Ultra High Efficiency 82 - 91%

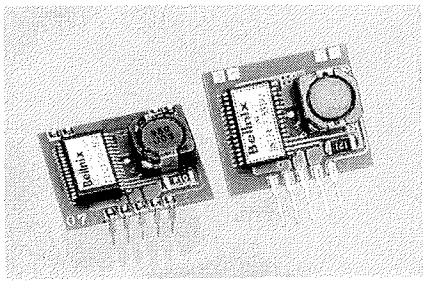
High Efficiency, Small, Low price, Step-Down DC-DC Converter

5 Watt BSA Series

BSA-5W Series is a step down converter which has achieved high efficiency with the ultra low price. By adopting an original multi chip module IC, it succeeded in cutting down the number of parts drastically. According to that, the reliability is improved higher and low cost has been achieved. For the function, it is built in the heat protection and over current protection. Heat sink is not required.

<Features>

- Ultra Small Type
- High Efficiency (82-91%)
- Original MCM - IC
- MTBF 1,000,000Hrs.
- Low cost
- Simple structure
- Easy to use ; SIP / DIP type
- Adjustable output range
- Over-Heat Protection (For BSA24 model only)
- Over-Current Protection
- Non- isolation converter
- Heat sink not required
- Operating Temperature range -20°C to +70°C
  (Possible Start up range -30°C to -20°C)
  (Temperature derating required)
- Long life, High reliability



<Model, Rating>

Table 1

Model BSA (5W) Series	Rating Input Voltage Vdc	Rating Output Voltage Vdc	Output Current A	Line Regulation %(typ)	Load Regulation %(typ)	Ripple & Noise mVpp(typ)	Efficiency %(typ)	Package Type
BSA05-2.5S1R2	5	2.5	0-1.2	0.2	0.7	30	89	SIP
BSA05-2.5S1R2-D	(4.75-6)	(1.5-3.3)						DIP
BSA24-3.3S1R2	24	3.3	0-1.2	1.5	1	60	82	SIP
BSA24-3.3S1R2-D	(9-36)	(3-5)						DIP
BSA24-12S0R6	24	12	0-0.55	1.5	1	100	91	SIP
BSA24-12S0R6-D	(18-36)	(9-12)						DIP

Note 1: Rating input voltage ( ) value indicates Input voltage range.

Note 2: Rating output voltage ( ) value indicates adjustable, possible range.

<Specification>

Table 2

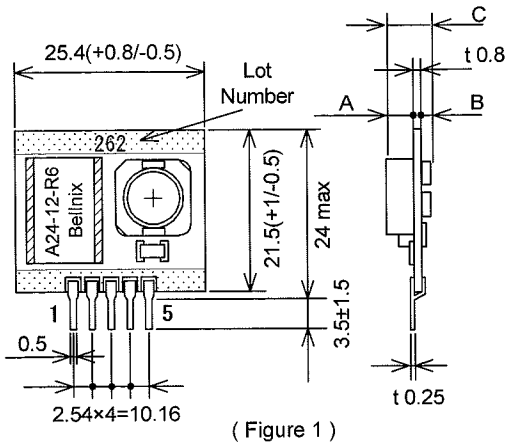
Rating Input Voltage	Refer to Table 1
Rating Output Voltage	Refer to Table 1
Adjustable Output range	Output voltage is adjustable within the above range in Table 1. (By the external resistance)
Line regulation	BSA05 model: 0.2% typ., BSA24 model: 1.5% typ. (For the input voltage range of table1, at rating load)
Load regulation	BSA05 model: 0.7% typ., BSA24 model: 1.0% typ. (At rating input voltage, when load changes 0 to 100%)
Temperature coefficient	±0.01%/ °C typ. (When operating temperature changes between -20 to +50°C)
Ripple & Noise	Refer to Table 1 (20 MHz bandwidth)
Efficiency	82% to 91% typ. (Rating I/O, room temperature, refer to Table 1)
Over-Current Protection	Operates at more than 105% of rating load current.
Over-Voltage Protection	None
ON/OFF Control	Between 1 pin (ON/OFF) and 3 pin (GND) [Open: Output OFF, Short: Output ON]
No - load Input current	2.5V model: 11mA typ., 3.3V model:15mA typ., 12V model: 25mA typ.(No load)
Stand-by current	2.5V model: 100μA typ., 3.3V/ 12V model: 1mA typ. (OFF Control)
MTBF	1,000,000Hr min (EIAJ RCR-9102)
Oscillation frequency	2.5V model: 300kHz typ., 3.3V/ 12V model: 250 kHz typ.
Operating Temp. range	-30°C to +70°C, Possible start-up Range (-30 to -20°C) (Refer to Page 6, Thermal derating)
Storage Temp. range	-30°C to +85°C
Humidity range	20% to 95% R.H (Max temperature 35 °C, no - condensing)
Cooling Condition	Natural air - cooling (Set in a place with good air circulation.)
Vibration	5 to 10 Hz All amplitude 10 mm, 10 to 55 Hz acceleration 2G (1 hr. in each of 3 orthogonal axes)
Shock	Acceleration 20G (3 times in each of 3 orthogonal axes), Shocking time 11±5ms
Weight	4g typ.
Outline Dimensions	Refer to Page 2, "Outline"

