

High current, SIP Type, Non-Isolated type DC-DC Converter

82.5Watt BSR Series

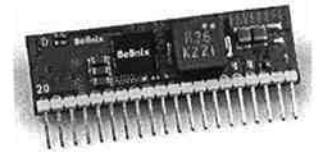
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<Summary>

BSR-25A series is a 25A output, SIP type, ultra high efficiency, non isolated type DC-DC converter developed for Distributed Power Architecture(DPA). It can correspond from ultra low output voltage of 0.6V, and its output voltage accuracy is $\pm 1\%$ (typ). It has actualized a variety of functions with output voltage trim, Remote ON/OFF function, frequency synchronous, current share function, sequence function.

<Features>

- Sequence Function
- Sequential Operation.
- Ratio-Metric Tracking Operation.
- Simultaneous Tracking Operation.
- Ultra High Speed Response
- Ultra High Efficiency
- Heat Sink Not Required
- Parallel Operation (Max. 5pcs.)
- Wide Input Voltage Range
- Built-in Over-Current Protection
- Under Voltage Lock Out
- Non-Isolation between Input and Output
- Remote On/Off Function
- Frequency Synchronous Function
(Synchronous mode and 2 Phase mode)
- Current Share Function
- Adjustable Output Voltage
- High Reliability, High Performance
- Operating Temp. Range - 40°C to +85°C
(Temp. derating required)
- RoHS Compliance



<Model, Rating> Table1

Models BSR Series	Input V Vdc	Output V Vdc	Output I A	Line Reg. %(typ.)	Load Reg. %(typ.)	Ripple & Noise mVpp(typ.)	Efficiency %(typ.)
BSR12-0.6S25R0	12 (8 - 14)	0.6 (0.6 - 3.3)	25	1.0	1.0	50	92

Note 1 : The input voltage inside the () indicates the input voltage range.

Note 2 : The output voltage inside the () indicates the adjustable voltage range.

Note 3 : Output derating is required depending on output voltage.

Note 4 : The efficiency indicates when $V_{in}=12V$, $V_{out}=3.3V$, $I_{out}=25A$.

<Specification>

Table2

Input Voltage Range	Refer to Table1
Rated Output Voltage	0.6V \pm 1%(typ)
Output Voltage Adjustable Range	0.6 - 3.3V
Line Regulation	Refer to Table1 (For the regulation of input voltage range of Table 1, at rating output)
Load Regulation	Refer to Table 1 (For the load regulation of 0 to 100 %, at rating input and output, voltage)
Temperature Coefficient	TBD
Ripple & Noise	Refer to Table1 (Rating input / output, room temperature, 20MHz bandwidth)
Efficiency	92%typ. ($V_{in}=12V$, $V_{out}=3.3V$, $I_{out}=25A$)
Over-Current Protection	Operates at 105% or more rating load current, auto recovery type. (Hiccup mode)
Over-Voltage Protection	None
Input Under Voltage Lock Out	Yes
Over-Input Current Protection	None
Remote On / Off	Yes
Standby Current	0.6 - 2.4mA typ.
Frequency Synchronous Function	Yes (Synchronous mode or 2 phase mode)
Sequence Function	Yes
Parallel Operation	Yes (Max. 5pcs.)
Operating Temp. Range	Operating Temp. -40°C to +85°C (Temp. derating required)
Storage Temp. Range	Storage Temp. -40°C to +85°C
Humidity Range	20% - 95%RH (Non-Condensing)
Cooling Condition	Natural Cooling (Refer to the thermal derating graph.)
Vibration	5 - 10Hz all amplitude 10mm. Acceleration 2G, 1 hour in each of 3 orthogonal axes.
Shock	Acceleration 20G (3 directions, 3 times each), Shocking time 11 \pm 5ms
Weight	TBD
Outline	SIP type W=52.26 L=16.0 H=9.6 typ.(mm) (For detail dimensions refer to the outline p.3.)

*The above specification is provided with rating value, unless otherwise specified.

Preliminary

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1. Applicable Range

This specification is applied to DC input, Non-Isolated type DC/DC converter **BSR12-0.6S25R0**.

2. Model and Input / Output Rating

MODEL	Rating Input Voltage	Rating Output	Remarks
BSR12-0.6S25R0	12.0V	0.6V, 25A	

NOTE1: Unless otherwise specified in this specification, output voltage is 0.6V, ambient temperature is 25°C±5°C.

