Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz] (reference)	Input current [A]	Inrush current protection	PCB/Pattern			Series/Parallel operation	
					Material	Single sided	Double sided	Series operation	Parallel operation
BRNS6	Buck Converter	600	✻1	-	glass fabric base,epoxy resin	-	Multilayer	-	-
BRNS12	Buck Converter	600	✻1	-	glass fabric base,epoxy resin	-	Multilayer	-	-
BRNS20	Buck Converter	600	✻1	-	glass fabric base,epoxy resin	-	Multilayer	-	-

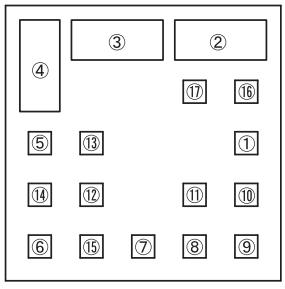
✻1 Refer to Specification.

1 Pin Connection

Table 1.1 Pin connection and function

Pin No. BRNS 6/12	Pin No. BRNS 20	Pin Connection	Function
①		RC	Remote ON/OFF
②		+VIN	+DC input
③	④	GND	GND(-DC input, -DC output)
④	⑥	+VOUT	+DC output
⑤	⑦	+S	+Remote sensing
⑥	⑤	TRM	Adjustment of output voltage
⑦	⑭	SGND	Signal GND
⑧	⑰	CLK(NC)	Clock output
⑨	③	SEQ	Control of Start up time and turn
⑩	⑨	PGOOD	Power good
⑪	⑩	SYNC	Input for frequency synchronization
⑫	⑧	-S	NC : BRNS6/12 -Remote sensing : BRNS20
⑬	⑪	NC	NC
⑭	⑬	NC	NC
⑮	⑫	NC	NC
⑯	⑯	NC	NC
⑰	⑮	NC	NC

■BRNS6/12



■BRNS20

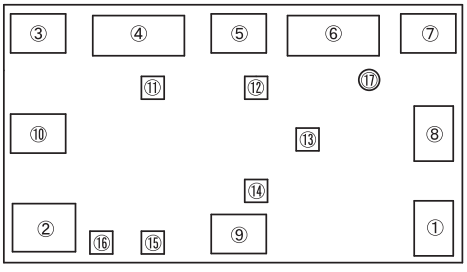


Fig.1.1 Pin Connection (Bottom View)

2 Connection for Standard Use

■In order to use power supply,it is necessary to wire as shown in Fig 2.1.

[Reference 3 "Wiring Input/Output Pin"
8 "Derating"]

■Short the following pins to turn on the power supply.

[Reference 4.3 "Remote Sensing"]

■Connect resistance to set the output voltage between TRM and GND

[Reference 4.4 "Adjustment output voltage"]

■Between input and output is not isolated.

■The BRNS series handle only the DC input.
Avoid applying AC input directly.
It will damaged the power supply.

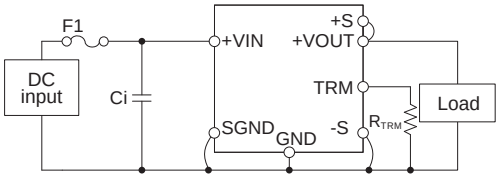


Fig.2.1 Connection for standard use

Table 2.1 External parts

No.	parts	Reference
1	F1:Fuse	3.1 (1)External fuse
2	Ci:External output capacitor	3.1 (2)External input capacitor
3	RTRM:Resistance for adjustment output voltage	4.4 Adjustable voltage range

3 Wiring Input / Output Pin

3.1 Wiring input pin

(1) External fuse

■Fuse is not built-in on input side. in order to protect the unit, install the normal-blow type fuse on input side.

■When the input voltage from a front end unit is supplied to multiple units, install the normal-blow type fuse in each unit.

■When the fuse is open, power good signal is not outputed.

