

# DC-DC Converter Application Manual

## MPDKN1\*\*S

### 1. Features

These are eighth brick DC-DC Converter of industry-standard.

High efficiency & High power density is realized by using original Synchronous rectifier circuit.

It corresponds to wide range temperature of operation. (-40 °C ~ +85 °C)

It corresponds to wide range input voltage. (36V ~ 75V)

Output voltage adjustment is possible by connection of external resistance.

Input to output isolation voltage: 1.5kV(DC) for one minute

Over current protection, over voltage protection & overheating protection is built in.

UL60950 is recognized.)

### 2. Product Line Up

Nominal Output Voltage[V]	Parts No.
1.8	MPDKN104S
2.5	MPDKN106S
3.3	MPDKN107S
3.3	MPDKN117S
5.0	MPDKN118S

### 3. Ratings

3.1 Operating Temperature Range -40 °C ~ +85 °C (Please refer the temperature derating table.)

3.2 Operating Humidity Range 20% ~ 85% (No dew deposit)

3.3 Storage Temperature Range -45 °C ~ +90 °C

3.4 Storage Humidity Range 10% ~ 95% (No dew deposit)

### 4. Electrical Characteristics (Ta=25 °C, Airflow=1m/s, TRIM=Open)

Item	Symbol	Condition	Model Number	Value			Unit
				Min.	Typ.	Max.	
Input Voltage	Vin		All	36	48	75	V
Output Voltage	Vout	Vin =Min ~ Max Iout=Min ~ Max	MPDKN104S MPDKN106S MPDKN107S MPDKN117S MPDKN118S	1.746 2.425 3.200 3.200 4.850	1.8 2.5 3.3 3.3 5.0	1.854 2.575 3.400 3.400 5.150	V
Output Voltage Adjustable Range	Vout (adj)	Vin =Min ~ Max Iout=Min ~ Max	MPDKN104S MPDKN106S MPDKN107S MPDKN117S MPDKN118S	-20 -10 -20 -20 -20	- - - - -	+10 +10 +10 +10 +10	%
Output Voltage Remote Sense Range	Vout (sense)	Between 4-5 and 7-8 pin voltage	All	-	-	10	%

