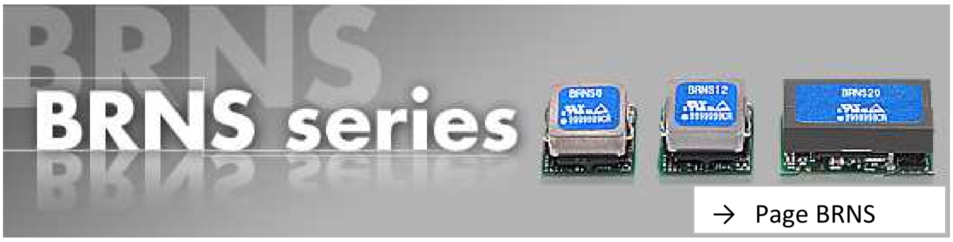
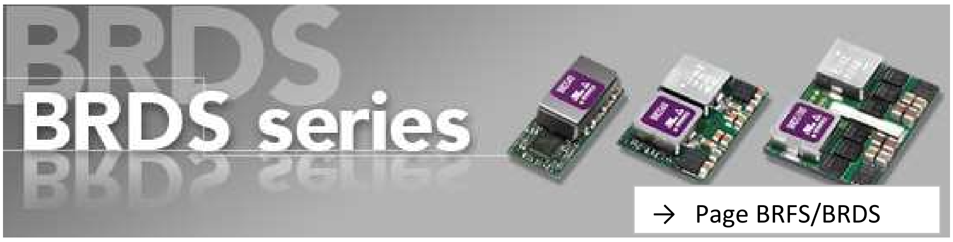
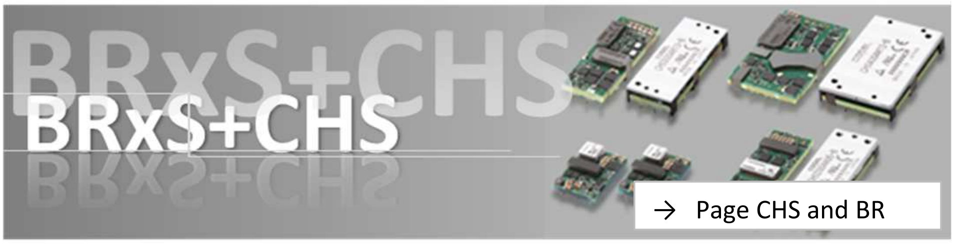
Qualification of BRNS/BRFS/BRDS series (Point of Load applications) to Intermediate Bus Architecture





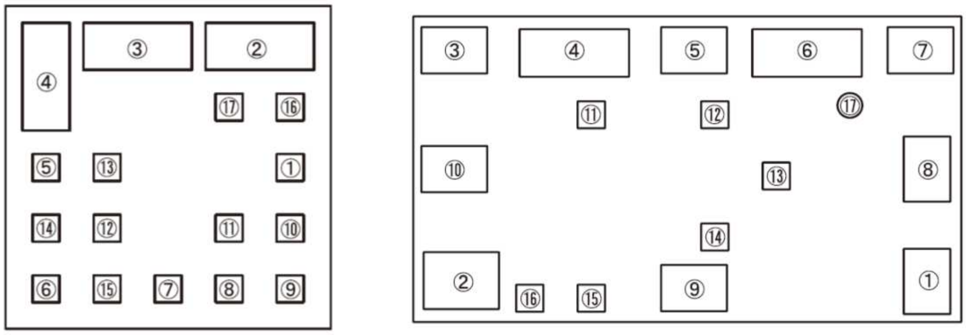


VER1.4

BRNS series

1. Pin configuration

Fig. 1.1
Pin connection
for BRNS
(bottom view)



(a) BRNS6/12 (b) BRNS20

Table 1.1
Pin connection and
function of BRNS

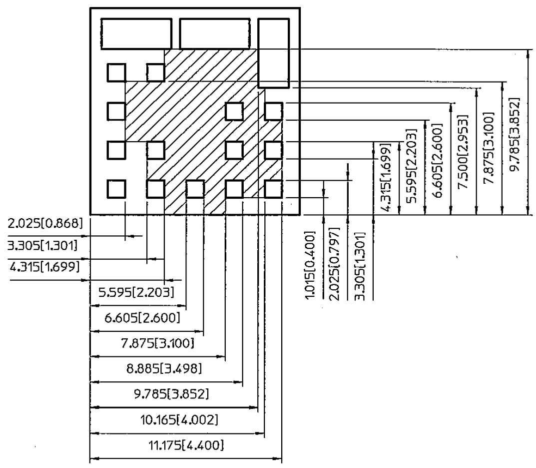
Pin No. BRNS 6/12	Pin No. BRNS 20	Pin Connection	Function
①	①	RC	Remote ON/OFF
②	②	+VIN	+DC input
③	④	GND	GND(-DC input, -DC output)
④	⑥	+VOUT	+DC output
⑤	⑦	+S	+Remote sensing
⑥	⑤	TRM	Adjustment of output voltage
⑦	⑭	SGND	Signal GND
⑧	⑰	CLK(NC)	Clock output
⑨	③	SEQ	Control of Start up time and turn
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

2. Mounting and storage

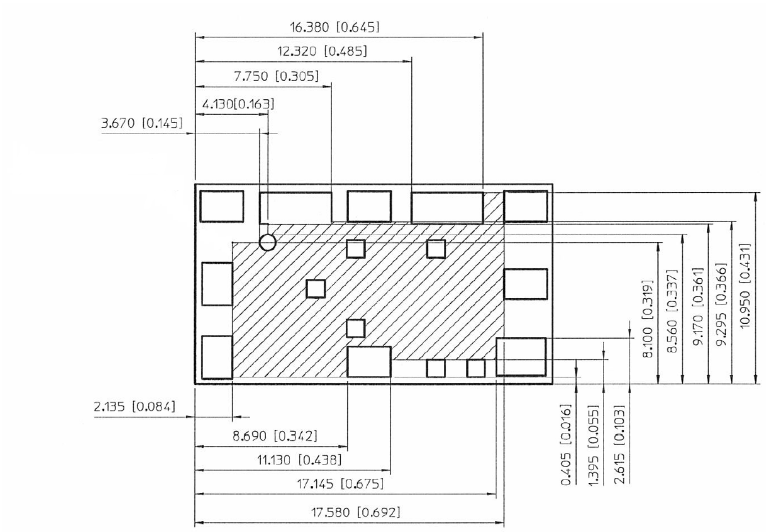
2.1 Mounting

- 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.
- Avoid placing the DC input line pattern layout underneath the unit, it will increase the line conducted noise. Make sure to leave an ample distance between the line pattern layout and the unit. Also avoid placing the DC output line pattern underneath the unit because it may increase the output noise. Lay out the pattern away from the unit.
- Avoid placing the signal line pattern layout underneath the unit, this power supply might become unstable.
  Lay out the pattern away from the unit.
- Avoid placing pattern layout in hatched area in Fig.2.1.1 to insulate between pattern and power supply.

Fig. 2.1.1
Prohibition area of
Pattern layout(top view)



(a)BRNS6/12

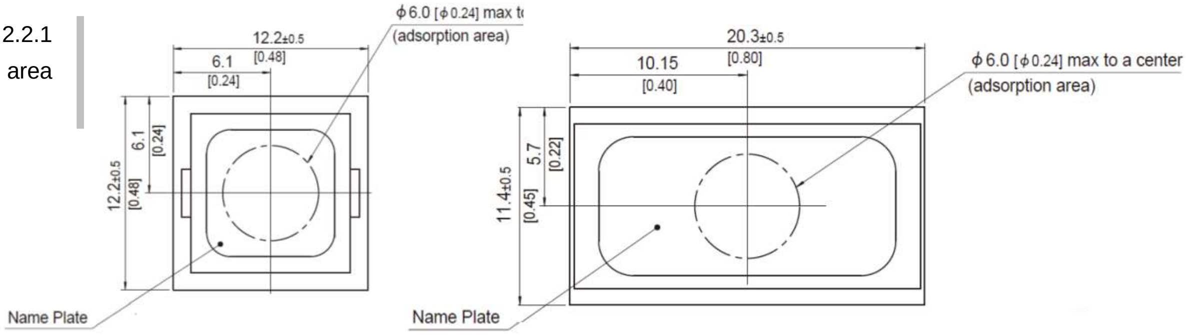


(b)BRNS20

2.2 Automatic Mounting

- To mount BRNS series automatically, use the coil area near the center of the PCB as an adsorption point. Please see Fig.2.2.1 for details of the adsorption point.

Fig. 2.2.1
Adsorption area

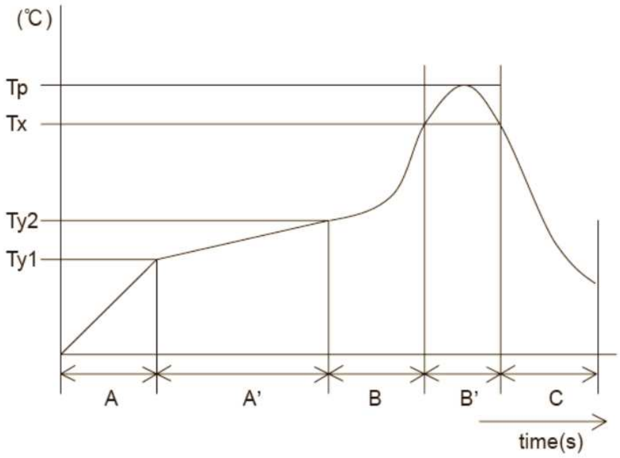


(a) BRNS6/12 (b) BRNS20

2.3 Soldering

- Fig.2.3.1 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.
- Please do not do the implementation except the reflow.
- Because some parts drops, please do not do reflow of the back side.

Fig. 2.3.1
Recommended reflow soldering condition

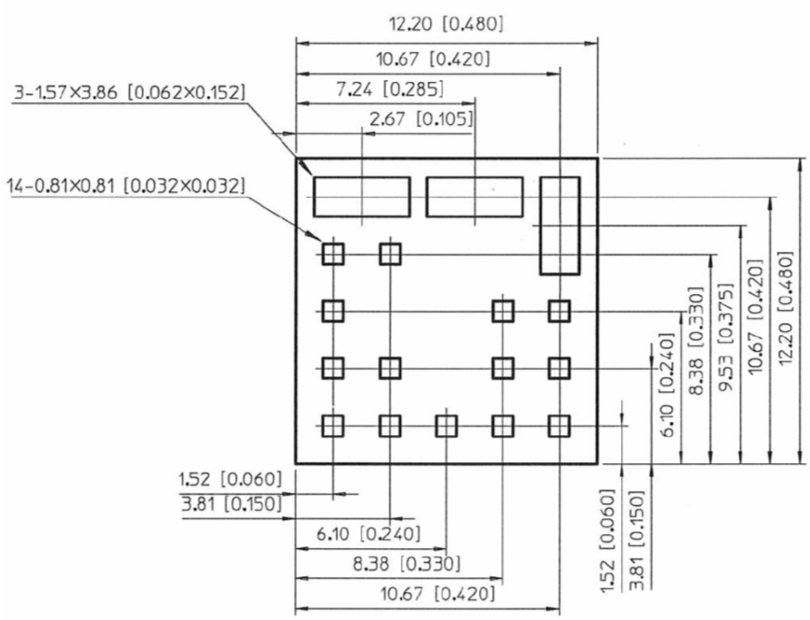


A	1.0 - 5.0℃/ s
A'	Ty1 : 160±10℃ Ty2 : 180±10℃ Ty1 - Ty2 : 120s max
B	1.0 - 5.0℃/ s
B'	Tp : Max245℃ 10s max Tx : 220℃ or more : 70s max
C	1.0 - 5.0℃/ s

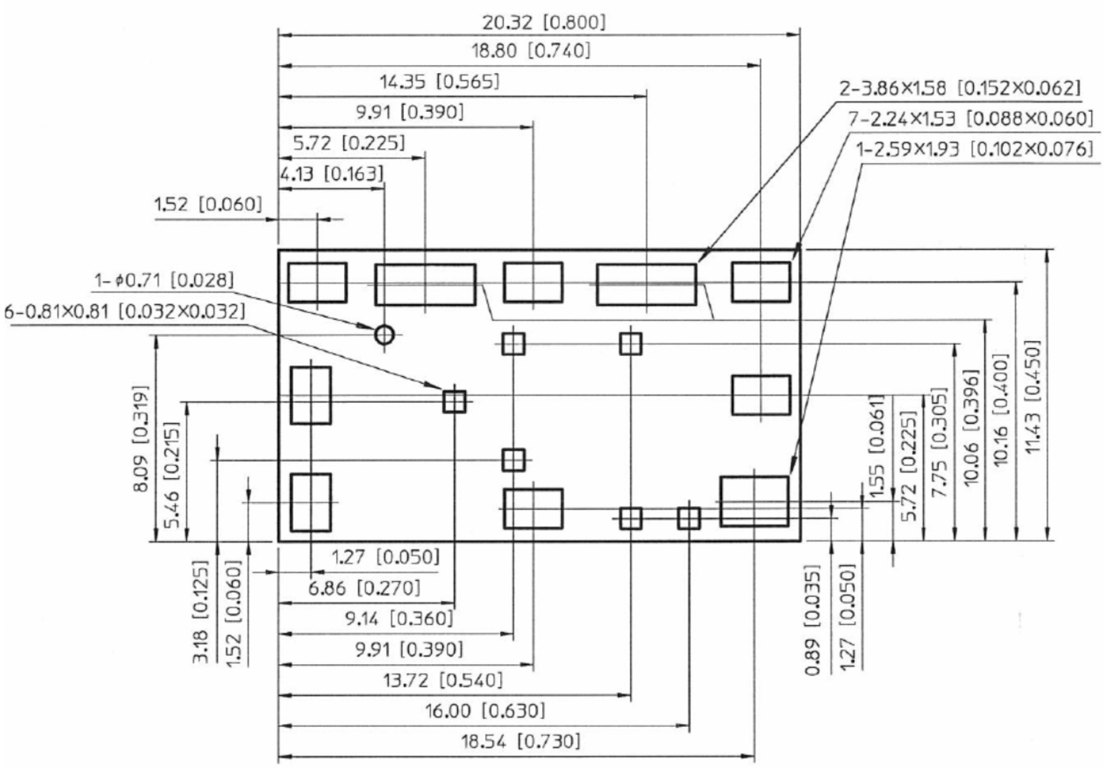
2.4 Stencil Openings

■ Recommended size for stencil openings is shown in Fig.2.4.1.

Fig. 2.4.1
Recommended size
for stencil openings
(Top view)



(a) BRNS6 / 12



(b) BRNS20

Dimensions in mm , [   ] = inches
Recommended stencil thickness is 0.12mm

2.5 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.

2.6 Storage

- 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 heatresistant 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.

2.7 Safety Consideration

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

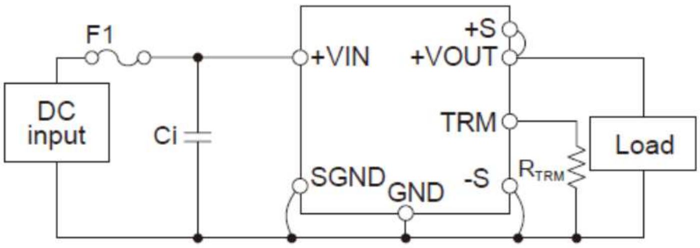
  - This unit must be used as a component of the end-use equipment.
  - Safety approved fuse must be externally installed on input side.

3. Connection and wiring

3.1 Connection for standard use

- In order to use power supply, it is necessary to wire as shown in Fig. 3.1.1.