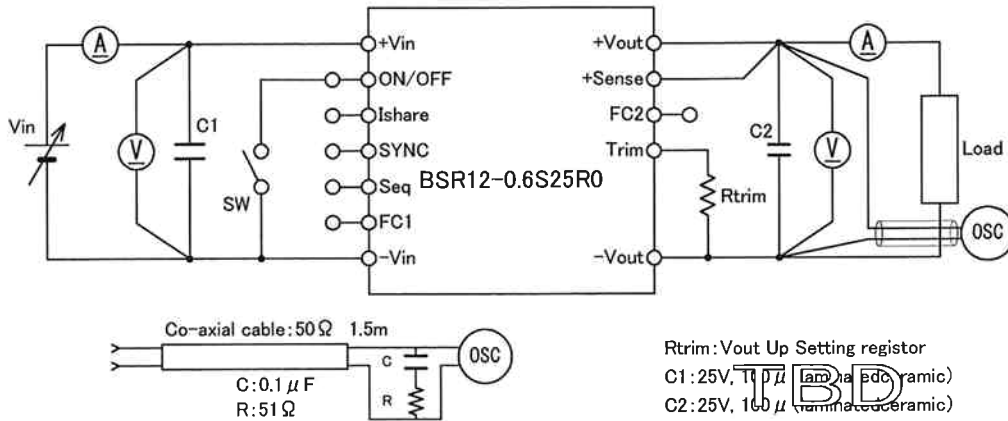
3. Environmental Condition

Item	Specification / Standard	Condition
Input Feature		
Input Voltage Range	+8.0 - 14.0V(Rating12.0V)	
Input Current	7.50A typ.	At the rating input (12.0V)
Output Feature		
Output Voltage Set Accuracy	0.6V±1%(typ.), 3%max.	
Output Current	25.0A	Air cooling
Line Regulation	1% typ., 2% max.	For line regulation of 8.0 - 14.0V
Load Regulation	1% typ., 2% max.	For load regulation of 0 - 25A
Temp. Coefficient	TBD	For the coefficient of -40 to +85°C
Ripple & Noise	50mVp-p typ. 100mVp-p max.	BW=20MHz
Output Voltage Range	0.6 - 3.3V	Adjustable by a external resistor
Attached Function		
Over-Current Protection	Operates at 105% or more rating load current, auto recovery	
Over-Voltage Protection	None	
ON/OFF Control	Yes	
Frequency Synchronous Function	Yes	Synchronous mode or 2 phase mode
Tracking Function	Yes	
Parallel Operation	Yes (Max. 5pcs.)	
General condition		
Operating Temp. Range	-40°C to +85°C	Temp. derating required
Storage Temp. Range	-40°C to +85°C	
Operating Ambient Humidity	20 - 95%RH (Non-Condensing)	
Storage Humidity	20 - 95%RH (Non-Condensing)	
Cooling Condition	Refer to the graph of temp. derating	
Outline / Weight		
Outline	Refer to the article of the outline	
Weight	TBD	

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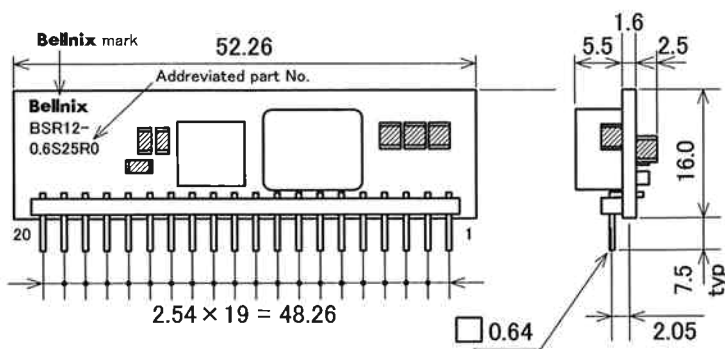
4. Measurement Circuit



- NOTE1. Keep open the ON/OFF pin when the ON/OFF control is not being used.
- NOTE2. Keep open the Trim pin when the output adjustability is not being operated.
- NOTE3. Keep open the SYNC pin when the frequency synchronous is not being operated.
- NOTE4. Keep open the Seq pin when the sequence is not being used.
- NOTE5. Keep open the Ishare pin, the FC1 pin and the FC2 pin when parallel operation function is not being used.
- NOTE6. Be sure to add the Input / Output capacitor and wire it with a thick pattern at a nearby site of pins as much as possible.