#### ⚠ Note:

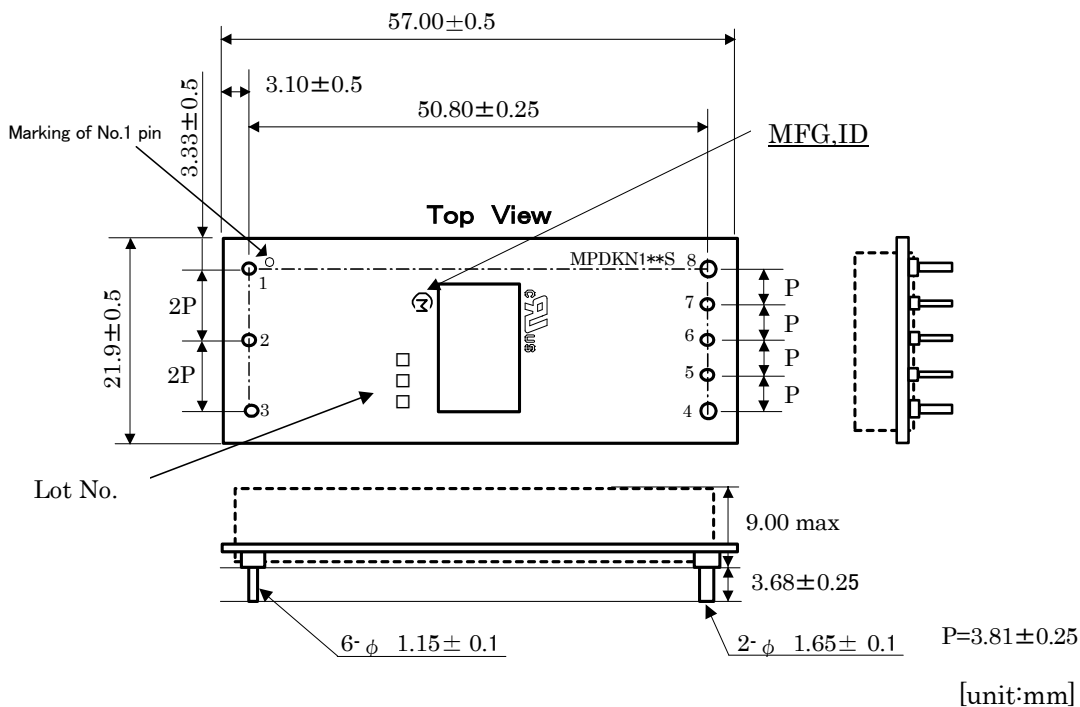
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Item	Symbol	Condition	Model Number	Value			Unit
				Min.	Typ.	Max.	
Output Current	Iout		MPDKN104S	0	-	20	A
			MPDKN106S	0	-	18	
			MPDKN107S	0	-	15	
			MPDKN117S	0	-	20	
			MPDKN118S	0	-	13	
Ripple Voltage	Vripl	Vin =48V Iout=Max f BW=20MHz	MPDKN104S	-	25	100	mV(p_p)
			MPDKN106S	-	25	100	
			MPDKN107S	-	30	100	
			MPDKN117S	-	30	100	
			MPDKN118S	-	30	100	
Efficiency	$\eta$	Vin =48V Iout=Max	MPDKN104S	79.0	84.0	-	%
			MPDKN106S	82.0	87.0	-	
			MPDKN107S	84.0	89.0	-	
			MPDKN117S	84.0	89.0	-	
			MPDKN118S	85.0	90.0	-	
ON/OFF pin Control Voltage	Von		All	0	-	0.7	V
	Voff		All	3	-	20	V
Setting point of Over Current Protection	OCP	Vin =48V	MPDKN104S	20.80	-	42.00	A
			MPDKN106S	18.70	-	37.80	
			MPDKN107S	15.60	-	31.50	
			MPDKN117S	20.80	-	41.00	
			MPDKN118S	13.52	-	26.70	
Setting point of Over Voltage Protection	OVP	Vin =48V	MPDKN104S	2.16	-	2.52	V
			MPDKN106S	3.00	-	3.50	
			MPDKN107S	3.96	-	4.62	
			MPDKN117S	3.96	-	4.62	
			MPDKN118S	6.00	-	7.00	
Protection			All	If output is shorted to GND , or output voltage is over the value specified in OVP, DC-DC Converter will shut down. After reject the abnormal mode, DC-DC Converter will restart by re-inputting Vin or toggling ON/OFF pin. If DC-DC Converter is heated abnormally, it will shut down. After it is cooled down, DC-DC Converter will automatically restart.			
Input to Output Isolation Voltage		DC for one minute	All	1500	-	-	V
Safety standards			All	UL60950(UL/C-UL) recognized			

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## 5 Appearance, Dimensions



## Marking

(1) Parts No.

MPDKN1\*\*S

(2) MFG, ID

M

(3) Lot No.

□ □ □

① ② ③

① Production Factory

② Production Year

③ Production Month (1,2,3,...9,O,N,D)

## Pin Number and Function

Pin No.	Signal	Function
1	Vin(+)	(+) Positive Input Voltage
2	ON/OFF	Remote ON/OFF
3	Vin(-)	(-) Negative Input Voltage
4	Vout(-)	(-) Negative output Voltage
5	SENSE(-)	(-) Negative Remote Sense
6	TRIM	Output Voltage Adjustment
7	SENSE(+)	(+) Positive Remote Sense
8	Vout(+)	(+) Positive output Voltage

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## 6 Recommendable Solder Land Pattern

Pin No	Pin Size	Hole diameter	Land diameter
1.Vin(+) 2.ON/OFF 3.Vin(-) 5.SENSE(-) 6.TRIM 7.SENSE(+)	$\phi$ 1.15	$\phi$ 1.5	$\phi$ 3.0
4.Vout(-) 8.Vout(+)	$\phi$ 1.65	$\phi$ 2.0	$\phi$ 4.0

