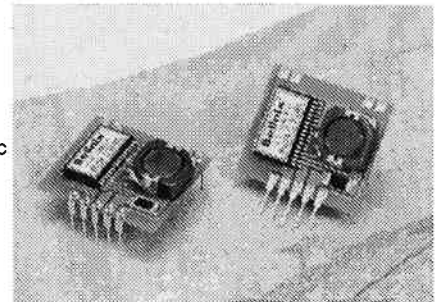


Output Voltage 3.3V-5V Ultra High Efficiency 83~87%
TO-3PL Size, Step-Down Non-Isolated Type DC-DC Converter
Bellnix® **6 Watt BSI24-mini Series**

BSI24-mini Series is an ultra small, TO-3PL packaged type, and non-isolated type step-down DC-DC converter which has achieved ultra high efficiency by the latest synchronous rectification circuit technology. BSI24-mini Series with the size of 25.4×21.5×8.3mm and 6W can be used without heat sink and external capacitor. BSI24-mini Series is the next generation three terminal regulator which has fundamentally changed dropper regulator with big heat.

<Features>

- Synchronous Rectification Control IC equipped.
- TO-3PL Wide type
- High efficiency 87%
- Adjustable output voltage
- Heat Sink not required
- Input voltage range +8V~+36V
- High reliability, high performance
- MTBF 1,000,000 Hrs
- Ultra low profile, Ultra small type
- Remote on/off control
- Over current protection Circuit
- Non-Isolated type
- Wide operating temperature range -10~+70°C
(Derating above +50°C)
- New Development MCM Power-IC loaded



<Model>

Table 1

Model	Rating Input Voltage Vdc	Input Voltage Range Vdc	Rating Output Voltage Vdc	Output Voltage Trim Range Vdc	Output Current A	Ripple & Noise mVpp(typ.)	Efficiency %(typ.)	Package
BSI24-mini Series								
BSI24-3/5S1R2	+24	+8~+36	+3.3	+3.3/+5	0~1.2	40	83/87	SIP
BSI24-3/5S1R2F								DIP

DIP type : Order received product

<Specification>

Table 2

Rating input voltage/range	Refer to Table 1.
Rating output voltage	When 1 pin is open, output voltage will be set at +3.3V. (The accuracy of voltage setting ±5%)
Output Voltage Trim Range	3.3V or 5V
Line regulation	2.0% typ. (3.3V)/2.5% typ. (5V) (For the input voltage range of table 1, at rating load.)
Load regulation	0.4% typ. (At rating input voltage, when load changes 0%~100%)
Temperature coefficient	±0.01%/°C typ. (When operating temperature changes between -10°C~+50°C)
Ripple & Noise	40mVp-p typ. (Rating input / output, room temperature) (20MHz bandwidth)
Efficiency	83% (3.3V)/87% (5V) (Rating input / output, room temperature, refer to table 1)
Over-Current Protection	Operates at more than 105% of rating load current, auto recovery type. Avoid more than 30 second of short-circuit condition.
Over-Voltage Protection	None
No Load Input Current	13mA typ. (At no load)
Standby Input Current	1mA typ. (Off control)
Remote on/off control	Between 1pin(on/off pin) and 3pin(GND); Open=output OFF, short=output ON
MTBF	1,000,000Hr min(EIAJ RCR-9102)
Switching frequency	250kHz typ.
Operating temperature range	-10°C~+70°C (Derating above +50°C)
Storage temperature range	-20°C~+85°C
Humidity range	20%~95%R.H. (non condensing)
Cooling condition	Natural air cooling (Set in a place with good air circulation.)
Vibration	5~10Hz All amplitude 10mm (1 hour in each of 3 orthogonal axes), 10~55Hz acceleration 2G (1 hour 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	Refer to page 2.

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

Output Voltage 3.3V-5V Ultra High Efficiency 83~87%
TO-3PL Size, Step-Down Non-Isolated Type DC-DC Converter