5. Outline and Pin Function

5-1. Figure / Dimensions



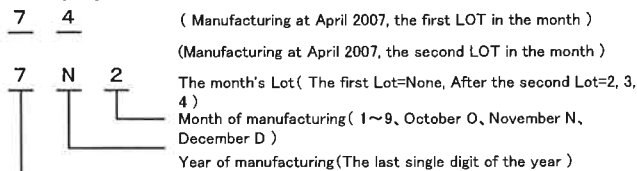
Dimensions : mm
General tolerance : ±0.5

Pin	Function	Pin	Function
1	+Vout	11	NC
2	+Vout	12	FC1
3	+Sense	13	SYNC
4	+Vout	14	Ishare
5	-Vout	15	-Vin
6	-Vout	16	+Vin
7	FC2	17	+Vin
8	NC	18	Seq
9	NC	19	Trim
10	NC	20	ON/OFF

Pin substances: Copper

Plating: Tin plating after nickel plating

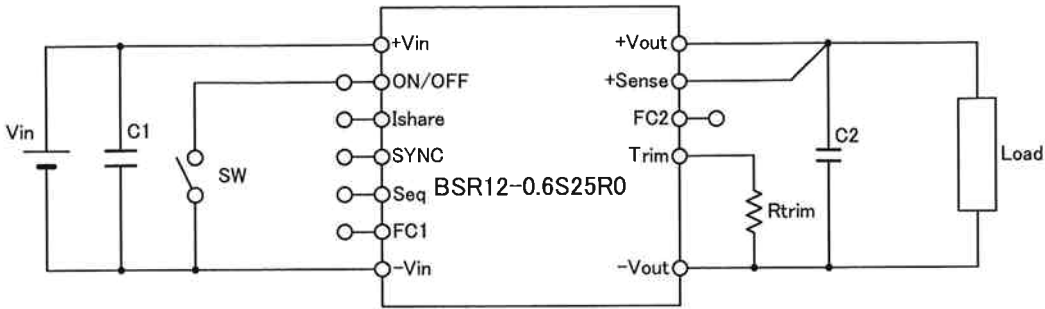
5-2. LOT Display



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6. Usage Method

6-1. Standard Connection Circuit Diagram



<Operating Summary>

Output voltage when Rtrim=OPEN is +0.6V. Connect up to Rtrim between Trim pin and -Vout pin in case of setting the output voltage except +0.6V.

If ON/OFF pin will be connected to -Vin pin, converter will stop. When ON/OFF pin will be opened, the converter will be operating condition.

In case of not using remote ON/OFF function, keep open the ON/OFF pin.

Refer to the function description for the detail of output voltage change, remote ON/OFF and other functions.

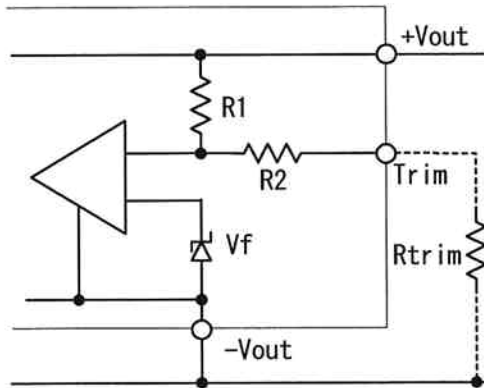
NOTE: Wire from the converter to the Input power as short as possible.

6-2. Setting output voltage

In case of setting output voltage except +0.6V, connect the resistor which is calculated with the following equation between Trim pin and -Vout pin on standard connection circuit diagram. And place Rtrim nearest the converter, wire from the resistor to the converter as short as possible.

Set 2 resistors series, when the setting is not available with one resistor.

EX. : 1.6kΩ (1.5kΩ+100Ω)



< Rtrim Equation >

$$R_{trim} = \frac{V_f \times R1}{+V_{out} - V_f} - R2 (\Omega)$$

+Vout=requested output voltage[V],
R1=18kΩ,R2=2.4kΩ,Vf=0.6V

<Rtrim Representative Example>

Output voltage setting Vo[V]	Rtrim[kΩ]
+0.6	Open
+1.2	15.60
+1.8	6.60
+2.5	3.28
+3.3	1.60

6-3. Remote ON/OFF Control

ON/OFF control without input disconnection is available by using ON/OFF control function. It is the effective function for constructing sequence of power system. Electric power saving control is available by using this function as the standby power supply function.