Table 3.1 Recommended fuse

Model	BRNS6	BRNS12	BRNS20
Rated current	15A	20A	40A

(2) External capacitor on the input side

■Install an external capacitor Cin, between +VIN and GND input pins for low line-noise and for stable operation of the power supply.

Table 3.2 Recommended external input capacitor(Ceramic)

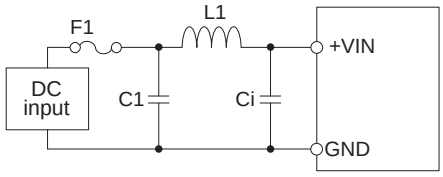
Model	BRNS6	BRNS12	BRNS20
Cin	22μF×2	22μF×2	22μF×3

■Cin is within 5mm for pins. Make sure that ripple current of Cin is less than its rating.

■When an impedance and inductance level of the input line become higher, the input voltage may become unstable.
In that case, the input voltage becomes stable by increasing Cin.

(3) Recommendation for noise-filter

■Install an external input filter as shown in Fig.3.1 in order to reduce conducted noise. Cin is shown in Table 3.2



C1 : 100μF
L1 : 0.2μH

Fig.3.1 Example of Recommended external input filter

(4) Reverse input voltage protection

■Avoid the reverse polarity input voltage. It will damage the power supply.
It is possible to protect the unit from the reverse input voltage by installing an external diode as shown in Fig 3.2

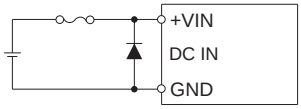


Fig.3.2 Reverse input voltage protection

3.2 Wiring output pin

■When the BRNS series supplies the pulse current for the pulse load, please install a capacitor Co between +VOUT and GND pins.

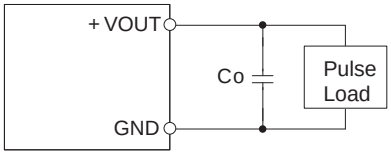


Fig.3.3 wiring external output capacitor

Table 3.3 Recommended capacitor and max Co

No.	Model	Recommended	Max Co
1	BRNS6	47μF×1+100μF×1	1,000μF
2	BRNS12	47μF×1+100μF×1	1,000μF
3	BRNS20	100μF×2	1,000μF

■The output ripple voltage may grow big by resonance with Co and ESL of the wiring. If resonance frequency and switching frequency are close.

■Ripple and Ripple Noise are measured, as shown in the Fig.3.4. Cin is shown in Table3.2, Co1 and Co2 is shown in Table 3.4.

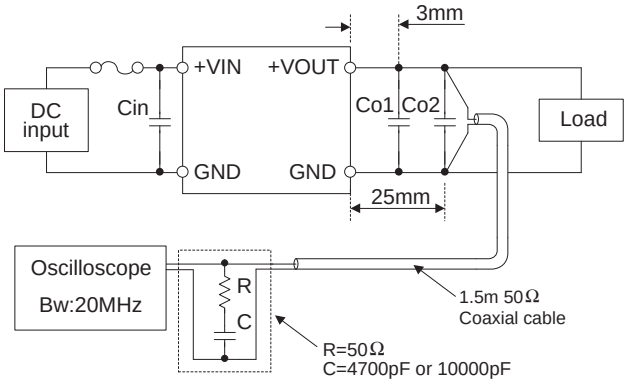


Fig.3.4 Measuring method of Ripple and Ripple Noise

Table 3.4 Co1 and Co2 which is used in measuring

No.	Model	Vo	Co1	Co2
1	BRNS6	0.6-3.3V	47μF×1	100μF×1
2		3.3-5.5V	22μF×1	22μF×1
3	BRNS12	0.6-3.3V	47μF×1	100μF×1
4		3.3-5.5V	22μF×1	22μF×2
5	BRNS20	0.6-3.3V	100μF×1	100μF×1
6		3.3-5.5V	22μF×2	22μF×2

4 Function

4.1 Overcurrent protection

■Over Current Protection (OCP) is built-in and works at 105% of the rated current or higher. However, use in an overcurrent situation must be avoided whenever possible.
The output voltage of the power module will recover automatically when the fault causing overcurrent is corrected.
When the output voltage drops after OCP works, the power module enters a “hiccup mode” where it repeatedly turns on and off at a certain frequency.