Fig. 3.1.1
Connection for standard use



- Short the following pins to turn on the power supply.
  GND⇔RC, +VOUT⇔+S, GND⇔-S (-S : only BRNS20)
- Connect resistance to set the output voltage between TRM and GND.
- 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.

3.2 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 outputted.
- It is not necessary to use fuse if it can be protected by the overcurrent protection function of bus converter on the input side.

Table 3.2.1 Recommended fuse

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

(2) External capacitor on the input side

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

Table 3.2.2 Recommended external input capacitor (Ceramic)

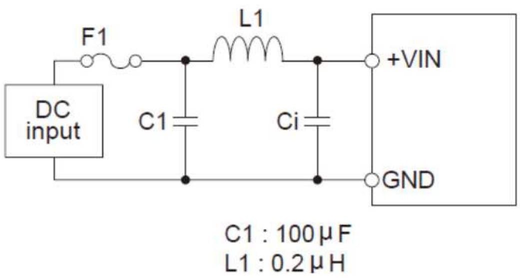
Model	BRNS6	BRNS12	BRNS20
Ci	22μF×2	22μF×2	22μF×3

- Ci is within 5mm for pins. Make sure that ripple current of Ci 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 Ci.

(3) Recommendation for noise-filter

- Install an external input filter as shown in Fig.3.2.1 in order to reduce conducted noise. Ci is shown in Table 3.2.2.

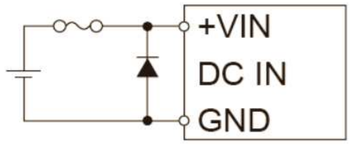
Fig. 3.2.1 Example of recommended external input filter



(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.3.2.2.

Fig. 3.2.2
Reverse input voltage protection



3.3 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. 3.3.1
Wiring external
output capacitor

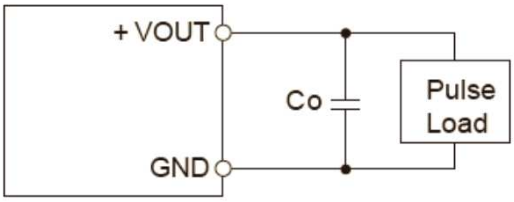


Table 3.3.1
Recommended
Co and MaxCo

No.	Model	Recommended Co	Max Co
1	BRNS6	47μFx1+100μFx1	1,000μF
2	BRNS12	47μFx1+100μFx1	1,000μF
3	BRNS20	100μFx2	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.3.3.2. Cin is shown in Table 3.2.2. Co1 and Co2 is shown in Table 3.3.2.

Fig. 3.3.2
Measuring method of
Ripple and Ripple Noise

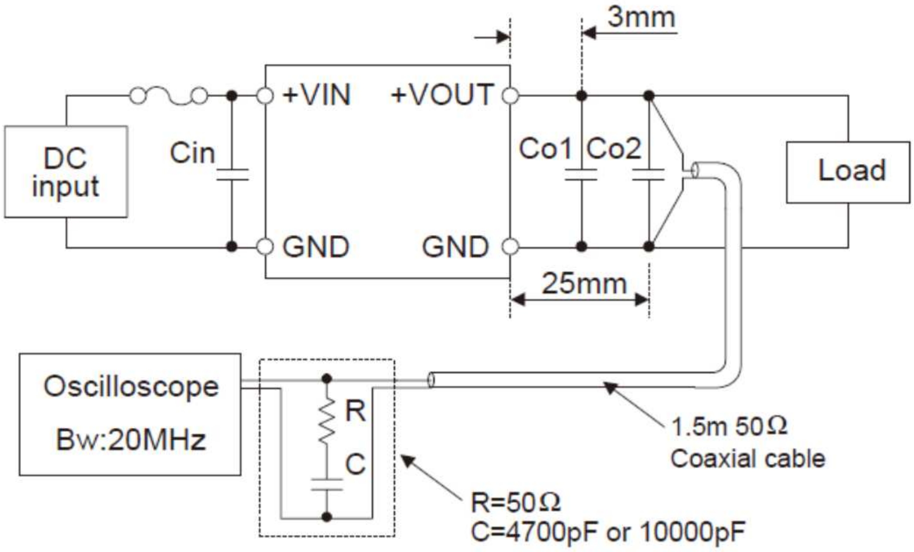


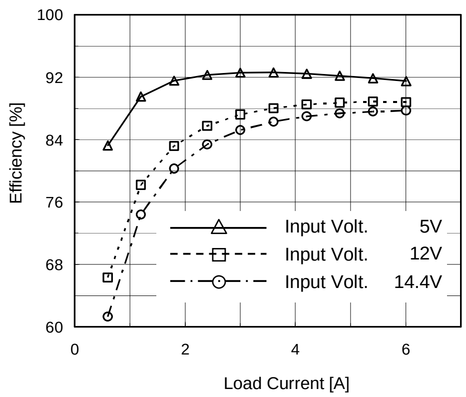
Table 3.3.2
Co1 and Co2
which is used in
measuring

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

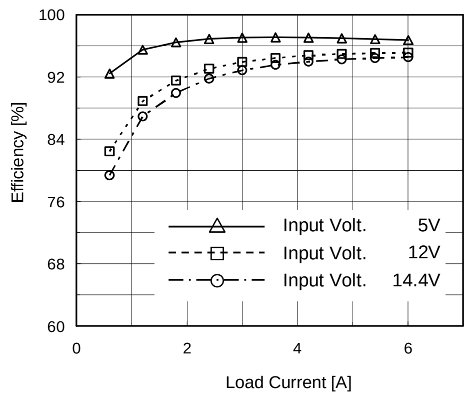
4. Applications data

4.1 Efficiency

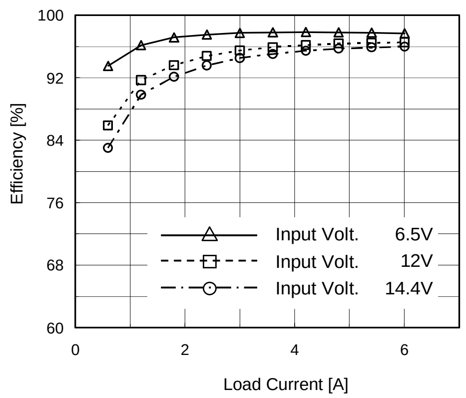
Fig. 4.1.1
Efficiency
(BRNS6)
at 25℃



Vout = 1.2V

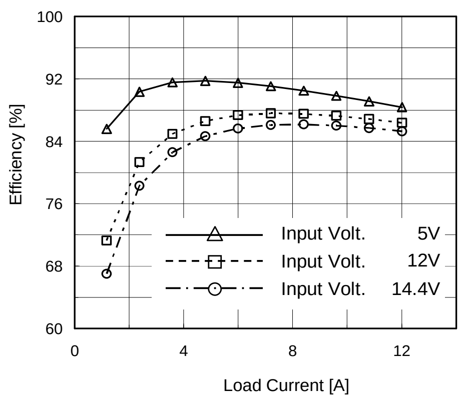


Vout = 3.3V

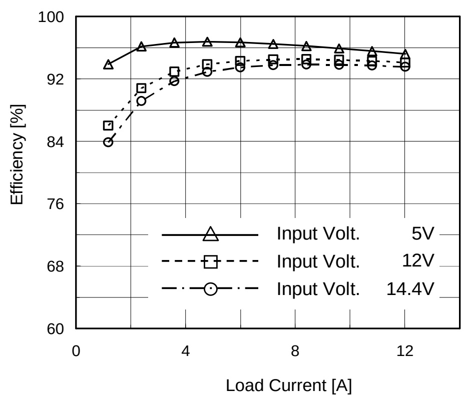


Vout = 5.0V

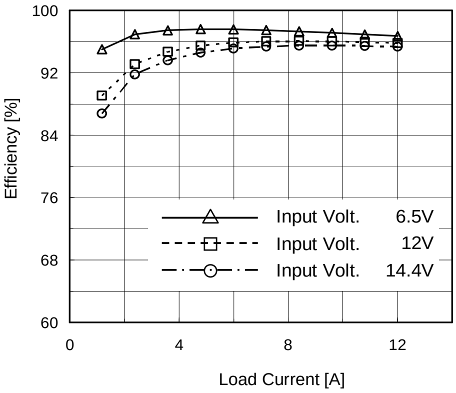
Fig. 4.1.2
Efficiency
(BRNS12)
at 25℃



Vout = 1.2V

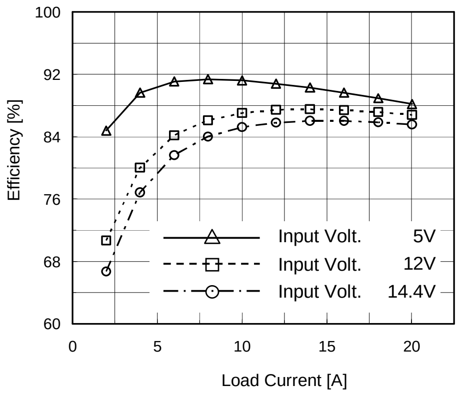


Vout = 3.3V

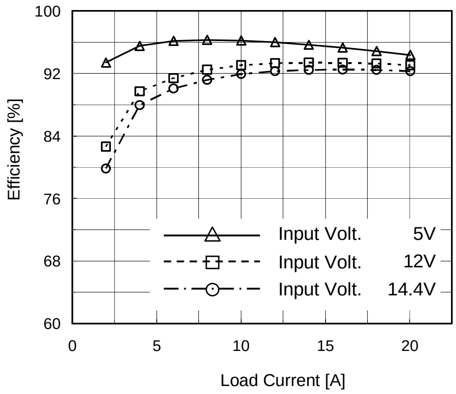


Vout = 5.0V

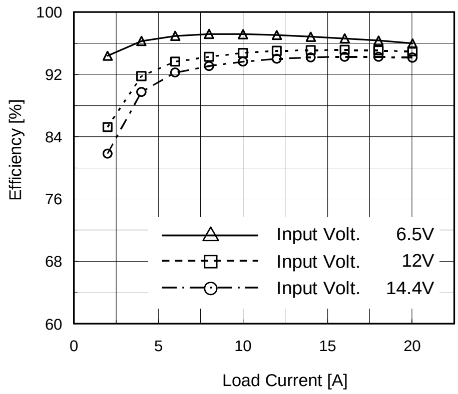
Fig. 4.1.3
Efficiency
(BRNS20)
at 25℃



Vout = 1.2V



Vout = 3.3V



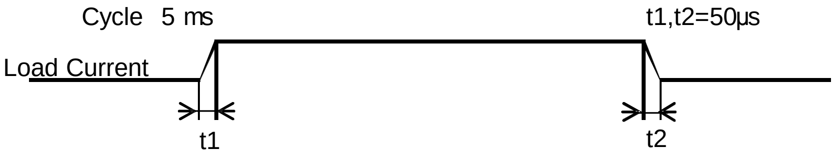
Vout = 5.0V

4.2 Dynamic Load Response

4.2.1 BRNS6

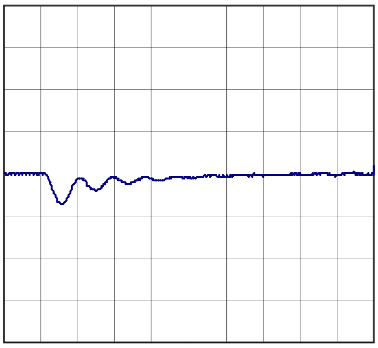
Vin 12V, Vout 1.2V, Cin 22μF×2, Cout 1000μF
Testing Circuitry Fig .4.2.3.2

Fig. 4.2.1.1
Dynamic Load
Response

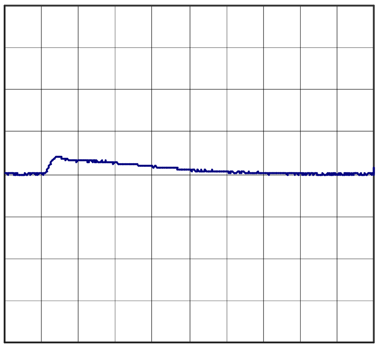


Load 0% (0A)⟷
Load 50% (3A)

100 mV/div



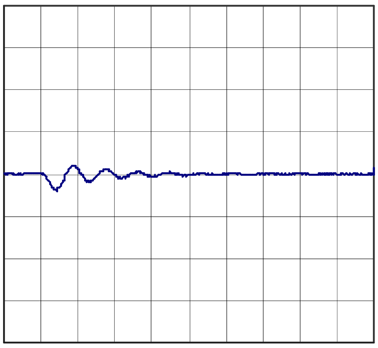
100 μs/div



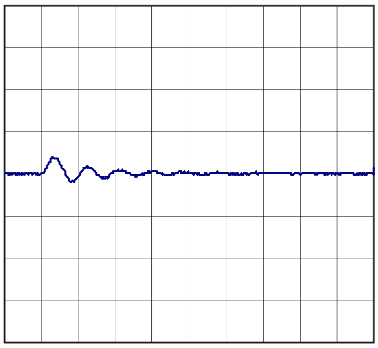
100 μs/div

Load 50% (3A)⟷
Load 100% (6A)

100 mV/div



100 μs/div



100 μs/div

4.2.2 BRNS12

Vin 12V, Vout 1.2V, Cin 22μF×2, Cout 1000μF
Testing Circuitry　Fig. 4.2.3.2

Fig. 4.2.2.1
Dynamic Load
Response

Cycle　5 ms　　　　　　　　　t1,t2=50μs

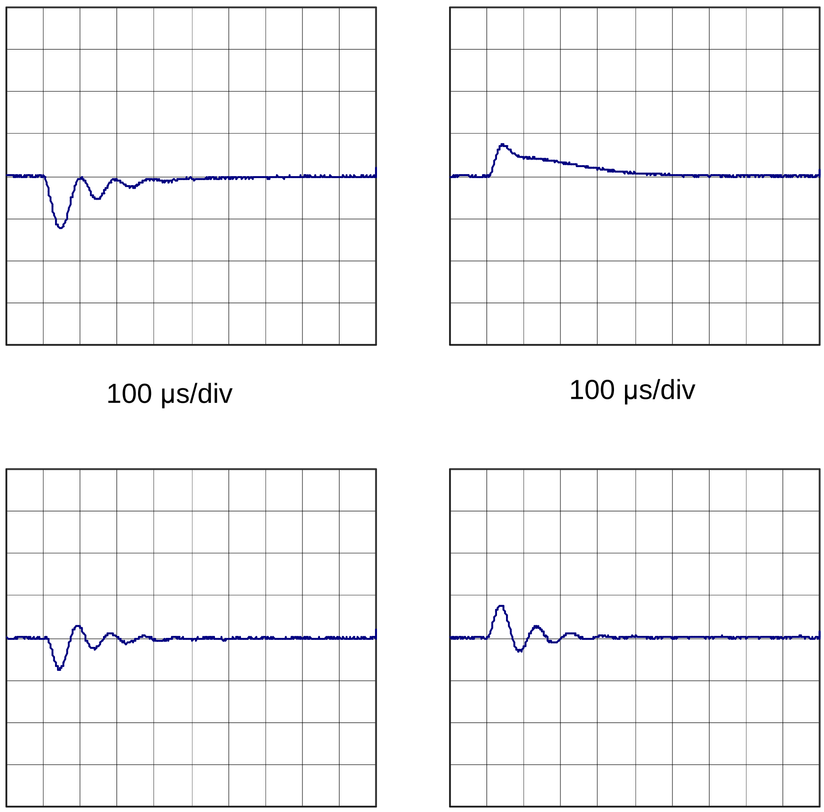
Load Current

Load 0% (0A) ⟷
Load 50% (6A)

100 mV/div

Load 50% (6 A) ⟷
Load 100% (12A)

