

■Information

The BSV-HE series is a small type (16.5 x 27 x 4mm) light weight (2.2g) step down DC-DC converter which has achieved 9.5A. Since it can corresponds to low output voltage from 0.8V and output voltage setting accuracy is less than ±1%, it is suitable with the latest DSP, ASIC applications. Furthermore, high efficiency, very high speed response and SMD package which requires non-external parts have been achieved with a synchronous rectification system. This product breaks all the barriers of a normal product.



Figure 1

■Features

- Ultra small type (16.5 x 27mm)
- Ultra thin type 4.0mm
- Very high-speed load response
- Output setting accuracy ±1%
- Very high efficiency
- Over current protection
- Under Voltage Lock Out
- Remote ON/OFF control
- Adjustable output voltage
- SMD package
- External capacitor not required
- Heatsink not required
- Non-Isolated type converter
- Operating temp -40°C to +85°C (Temp derating required)
- RoHS compliance

■Model/Rating

Model BSV-H Series	Input V Vdc	Output V Vdc	Output I A	Output ADJ Vdc	Ripple Noise mVpp(typ.)	Efficiency % (typ.)
<b>BSV-1.8S9R5HE</b>	3.0-5.5	1.8	0-9.5	0.8-1.8	10	87

Note 1 : Ripple noise and efficiency are when input voltage is 5V and load is rated  
 Note 2 : Ripple noise is measured by 20MHz bandwidth, with a multi-layered ceramic capacitor with 47µF at input and 4.7µF at output.  
 Note 3 : Depending on ambient temp conditions, cooling air flow may be required.

■Specifications

Figure 2

Input voltage range	Refer to Figure 1
Rated output voltage	1.8V±1% (Trim pin when open)
Adjustable output voltage range	0.8 to 1.8V
Line Regulation	0.5% typ. (Rated output, refer to Figure 1 for input voltage range)
Load Regulation	0.5% typ. (Rated input/output voltage, load varying from 0 to 100%)
Temp Regulation	0.02%/°C (Rated input/output, temp change from -40°C to +85°C)
Ripple noise	Refer to Figure 1 (Rated input/output, common temp, measurement frequency bandwidth 20 MHz)
Efficiency	87% typ. (Rated input/output, common temp, refer to figure 1)
Start up time	2ms typ. (Resistance load)
Maximum output load capacity	2200 µ F max
Over current protection	Rated load current operates at 105%+. Auto recovery type.
Over voltage protection	None
Under Voltage Lock Out	Yes
Over input current protection	None
Remote ON/OFF control	Between 9pin (ON/OFF) and 8pin (GND) : Output switches on when open, output switches off when short. *Refer to Page 7
Standby current	0.2mA typ.
P-Good signal	At normal output : HIGH, at decreased output : LOW (This terminal is open-drain)
Remote sensing	Yes
Operating temp range	-40°C to +85°C (Refer to the thermal derating graph on Page 5)
Storage temp range	-40°C to +85°C
Humidity range	20 to 95%R.H. (While the max wet bulb temp is 35°C, no dewing)
Storage condition	Store the product at 30°C/60% R.H. or lower before mounting
Cooling condition	Refer to the thermal derating graph on Page 5
Vibration	5-10Hz, all amplitude 10mm, 10-55Hz acceleration 2G (1 hour in each of 3 orthogonal axes)
Shock	Acceleration 20G (3 directions, 3 times each), Shocking time 11±5 m s
Weight	2.2g typ.
Dimensions	W=16.5 L=27.0 H=4.0 typ. (mm) *For detail dimensions refer to the outline

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

## Application Range

This specification is applied to the direct current input and non-isolated type DC/DC converter, BSV-1.8S9R5HE.

## 1. Model and Rating

Model	Rating Input Voltage	Rating Output	Package type	Note
BSV-1.8S9R5HE	DC5.0V	1.8V, 9.5A	SMD	

When the condition is not described in this specifications, the input/output is rated and the ambient temperature is 25°C±5°C.