4.2 Remote ON/OFF

■The remote ON/OFF function is incorporated in the circuit and operated with RC and -Vin. If positive logic control is required, order the power supply with “-R” option.

Table 4.1 Specification of Remote ON/OFF

	ON/OFF logic	Between RC and GND	Outout voltage
Standard	Negative	L level (-0.2-0.8V) or short or open	ON
		H level (3.0-VIN)	OFF
Optional -R	Positive	L level (-0.2-0.3V) or short	OFF
		H level (3.0-VIN) or open	ON

■When remote on/off function is not used, please open RC or connected to the GND terminal.

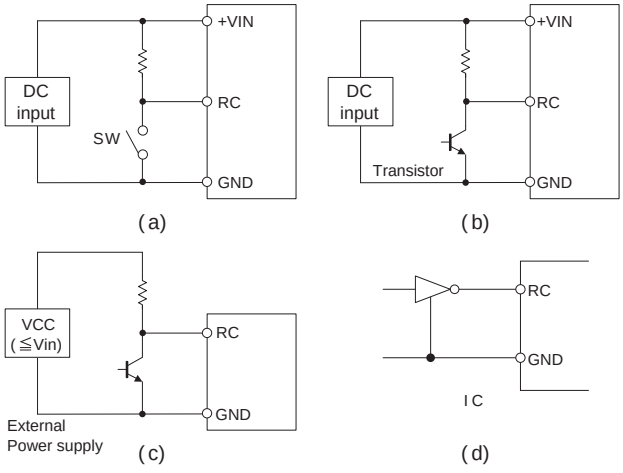


Fig.4.1 RC connection example

4.3 Remote sensing

(1) When the remote sensing function is not in use

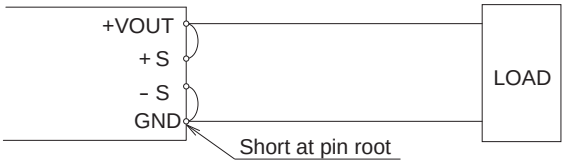


Fig.4.2 Connection when the remort sensing is in use

■When the remote sensing function is not in use, it is necessary to confirm that pins are shorted between +S & +VOUT and between -S & GND.
■Wire between +S & +VOUT and between -S & GND as short as possible.
Loop wiring should be avoided.
This power supply might become unstable by the noise coming from poor wiring.

(2) When the remote sensing function is in use

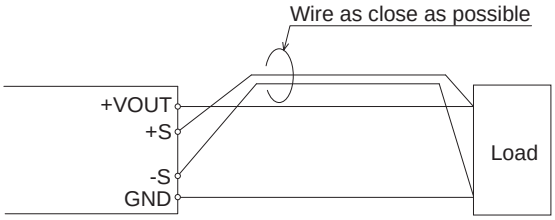


Fig.4.3 Connection when the remort sensing is in use

■Twisted-pair wire or shield wire should be used for sensing wire.
■Thick wire should be used for wiring between the power supply and a load.
Line drop should be less than 0.5V.
Voltage between +VOUT and GND should remain within the output voltage adjustment range.
■If the sensing patterns are short, heavy-current is drawn and the pattern may be damaged.
The pattern disconnection can be prevented by installing the protection parts as close as possible to a load.