NOTE: Keep open the ON/OFF pin when not using the ON/OFF control.

6-4. Input Under Voltage Lock Out Function

For preventing the malfunction on the occasion that the input voltage will drop down, this converter has the input under voltage lock out function (UVLO) which will stop the converter's output. The Ripple may be caused in case that the impedance of input electric line is large when starting / stopping the converter.

For avoiding the Ripple, it should be controlled the dropping down of the voltage (transient and stationary dropping down of the voltage) by the impedance of the input electric line as small as possible.

6-5. Frequency Synchronous Function

It is available to synchronize frequency with other converters and shift the phase by inputting 5V external clock to SYNC pin.

This converter operates approximately 465 kHz oscillating frequency. In case of operating the frequency control, chose frequency.

NOTE1: In case that the controlled frequency is too high, the loss will increase and the heat will generate, and besides, the output voltage regulation will become large and it may not be controlled by the condition of load.

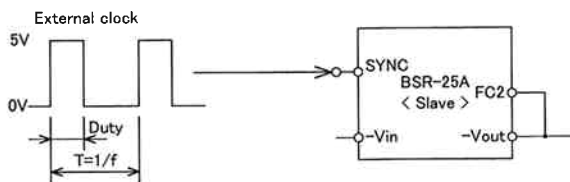
NOTE2: For the external clock which is for input to SYNC pin, use the square wave Duty=10 - 99%, Voltage level=3.3 to 5.0V.

NOTE3: Open SYNC pin and FC2 pin when not using frequency synchronous function.

6-5-1. Synchronous mode

It is available to synchronize frequency with other converters using Synchronism mode.

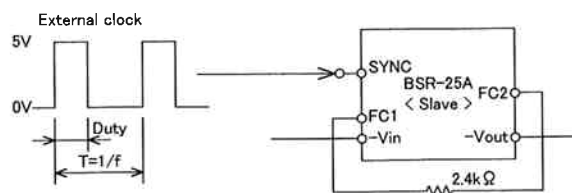
Input 5V external clock to SYNC pin of the slave converter and connect FC2 pin to -Vout pin.



6-5-2. Two phase mode

It is available to shift phase of other converters using 2 phase mode.

Input 5V external clock to SYNC pin of the slave converter and pull up FC2 pin with 2.4kΩ resistor to FC1 pin.

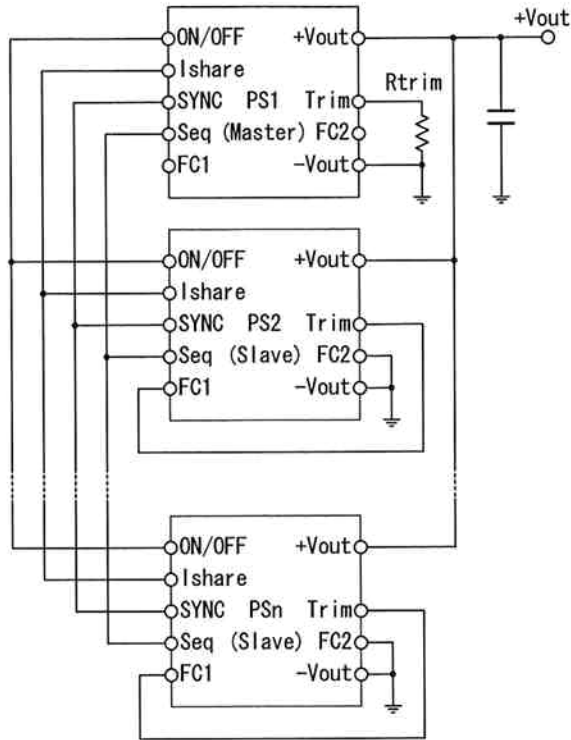


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6-6. Current Share Function

Taking current balance is possible at operating in plural parallel with using the Ishare pin.

Connect the Ishare pin of each converter, and then connect the Trim pin of Slave converter to FC1 and connect the FC2 pin of Slave converter to -Vout pin. The parallel operation of maximum 5 pieces is available.