## 2. Environmental Condition

## 3-1. Temperature range

When operating : -40°C to +85°C (Load derating from 50°C is required, only when mounting on both sided PCB of 100 X 100mm and thickness 1.6mm.)

When storing : -40°C to +85°C

## 3-2. Humidity range

When operating : 20-95%RH (Maximum wet bulb temperature is 35°C, and no dew condensation)

When storing : same as above

Note) Before mounting, store the product at 30°C/60% RH or lower.

## 3. Specification and Standard

This product is a lead free product.

## 4-1. Input characteristic

Article	Specification and Standard	Terms
Input voltage	+3.0 to 5.5V (Rating 5.0V)	
Input current	3.93A typ.	When input/output is rated
Standby current	0.20mA typ.	Vin=5.0V, Short Between ON/OFF Pin and GND Pin

## 4-2. Output characteristics and attached functions

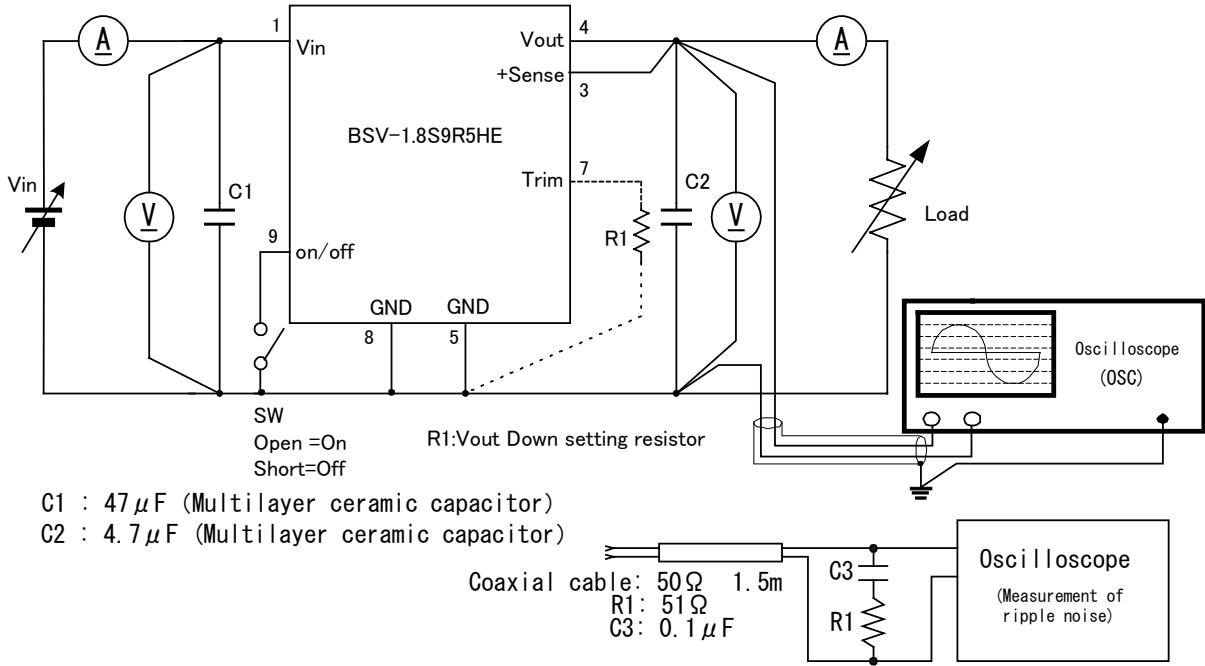
Article	Specification and Standard	Terms
Output voltage	1.8V	
Output voltage setting accuracy	1.8V±1.0% (±0.018V)	
Adjustable output voltage range	0.8V to 1.8V	Depending on external resistance
Output current	0 to 9.5A	Derating required
Line Regulation	0.5% typ. (1.0% max)	Input varying from 3.0 to 5.5V
Load Regulation	0.5% typ. (1.0% max)	Load varying from 0 to 9.5A
Temp Regulation	±0.02%/°C typ.	Varying from -40 to +50°C
Efficiency	91% typ. (I <sub>o</sub> =5A), 87% typ. (I <sub>o</sub> =9.5A)	
Ripple Noise	10mVp-p typ. 50mVp-p max.	Bw=20MHz, with external capacitor attached on both load sides
Over current protection	Operates at 105%+, Auto recovery type	
Over voltage protection	None	
Under Voltage Lock Out	Yes. Start up voltage : 2.85 typ. Shut down voltage : 2.75 typ.	
ON/OFF control	Between the ON/OFF pin (9) and the GND pin (8) OPEN → Output ON SHORT (0-0.6V, 0.2mA max) → Output OFF	
P-Good low level voltage	0.3V max	Sink current : 4mA max
Max. output load capacitance	2200 μF max	