4.4 Adjustable voltage range

■Output voltage is adjustable by the external resistor.
■The temperature cofficiect could become worse, depending on the type of a resistor.
Resistor・・・Metal film type,coefficient of less than ±100ppm/℃
■When TRM is opened, output voltage is 0.6V.
■R_{TRM} is calculated in the following expressions.

$$R_{TRM} = \frac{12}{Vout - 0.6}[k\Omega]$$

Table.4.2 Calculation result of R_{TRM}

No.	+VOUT	R_{TRM}
1	0.6	OPEN
2	1.2	20.00kΩ
3	1.8	10.00kΩ
4	2.5	6.32kΩ
5	3.3	4.44kΩ
6	5.0	2.73kΩ

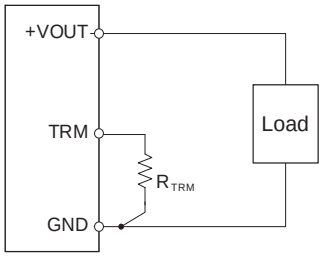


Fig.4.4 Connecting R_{TRM}

■Please use the output voltage in the operating area of Fig.4.5 Transient responsce may worsen when used in vicinity of the border of the operating area.

■Only for output voltage is rising and output current is small, there is a possibility that the ripple voltage is high value. If the ripple voltage value is problem, connecting a capacitor of table 3.4 value.

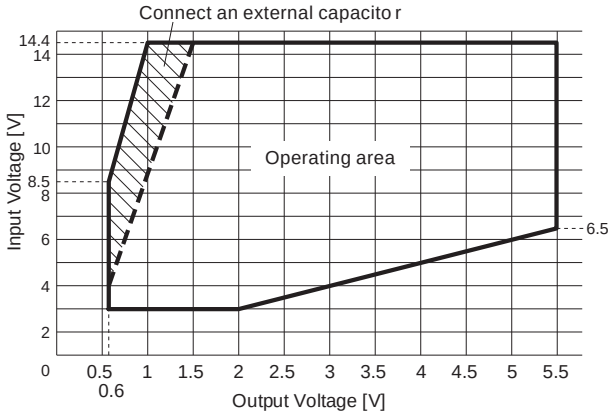


Fig.4.5 Operating area of BRNS series

■When start of DC INPUT is slow, BRNS may start on the outside of the operating area.By the circuit of the Fig.4.6, you can raise the start-up voltage.

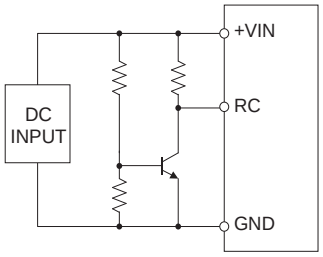


Fig.4.6 RC circuit for start up

4.5 Softstart / Start-up sequence

■The adjustment of the rise time is possible by connecting C_{SEQ}.

$$C_{SEQ}[nF] = 6 \times T_{RISE}[ms] - 15$$

■C_{SEQ} should be less than 1μsec.

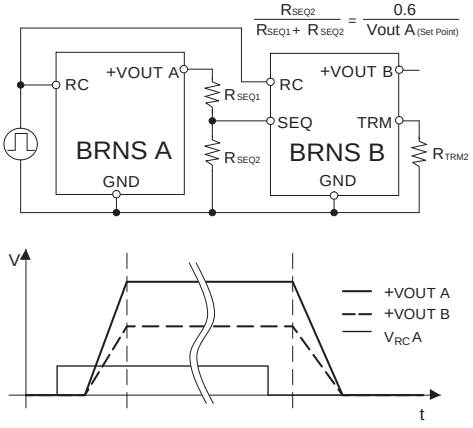
■At the time of start, the output voltage follows the SEQ voltage. Output voltage and SEQ voltage are expressed in the following calculation.

$$VOUT = V_{SEQ} \times \left(\frac{20k\Omega}{R_{TRM}} + 1 \right)$$

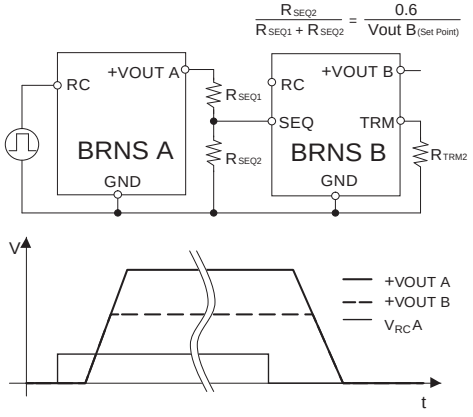
✻ V_{SEQ} < 0.6V

■With the voltage to input into SEQ pin, you can control a start sequence of plural BRNS.