Bellnix®

6 Watt BSI24-mini Series

<Outline>

[SIP type]
BSI24-3/5S1R2

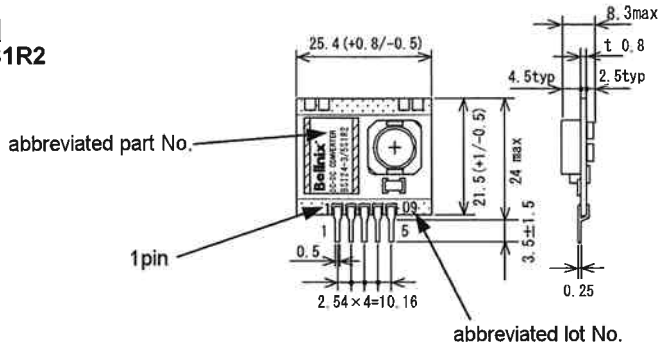


Figure1

pin	Function
1	ON/OFF CONT
2	+Vin
3	GND
4	+Vout
5	Vout.sel

Dimensions: mm
Tolerance when nothing specified ±0.5

[DIP type]
BSI24-3/5S1R2F

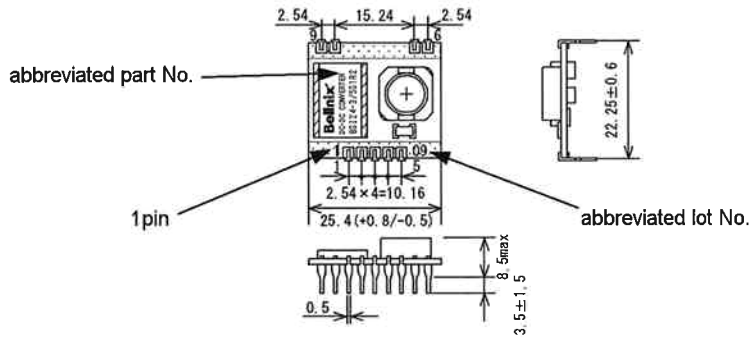


Figure2

pin	Function
1	ON/OFF CONT
2	+Vin
3	GND
4	+Vout
5	Vout.sel
6	NC
7	NC
8	NC
9	NC

Dimensions: mm
Tolerance when nothing specified ±0.5

<Block Diagram>

- Use this model according to a usual three terminal regulator.
- Output Voltage
5pin Open=+3.3V (rating output voltage)

Recommended additional capacitor

- C1 : 120µF50VV ZL series(Rubycon)
- C2 : 220µF10VV SH typeOScon(SANYO)
- C3 : 0.1µF

- In case that the wiring is long to the load, output noise may be further reduced with the 2.2µF~4.7µF added.
- Refer to figure 5~7 about :
adjustment output voltage, on/off control.
- Refer to page 6 about :
over-voltage protection, soldering conditions, and cleaning conditions.

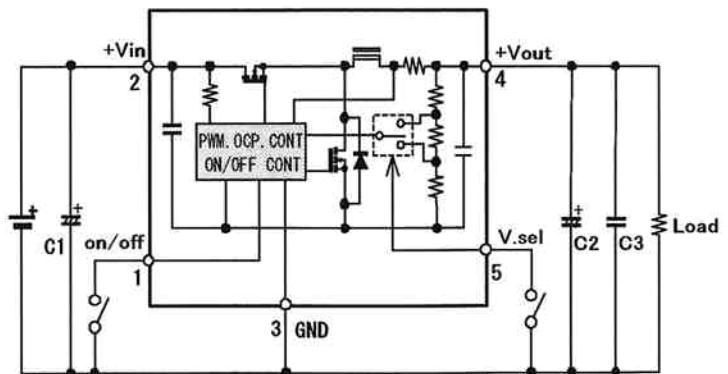


Figure3

Output Voltage 3.3V-5V Ultra High Efficiency 83~87%
TO-3PL Size, Step-Down Non-Isolated Type DC-DC Converter

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6 Watt BSI24-mini Series

<Technical Notes>

(A) Standard Connection

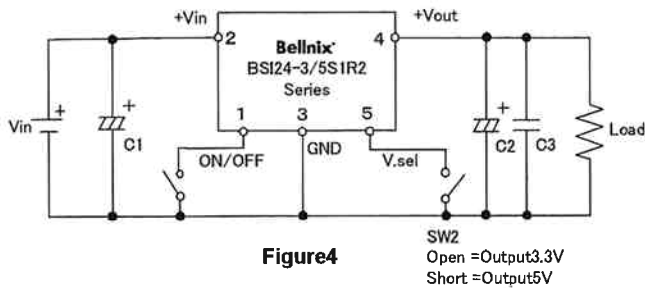


Figure4

Choice of external capacitors
C1=120 μ F50WV ZL series (Rubycon)
C2=220 μ F10WV SH type OS-CON (SANYO)
C3=0.1 μ F

C2: In case that the wiring is long to the load, output noise may be further reduced with the 2.2 μ F~4.7 μ F added.