Note 1) About the measurement circuit of 4-3

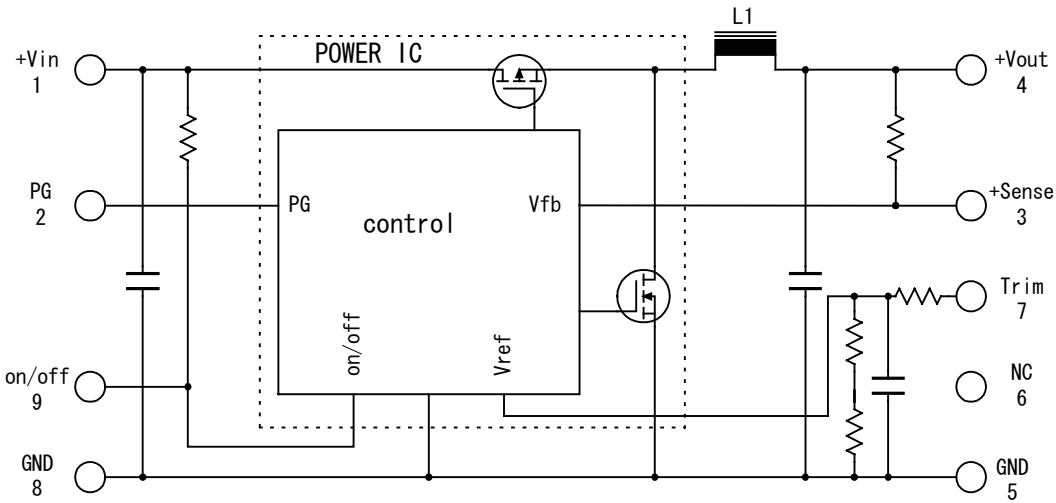
Note 2) Measured by the following conditions unless otherwise specified :

Input voltage 5.0V, Output voltage 1.8V, Output current 9.5A (Resistance load), Ambient temperature 25°C±5°C.

4-3. Measurement Circuit



4. Block Diagram



5. Temperature Derating

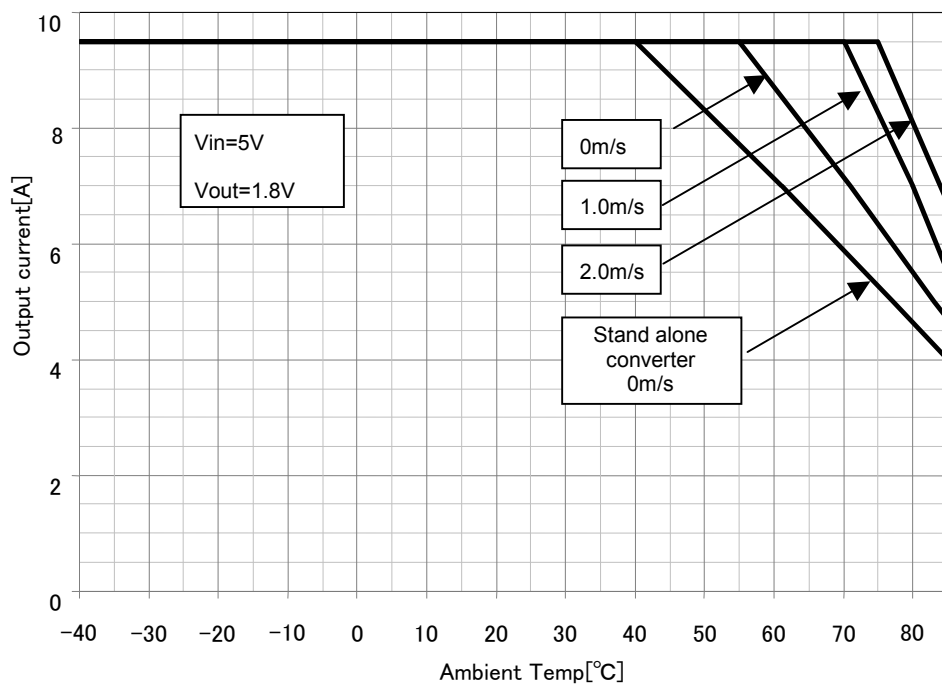
Place this product in a position with good airflow. The product must be mounted on a board during use. This product has been designed to radiate heat utilizing the mounted board. Since the GND pin radiates a larger amount of heat making the GND line wider.