100 mV/div



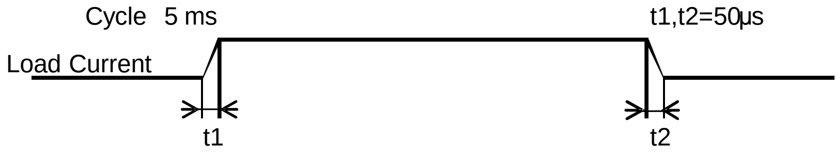
100 μs/div　　100 μs/div

100 μs/div　　100 μs/div

4.2.3 BRNS20

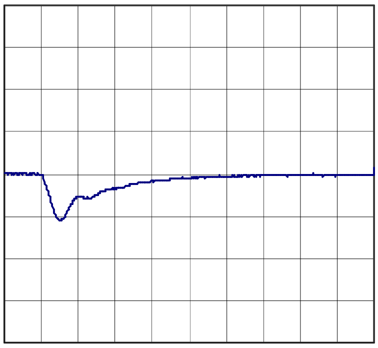
Vin 12V, Vout 1.2V, Cin 22μF×3, Cout 1000μF
Testing Circuitry Fig. 4.2.3.2

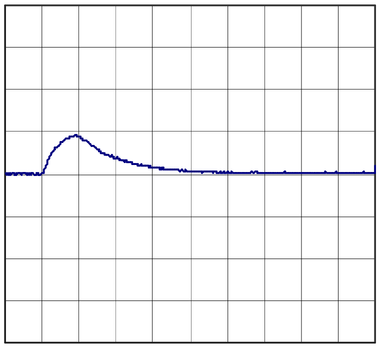
Fig. 4.2.3.1
Dynamic Load
Response



Load 0% (0A) ⟷
Load 50% (10A)

100 mV/div



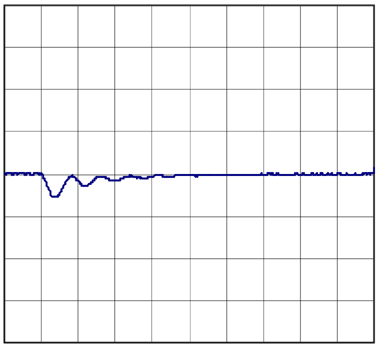


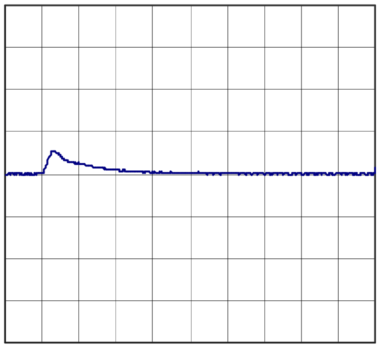
100 μs/div

100 μs/div

Load 50% (10A) ⟷
Load 100% (20A)

100 mV/div

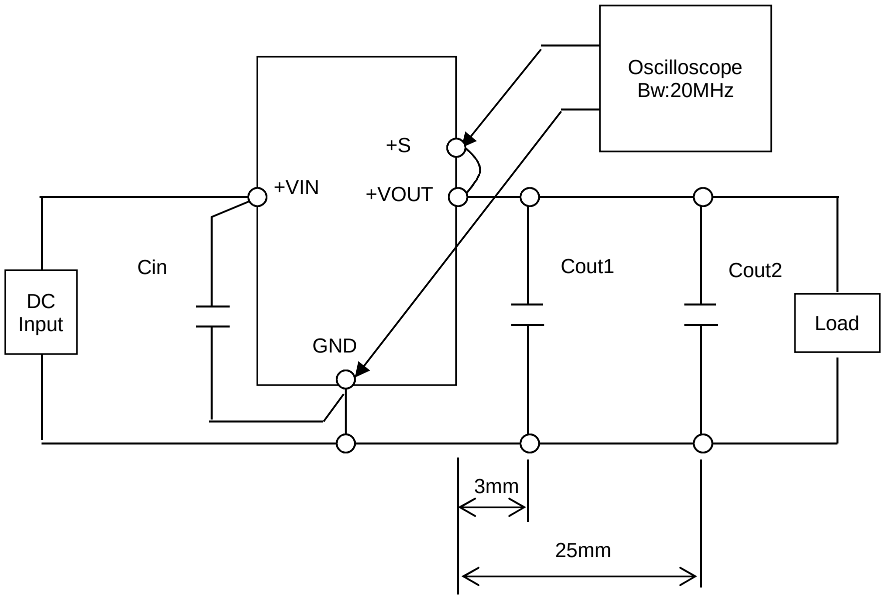




100 μs/div

100 μs/div

Fig. 4.2.3.2
Measuring method
of Dynamic Load
Response

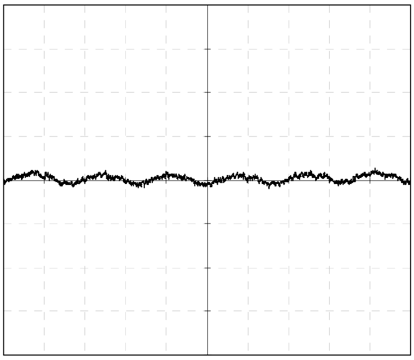


No.	Model	Cin	Cout1	Cout2
1	BRNS6	22μF×2	100μF	900μF
2	BRNS12	22μF×2	100μF	900μF
3	BRNS20	22μF×3	100μF	900μF

4.3 Ripple Voltage

Fig. 4.3.1
Ripple Voltage
of BRNS at 25℃

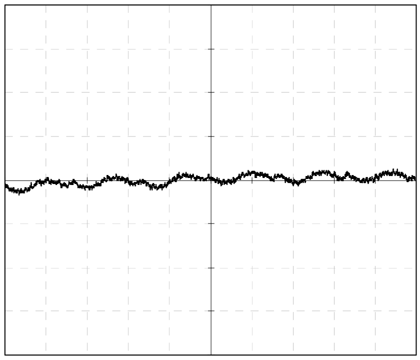
5 mV/div



Vin 12V Vout1.2V 1 μs/div
Load Current 6A

(a) BRNS6

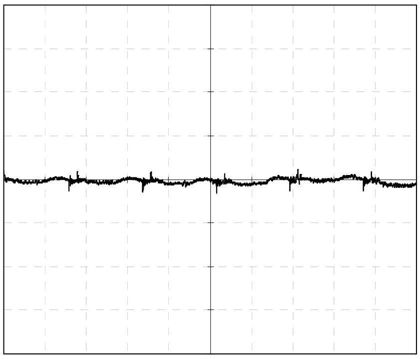
5 mV/div



Vin 12V Vout1.2V 1 μs/div
Load Current 12A

(b) BRNS12

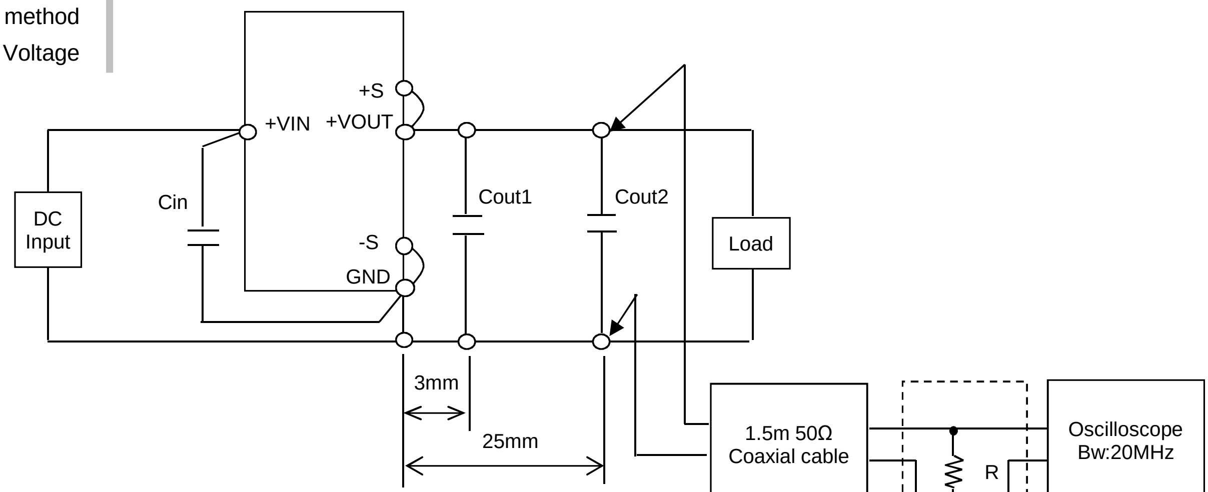
10 mV/div



Vin 12V Vout1.2V 1 μs/div
Load Current 20A

(c) BRNS20

Fig. 4.3.2
Measuring method
of Ripple Voltage

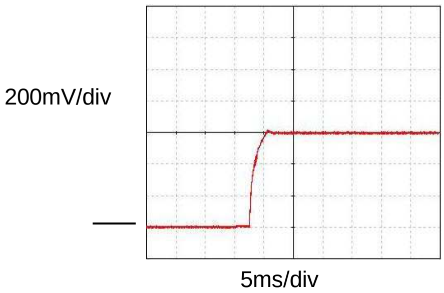


No.	Model	Cin	Cout1	Cout2
1	BRNS6	22μF×2	47μF	100 μF
2	BRNS12	22μF×2	47μF	100 μF
3	BRNS20	22μF×3	100μF	100 μF

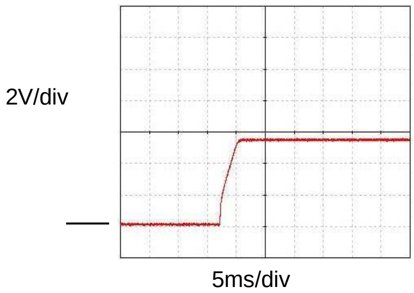
4.4 Rise time

Fig. 4.4.1
BRNS6
Rise at 25℃

Load current:0A, Cin:22μF×2, Cout:47μF+100μF



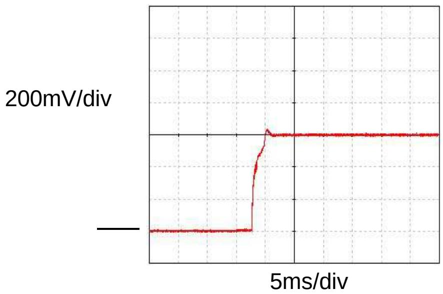
Rise time: 3.3ms
Vin:8V, Vout:0.6V



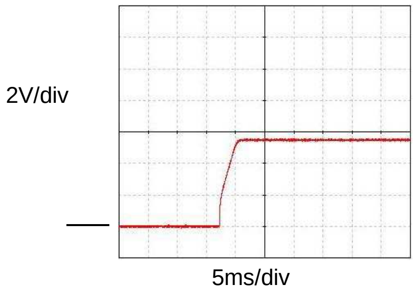
Rise time: 3.8ms
Vin:12V, Vout:5.5V

Fig. 4.4.2
BRNS12
Rise at 25℃

Load current:0A, Cin:22μF×2, Cout:100μF+47μF



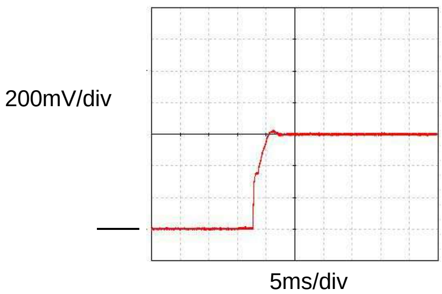
Rise time: 3.5ms
Vin:8V, Vout:0.6V



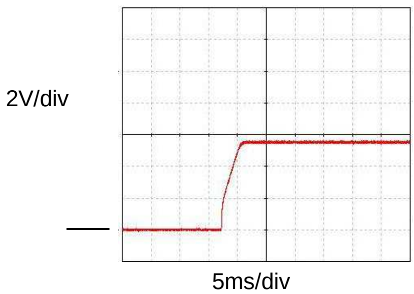
Rise time: 3.8ms
Vin:12V, Vout:5.5V

Fig. 4.4.3
BRNS20
Rise at 25℃

Load current:0A, Cin:22μF×3, Cout:100μF+100μF



Rise time: 3.3ms
Vin:8V, Vout:0.6V



Rise time: 3.5ms
Vin:12V, Vout:5.5V

4.5 Derating

■ Shows the temperature measurement points in Figure 4.5.2 and Figure 4.5.3.
That the temperature of the specified point be less than or equal to the temperature shown in FIG. 1.Ambient temperature must be maintained at 85 ℃ or less.

Fig. 4.5.1
Derating curve
for BRNS

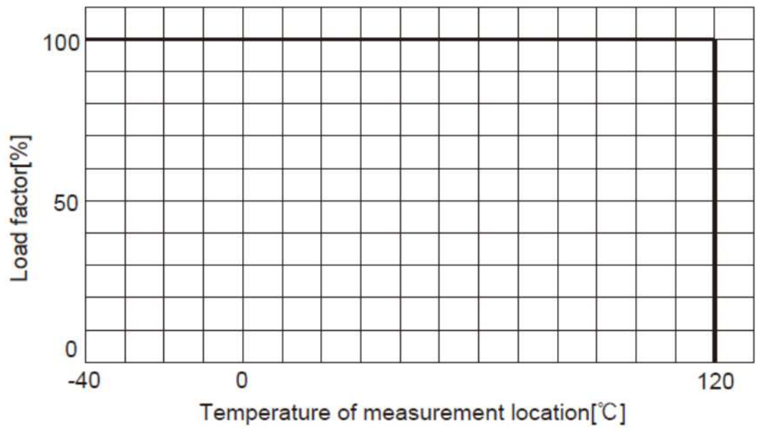


Fig. 4.5.2
Temperature
measurement
location for BRNS6/12

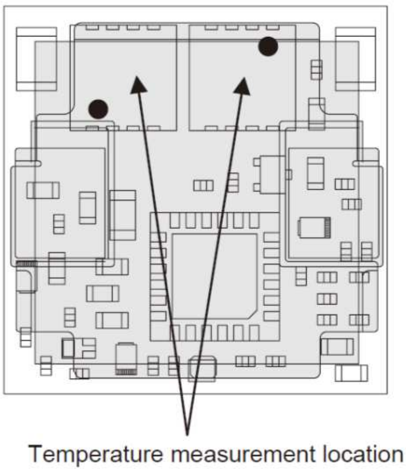
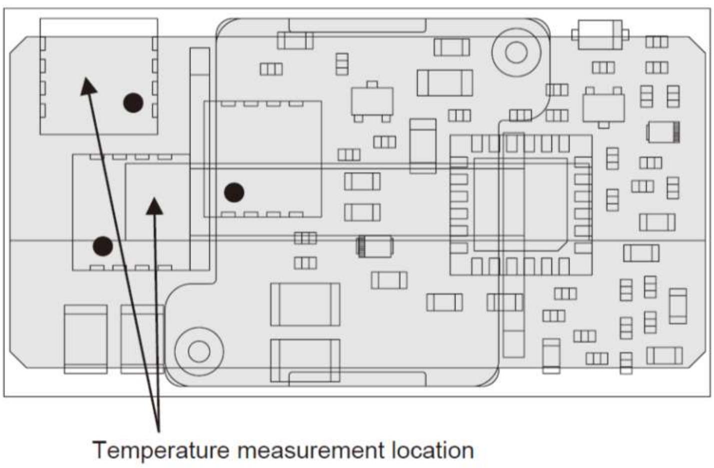


Fig. 4.5.3
Temperature
measurement
location for BRNS20



■ Fig.4.5.5 ~ 4.5.13 show the derating curve in the condition that is measured as shown in Fig.4.5.4.
Verify final design by actual temperature measurement.
The temperature measurement location as shown in Fig.4.5.2 and Fig.4.5.3 must keep below 120℃.