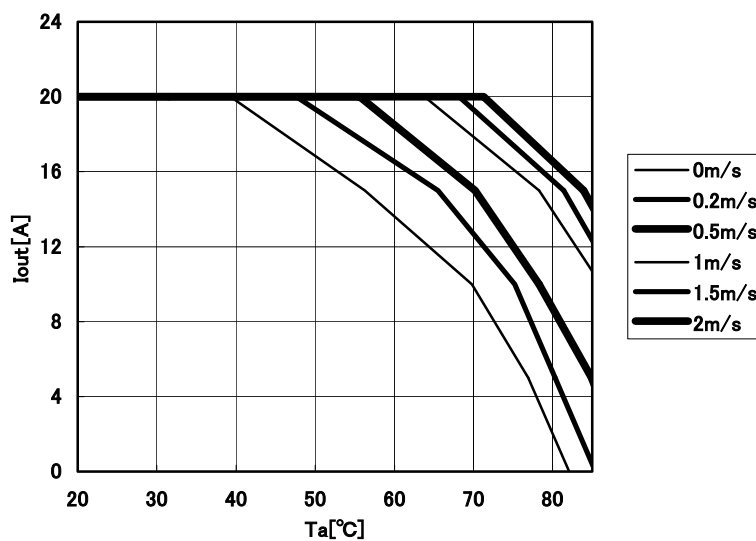
As for a position of a hole, refer to an appearance figure.

## 7 Temperature Derating

When using this product at the ambient air temperature of 30 °C more, it is used by the following temperature derating.

## 7.1 MPDKN104S(Vout=1.8V)

Temperature Derating (MPDKN104S)

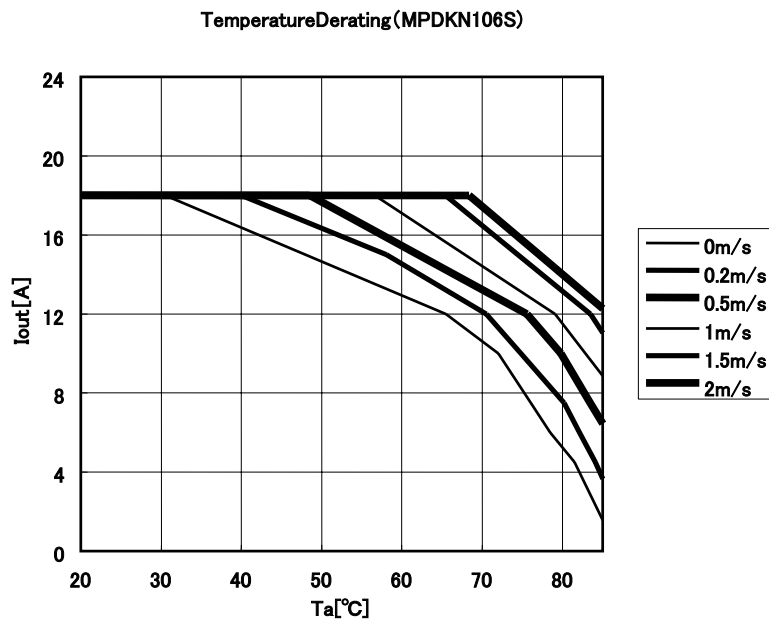


Vout=1.8V, Vin=36~75V  
 TRIM=OPEN, 4-5pin · 7-8pin short  
 110mm×180mm Both sides circuit board mounting condition

