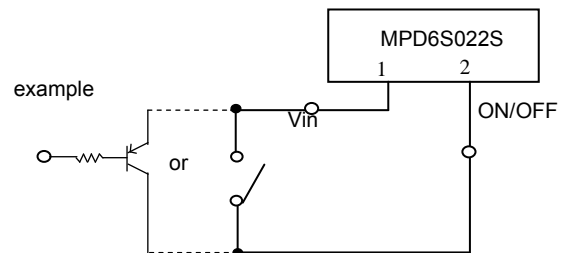
UNIT:[V] [k $\Omega$ ]

< R1 calculation example >

VOUT [V]	R1 [k $\Omega$ ]	Voadj	R1 [k $\Omega$ ]
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



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9. Characteristics Data

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

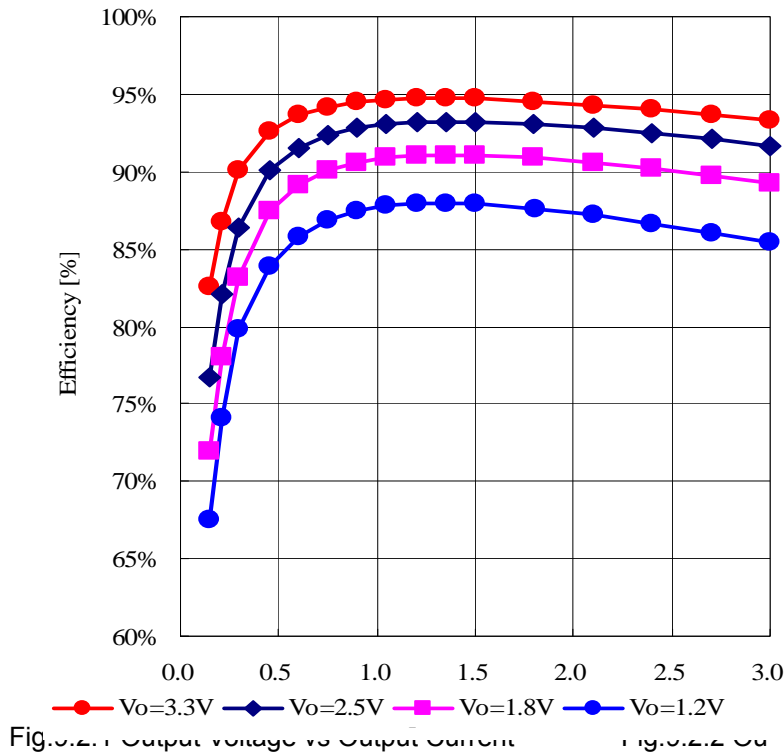
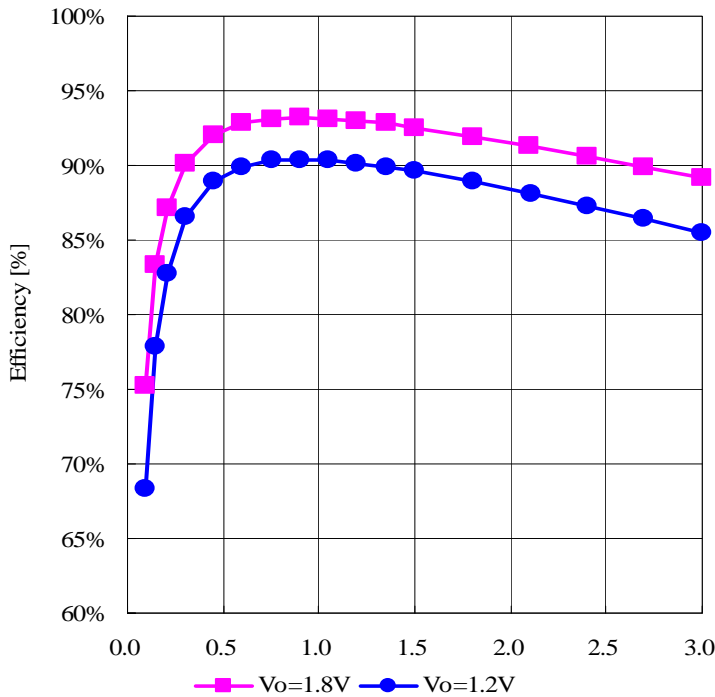