(1) The same time



(2) The same voltage



(3) The time lag

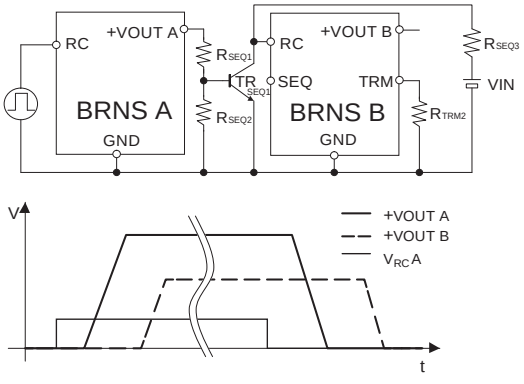


Fig.4.7 Example of sequence control

■If this function is unnecessary, please make SEQ pin open.

4.6 Power good

■By using PGOOD, it is possible to monitor power supply whether normal operation or abnormal operation.

■PGOOD terminal inside is comprised of an open drain.
Sink current of PGOOD is 50μA min.

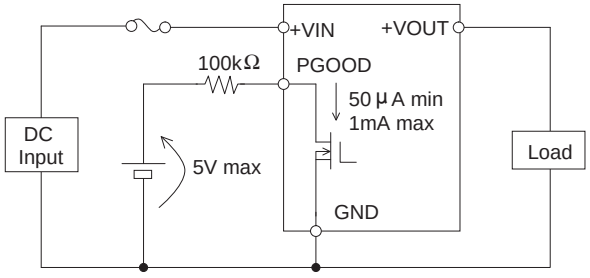


Fig.4.8 Example of PGOOD circuit

■Voltage of PGOOD pin become low when over current protection circuit is work, or output voltage is different from a set point more than ±10%.

■If this function is unnecessary, please make PGOOD pin open.

4.7 Sequence

■Fig.4.9 is a sequence chart of each function of BRNS.

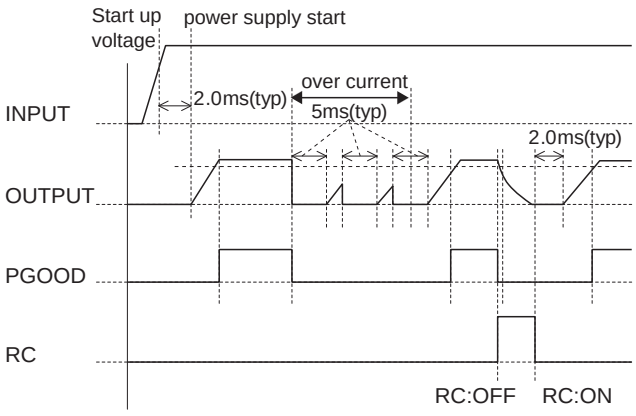


Fig.4.9 Sequence chart of BRNS

4.8 Frequency synchronization

■BRNS can operate at the switching frequency that synchronized to frequency of square wave input into SYNC pin.
There is a delay of 300nsec.

■Fig.4.10 is example of frequency synchronization. And recommended wave form of SYNC pin is shown in Fig.4.11

■If this function is unnecessary, please make PGOOD pin open or short to GND.

■Please wire the input pin of both power supplies which is synchronizing to the same pattern and voltage.