## ⚠ Note:

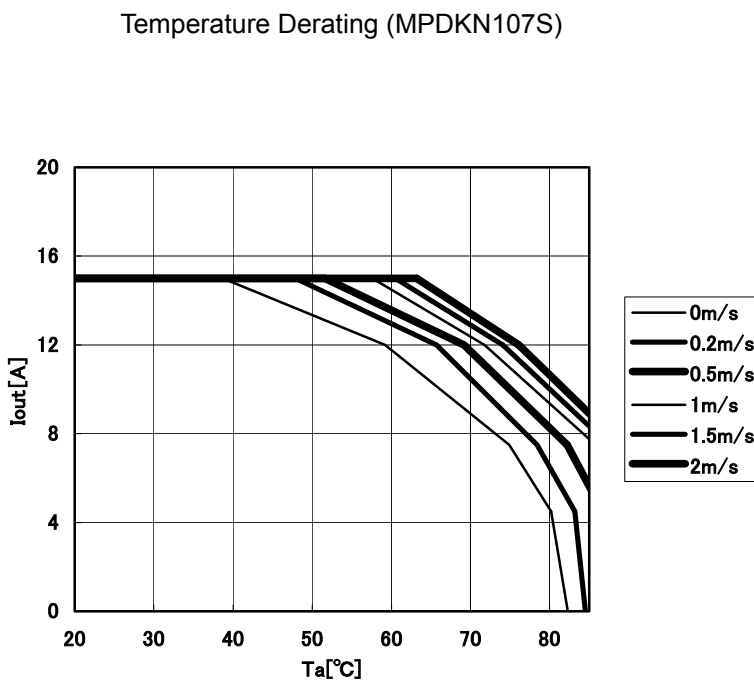
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## 7.2 MPDKN106S(Vout=2.5V)



Vout=2.5V、Vin=36~75V  
 TRIM=OPEN、4-5pin · 7-8pin short  
 110mm×180mm Both sides circuit board mounting condition

## 7.3 MPDKN107S(Vout=3.3V)



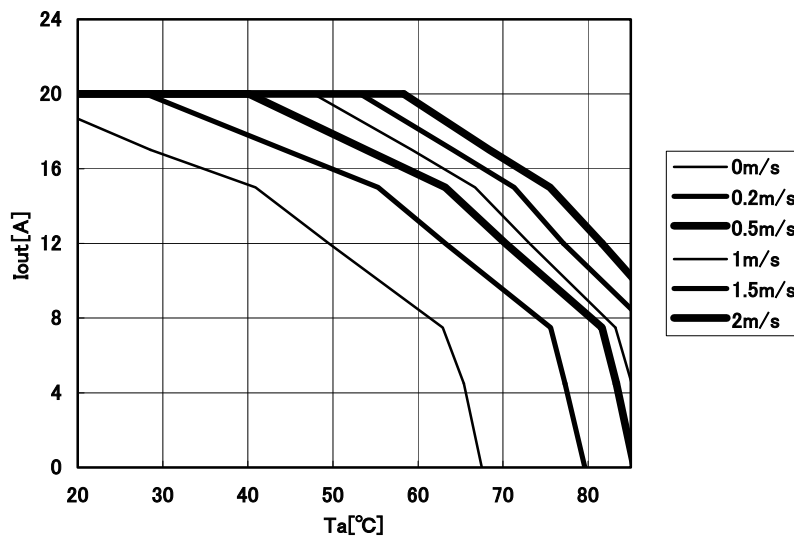
Vout=3.3V、Vin=36~75V  
 TRIM=OPEN、4-5pin · 7-8pin short  
 110mm×180mm Both sides circuit board mounting condition

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## 7.4 MPDKN117S(Vout=3.3V)

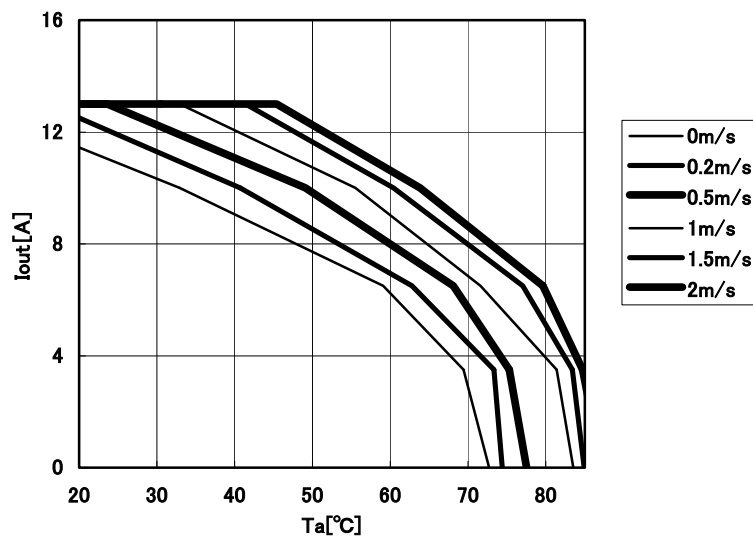
Temperature Derating (MPDKN117S)