The derating curve below shows the product data when mounted on a double-sided board of copper foil (thickness 70 μ m), copper foil area (100x100mm) and thickness of the board (1.6mm). Since the heat radiation characteristics will vary depending on the wiring, please use the data as a reference.

The thermal characteristics of this converter will be largely influenced by the mounted board and the ambient condition.

For this reason, ultimately mount the converter inside the device and operate at the max ambient temperature of the device.

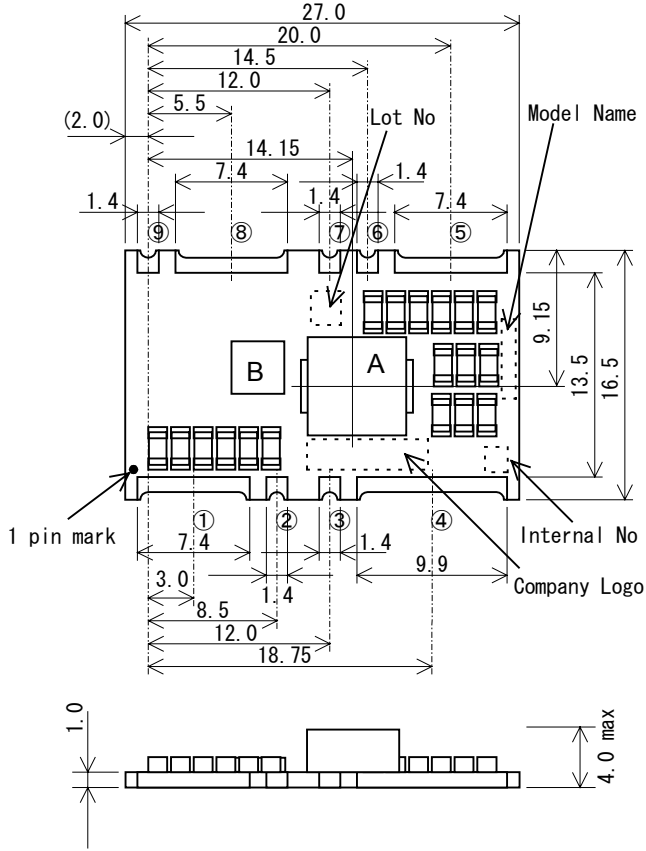
Make sure that the surface temperature of the board does not exceed 100°C.



The derating curve shows the product data when mounted on a double-sided board of copper foil 100x100mm

7. Outer dimensions and pin information

7-1. Configurations/Dimensions



Pin	Function
①	+Vin
②	P-Good
③	+Sense
④	+Vout
⑤	GND
⑥	NC
⑦	Trim
⑧	GND
⑨	On/Off

Units : mm

Tolerances unless otherwise specified : ±0.5

Weight : 2.2g typ.