* If no specified condition is described in the above specification, I/O voltage is rating, Output current is max., and ambient temperature is 25 °C

<Outline>

[1] SIP Type

BSA05-2.5S1R2
BSA24-3.3S1R2
BSA24-12S0R6



(Figure 1)

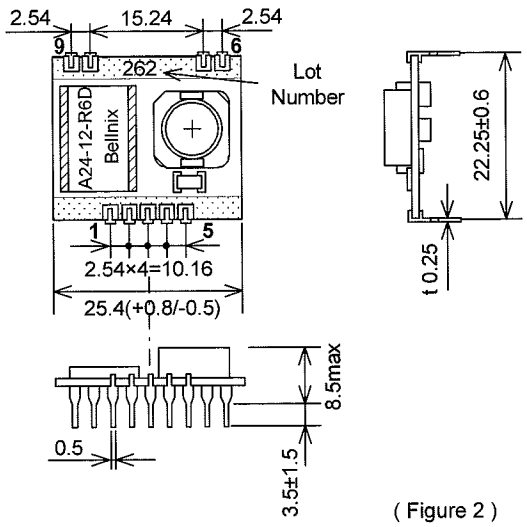
Model	A	B	C
BSA05model	4.5 typ	2.5 typ	8.0 max
BSA24model	4.2 typ	2.0 typ	7.0 typ

pin	Function
1	On/Off
2	+Vin
3	GND
4	+Vout
5	V.adj

Dimensions: mm
Tolerances with nothing specified ±0.5

[2] DIP Type

BSA05-2.5S1R2-D
BSA24-3.3S1R2-D
BSA24-12S0R6-D

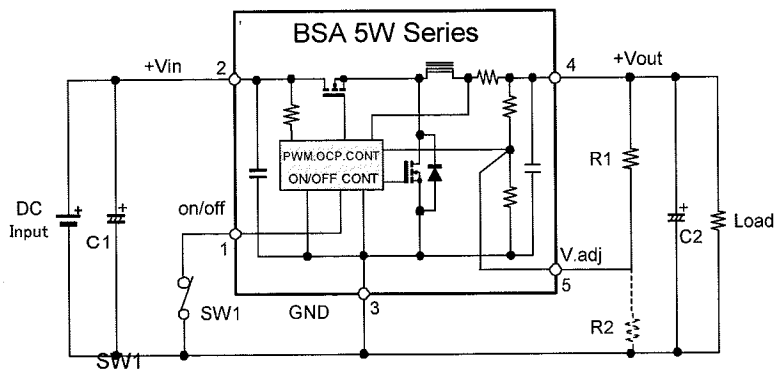


(Figure 2)

pin	Function
1	On/Off
2	+Vin
3	GND
4	+Vout
5	V.adj
6	NO CONNECTION
7	NO CONNECTION
8	NO CONNECTION
9	NO CONNECTION