6-7. Sequence Function

TBD

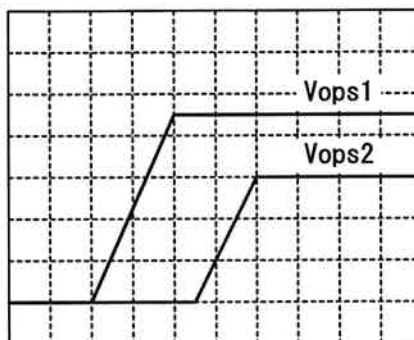
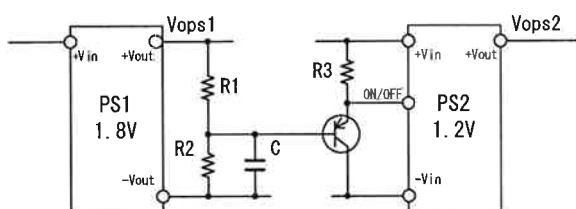
*Sequential operation

*Ratio-Metric tracking operation

6-7-1. Sequential Operation

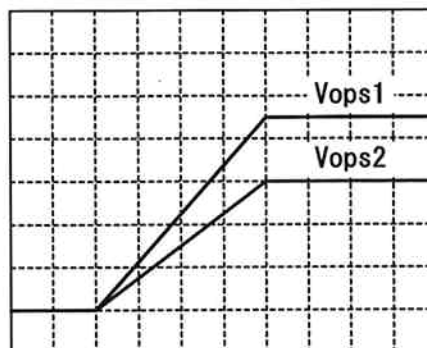
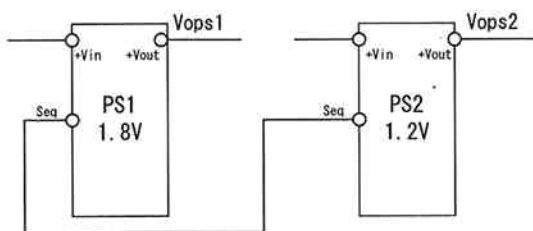
In case of operating the Sequential operation, detect the signal of output voltage from PS1 by additional circuit etc, and impress to ON/OFF pin of PS2.

(Dividing the output voltage of PS1 with R1 & R2, it will be performed by impressing to the Seq pin of PS2.)



6-7-2. Ratio-Metric Tracking Operation

In case of operating the ratio operation connect the Seq pin of PS1 and Seq pin of PS2.



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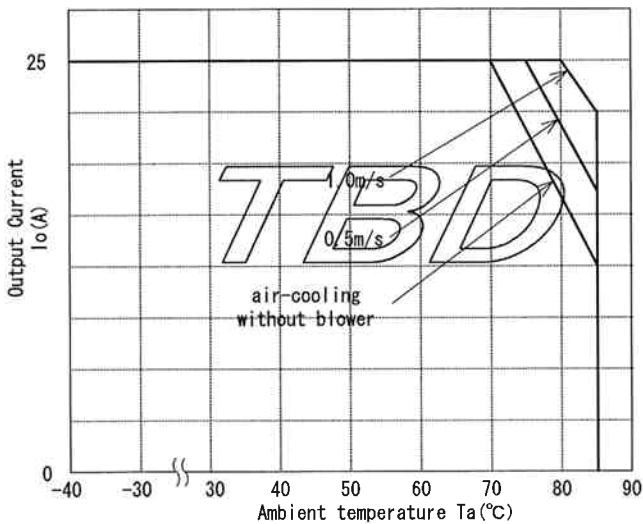
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6-8. Over-Current Protection

Over-current protection circuit will operate at over 105% in rating. The converter will return to the usual rating voltage operation after released from the over current condition. Please avoid keeping the over-current condition or the loading short condition in long time. This will cause the thermal destruction for the inner element of the converter. It should not be exceeded the temperature measurement point (upper surface of IC) over *TBD*.

7. Temperature Derating

This converter operates in wide temperature range. In case of high ambient temperature, air-cooling will be needed. The Temperature Derating as mentioned in below figure is to support the temperature layout in proper use of the converter. For the certain cooling, it will be needed to mount the converter inside the equipment / system, and to measure the temperature in condition of the maximum ambient temperature and the minimum cooling blast. On this occasion, the board temperature of the converter should not exceed *TBD*.



Pattern Condition for heat radiation

*Board material: FR-4, t1.6, double-side board.