Fig.9-2.1 Output voltage vs Output Current      Fig.9-2.2 Cu

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



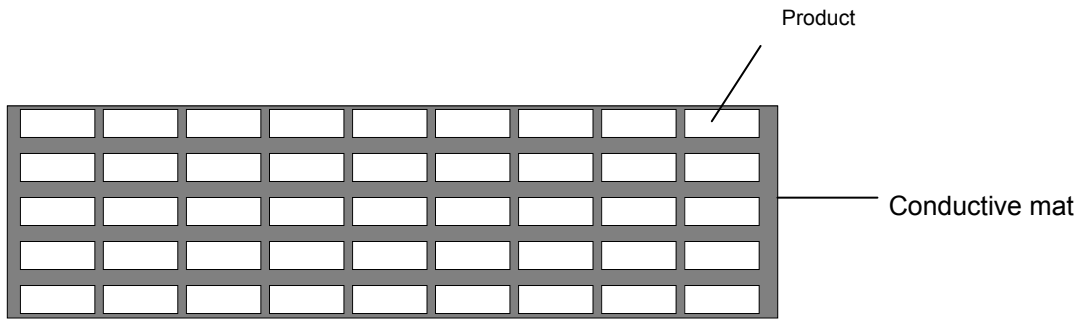
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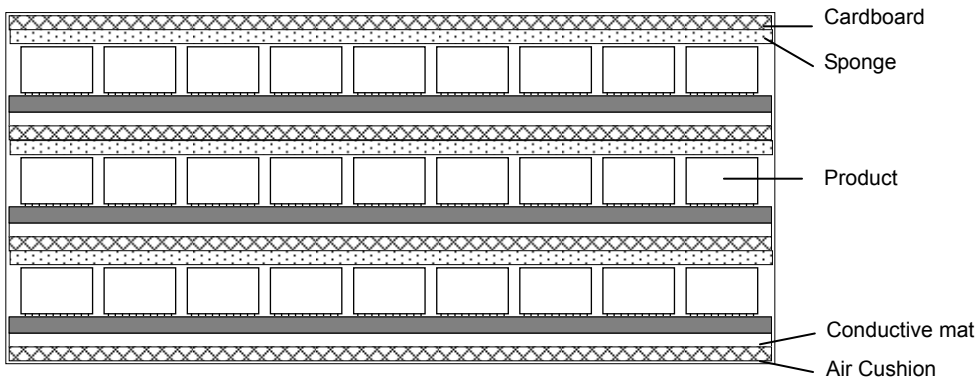
10. Packaging Specification

10. 1 Packing form

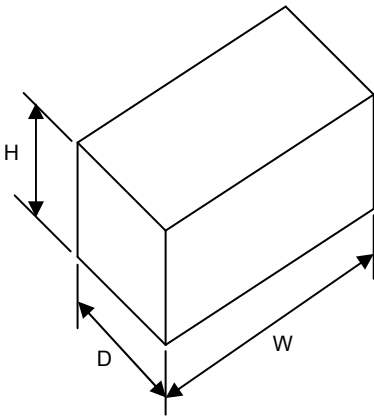
① The products are putted on the conductive mat in a row as below. (9lines×5pcs.)



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



10. 2 Packaging Form

Item	Specification
Packaging form typical classification	Box
Dimensions of packaging form	 <p>W = 245 ( mm ) D = 78 ( mm ) H = 104 ( mm )</p>
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 after 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 :  $120\pm 10^{\circ}\text{C}$  60~120 seconds
- Soldering :  $260\pm 5^{\circ}\text{C}$
- Time within : 10 seconds
- Condition of iron soldering : under  $350^{\circ}\text{C}$ , 5 seconds at maximum  
(Only iron less than 30W should be used.)

##### 11.1.3.2 Lead Free Solder

- Flow soldering Preheating :  $120\pm 10^{\circ}\text{C}$  60~120 seconds
- Soldering :  $230\pm 5^{\circ}\text{C}$
- Time within : 5 seconds
- Condition of iron soldering : under  $300^{\circ}\text{C}$ , 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 an inductance or a switch device 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.

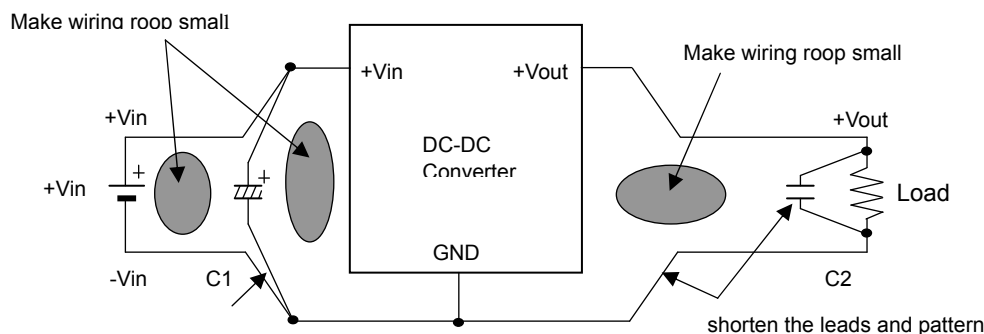
Please use external input capacitor in order to decrease inductance of input line.

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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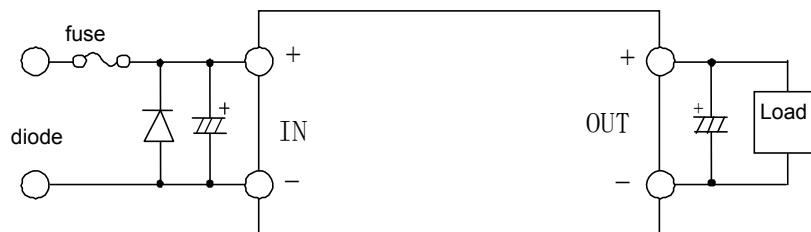


3 This product could not be operated parallel or series.

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.

 Note

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.

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

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