Adsorption position : Use A point on the left diagram

Display 'BSV-1.8S9R5HE' for the model name

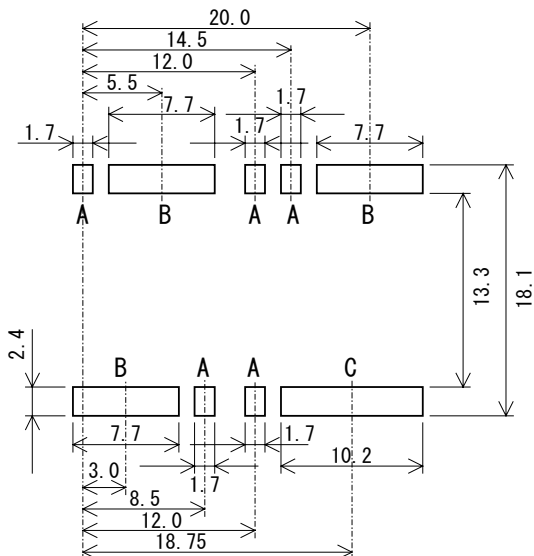
Lot No.is inscribed on the 1 pin side

- ① Suffix = year of manufacture
- ② Manufacturing month(O, N, D for Oct, Nov, Dec respectively)
- ③ Lot of the month (None is inscribed for the first month)

Floppy pin : 0.2mm max (when placed horizontally)

Note) Be sure to pick up at A point in the outline when mounting by an automated machine. Avoid pick up at the component (IC) placed in the center of the board.

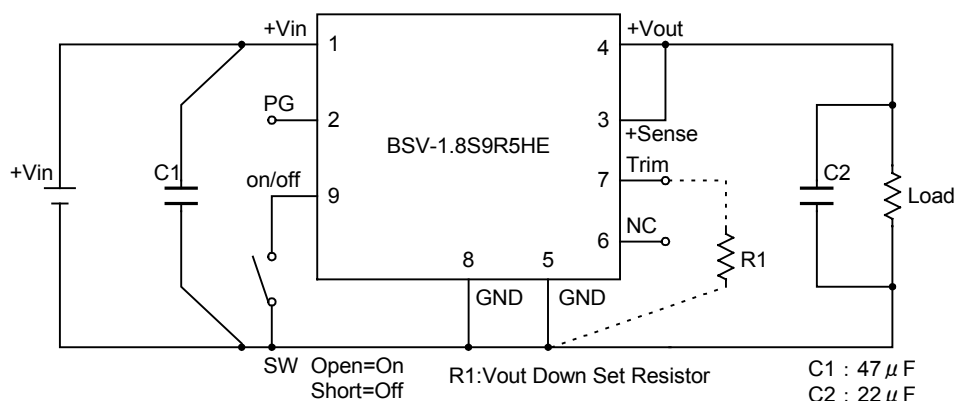
7-2. Recommended Pad Layout



Note) Do not wire a pattern below the converter (The first layer). The converter adopts an ordinary through hole board. If there is a pin hole on the resist film, it could be a problem.

## 8. Usage

## 8-1. Standard connection circuit



Note 1) It is a prerequisite for this product to be mounted onto a board, thereby heat relation is done. 70% or more of the heat radiation is done from the GND pin(5, 8pin) and the rest is done from the +Vin pin and +Vout pin. Take space of the pattern as much as possible and design the board to make radiation easy. (Please use that surface temperature of converter's PCB will not exceed 100°C.)

Note 2) When not using the On/Off control, keep the On/Off pin open.

Note 3) P-Good pin is open-drain. If using P-Good function, please pull up to the input voltage at the resistor.

Note 4) When not adjusting the output, keep the trim pin open.

Note 5) GND pin (5, 8pin) is connect inside, however to secure the performance, use it with the 2 pins connected to the GND line.

Note 6) Be sure to connect the sense pin and output pin on the board. Unless the sense pin is connected, there is a possibility that a higher voltage than the rating voltage may be output.

Note 7) Do not wire a pattern right under the converter (first layer). For other layers wiring a pattern will be no problem.