Dimensions: mm
Tolerances with nothing specified ±0.5

<Block Diagram>

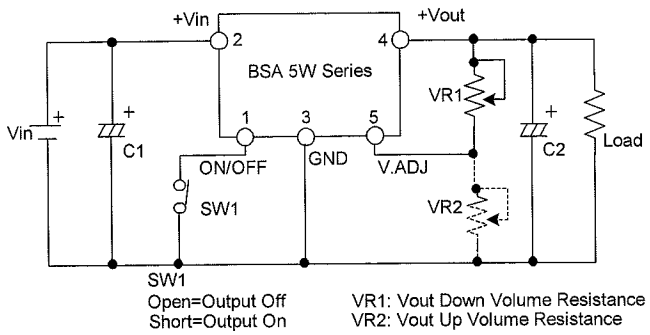


Open=Output OFF
Short=Output ON

(Figure 3)

<Usage>

(A) Standard Connection



(Figure 4)

Recommended Additional Capacitor

BSA05-2.5S1R2

C1=16ZL330M (Rubycon) or KZE16VB330 (Nippon Chemi-con)

C2=10ZL680M (Rubycon) or KZE16VB680 (Nippon Chemi-con)

BSA24-3.3S1R2

C1=50ZL120M (Rubycon) or KZE50VB120 (Nippon Chemi-con)

C2=10ZL470M (Rubycon) or KZE10VB470 (Nippon Chemi-con)

BSA24-12S0R6

C1=50ZL120M (Rubycon) or KZE50VB120 (Nippon Chemi-con)

C2=16ZL330M (Rubycon) or KZE16VB330 (Nippon Chemi-con)

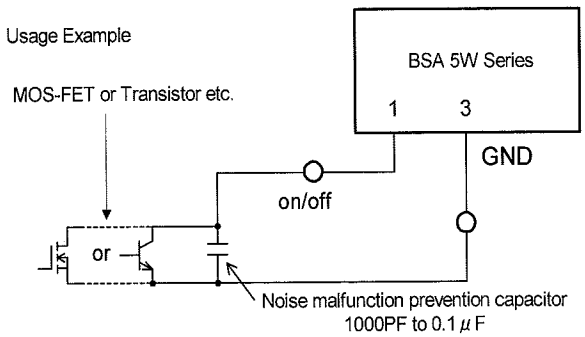
Note 1: If ON/OFF is not controlled, it should be connected to GND line.

Note 2: When output voltage is rating, please open the terminal V. ADJ (5 pin)

Note 3: I/O capacitor (C1, C2) must be added. Please put I/O capacitor to pin close as much as possible and wire with thick pattern. For C1 & C2, please use low impedance capacitor.

Note 4: For BSA05 model, when the additional capacitor's capacity is large, startup failure may occur. So please use an additional capacitor which capacity is 8,200μF or below.

(B) ON/OFF Control



(Figure 5)

Input voltage is turned on by using ON/OFF control function, and it is possible for ON/OFF control of output voltage without cutting it. That is the effective function to compose the sequence of Power Supply Systems. Also using this function, you can save the electric power when Power Supply stands by. Please connect the terminal ON/OFF with GND.