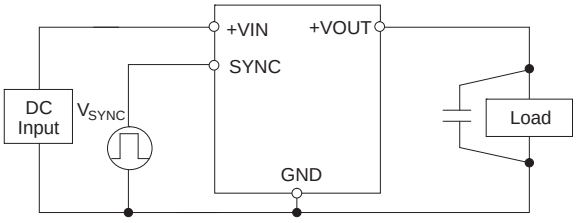


Fig 4.10 Example of frequency synchronization

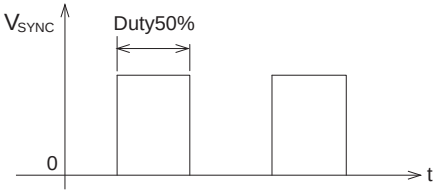


Fig 4.11 Recommended wave form of SYNC

Table 4.3 Specification of SYNC pin voltage

No.	VIN	VSYNC			
		Lo level		Hi level	
		min	max	min	max
1	≦5.5V	-0.2V	0.3V	2.0V	VIN-1.0V
2	>5.5V				4.5V

■As shown in Fig.4.12, frequency synchronization is possible without using an outside clock.

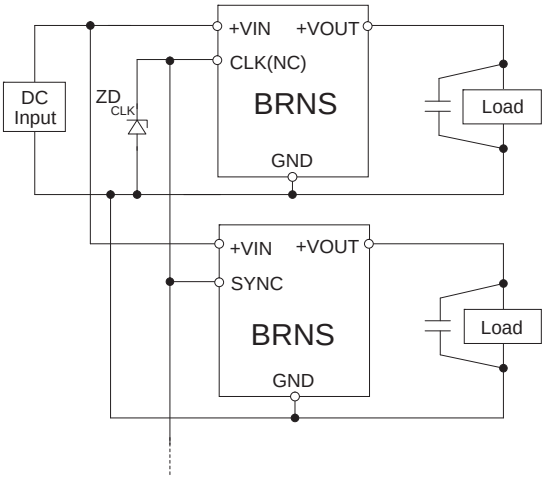


Fig.4.12 Example of CLK pin connection.

■The maximum synchronization number is 5.

■After the power supply which output CLK started, please start the synchronizing power supplies. And when stop power supplies, you should stop the powersupply which output CLK at first.

■The max voltage of CLK pin is DC input voltage.

■Please connect ZD_{CLK} when the voltage more than 5.5V is input into SYNK pin.(refer to Table.4.3)

■It is not possible to shorten rise time when not using this function.

5 Series and Parellel operation

5.1 Series operation

■Series operation is not possible.

5.2 Parallel operation

■Parallel operation is not possible.
■Redundancy operation is available by wiring as shown below.

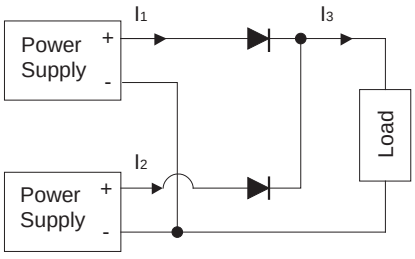


Fig.5.1 Redundancy operation

■Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2.
Please make sure that the value of I_3 does not exceed the rated current of the power supply.

$I_3 \leqq$ the rated current value

6 Implementation・Mounting Method

6.1 Mounting method

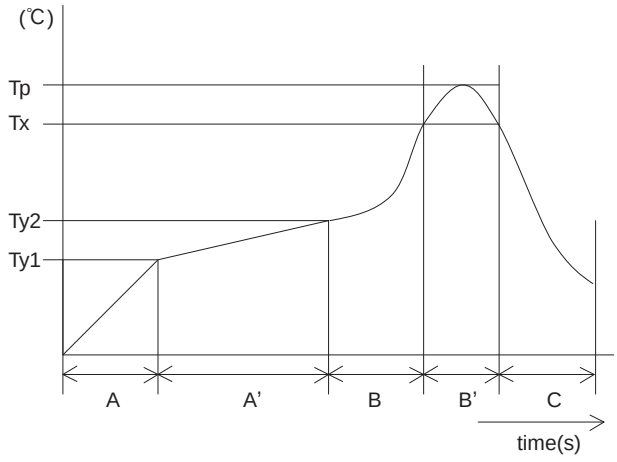
■The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. The temperature around each power supply should not exceed the temperature range shown in derating curve.