## Recommended Capacitor

C1=47 μF

C2=2.2 μF -200 μF

C1 : It is unnecessary if impedance of the power supply on the input side is low enough and the power supply on input side is connected by the enough thick and short line, however, it is necessary if the impedance is high. Use ones with low ESR such as organic semiconductor solid capacitor, multilayer ceramic capacitor

C2 : The converter will operate without C2 because the output capacitor has built in, however, it is necessary to satisfy with the electric characteristic (Ripple Noise). The connecting to the load side will make noise decrease. Use a multilayer ceramic capacitor.

## 8-2. ON/OFF Control

By using the ON/OFF control function, ON/OFF of the output without connecting and disconnecting the input can be controlled. ON/OFF Pin has been connected with +Vin terminal internally by the resistance of 30kΩ.

When not using the ON/OFF control, keep the ON/OFF pin open.

## 3.3V Input

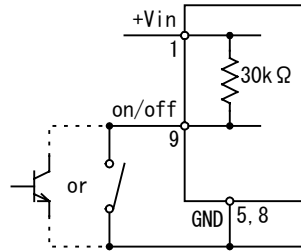
ON/OFF Pin(9pin)-GND Pin(8pin) Open or High (Above 2.6V) ON

ON/OFF Pin(9pin)-GND Pin(8pin) Short or Low (Below 0.65V) OFF

## 5.0V Input

ON/OFF Pin(9pin)-GND Pin(8pin) Open or High (Above 3.75V) ON

ON/OFF Pin(9pin)-GND Pin(8pin) Short or Low (Below 0.9V) OFF



**8-3. Adjusting Output Voltage**

When using at 1.8V without adjusting output voltage, keep Trim pin (7pin) open. By connecting a resistor between Trim (7pin) and GND pin (5pin), the output voltage can be adjusted within the range of 0.8-1.8V.

When adjusting the output voltage, please be careful not to draw around the wire of Trim pin. If the Trim pin catches noise, malfunction may occur.

To calculate the external resistance, please refer to the equation below. After calculating the external resistance, please check the output voltage and adjust the resistance value.

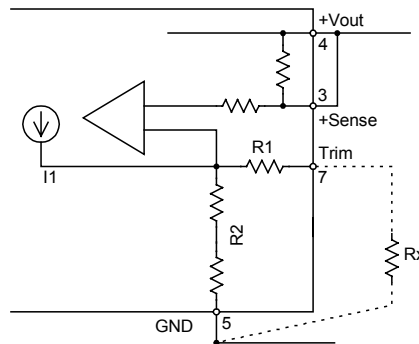
To set within the range of 0.8V-1.8V

$$R_x = \frac{R_2 \times V_{out}}{R_2 \times I_1 - V_{out}} - R_1(\Omega)$$

R1=47000(Ω), R2=63800(Ω), I1=0.000028186(A), Vout=Requested output voltage (V)

Ex.)

Desired Output Voltage Vout (V)	Rx Calculated Value (kΩ)
1.8	Open
1.5	273.85
1.2	80.97
1.0	32.92
0.8	4.13



**8-4. Sensing function**

An excellent load regulation characteristic can be obtained by using the sensing function on the load side. Make sure to connect the +Vout pin (4 pin) and +Sense pin (3 pin) as close to each other as possible.

**8-5. P-Good Function**

By utilizing this P-Good pin (2 pin), the output condition of the converter can be obtained.

This terminal is open-drain. If using P-Good function, please use P-Good terminal connecting the resistor outside and pulling-up to the input voltage. (5.5V max.)

It may become low when output voltage (+Sense voltage) is very different from the voltage set by the converter.

It will be open by

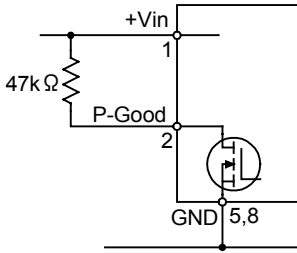
Vout<1.2V : |Output voltage-Set voltage| ≤ 0.076V typ.

Vout ≥ 1.2V : |Output voltage-Set voltage| ≤ 6.25%typ. of set voltage.