Vout=3.3V, Vin=36~75V  
 TRIM=OPEN, 4-5pin · 7-8pin short  
 110mm×180mm Both sides circuit board mounting condition

## 7.5 MPDKN118S(Vout=5.0V)

Temperature Derating (MPDKN118S)



Vout=5.0V, Vin=36~75V  
 TRIM=OPEN, 4-5pin · 7-8pin short  
 110mm×180mm Both sides circuit board mounting condition

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### 8. To Adjust Output Voltage

When TRIM-pin (6pin) is left open, DC-DC Converter applies nominal output voltage.

Resistors connected between TRIM-pin(6pin) to SENSE(+)-pin (7pin) will increase the output voltage ( $V_{o,adj}$ ) between 100% ~ 110% of the nominal output voltage( $V_{o,nom}$ ). (Vout-Up control)

Resistors connected between TRIM-pin(6pin) to SENSE(-)-pin (5pin) will decrease the output voltage( $V_{o,adj}$ ). (Vout-Down control)

MPDKN106S Adjustable Range : 90% ~ 100% of the nominal output voltage( $V_{o,nom}$ )

Others Adjustable Range : 80% ~ 100% of the nominal output voltage( $V_{o,nom}$ )

The following equations give the required external-resistor value to adjust the output voltage to  $V_{o,adj}$ .

After calculating external resistance, it is necessary to check the output voltage and to adjust of the resistance value at your board conditions.

When you increase the output voltage,

$$R_{adj - up} = \left[ \frac{5.11 \times V_o(100(\%) + \Delta(\%))}{1.225 \times \Delta(\%)} - \frac{5.11 \times 100(\%)}{\Delta(\%)} - 10.22 \right] [k\Omega]$$

When you decrease the output voltage,

$$R_{adj - down} = \left[ \frac{5.11 \times 100(\%)}{\Delta(\%)} - 10.22 \right] [k\Omega]$$

Where,

$$\Delta = \left| \frac{V_{o, nom} - V_{o, adj}}{V_{o, nom}} \right| \times 100 (\%)$$

If you change output voltage, it is necessary to evaluate the characteristics of DC-DC Converter at your board conditions.

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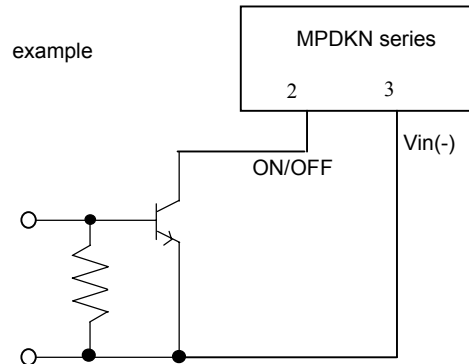
## 9. ON/OFF Control

On control

ON/OFF Pin (Pin2) should be connected to Vin(-) Pin (Pin3) or made at less than 0.7V.

Off control

ON/OFF Pin (Pin2) should be opened or made at more than 3.0V.



The voltage of maximum 20V appears in the ON/OFF pin at the time of pin opening.

The maximum current which flow out of ON/OFF pin, is 0.5mA, While the pin is " Low " level.