Between the terminal ON/OFF (1 Pin) and GND (3 Pin)

BSA05-2.5S1R2

Output voltage OFF mode : OPEN (2V to +Vin)

Output voltage ON mode : SHORT (-0.2 to 0.7V, 10μA)

BSA24-3.3S1R2

Output voltage OFF mode : OPEN (2.5 to 5.3 V)

Output voltage ON mode : SHORT (-0.2 to 0.5 V, 250μA)

BSA24-12S0R6

Output voltage OFF mode : OPEN (2.5 to 5.3 V)

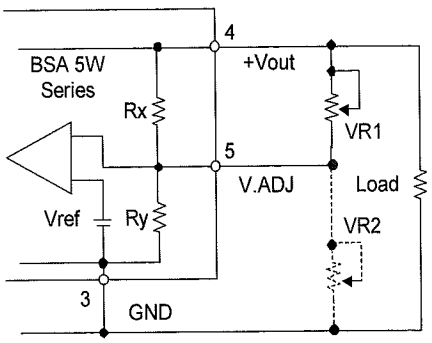
Output voltage ON mode : SHORT (-0.2 to 0.5 V, 250μA)

Note 1: Use an open collector (or drain) switch element for on/ off control.

Note 2: Set the switch element for on/ off control close to the converter, and lessen the noise effect by parallel patern short loops, or by using shield wires.
To prevent miss operation caused by noise, it is effective to connect a capacitor between the on/ off pin and GND. However, if this capacitor is too large, when impressing the input voltage at off, the charged current may flow and momentarily voltage may occur, so be sure that the max. value is 3300pF.

Note 3: The on/ off pin voltage will be pulled up internally, so it is not necessary to impress voltage externally at off.

(C) Output voltage changeable direction



(Figure 6)

Please open the terminal V.ADJ when you use the output voltage with rating, without changing. By connecting resistance between the terminal GND (3 Pin) and V.ADJ (5 Pin), you can change output voltage within the range of voltage in Table 1. Please refer to the undermentioned equation for the calculation of external resistance. Please confirm the output voltage and adjust resistance value after calculating external resistance.

To reduce the output voltage

$$VR1 = \frac{Rx \times Ry \times (Vo - Vref)}{Rx \times Vref - Ry(Vo - Vref)}$$

VR2 = OPEN

VO = It is your option.

Model	2.5S	3.3S	12S
Voltage Range	(1.5 to 2.5V)	(3 to 3.3V)	(9 to 12V)
Rx	2.13K ohm	765 ohm	8.6K ohm
Ry	1.0K ohm	2.2K ohm	2.2K ohm
Vref	0.8V	2.45V	2.45V

To add the output voltage (for 2.5V and 3.3V model)

$$VR2 = \frac{Vref \times Rx \times Ry}{Ry(Vo - Vref) - Vref \times Rx}$$

VR1 = OPEN

VO = It is your option.

Model	2.5S	3.3S	12S
Voltage Range	(2.5 to 3.3V)	(3.3 to 5V)	N/ A
Rx	2.13K ohm	765 ohm	
Ry	1.0K ohm	2.2K ohm	
Vref	0.8V	2.45V	

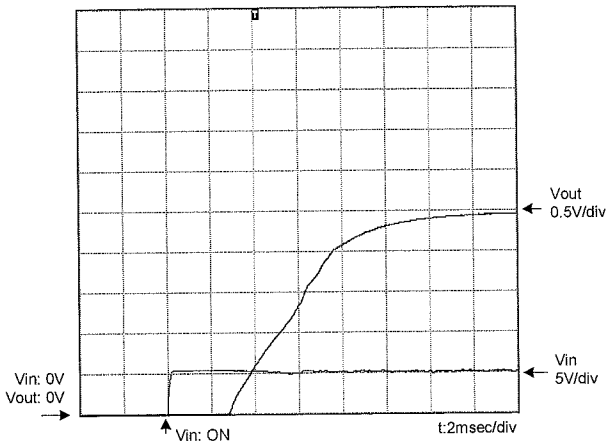
Note 1: When using at rating without adjusting the output voltage, keep the V. ADJ pin (5pin) open.

Note 2: V. ADJ pin (5pin) is a high impedance point, so in a bad environment this wiring may pick up noise and cause bad effect. When energizing, avoid switching the output by opening and shortening or switching the adjustable output resistor(R1, R2). And select a R1, R2 that is accurate and has good temperature characteristics, and mount it by soldering without using connectors or sockets when it is pretty close to the converter.