Fig. 4.5.4
Measuring method

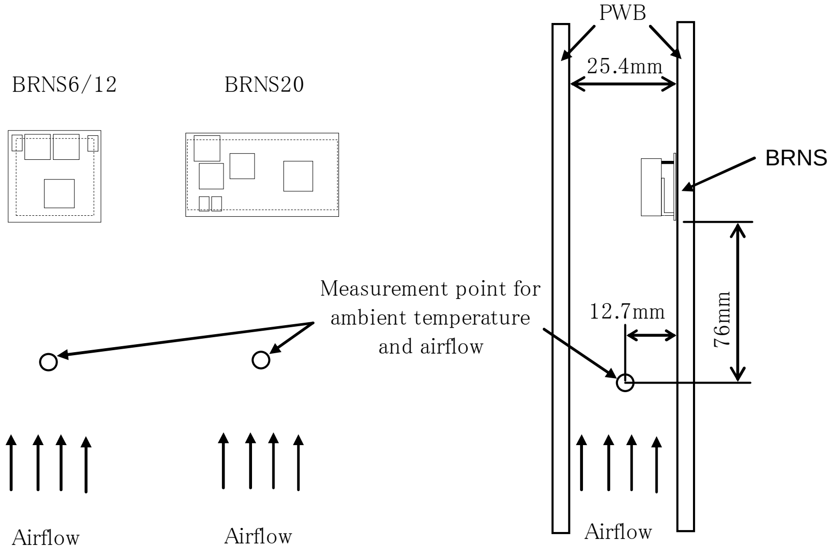


Fig. 4.5.5
Derating curve
for BRNS6
at 12Vin 1.2Vout

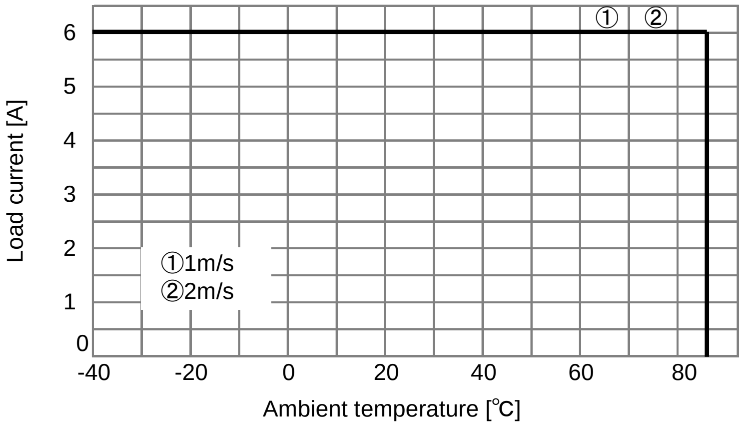


Fig. 4.5.6
Derating curve
for BRNS6
at 12Vin 3.3Vout

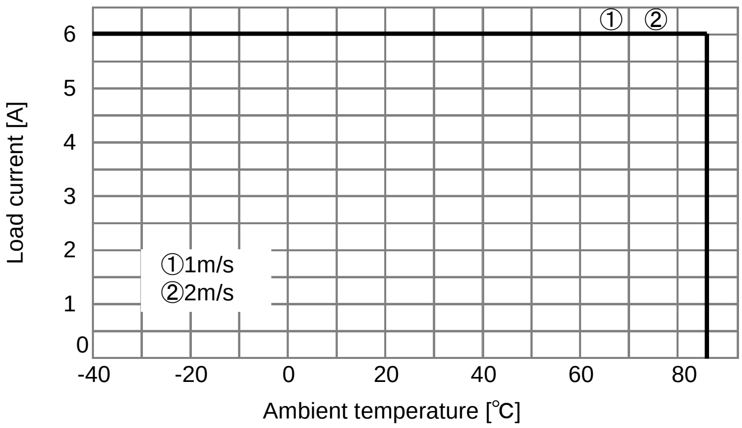


Fig. 4.5.7
Derating curve
for BRNS6
at 12Vin 5.5Vout

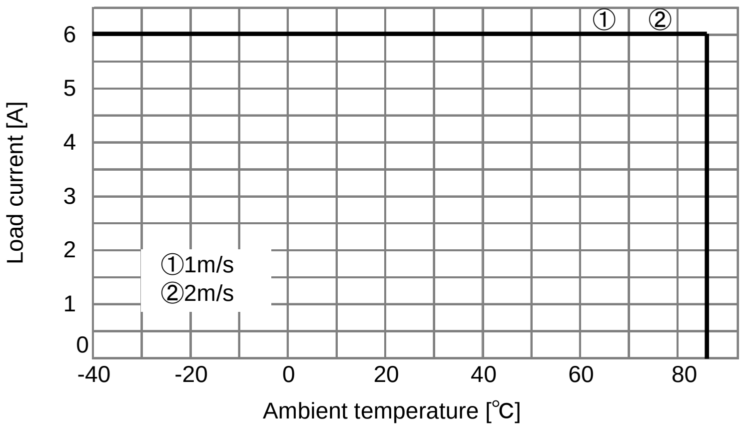


Fig. 4.5.8
Derating curve
for BRNS12
at 12Vin 1.2Vout

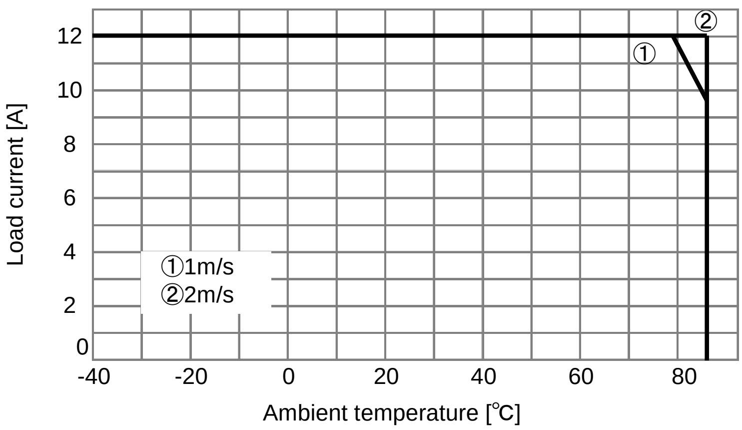


Fig. 4.5.9
Derating curve
for BRNS12
at 12Vin 3.3Vout

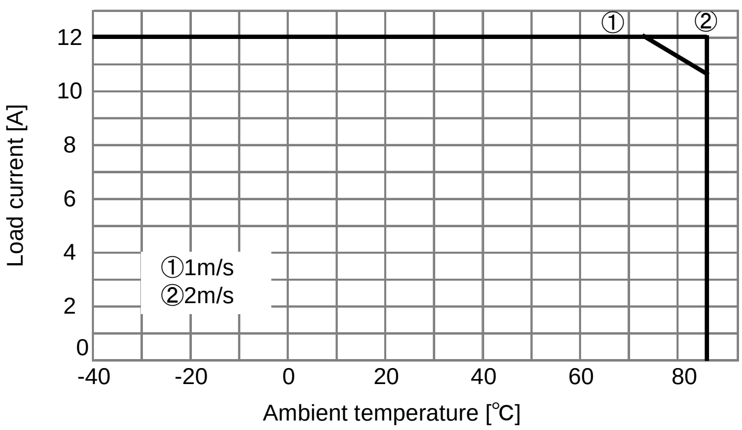


Fig. 4.5.10
Derating curve
for BRNS12
at 12Vin 5.5Vout

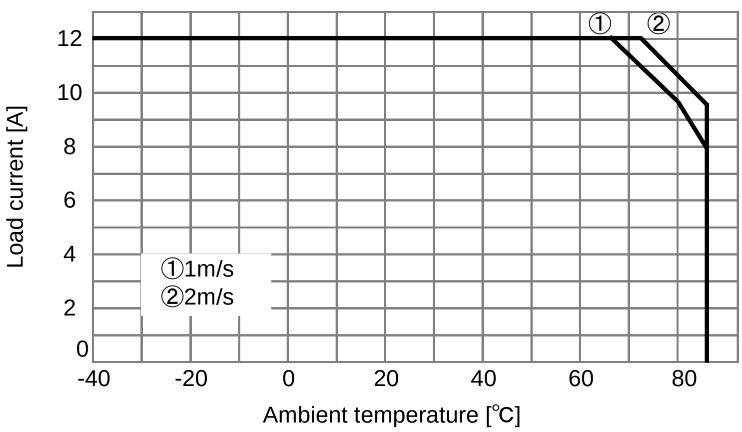


Fig. 4.5.11
Derating curve
for BRNS20
at 12Vin 1.2Vout

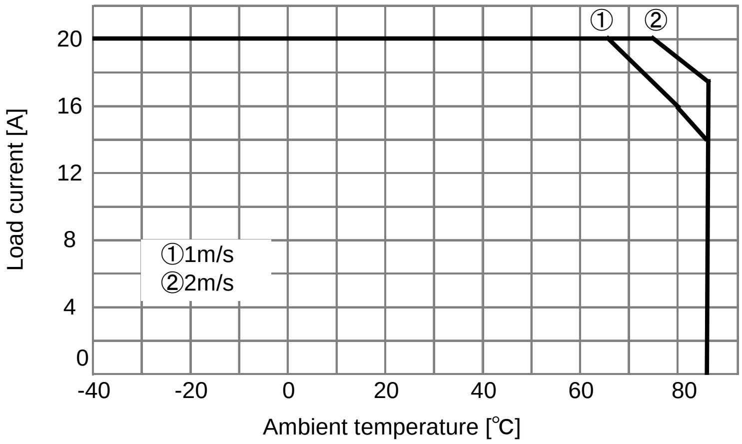


Fig. 4.5.12
Derating curve
for BRNS20
at 12Vin 3.3Vout

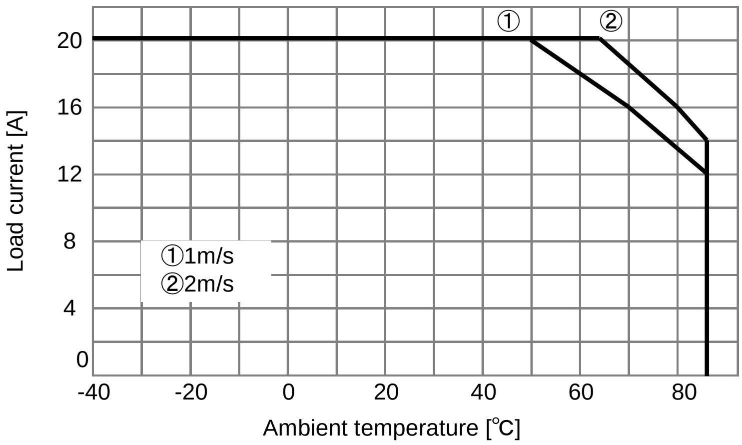
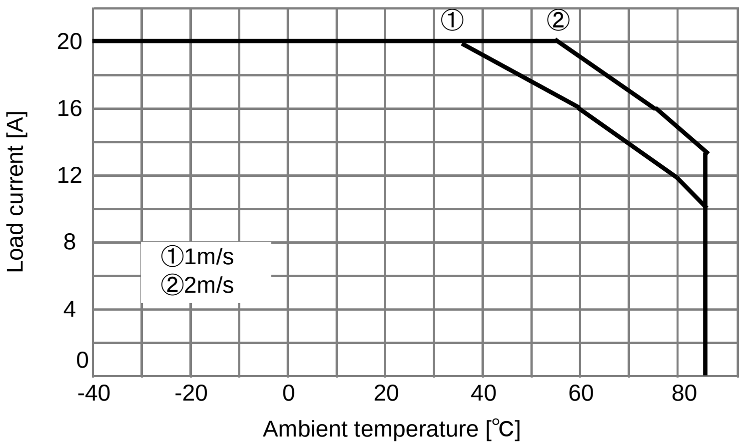


Fig. 4.5.13
Derating curve
for BRNS20
at 12Vin 5.5Vout



5. Adjustable voltage range

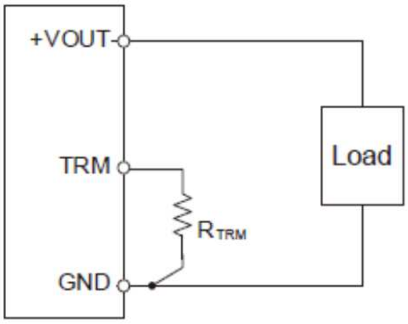
- Output voltage is adjustable by the external resistor.
- The temperature coefficient could become worse, depending on the type of a resistor.
  Resistor・・・・Metal film type, coefficient of less than ±100ppm/℃
- When TRM is opened, output voltage is 0.6V.
- R_{TRM} is calculated in the following expressions.

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

Fig. 5.1.1
Calculation result

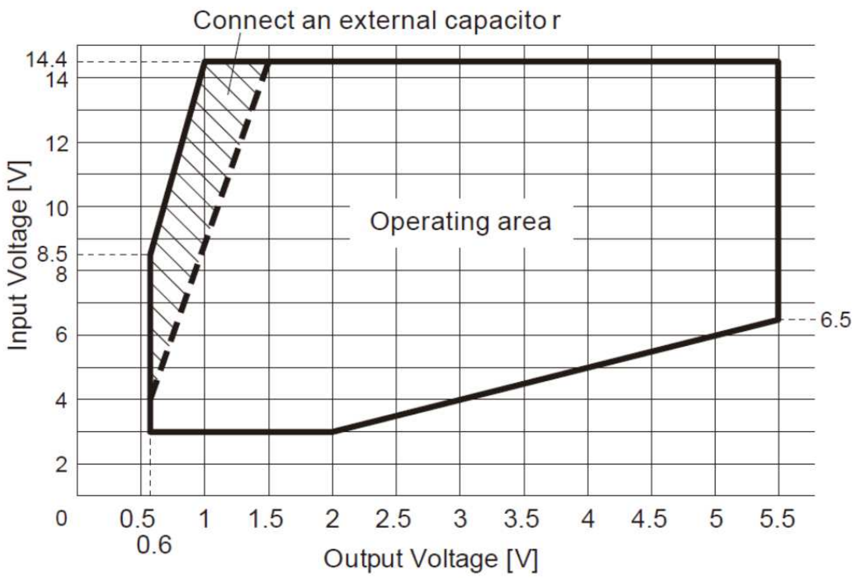
No.	+VOUT	R_{TRM}
1	0.6	OPEN
2	1.2	20.00kΩ
3	1.8	10.00kΩ
4	2.5	6.32kΩ
5	3.3	4.44kΩ
6	5.0	2.73kΩ

Fig. 5.1.2
Connecting R_{TRM}



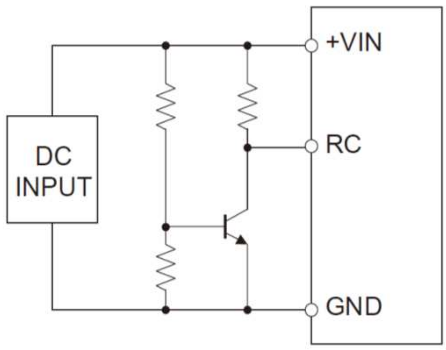
■ Please use the output voltage in the operating area of Fig.5.1.3.
Transient response may worsen when used in vicinity of the border of the operating area.
Only for output voltage is rising and output current is small, there is a possibility that the ripple voltage is high value. If the ripple voltage value is problem, connecting a capacitor of Table 3.3.1 value.

Fig. 5.1.3
Operating area
of BRNS series



■ When start of DC INPUT is slow, BRNS may start on the outside of the operating area.
By the circuitry of the Fig.5.1.4, you can raise the start-up voltage.

Fig. 5.1.4
RC circuitry for start up



6. Protect circuit

6.1 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(5ms typ).