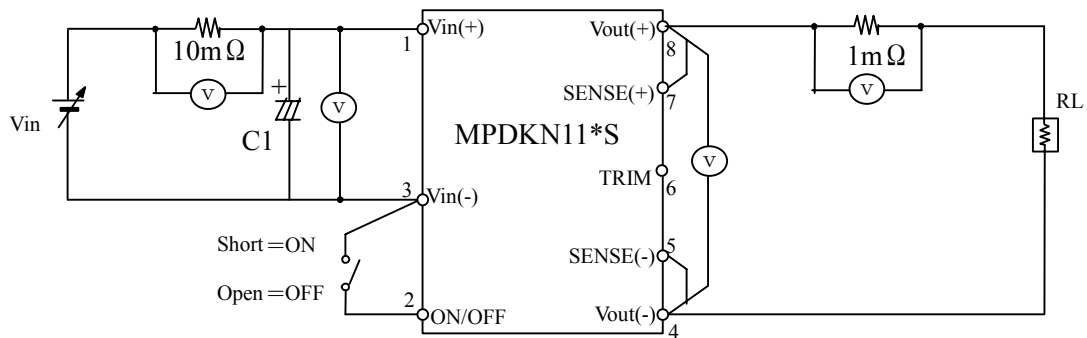
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## 10. Test Circuit

In the following test circuit, the initial values under item 4 should be met.



C1: Low Impedance Electrolytic Capacitor 33 $\mu$ F

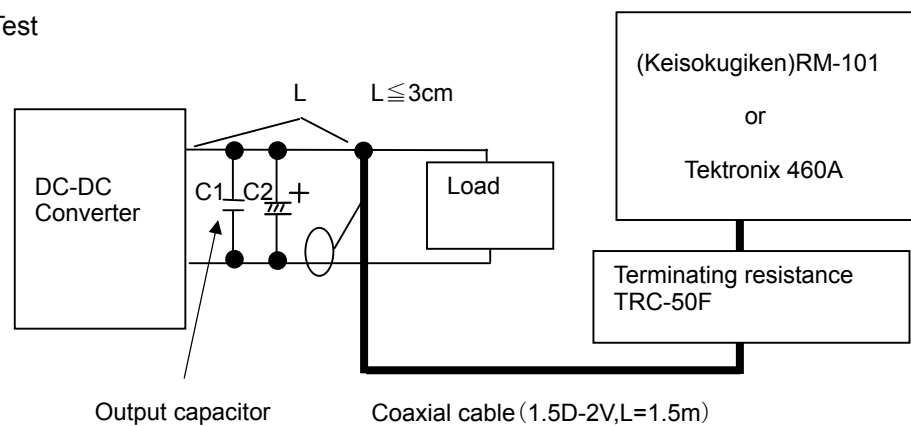
RL: Electronic Load Device :Model EUL150  $\alpha$  XL Fujitsu-Access equivalent

Vin: DC Power Supply :Model HP6655A HP equivalent

(V) : Digital Multimeter :Model HP34401A HP equivalent

When deviating from the above, DC-DC Converter may incorrect-operate. In use, it fully confirms on your board.

### ※Ripple Noise Test



C1: Ceramic Capacitor 1 $\mu$ F

C2: Low Impedance Tantalum Capacitor 10 $\mu$ F

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## 11. External Input-Output Capacitor

### <External Input capacitor>

When an inductance or a switch device are connected to the input line, and the transient response at the time of a sudden change of input power supply is bad, the input voltage is greatly changed at the time of a sudden change of DC-DC Converter.

Since the load response ability of DC-DC Converter may not be normally demonstrated by this influence, and DC-DC Converter may cause unusual oscillation in such a case, please connect an input capacitor.

### <External output capacitor>

Applying an external output capacitor, the total output capacitance should be the following maximum external output capacitance or less.

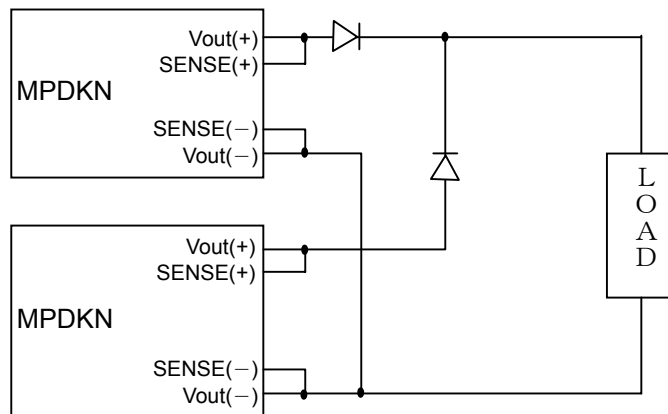
Maximum External Output Capacitance : 1000 $\mu$ F MAX

## 12. Parallel Operation / Redundant Operation

This product does not have a function to share output current, so it cannot apply to parallel operation.