(B) ON/OFF Control connection

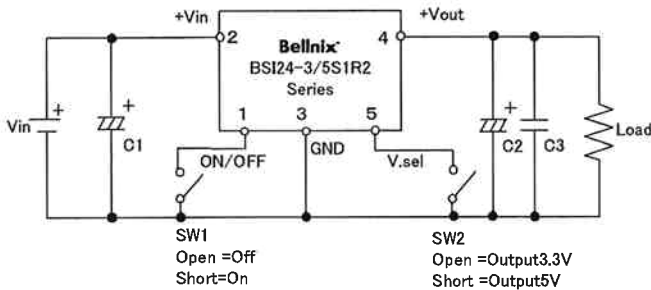


Figure5

ON/OFF can be controlled by opening or shortening 1 pin and 3 pin. Transistor(open collector) is recommended for the open and short control parts.

Output ON mode
Between 1 pin and 3 pin : short
Off state voltage 0~0.5Vdc (1mA max.)
Output OFF mode
Between 1 pin and 3 pin : open
2.5~5.3

(C) Output Voltage Adjustment Connection

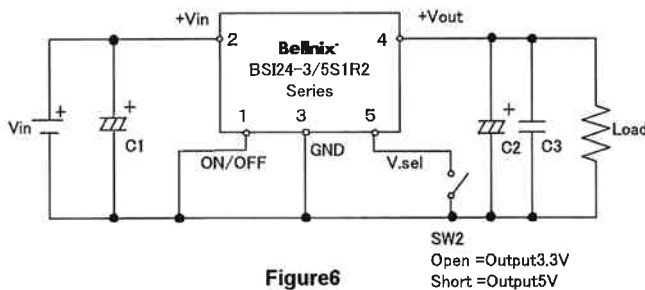


Figure6

5pin(V.ADJ)-3pin(GND)
open : 3.3V
short : 5V

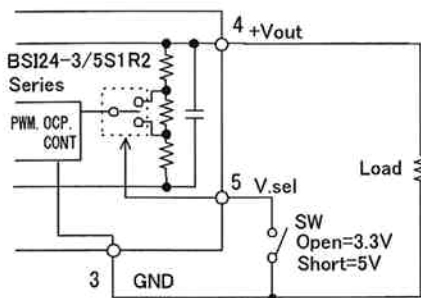


Figure7

Internal circuit diagram

Output Voltage 3.3V-5V Ultra High Efficiency 83~87%
 TO-3PL Size, Step-Down Non-Isolated Type DC-DC Converter

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6 Watt BSI24-mini Series

These test data do not represent all product.