7. Remote ON/OFF

- The remote ON/OFF function is incorporate in the input circuitry and operated with RC and GND. If positive logic control is required , order the power supply with "-R" option.
- When remote on/off function is not used, please open RC.

Table. 7.1.1 Specification of Remote ON/OFF

	ON/OFF logic	Between RC and GND	Output voltage
Standard	Negative	L level (-0.2-0.3V) 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

Fig. 7.1.1 Internal circuitrys of Remote ON/OFF

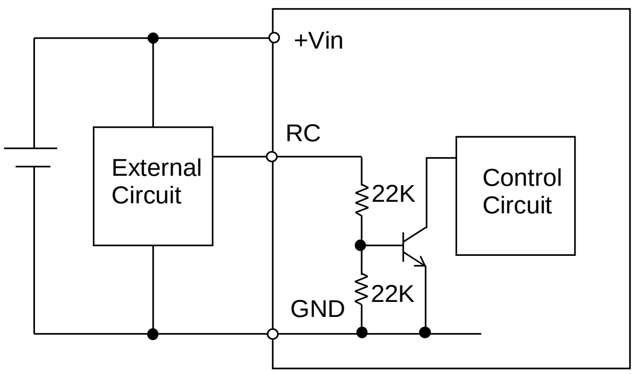
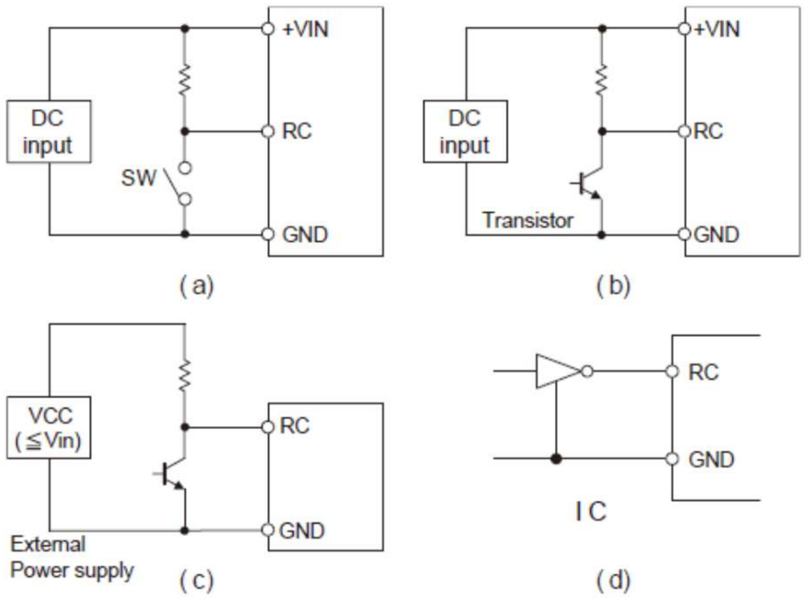


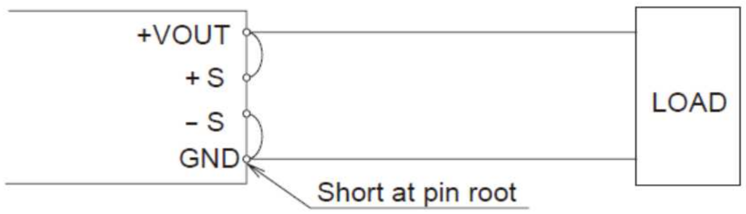
Fig. 7.1.2 RC connection example



8. Remote sensing

8.1 When the remote sensing function is not use

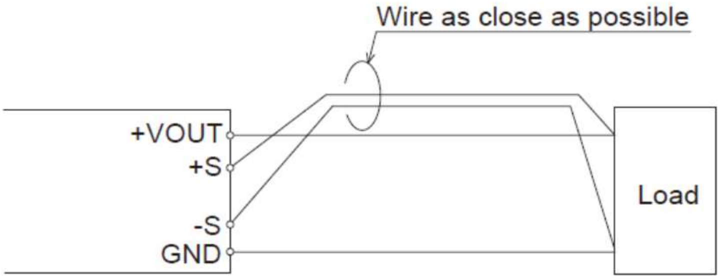
Fig. 8.1.1
Connection
when the remote
sensing is not in use



- 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.

8.2 When the remote sensing function is use

Fig. 8.2.1
Connection
when the remote
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.

9.Power Good

- By using PGOOD, it is possible to monitor power supply whether normal operation or abnormal operation.
- PGOOD terminal inside is comprised of at open drain.
  Sink current of PGOOD is 50μA.
- Voltage of PGOOD pin become low when over current protection circuitry is work, or output voltage is different from a set point more than ±10%.

Fig. 9.1.1
Internal circuitry of PGood

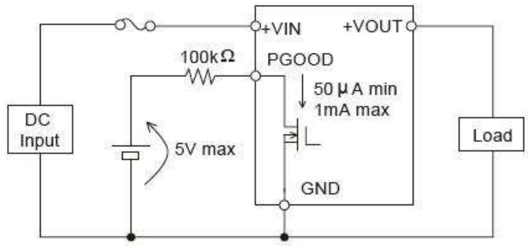
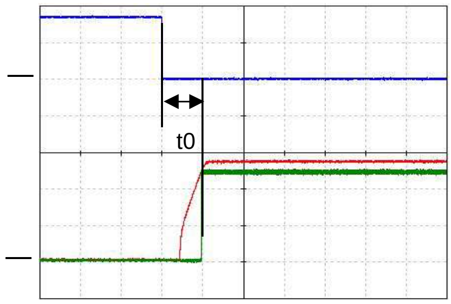


Fig.9.1.2
BRNS6
PGOOD



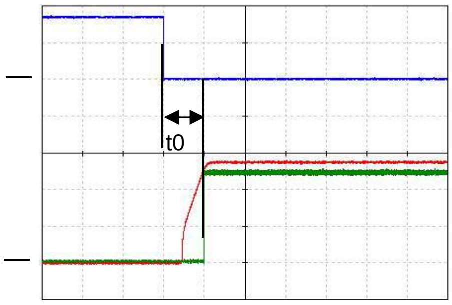
5ms/div

RC(5V/div)
Vout(2V/div)
PGOOD(2V/div)

Vin:12V
Vout:5.5V
load current:0A
Cin:22uFx2
Cout:100uF+47uF

t0: 5ms(Max)

Fig.9.1.3
BRNS12
PGOOD



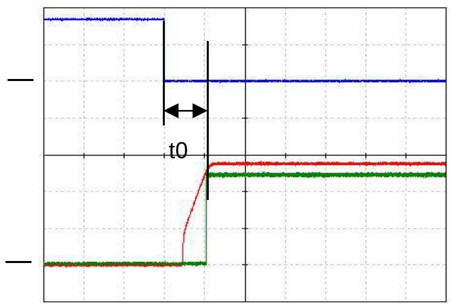
5ms/div

RC(5V/div)
Vout(2V/div)
PGOOD(2V/div)

Vin:12V
Vout:5.5V
load current:0A
Cin:22uFx2
Cout:100uF+47uF

t0: 5ms(Max)

Fig.9.1.4
BRNS20
PGOOD



5ms/div

RC(5V/div)
Vout(2V/div)
PGOOD(2V/div)

Vin:12V
Vout:5.5V
load current:0A
Cin:22uFx3
Cout:100uF×2

t0: 5.0ms(Max)

10. Sequence

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

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

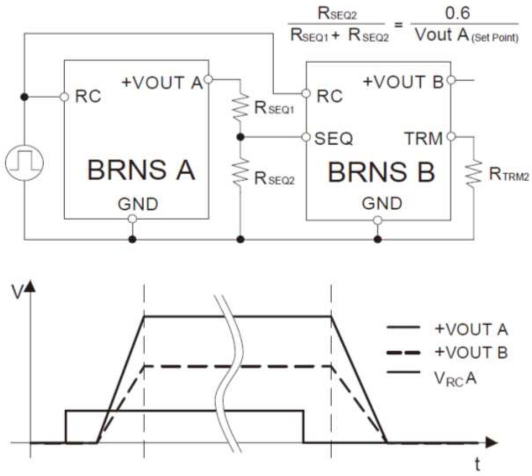
- C_{SEQ} should be less than 1.0μF.
- At the time of start, the output voltage follows the SEQ voltage.
  Output voltage and SEQ voltage are expressed in the following calculation.

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

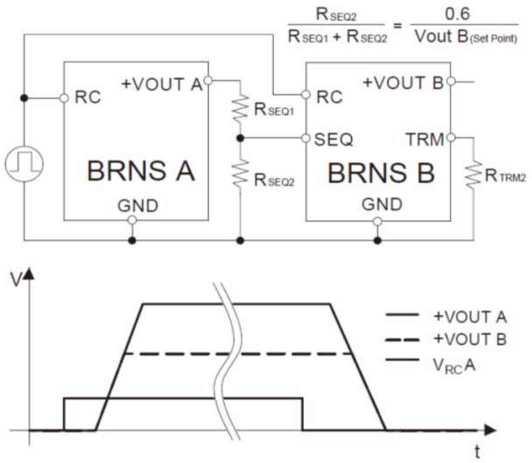
＊ $V_{SEQ} < 0.6V$

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

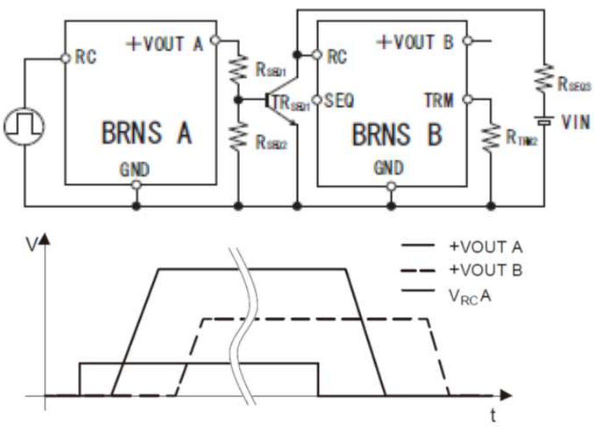
Fig.10.1.1
Example of
sequence control



(a) The same time



(b) The same voltage



(c) The time lag

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

11. 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.11.1.1 is example of frequency synchronization. And recommended wave form of SYNC pin is shown in Fig.11.1.2
- If this function is unnecessary, please make SYNC 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. 11.1.1
Example of frequency synchronization

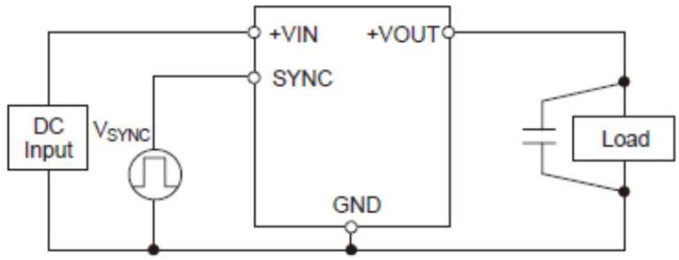


Fig. 11.1.2
Recommended wave from of SYNC

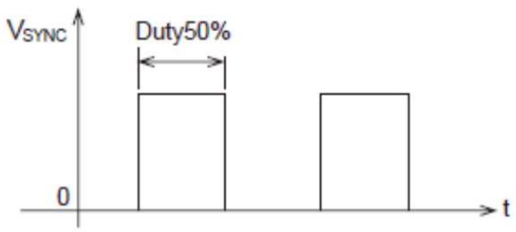
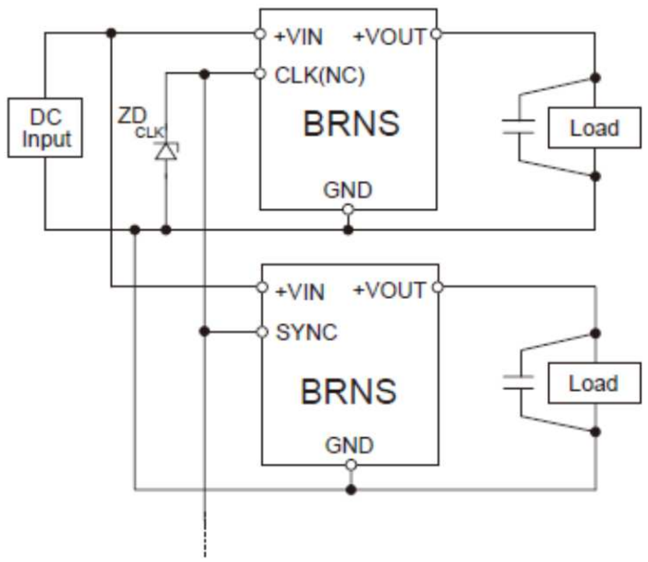


Table. 11.1.1
Specification of SYNC pin voltage

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

■ As shown in Fig.11.1.3, frequency synchronization is possible without using an outside clock.

Fig. 11.1.3
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 power supply which output CLK at first.
■ The max voltage of CLK pin is DC input voltage.
■ Applied voltage of the SYNC pin is equal to or larger than 5.5V to connect the ZD_{CLK} (refer to Table.11.1.1)

12. Series operation/Parallel operation/Redundancy operation

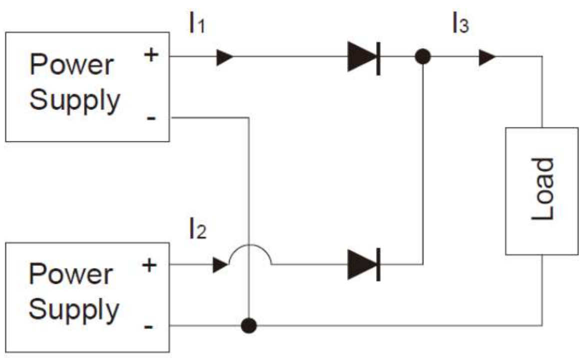
12.1 Series operation

■ Series operation is not possible.

12.2 Parallel operation/Redundancy operation

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

Fig. 12.2.1 Redundancy operation



■ Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2.
■ Current I_3 should not exceed the rated current of the power supply.

$I_3 \leqq$ the rated current value

13. Package Information

- Please refer to Fig.13.1.1 ~ Fig.13.1.3 for Package form (Reel).
- The packed number is 200.