6.2 Automatic Mounting

■To mount BRNS series automatically, use the coil area near the center of the PCB as an adsorption point. Please see the External View for details of the adsorption point.

6.3 Soldering

■Fig6.1 shows condition for reflow of BRNS series. Please make sure that the temperature of board's pattern near by +VOUT and GND terminal.
■While soldering, having vibration or impact on the unit should be avoided, because of solder melting.



A	1.0 - 5.0℃/ s
A'	Ty1 : 160±10℃ Ty2 : 180±10℃ Ty1 - Ty2 : 120s max
B	1.0 - 5.0℃/ s
B'	Tp : Max245℃ 10s max Tx : 220℃ or more : 70s max
C	1.0 - 5.0℃/ s

Fig.6.1 Recommended reflow soldering condition

6.4 Cleaning

■When cleaning is necessary, clean under the following conditions.
Method : Varnishing, ultrasonic wave and vapor
Cleaning agents : IPA (Solvent type)
Total time : 2 minutes or less
■Do not apply pressure to the lead and name plate with a brush or scratch it during the cleaning.
■After cleaning, dry them enough.

6.5 Storage method

■To stock unpacked products in your inventory, it is recommended to keep them under controlled condition, 5-30℃, 60%RH and use them within a year.
■24-hour baking is recommended at 125℃, if unpacked products were kept under uncontrolled condition, which is 30℃, 60%RH or higher.
Original reels are not heat-resistant. Please move them to heat-resistant trays in preparation to bake.
To check moisture condition in the pack. Silica gel packet has some moisture condition indicator particles.
Indicated blue means good. Pink means alarm to bake it.
■The reels will be deformed and the power supply might be damaged, if the vacuum pressure is too much to reseal.

7 Safety Considerations

■To apply for safety standard approval using this power supply, the following conditions must be met.

●This unit must be used as a component of the end-use equipment.

●The equipment must contain basic insulation between input and output. If double or reinforced insulation is required, it has to be provided by the end-use equipment in accordance with the final build-in condition.

●Safety approved fuse must be externally installed on input side.

8 Derating

8.1 BRNS series Derating

■Make sure the temperatures measurement locations shown from Fig.8.2 and Fig.8.3 below are on or under the derating curve in Fig.8.1.

Ambient temperature must be kept at 85℃ or under.

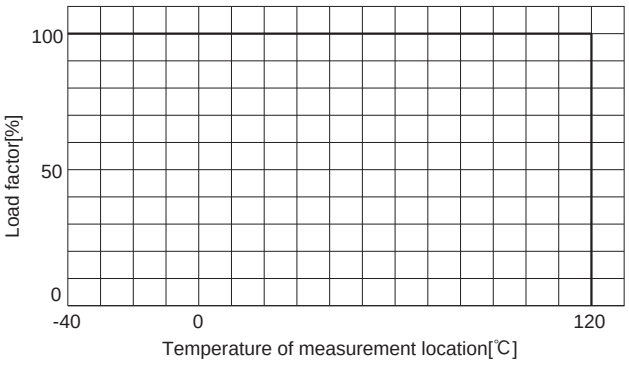


Fig.8.1 Derating curve

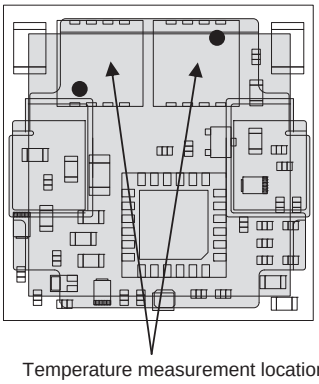


Fig.8.2 Temperature measurement location (BRNS6/12)