<Turn on transient>

BSI24-3/5S1R2

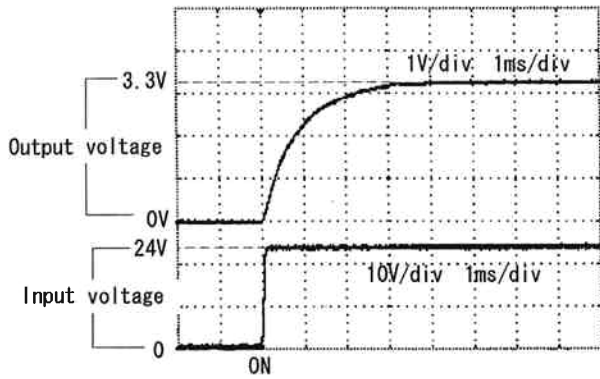


Figure8

Test condition : Rating Input/Rating Load/ Room temperature

BSI24-3/5S1R2

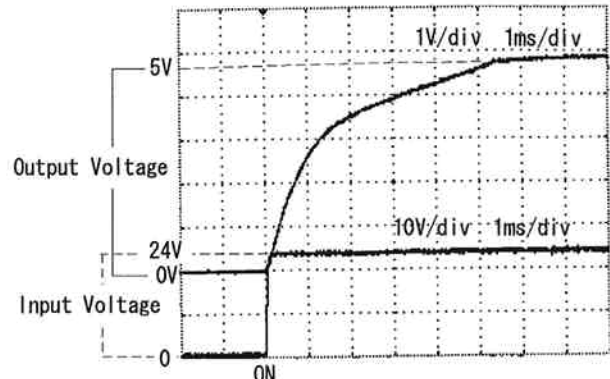


Figure9

<Output Ripple & Noise>

Test Condition
 Vin=24V
 Vout=3.3V
 Io=1.2A
 Ta=25°C
 Bw=20MHz

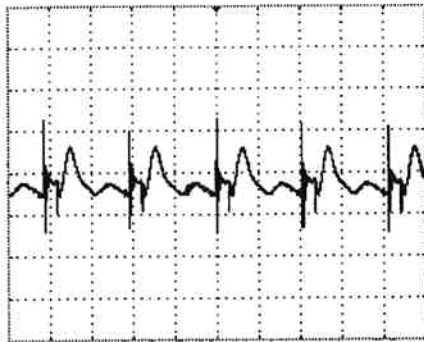


Figure10

Test Condition
 Vin=24V
 Vout=5V
 Io=1.2A
 Ta=25°C
 Bw=20MHz

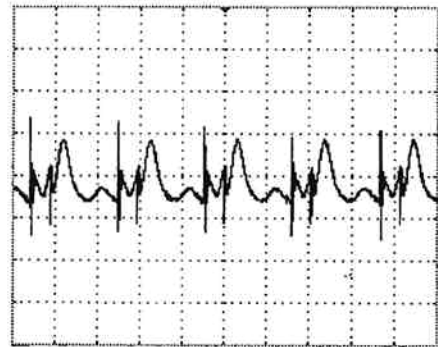


Figure11

Test condition : Rating Input/Rating Load/ Room temperature
 Test circuit is indicated in figure 15.

Output Voltage 3.3V-5V Ultra High Efficiency 83~87%
TO-3PL Size, Step-Down Non-Isolated Type DC-DC Converter

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6 Watt BSI24-mini Series

Note: These test data do not represent all product.

<Test Data>

Model: BSI24-3/5S1R2 (Vo=3.3V)

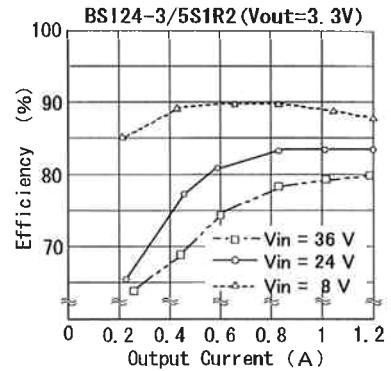
Table 5

Temp: 25°C

Input			Output				Efficiency (%)
Voltage (V)	Current (A)	Power (W)	Voltage (V)	Current (A)	Ripple & Noise (mVp-p)	Power (W)	
8.010	0.01077	0.086	3.243	0.000	6.6	0.000	-
8.006	0.096	0.769	3.233	0.202	7/17.4	0.654	85.12
8.020	0.183	1.466	3.231	0.405	7/19.3	1.309	89.26
8.018	0.272	2.181	3.230	0.607	7/20.8	1.961	89.88
8.010	0.362	2.900	3.228	0.804	7/22.4	2.596	89.51
8.014	0.461	3.696	3.226	1.016	8/24.3	3.276	88.63
8.004	0.552	4.417	3.224	1.203	9/26.7	3.877	87.78
24.074	0.01067	0.257	3.282	0.000	10.8	0.000	-
24.034	0.042	1.004	3.276	0.202	11/30.8	0.663	65.99
24.033	0.071	1.710	3.273	0.404	11/33.8	1.322	77.31
24.046	0.100	2.409	3.273	0.598	11/35.0	1.957	81.24
24.048	0.133	3.210	3.271	0.815	12/36.7	2.666	83.07
24.023	0.164	3.932	3.270	1.004	13/38.5	3.284	83.52
24.002	0.197	4.721	3.268	1.206	13/39.4	3.943	83.51
36.077	0.01100	0.397	3.292	0.000	10.9	0.000	-
36.074	0.034	1.212	3.292	0.203	11/37.3	0.669	55.18
36.057	0.054	1.932	3.291	0.406	12/39.9	1.336	69.15
36.055	0.073	2.639	3.291	0.601	12/41.2	1.978	74.94
36.039	0.095	3.407	3.289	0.807	13/42.9	2.653	77.87
36.057	0.116	4.185	3.288	1.009	14/45.2	3.319	79.32
36.081	0.138	4.980	3.287	1.211	14/47.2	3.980	79.93

Figure12

Efficiency vs. output current for input voltage



Model: BSI24-3/5S1R2 (Vo=5V)