Fig. 13.1.1
Taping dimensions
of BRNS6/12

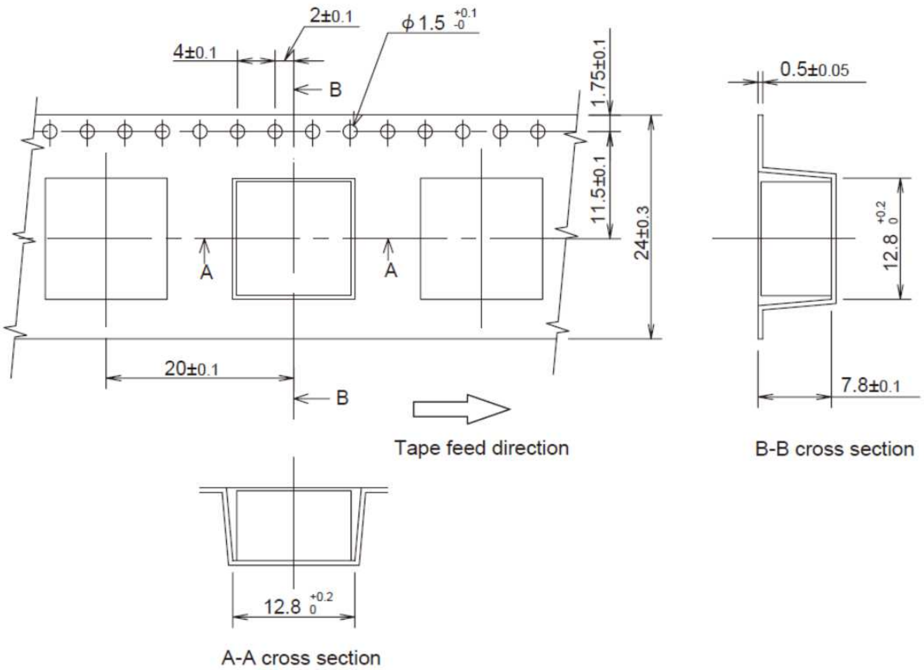


Fig. 13.1.2
Taping dimensions
of BRNS20

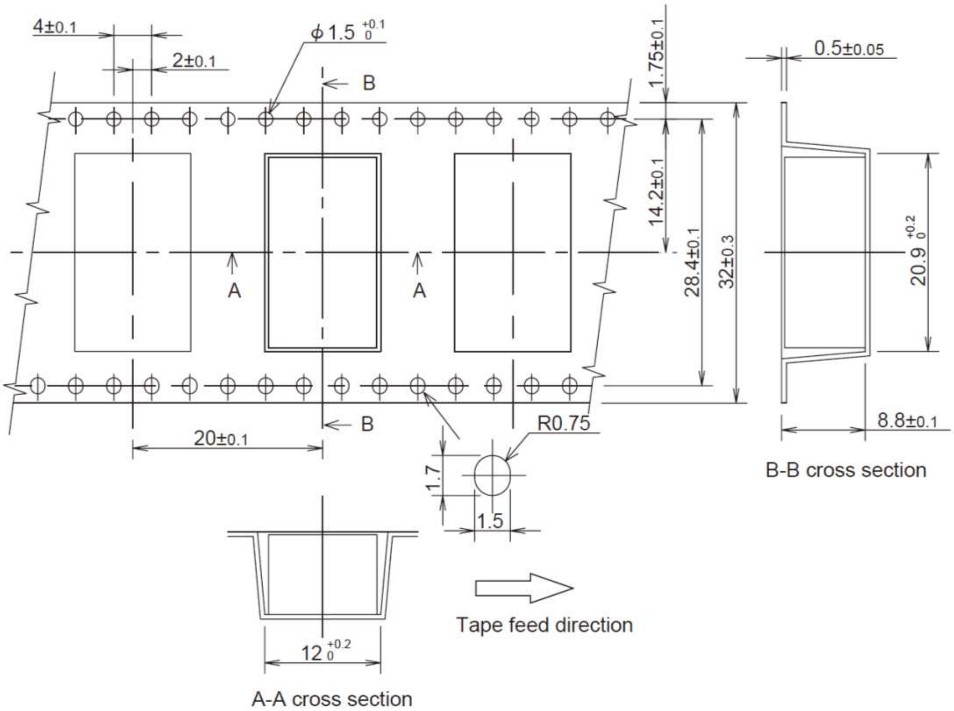
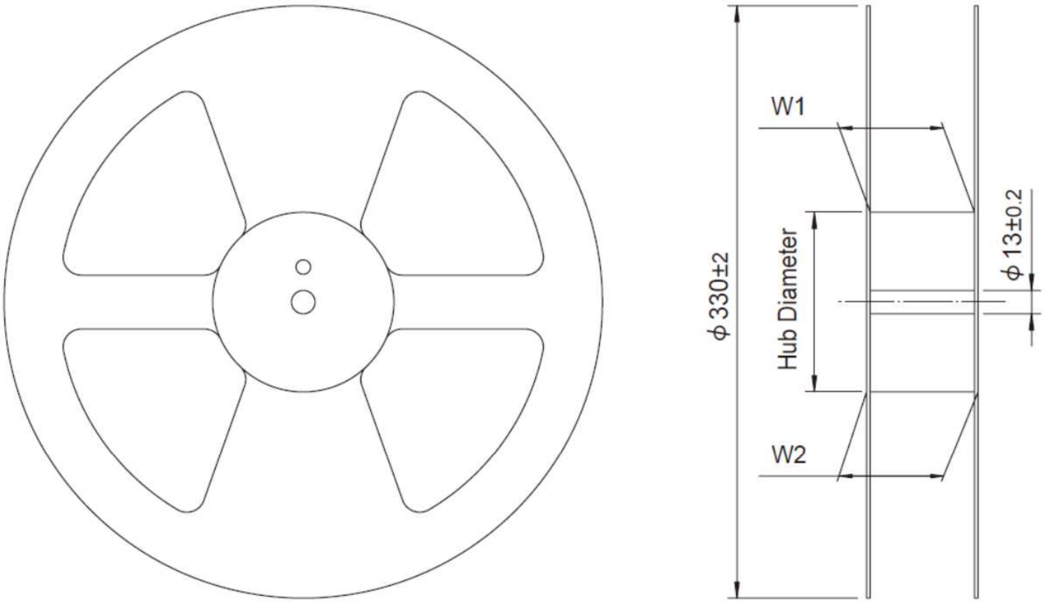


Fig. 13.1.3
Reel dimensions
of BRNS



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

BRFS/BRDS series

1. Pin configuration

1.1 BRFS30/40

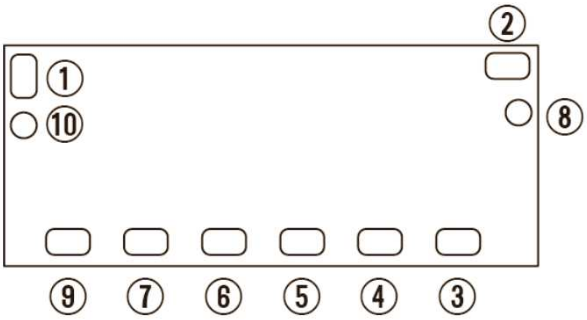


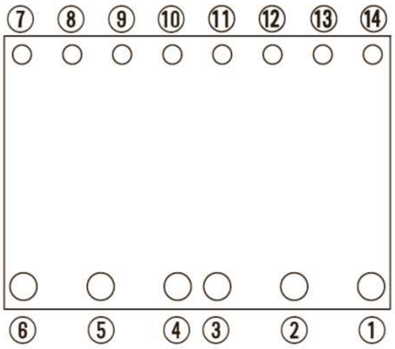
Fig.1.1.1
Pin connection
for BRFS30/40
(bottom view)

Table.1.1.1
Pin connection and
function of BRFS40

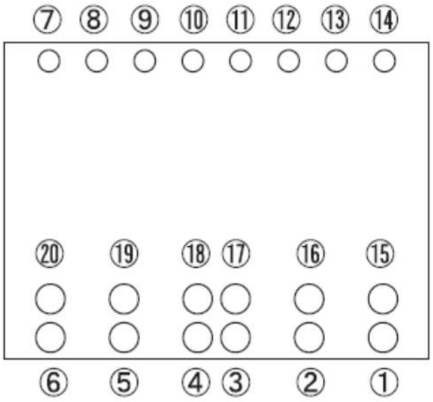
Pin No.	Pin Connection	Function
①	RC	Remote ON/OFF
②	+VIN	+DC input
③	SEQ	Control of Start up time and turn
④	GND	GND (-DC input, -DC output)
⑤	+VOUT	+DC output
⑥	TRM	Adjustment of output voltage
⑦	+S	+Remote sensing
⑧	GND	GND (-DC input, -DC output)
⑨	NC(PGOOD/ SHARE)	NC (optional : Power good (BRFS30/40), SHARE (BRFS40)
⑩	SGND	Signal GND

1.2 BRFS50/BRFS50L/BRFS60/BRFS100

Fig.1.2.1
Pin connection
for BRFS50/50L/60/100
(bottom view)



(a) BRFS50/50L/60



(b) BRFS100

Table.1.2.1
Pin connection and
function of BRFS50/
50L/60/100

Pin No.	Pin Connection	Function
① ⑮	+VIN	+DC input
② ⑯	GND	GND (-DC input, -DC output)
③ ⑰	+VOUT	+DC output
④ ⑱	+VOUT	+DC output
⑤ ⑲	GND	GND (-DC input, -DC output)
⑥ ⑳	+VIN	+DC input
⑦	SEQ	Control of Start up time and turn
⑧	PGOOD	Power good
⑨	RC	Remote ON/OFF
⑩	-S	-Remote sensing
⑪	+S	+Remote sensing
⑫	+TRM	+Adjustment of output voltage
⑬	-TRM	-Adjustment of output voltage
⑭	SHARE	Parallel operation

1.3 BRDS40

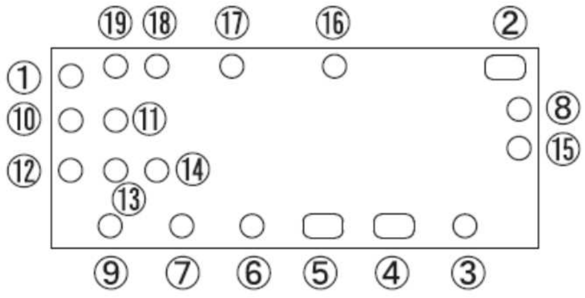


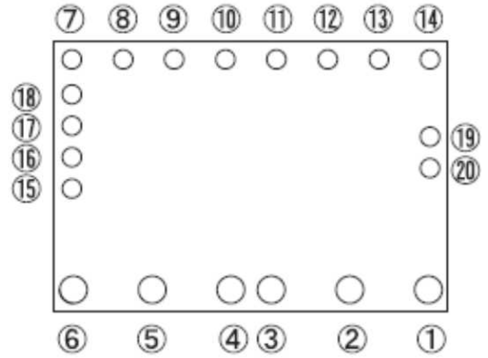
Fig.13.1
Pin connection
for BRDS40
(bottom view)

Table.13.1
Pin connection and
function of BRDS40

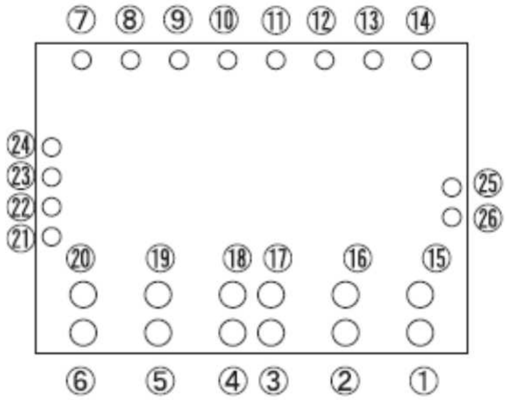
Pin No.	Pin Connection	Function
①	RC	Remote ON/OFF
②	+VIN	+DC input
③	SEQ	Control of Start up time and turn
④	GND	GND (-DC input, -DC output)
⑤	+VOUT	+DC output
⑥	TRM	Adjustment of output voltage
⑦	+S	+Remote sensing
⑧	GND	GND (-DC input, -DC output)
⑨	SHARE	Parallel operation
⑩	SGND	Signal GND
⑪	SGND	Signal GND
⑫	-S	-Remote sensing
⑬	CLK	PMBus communication clock input
⑭	DATA	PMBus communication data input & output
⑮	NC	NC
⑯	PGOOD	Power good
⑰	SMBALERT	PMBus alarm output
⑱	ADDR0	Address setting
⑲	ADDR1	Address setting

1.4 BRDS60/100

Fig.1.4.1
Pin connection
for BRDS60/100
(bottom view)



(a) BRDS60



(b) BRDS100

Table.1.4.1
Pin connection and
function of BRDS60/100

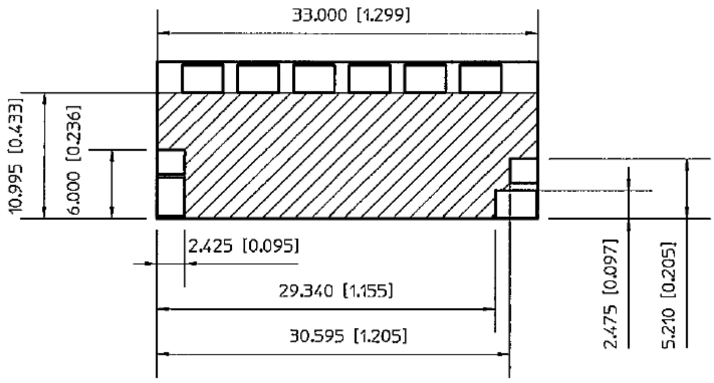
Pin No.		Pin Connection	Function
BRDS60	BRDS100		
①	① ⑮	+VIN	+DC input
②	② ⑯	GND	GND (-DC input, -DC output)
③	③ ⑰	+VOUT	+DC output
④	④ ⑱	+VOUT	+DC output
⑤	⑤ ⑲	GND	GND (-DC input, -DC output)
⑥	⑥ ⑳	+VIN	+DC input
⑦	⑦	SEQ	Control of Start up time and turn
⑧	⑧	PGOOD	Power good
⑨	⑨	RC	Remote ON/OFF
⑩	⑩	-S	-Remote sensing
⑪	⑪	+S	+Remote sensing
⑫	⑫	+TRM	+Adjustment of output voltage
⑬	⑬	-TRM	-Adjustment of output voltage
⑭	⑭	SHARE	Parallel operation
⑮	㉑	SMBALERT	PMBus alarm output
⑯	㉒	DATA	PMBus communication data input & output
⑰	㉓	SGND	Signal GND
⑱	㉔	CLK	PMBus communication clock input
⑲	㉕	ADDR0	Address setting
⑳	㉖	ADDR1	Address setting

2. Mounting and storage

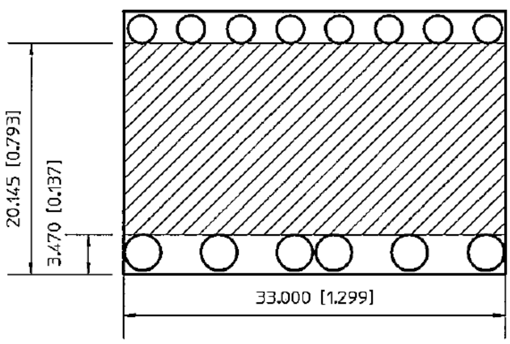
2.1 Mounting

- 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
- Avoid placing the DC input line pattern layout underneath the unit, it will increase the line conducted noise. Make sure to leave an ample distance between the line pattern layout and the unit. Also avoid placing the DC output line pattern underneath the unit because it may increase the output noise. Lay out the pattern away from the unit.
- Avoid placing the signal line pattern layout underneath the unit, this power supply might become unstable.
  Lay out the pattern away from the unit.
- Avoid placing pattern layout in hatched area in Fig.2.1.1 to insulate between pattern and power supply.