Connection of diodes as follows enables the products to apply to redundant operation.

For the application, a load current should be less than or equal to the maximum output current from a single product.



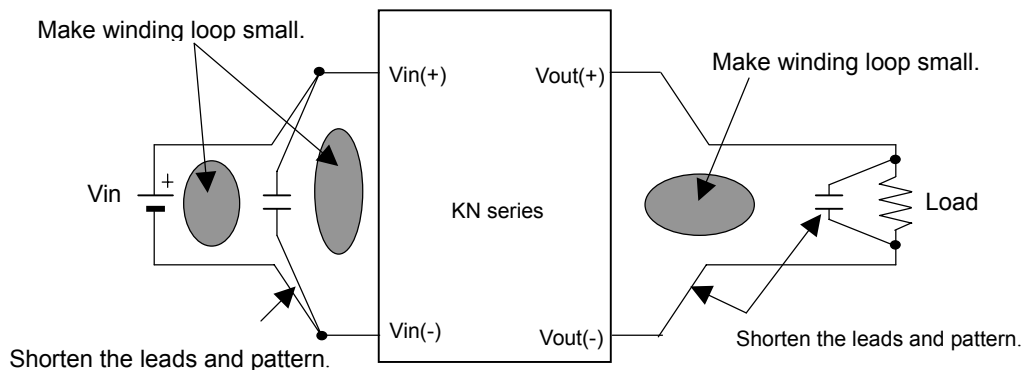
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**⚠ Caution**  
 The above capacitance and electrical characteristics are guarantees on a condition in measurement circuit by using DC power supply.  
 When you connect an input inductance or an input power supply which has an output inductance, please confirm the operation including nearby circuits. Because it has the possibility that a DC-DC Converter causes unusual oscillation.

Input / output capacitor connections; in order to minimize noise, please consider the following items.

- ① Be sure to carry out a system characteristic check.
- ② Use a low impedance capacitor with good high frequency characteristics.
- ③ Shorten the leads of each capacitor as much as possible to minimize lead inductance.
- ④ Make the area of wiring loop small in the input and output line to minimize leakage inductance.
- ⑤ Shorten the length of PCB pattern and widen patterns for main circuit.



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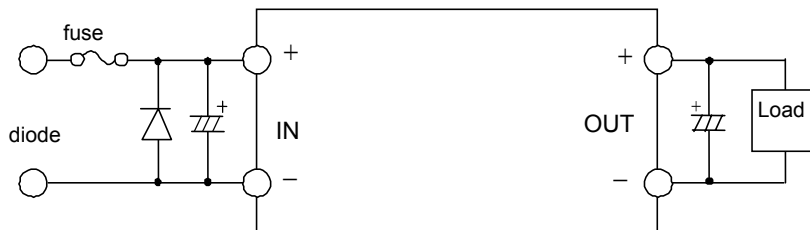
### 13. Caution

This product should not be operated parallel running and series running.

Please do not use a connector and a socket for connection with your board of this product. There is a possibility that it cannot be satisfied of a performance with the influence of contact resistance.

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.

Please connect the input terminal by right polarity. If you connect this by mistake, it may break the DC-DC Converter. In the case of destruction of the DC-DC Converter inside, over input current may flow, and so DC-DC Converter maybe occurred abnormal temperature rise, or your product may be damaged. Please add diode and fuse as following to protect them.



Standard of fuse: current rating

MPDKN104S : 3[A]

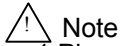
MPDKN106S · MPDKN107S : 4[A]

MPDKN117S · MPDKN118S : 5[A]

※ Please select Diode and Varistor after confirming the operation.

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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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