Table 6

Temp: 25°C

Input			Output				Efficiency (%)
Voltage (V)	Current (A)	Power (W)	Voltage (V)	Current (A)	Ripple & Noise (mVp-p)	Power (W)	
8.008	0.01212	0.097	4.848	0.000	7.0	0.000	-
8.013	0.135	1.080	4.832	0.198	7/17.9	0.954	88.38
8.019	0.263	2.109	4.830	0.402	7/19.9	1.941	92.04
8.039	0.391	3.146	4.827	0.604	7/21.8	2.915	92.65
8.025	0.523	4.195	4.825	0.804	7/24.3	3.880	92.49
8.013	0.641	5.138	4.822	0.981	8/25.0	4.729	92.03
8.031	0.791	6.349	4.821	1.203	10/28.4	5.801	91.36
24.014	0.01230	0.295	4.940	0.000	16.1	0.000	-
24.034	0.055	1.333	4.931	0.202	15/21.2	0.995	74.61
24.030	0.100	2.405	4.923	0.402	14/33.2	1.979	82.27
24.041	0.144	3.455	4.923	0.602	14/35.8	2.963	85.77
24.020	0.192	4.621	4.920	0.820	14/36.2	4.035	87.32
24.031	0.234	5.613	4.920	1.001	15/38.9	4.923	87.71
24.043	0.280	6.740	4.918	1.204	15/39.7	5.920	87.84
36.047	0.01240	0.447	4.958	0.000	17.3	0.000	-
36.043	0.042	1.514	4.951	0.203	17/25.1	1.003	66.26
36.054	0.073	2.640	4.945	0.404	17/39.3	1.997	75.64
36.051	0.103	3.702	4.944	0.604	17/41.8	2.988	80.69
36.065	0.136	4.887	4.942	0.824	17/43.3	4.072	83.33
36.063	0.163	5.871	4.941	1.003	18/46.1	4.954	84.38
36.074	0.195	7.030	4.940	1.209	19/47.4	5.974	84.97

Figure13

Efficiency vs. output current for input voltage

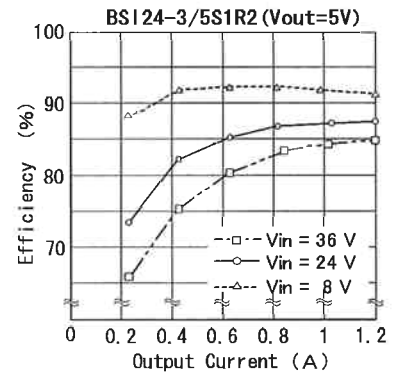
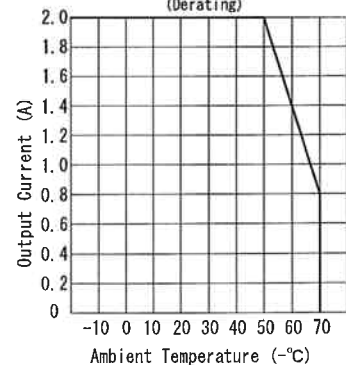


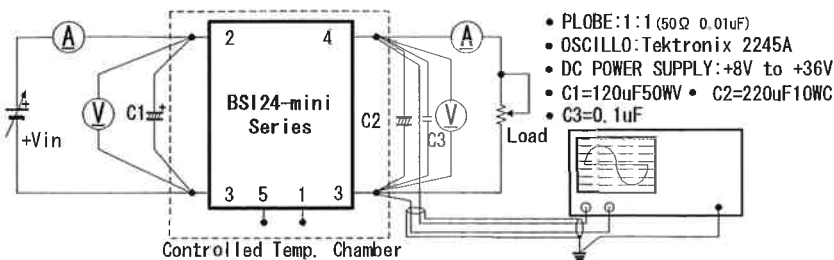
Figure14

Output power vs Ambient Temperature (Derating)



<Test Circuit>

Figure15



Output Voltage 3.3V-5V Ultra High Efficiency 83~87%
TO-3PL Size, Step-Down Non-Isolated Type DC-DC Converter

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6 Watt BSI24-mini Series

<Soldering Conditions>

Solder to be executed under the following conditions.