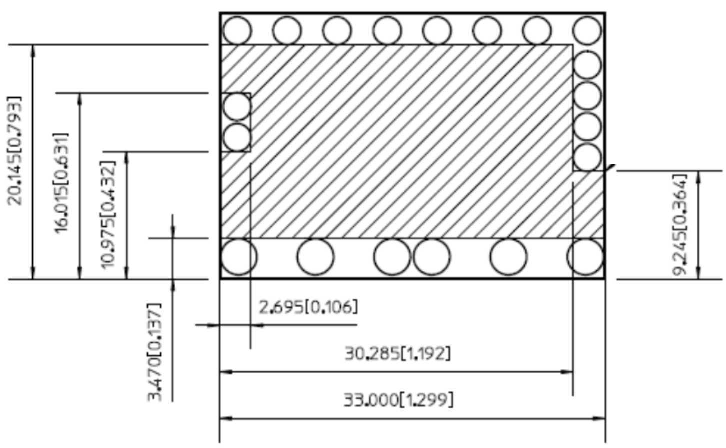
Fig.2.1.1
Prohibition area of
Pattern layout(top view)



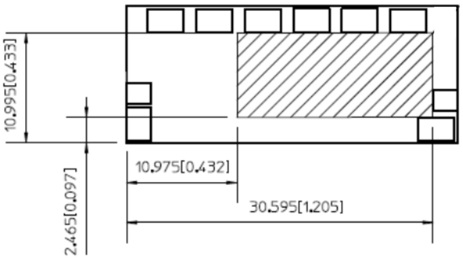
(a)BRFS30



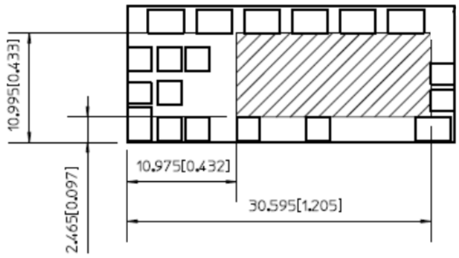
(b-1)BRFS50/BRFS50L/BRFS60



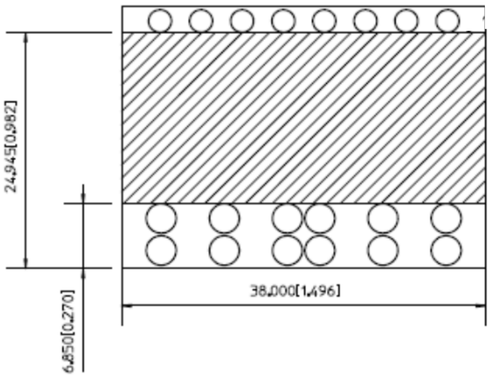
(b-2)BRDS60



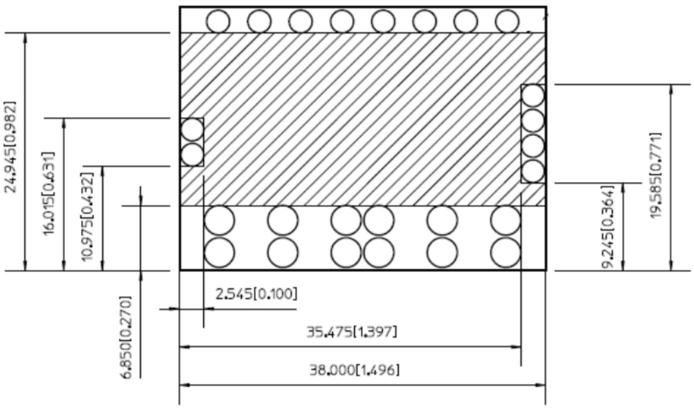
(c-1)BRFS40



(c-2)BRDS40



(d-1)BRFS100

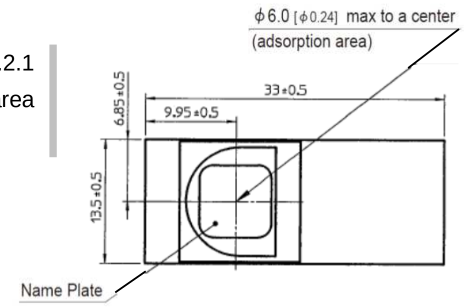


(d-2)BRDS100

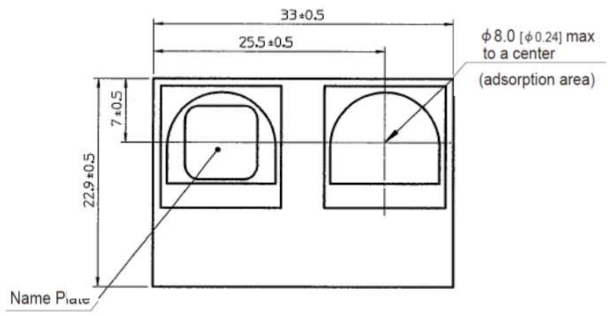
2.2 Automatic Mounting

■ To mount BRFS/BRDS series automatically, use the coil area near the center of the PCB as an adsorption point. Please see Fig.2.2.1 for details of the adsorption point.

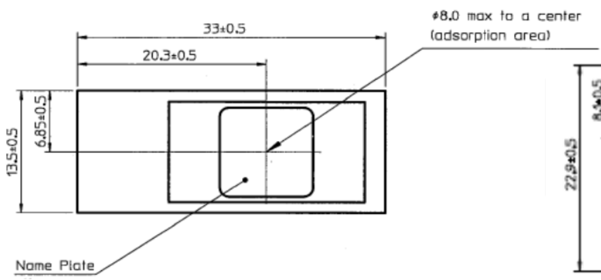
Fig.2.2.1
Adsorption area



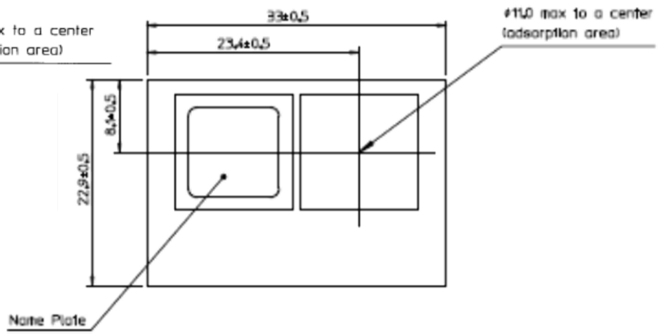
(a) BRFS30



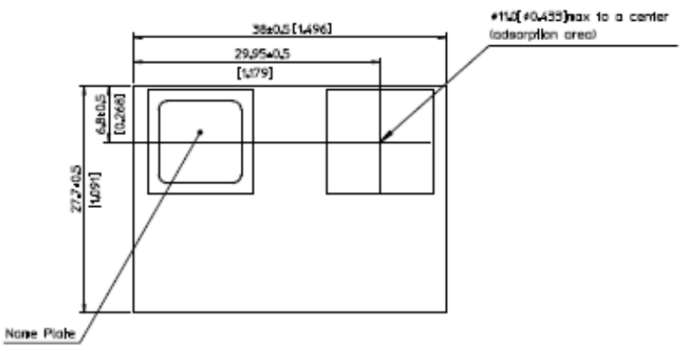
(b) BRFS50/BRFS50L



(c) BRFS40/BRDS40



(d) BRFS60/BRDS60

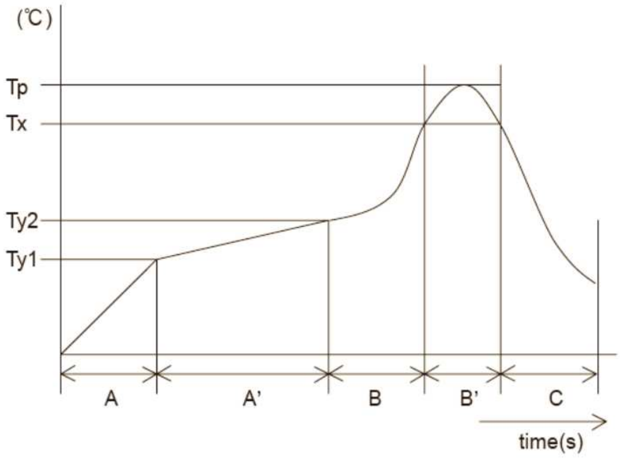


(e) BRFS100/BRDS100

2.3 Soldering

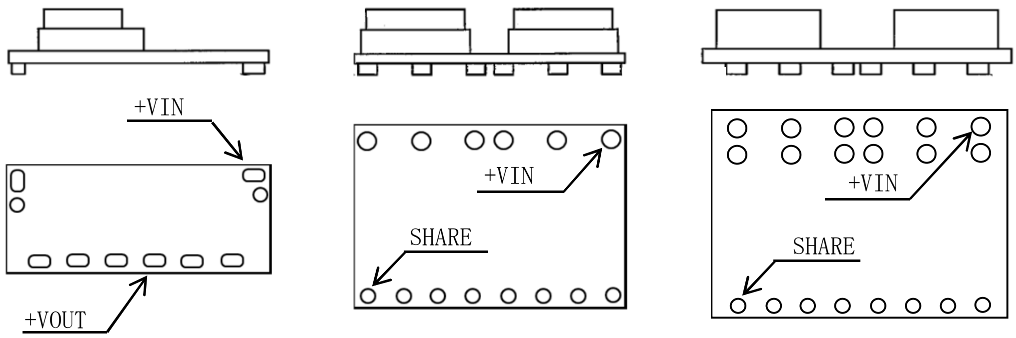
- Fig.2.3.1 shows condition for reflow of BRFS/BRDS series. Please make sure that the temperature of pin shown in Fig.2.3.2 do not exceed the temperatures shown in Fig.2.3.1
- While soldering, having vibration or impact on the unit should beavoided, because of solder melting.
- Please do not do the implementation except the reflow.
- Because some parts drops, please do not do reflow of the back side.

Fig.2.3.1
Recommended reflow
soldering condition



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.2.3.2
Measurement point
of temperature
(bottom view)



(a)BRFS30/40, BRDS40   (b)BRFS50/50L/60, BRDS60   (c)BRFS100, BRDS100

2.4 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.

2.5 Storage

- 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.

2.6 Safety Consideration

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

3. Connection method for standard use

3.1 Connection for standard use

■ Connection to be as Fig.3.1.1 and Fig.3.1.2.

Fig.3.1.1
Connection for standard use of BRFS30/40

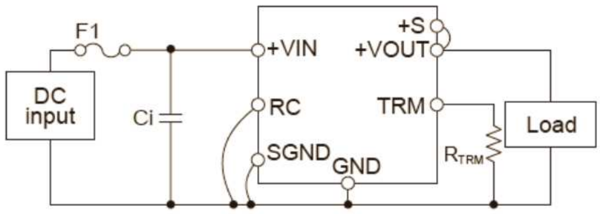
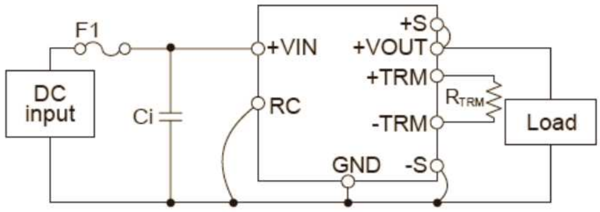


Fig.3.1.2
Other Model



■ Short the following pins to turn on the power supply.
GND←→RC, +VOUT←→+S, GND←→-S (-S : other model than BRFS30/40)
■ Connect resistance to set the output voltage between TRM and GND.
■ Between input and output is not isolated .
■ The BRFS/BRDS series handle only the DC input.
Avoid applying AC input directly.
It will damaged the power supply.

3.2 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.(Recommended fuse current shown by Table3.2.1)
- 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 outputted.
- It is not necessary to use fuse if it can be protected by the overcurrent protection function of bus converter on the input side.

Table.3.2.1
External fuse

No.	Model	Rated current
1	BRFS30/40,BRDS40	40A
2	BRFS50/50L	40A
3	BRFS60,BRDS60	60A
4	BRFS100,BRDS100	80A

(2) External capacitor on the input side

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

Table.3.2.2
Recommended
external input capacitor
(Ceramic)

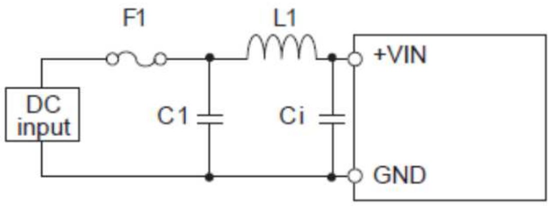
No.	Model	Rated current	
		Vin=5V	Vin=12V
1	BRFS30/40,BRDS40	8×22μF	4×22μF
2	BRFS50/50L		
3	BRFS60,BRDS60		
4	BRFS100,BRDS100		

- Ci is within 5mm for pins. Make sure that ripple current of Ci 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 Ci.

(3) Recommendation for noise-filter

- Install an external input filter as shown in Fig.3.2.1 in order to reduce conducted noise. Ci is shown in Table.3.2.1

Fig.3.2.1
Example of
recommended external
input filter

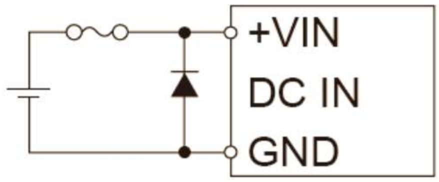


C1 :220μF(BRFS30/50/50L)
:470μF(BRFS40/60/100・BRDS40/60/100)
L1 :0.3μH

(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.3.2.2.

Fig.3.2.2
Reverse input voltage protection



3.3 Wiring output pin

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

Fig.3.3.1
Wiring external
output capacitor

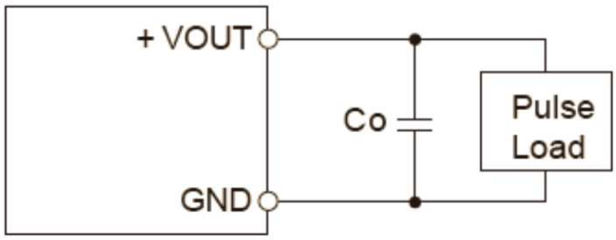


Table.3.3.1
Recommended
Co and MAX Co

No.	Model	Recommend Co	Maximum Co
1	BRFS30/40,BRDS40	3×100μF	10,000μF
2	BRFS50/50L	2×100μF	10,000μF
3	BRFS60,BRDS60	2×100μF	10,000μF
4	BRFS100,BRDS100	4×100μF	20,000μF

■ 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 Fig.3.3.2. Co1, Co2 and Co3 is shown in Table 3.3.2.

Fig.3.3.2
Measuring method of
Ripple and Ripple Noise

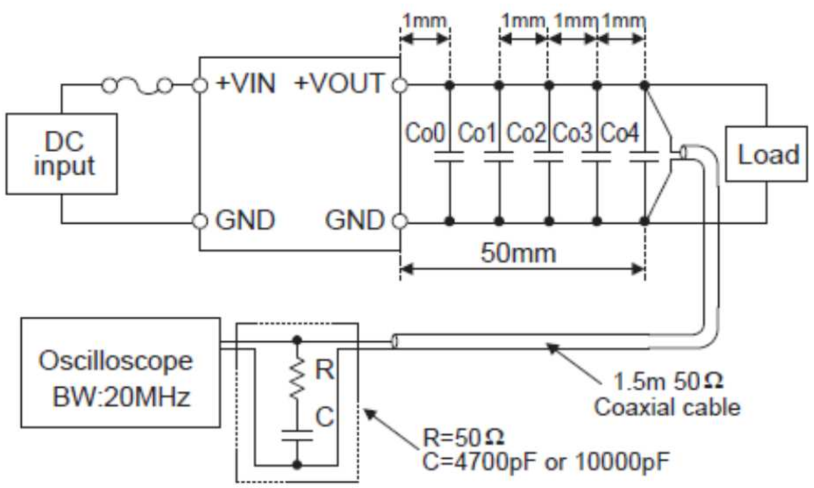
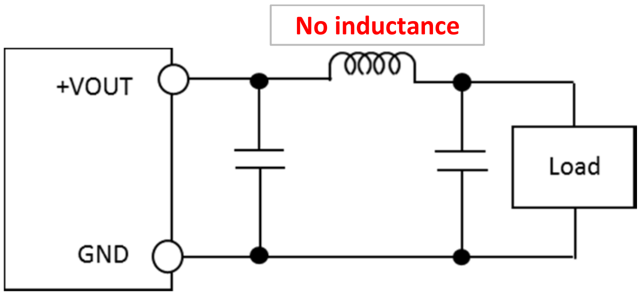


Table.3.3.2
Co1,Co2 and Co3
which is used in
measuring

No.	Model	Co0	Co1	Co2	Co3	Co4
1	BRFS30	–	–	100μF	100μF	100μF
2	BRFS40・BRDS40	100μF	–	100μF	100μF	100μF
3	BRFS50/50L/60・BRDS60	–	–	–	100μF	100μF
4	BRFS100・BRDS100	–	100μF	100μF	100μF	100μF

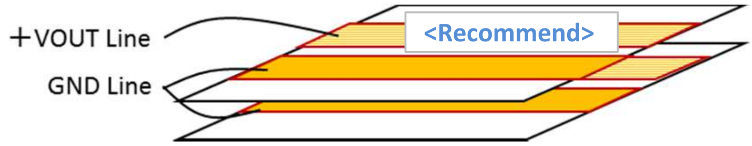
■ The inductance reduction of output line, it can reduce the fluctuation of the power supply output voltage.
■ Inductance must not be inserted
■ Lowering the inductance of the board pattern

Fig.3.3.3
Output pattern
Inductance



■ +VOUT and GND are adjacent to each other between the layers of the multilayer board.