Note: These test data do not represent all products.

<Turn-On transient>

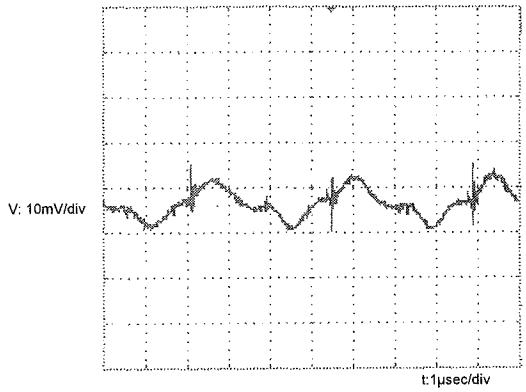
BSA05-2.5S1R2



Test conditions: Rating input/Rating load/Room temperature

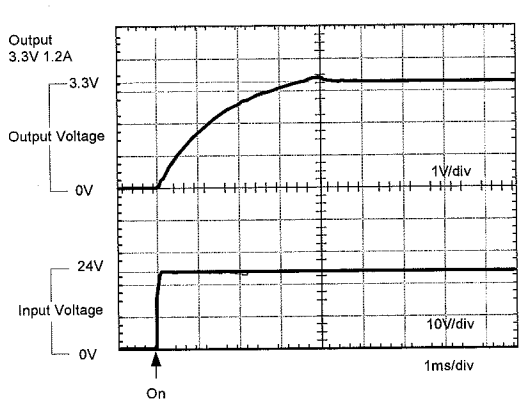
<Output Ripple & Noise>

BSA05-2.5S1R2



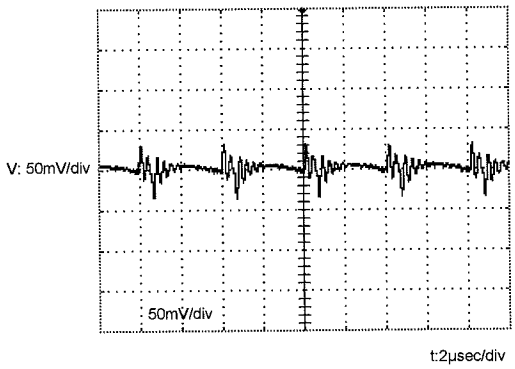
Test conditions: Rating input/Rating load/Room temperature

BSA24-3.3S1R2



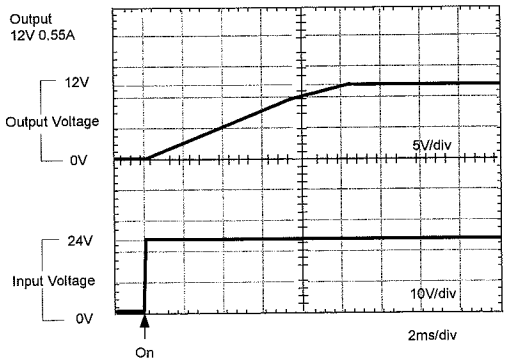
Test conditions: Rating input/Rating load/Room temperature

BSA24-3.3S1R2



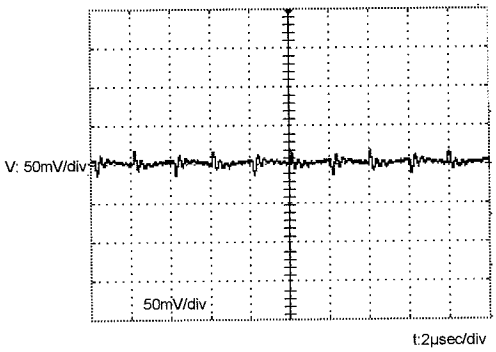
Test conditions: Rating input/Rating load/Room temperature