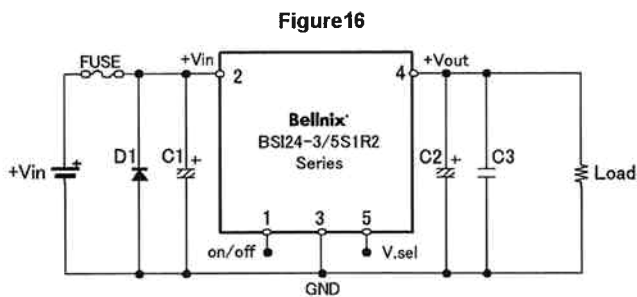
1. Soldering iron 340°C ~ 360°C within 5sec.
2. Soldering dip 240°C ~ 260°C within 10sec.

<Cleaning Condition>

This product can not be cleaned bodily and non-cleaned flux is recommended. 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.)>

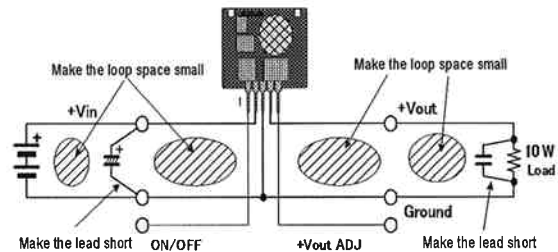
The input/ output of BSI-mini series is a non-isolated type and a step-down DC-DC converter from (+) polarity to (+) polarity. If you connect the input polarity reversed of this product by mistake it will be eventually damaged. If there is a possibility of reverse connection, please add a protection circuit as indicated in Figure16. The figure below is an example using fuse and diode.



<Method to decrease the noise level (ex.)>

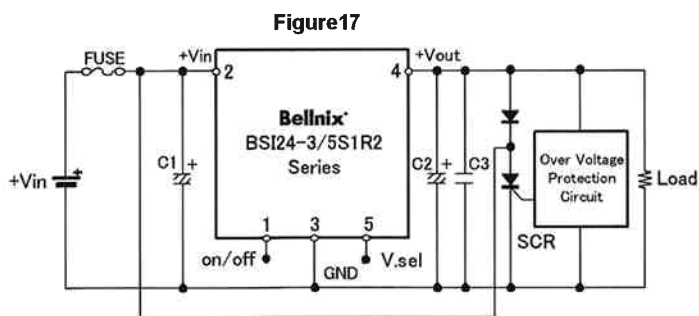
Usually BSI24-mini is used by adding input/output capacitor, please make sure to design the print board with special attention to the following items in order to obtain lower noise level by taking advantage of the performance of a converter.

1. Use low impedance capacitor with good high frequency characteristic.
2. Shorten the lead of each capacitor as much as possible, and make it low lead inductance.
3. Make the wiring loop space small between (+) and (-) of both input and output pin side as much as possible. You can decrease the influence of leakage inductance.
4. Design the print pattern of the main circuit thick and short as much as possible.



<Over Voltage protection>

BSI-mini series 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 as output. For emergency if it gets damages at over-voltage mode, please add a circuit as below to intercept the supplying power circuit.



Notes:

- 1 When it is damaged at over-voltage mode, On/Off control does not operate.
- 2 Be sure that the DC power supply on the supplying side has the capacity to fuse the fuse.

Output Voltage 3.3V-5V Ultra High Efficiency 83~87%
TO-3PL Size, Step-Down Non-Isolated Type DC-DC Converter
6 Watt BSI24-mini Series

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<Precautions>

For customer's safety, please see the specification and observe 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 for the medical equipment, the nuclear power equipment, and the train, etc. may influence the life and the property directly due to the damage of this product. Please confirm us when you use except for the general electronic equipment.
- For this product, parallel/series 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.
- This product has a 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 in a non-standard electric conditions and an environmental conditions etc. of such as for the temperature etc. Please make sure to use it in the standard.
- There is a possibility of damage due to the static. When the worker has electrified static, electrical discharge by grounding should be done and work in the static environment.
- This product does not built in the fuse. When it is abnormal, please connect the fuse with + input line as a protection for an excessive current flows to the input. Please give capacity, so that 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 such a mode that the input voltage appears to the output straight, and which may cause smoking and the ignition. Please make sure to add the overvoltage protection circuit to prevent it.
- No test certificate is attached to this product.

<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 replace with the new one at our own expense.

But in case that you should modify and / or make internal remodeling by itself whatsoever, we can not guarantee it.

This guarantee shall cover only 6 watt BSI24-mini series.

<Contact Bellnix>

For further information on this product, please contact to the number below.

TEL : 81-48-864-7733

FAX : 81-48-861-6402

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*All specification are subject to change without notice.

PRINTED IN JAPAN BDD20031031