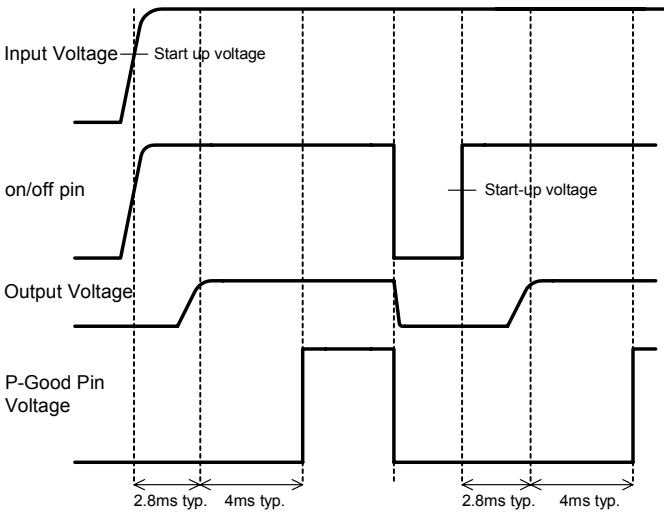
However, under the conditions written below, even if the output voltage is within this range, it may become low.

- At standing up. (4ms typ.)
- When the input voltage is below 3V
- When the output current is at over-current state.
- When the IC temperature is above 100°C





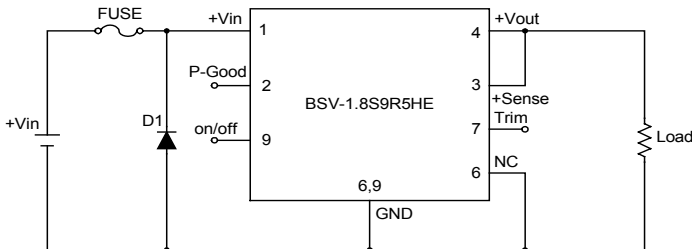
Output of output voltage and P-Good after reaching the start-up condition is as shown below:



9. To prevent reverse input voltage protection(Ex.)

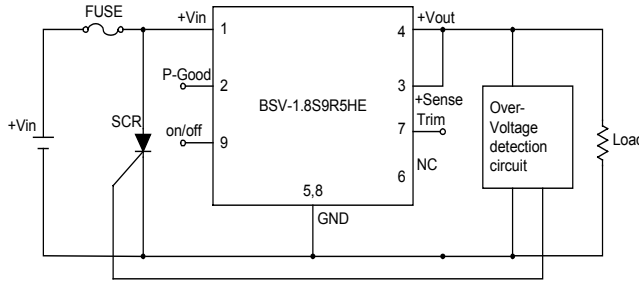
This product is a non-isolated type DC-DC converter that steps-down from (+) to (+).  
If the input voltage reversed is connected by mistake, it will be damaged.

If there is a possibility of reverse connection, please add a protection as shown in the below figure.  
The below figure is an example using fuse and diode.



10. Over-Voltage Protection Diagram (Ex.)

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 below.



- Note 1. When it is damaged at over-voltage mode, ON/OFF control will not operate.
- Note 2. When having ON/OFF function on the supplying power side, this circuit can be used.
- Note 3. Be sure that the DC power supply on the supplying side has the capacity to cut the fuse.

11. Soldering Conditions

Please conduct by the condition as below regarding the soldering temperature and time and storage before mounting.

11-1. Reflow method

Pre-heating temp.: 150-180°C, within 60 sec max. (Refer to the figure below)

Peak heading temp.: 250°C max.  
 220°C or more, within 60 sec max.