BSA24-12S0R6



Test conditions: Rating input/Rating load/Room temperature

BSA24-12S0R6



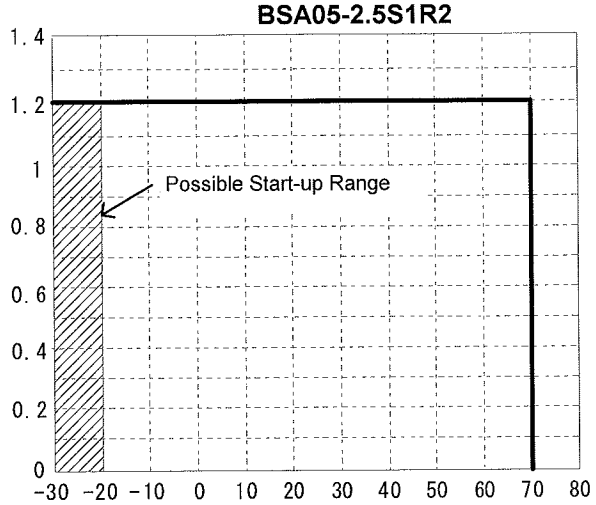
Test conditions: Rating input/Rating load/Room temperature

<Temperature derating>

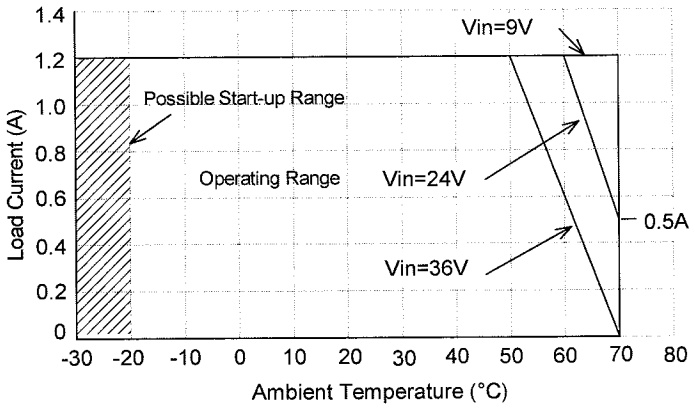
Please set this products at good place for the convection.
As to Temperature derating and air condition, please see the below.

Cooling Condition : Natural Air Cooling

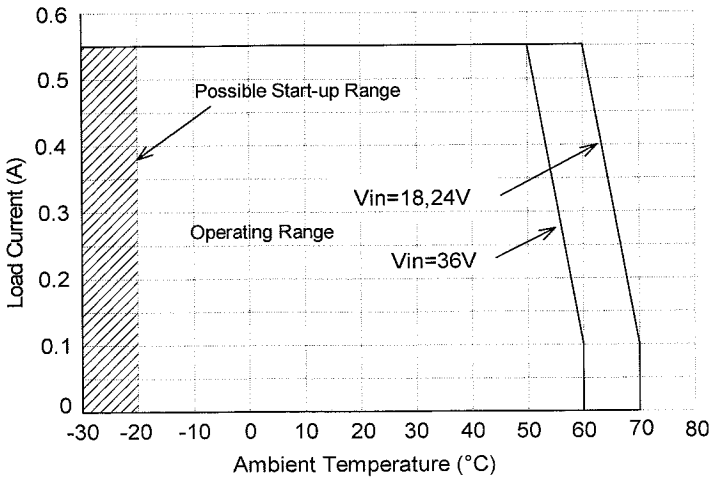
BSA05-2.5S1R2



BSA24-3.3S1R2



BSA24-12S0R6



<Over-Current Protection>

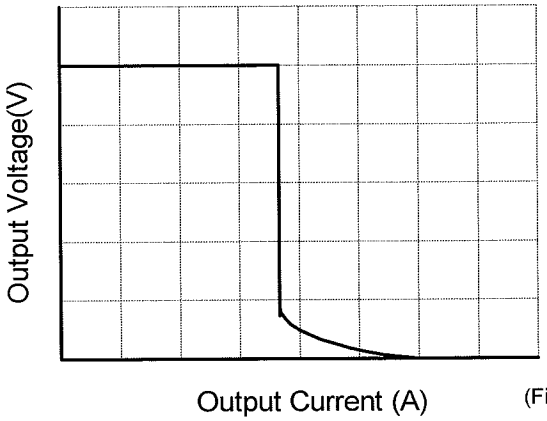
This model has a built-in over-current protection circuit (operating at rating 105% or more), and protects against the output over-current.