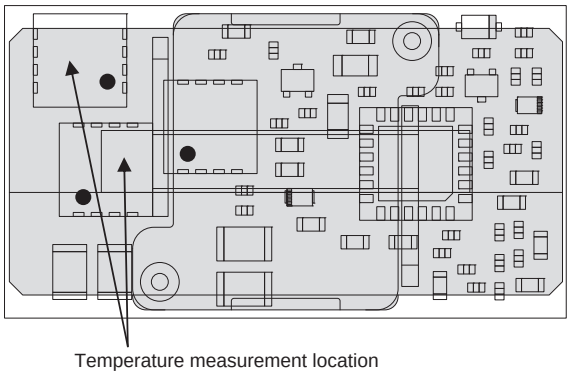


Fig.8.3 Temperature measurement location BRNS20)

9 Package Information

■Please refer to a Fig.9.1 to Fig.9.3 for Package form (Reel).
■The packed number is 200.

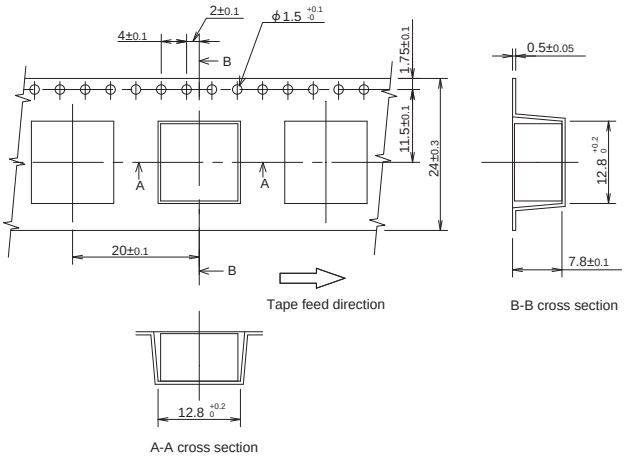


Fig.9.1 Taping dimensions of BRNS6/12

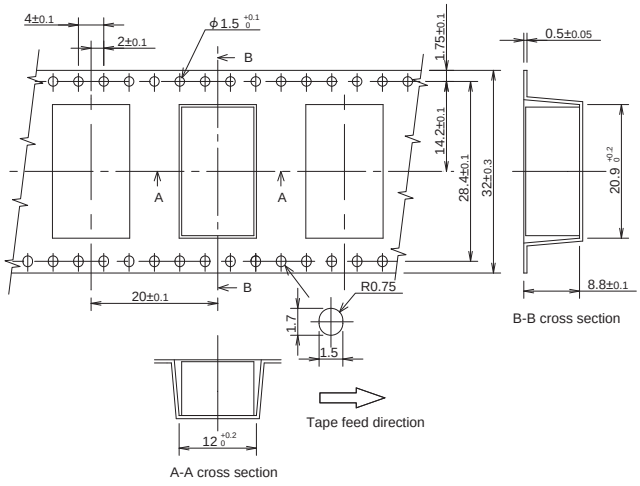
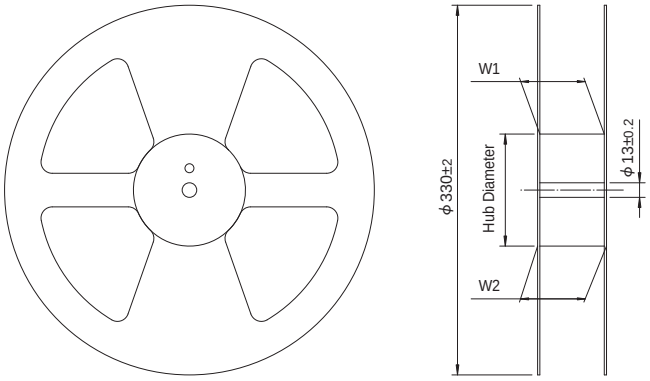


Fig.9.2 Taping dimensions of BRNS20



Model	Tape width [mm]	W1 [mm]	W2 [mm]
BRNS6	24	25.5±1.0	29.5±1.0
BRNS12	24	25.5±1.0	29.5±1.0
BRNS20	32	33.5±1.0	37.5±1.0

Fig.9.3 Reel dimensions of BRNS

■Please refer to specifications for the details of package information