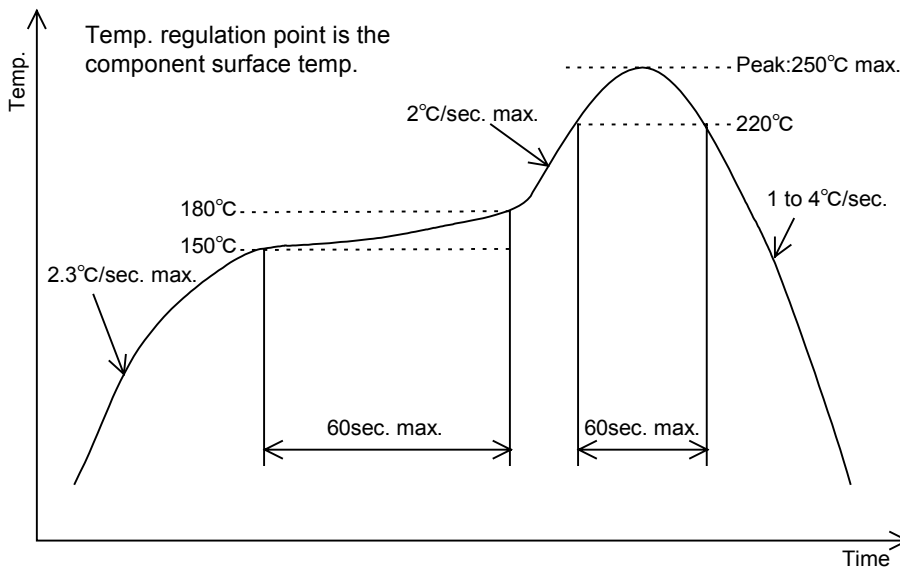
Reflow: twice

- Note 1. Do not give shock at reflow because components which compose the converter may move.
- Note 2. After mounting the converter on PCB, please do not reflow again turning the PCB over.

11-2. About storage before being mounted

When you open dry packing, storage conditions before being mounted should be 30°C/60% RH or below. Moreover, baking (125°C±5°C, 12H) is needed before the reflow when exceeding one year in a dry pack and 168 hours at 30°C/60% RH in an open dry pack conditions.

After mounting, it depends on the environmental condition.



12. Vibration and shock test

Vibration : 5-10 Hz All amplitudes 10mm, 10-55Hz Acceleration 2G (Three direction, for one hour each)

Shock : Acceleration 20G (Three direction, three times each)

Shocking time 11±5ms

13. Cleaning Conditions

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

14. Precautions

For customer's safety, when using this product, please refer to the specification and please use keeping the following precautions surely.

-This product is for being used in general electric equipments (business equipments, telecommunication equipments and measurement equipment).

Can not be used in medical equipments, nuclear equipments and trains which would affect lives or properties directly by the failure of this product.

Be sure to contact our sales when using in besides general use.

- For this product parallel and series operation are not possible.

- For mounting this product, please do not use connector of socket. The performance may not be fulfilled due to the effect of contacting resistor.

Mount to print board by soldering.

- This product has a built-in over-current, short protection, but long time short circuit will cause failure, so please avoid it.

- There is possibility of damage when used under electric conditions and environmental conditions such as temperature that are out of the standards.

Be sure to be use within the standards.

- Do not store in a place where corrodible gas may be generated or a dusty place.

- There is possibility of damage by static. When the worker has electrified static, electrical discharge should be done and the working on the table so grounded may be recommended.

- This product does not have a built-in fuse. Connect a fuse to the +input line for protection when over-current flows into input at abnormal. Please be sure that the supplying power has the capacity to fuse the fuse.

- This product does not have a built-in over-voltage protection. When over-voltage occurs due to the abnormality in the module, there is a mode that input voltage comes out at it is, and may cause smoke and ignition. To prevent this, be sure to add over-voltage protection.

- No test result certificate attached to this product.

15. Guarantee

The guaranteed term of this product is one year. When occurring any failure mode by the cause of our design and production in this guaranteed term, we will repair the failure product or replace to the good product by free of charge.

However, when being remodeled inside etc., we shall not guarantee it.

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

16. Miscellaneous

Any doubtful point arising in connection with the interpretation of any provision hereof shall be decided on by mutual agreement between the parties hereto.

17.If you have any further technical questions for this product, please contact us.

E-mail : [info@bellnix.com](mailto:info@bellnix.com)

URL : <http://www.bellnix.com>