It will automatically recover by releasing the over-current condition. Please avoid keeping long-time over-current or output short-circuit condition, it may cause converter's failure. For a protection in case a large current flows into the input, caused by the converter's failure, be sure to connect a fuse to the input +line.

BSA05 Series

1) Over-Current Protection

The over-current characteristics are as you can see in figure 7, and will automatically recover by releasing the over-current condition. However, when the load impedance comes close to 0 and the current grows, the latch circuiit may operate. When the latch circuit operates, release the over-current condition and restart the input.



(Figure 7)

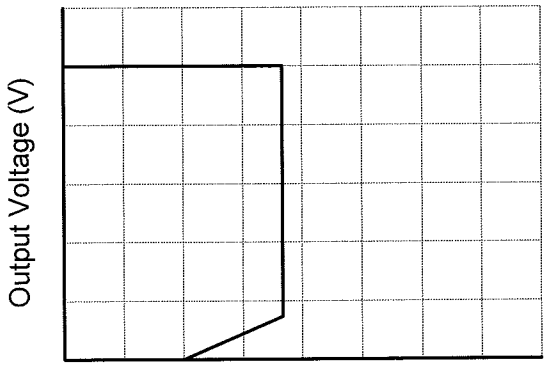
2) Output Short-Circuit Protection

The over-current protection will also operate when the output is short. However, when the output suddenly goes short, or restart the input when the output is still short, a very large current will flow into the converter momentarily and the over-current point may grow due to the short-circuit current.

For a protection in case the output goes short or the load failure causes an output short-circuit condition, be sure to connect a fuse.

BSA24 Series

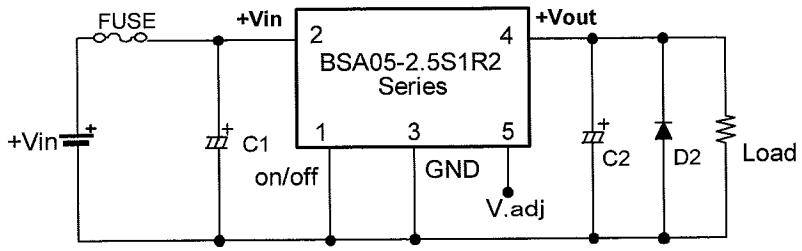
The over-current characteristics are as you can see in figure 8, and will automatically recover by releasing the over-current condition.



(Figure 8)

<Reverse Bias Protection Between Output Pin and GND Pin>

BSA05 Series



(Figure 9)

For this BSA05 series, at turn-off transient of output, a negative voltage will occur in the output due to the reverse current flowing in from the output additional capacitor into the coil inside the converter. To keep the voltage low, connect the low schottky diode (D2) of Vf between +Vout and GND.

BSA24 Series

A diode for reverse bias protection between the output pin and GND pin is not required.

<Soldering Conditions>

Solder to be executed under the following conditions.

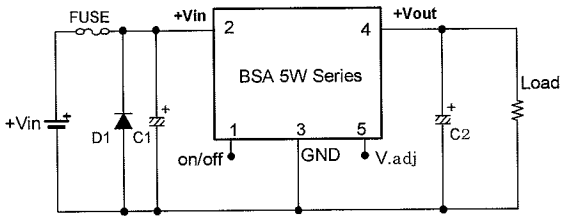
1. Hand Soldering Condition 340°C to 360°C within 5sec.
2. Wavesoldering Condition 240°C to 260°C within 10sec.