Size: 90X150, 35μ

Temperature Derating (At mounting on PCB)

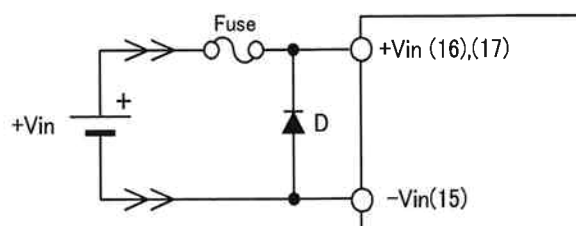
8. Vibration / Shock

Vibration	5-10Hz	All amplitude 10mm (1 hour in each 3 orthogonal axes)
	10-55Hz	Acceleration 2G (1 hour in each 3 orthogonal axes)
Shock	Acceleration	20G (3 times in each of 3 orthogonal axes)
	Shocking time	11±5ms

9. Countermeasure for avoiding failure

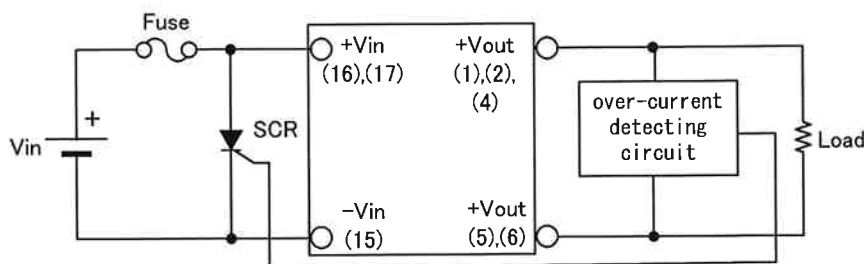
9-1. Protection against reverse connection of input power supply.

This product is a non-isolated type DC-DC converter that steps-down from (+) to (+). If the input voltage reversed is connected by mistake, it will be damaged. If there is a possibility of reverse connection, please add a protection as shown in the right figure. The right figure is an example using fuse and diode.



9-2. Output Over Voltage Protection (example)

This product does not have a built-in over-voltage protection. If the switching element in this converter is damaged in short mode, DC input voltage will go out as output. To avoid damage at over-voltage mode, in advance, please add the input interrupting circuit as the right figure.



10. Soldering Condition

Please operate the solder-temperature and time in the following condition.

1) Soldering iron

340°C to 360°C within 5sec.

2) Soldering dip

240°C to 260°C within 10sec.

11. Storage Condition & Humidity Measures before mounting

Please observe the directions as mentioned below.

- Keep it in the place where the unit will not be influenced by the poisonous gas (chlorine, sulfur).
- Keep it in the place to protect from the corrosive damage.
- Please avoid the dust.
- Keep it in a place where direct sunlight will not effect it.

12. Cleaning Conditions

This product can not be washed whole. No-clean solder paste is recommended for this product.

In case of cleaning out of necessity, clean by hand brush with isopropyl alcohol (IPA) only on soldered surface.

After cleaning, use the product after enough drying.

13. Precautions

For customer's safety, please see the specification and observe the under mentioned notes definitely when using this product.

- This product intends to be used for general electronic equipments (Clerical work machines, Telecommunications, and Measurement equipments). Therefore, do not use for medical equipments, nuclear power equipments, and trains, etc. the malfunction and damage of which may influence directly to human life and property. Please confirm when using it in the case expect general electronic equipment
- For this product, series/parallel operation is not possible.
- For mounting this product, please do not use connector or socket. The performance may not be fulfilled by the effect of contacting resistor. Mount to print board by soldering because constant taking out and putting in converter during turning on electricity will cause damage of the converter.
- This product has built-in over-current and short protection circuit, but long time short circuit will cause failure, so please avoid it.
- The product may be damaged if it is used under electric condition and environmental conditions such as temperature out of standard. So please be sure to keep the standards.
- There is a possibility of damage from static.
When the worker has electrified static, please earth discharge and working on an earthed worktable will be recommended.
- This product does not have a built in fuse. When it is abnormal, please connect the fuse with + input line as a protection for excessive current flowing into the input. Please give capacity, so that the fuse can be cut to from power supply
- This product does not have a built in over voltage protection. When over voltage is abnormally generated in the module, there is such a mode that the input voltage appears to the output straight, and which may cause smoke and ignition. Please make sure to add the overvoltage protection circuit to prevent it.
- No test certificate is attached in this product.

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14. Guarantee

This product shall be guaranteed for one year.

During this period, if there should be any failure definitely due to our designing or manufacturing workmanship, we will repair or exchange with new one at our own expense.

The range of the guarantee for this product is the one of this product concerned.