<Cleaning Conditions>

This product can not be cleaned bodily and is recommended non-cleaned flax. When and if cleaning only for SIP and DIP type should be necessary, use IPA and hand-wash the soldered surface by brush cleaning.
After cleaning, please dry enough to use it.

<To prevent reverse input voltage protection (ex.)>

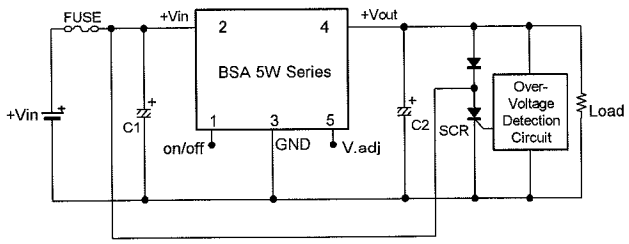
The input/output of this products is a non-isolated type and a step-down DC-DC converter from (+) polarity to (+) polarity. If you connect the input polarity reversed of this product by mistake it will be eventually damaged. If there is a possibility of reverse connection, please add a protection circuit as indicated in the following figure. The figure below is an example using huse and diode.



(Figure 7)

<Over-Voltage Protection (ex.)>

This product does not have a built-in over-voltage protection.
When the switching element of this converter gets damaged by short mode, input voltage (+Vin) will go out on the output.
For emergency if it gets damaged at over-voltage mode, please add a circuit as below to intercept the supplying power circuit.



(Figure 8)

<Directions>

For customer's safety, please see the specification and obey the undermentioned notes definitely when using this product.

- This product intends to be used for a general electronic equipment (Clerical work machine, Telecommunications equipment, and Measurement equipment). Please do not use the medical equipment, the nuclear power equipment, and the train, etc. with dread that the damage of this product might influence the life and the property directly. Please confirm us when you use except for the general electronic equipment.
- This product cannot be driven with parallel and series.
- Please use neither connector nor the socket to mount this product. The performance might not be able to be satisfied because of the contact resistance. Please execute mounting on the printed wiring board by soldering.
- Although the overcurrent and the short-circuit protection circuit are built in this product, please avoid short-circuit for a long time as it causes the breakdown.
- There is a possible to be damaged for this product if it is used in a non-standard electric condition and an environmental condition etc. of the temperature etc. Please use it in the standard.
- Please make the earth electrical discharge done, and work about worker's electrified static electricity which might be damaged by static electricity in the environment static electricity.
- This product does not built the fuse inside. When it is abnormal, please connect the fuse with + input line as protection for an excessive current flows to the input. Please give capacity by which the fuse can be cut to the power supply.
- This product does not built in the overvoltage protection.
- When the overvoltage is abnormally generated in the module, there is a mode that the input voltage appears to the output straight, and causes smoking and the ignition. Please add the overvoltage protection circuit to prevent it.
- The examination result is not attached to this product.

<Guarantee>

The guaranteed term of this product is one year. During this period, if there should be any failure definitely due to our designing or manufacturing workmanship, we will repair or replace with new one at our own expense. But in that case that you should modify and / or make internal remodeling by itself whatsoever, we cannot guarantee it.
This guarantee shall cover only 5 Watt BSA series.

<Others>

We will decide upon both deliberations when the doubt is caused in this catalog.

Notes:

1 When it is damaged at over-voltage mode, ON/ OFF control does not operate.
2 When there is a DC Power Supply on the supplying power side, please have the capacity the fuse can be cut.

Bellnix®
Bellnix Co., Ltd.
5-7-8 Negishi Minami-ku Saitama-shi, Saitama, JAPAN 336-0024 Bellnix Co., Ltd.
TEL: 81-48-864-7733 FAX: 81-48-861-6402 E-mail: info@bellnix .co.jp
URL http://www.bellnix.co.jp/
*All specification are subject to change without notice.
PRINTED IN JAPAN BDD20040715