Fig.3.3.4
Inductance reduction
of the multilayer board

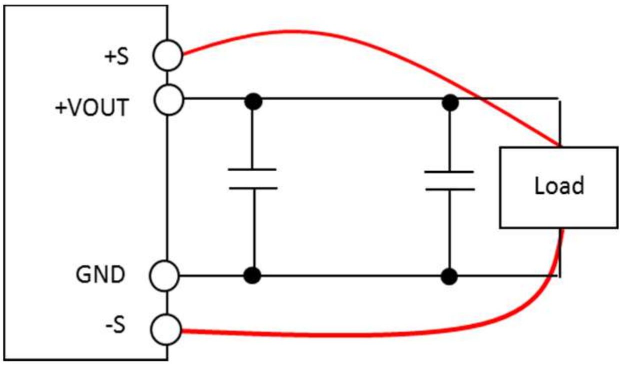


(a) Adjacent to the next layer

(b) Adjacent in the same layer

■ For the avoidance of unstable operation by the output pattern inductance, recommended remote sensing the nearby load

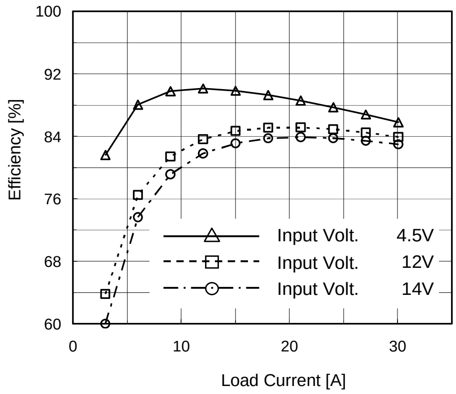
Fig.3.3.5
Remote sensing the
nearby load



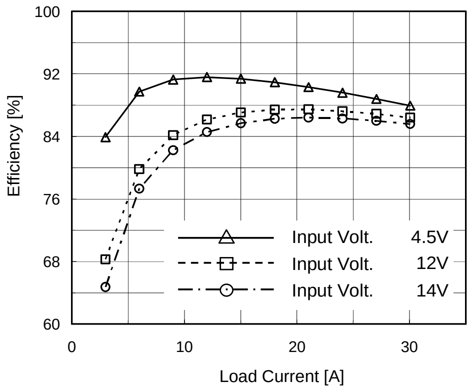
4. Overview

4.1 Efficiency

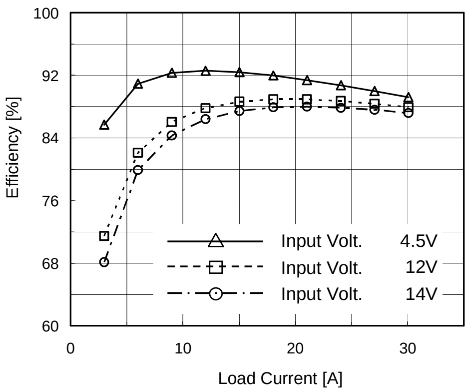
Fig 4.1.1
Efficiency
(BRFS30)
at 25℃



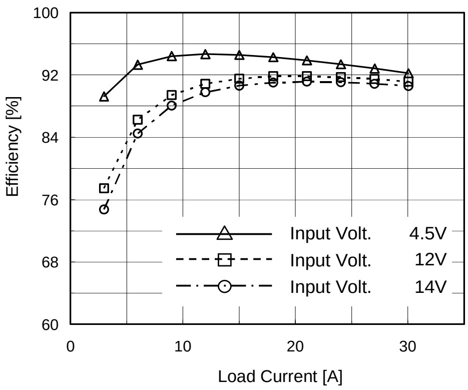
Vout = 0.8V



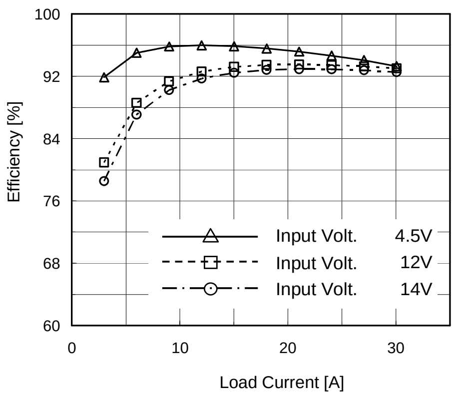
Vout = 1.0V



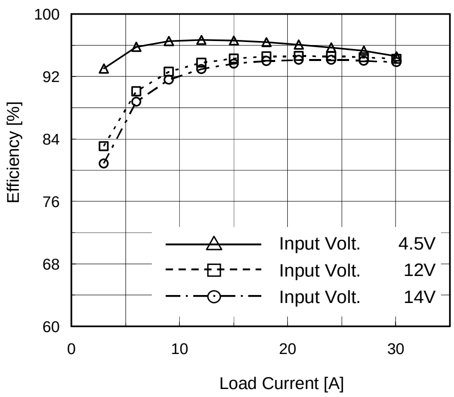
Vout = 1.2V



Vout = 1.8V

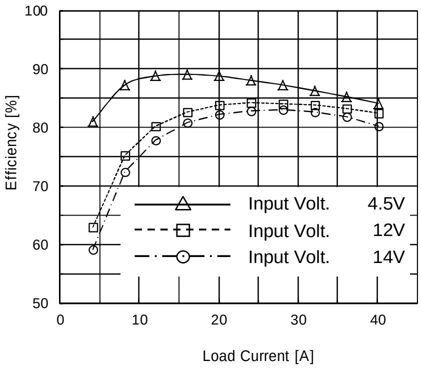


Vout = 2.5V

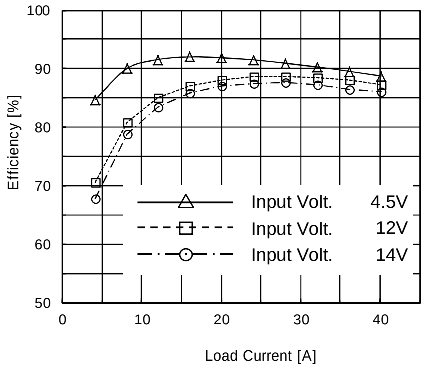


Vout = 3.3V

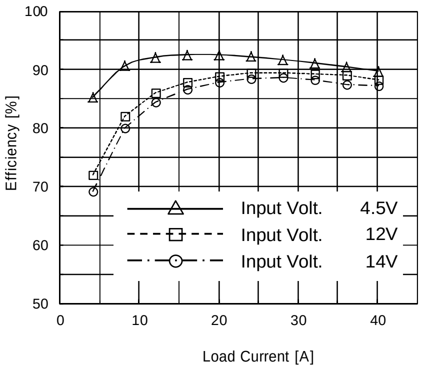
Fig 4.1.2
Efficiency
(BRFS40/BRDS40)
at 25℃



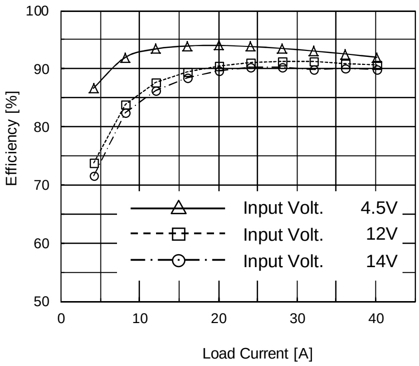
Vout = 0.6V



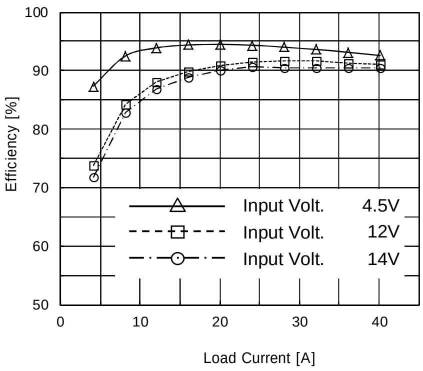
Vout = 1.0V



Vout = 1.2V

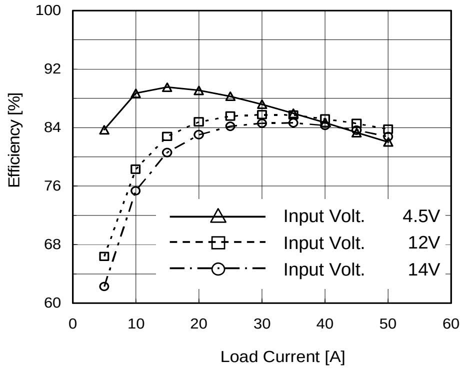


Vout = 1.8V

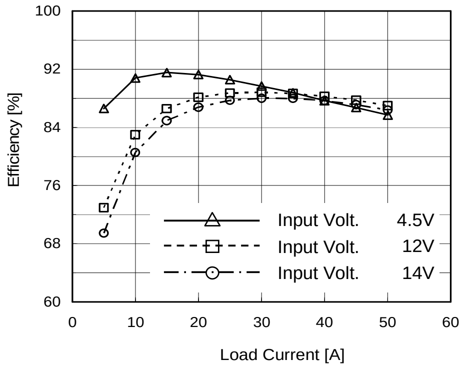


Vout = 2.0V

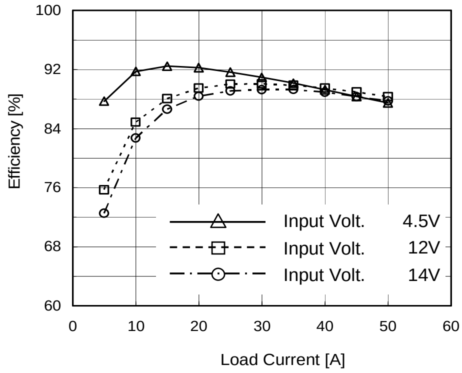
Fig 4.1.3
Efficiency
(BRFS50)
at 25℃



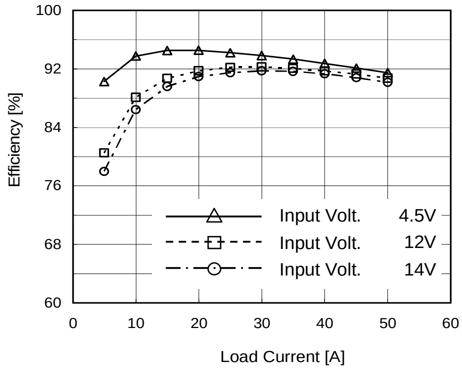
Vout = 0.7V



Vout = 1.0V

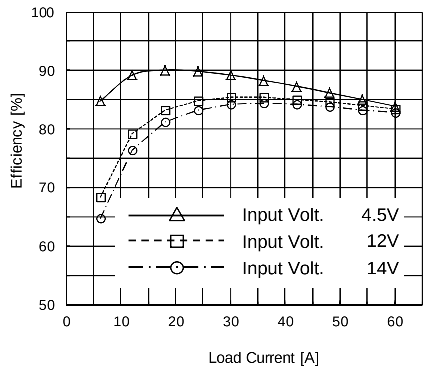


Vout = 1.2V

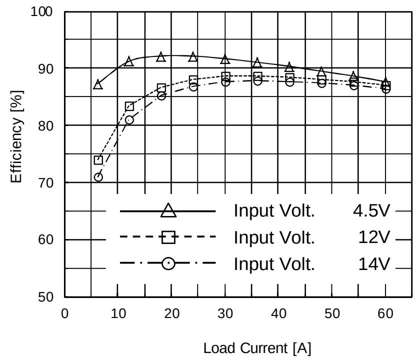


Vout = 1.8V

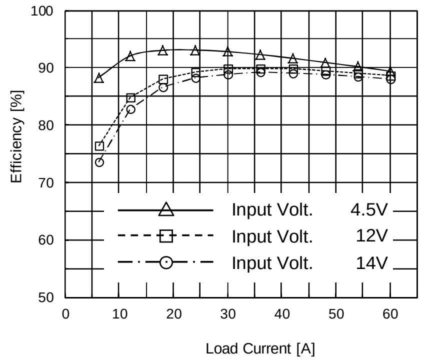
Fig 4.1.4
Efficiency
(BRFS60/BRDS60)
at 25℃



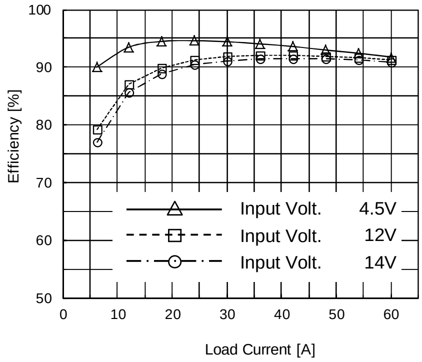
Vout = 0.7V



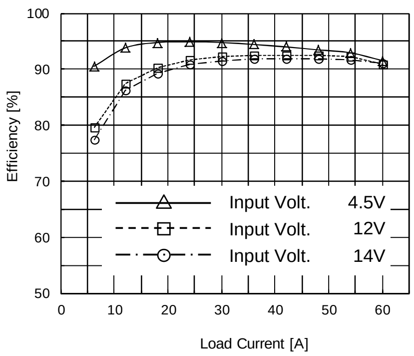
Vout = 1.0V



Vout = 1.2V

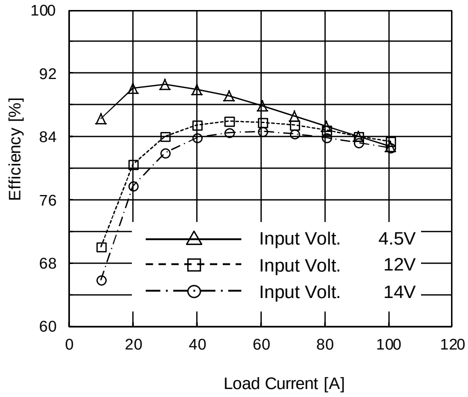


Vout = 1.8V

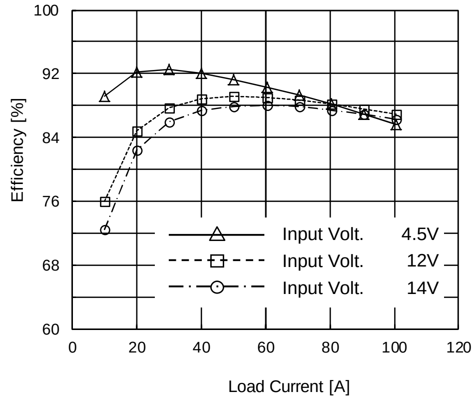


Vout = 2.0V

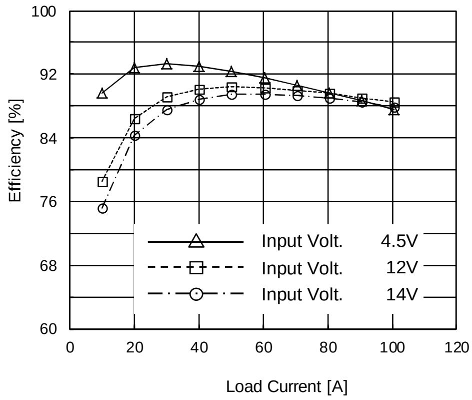
Fig 4.1.5
Efficiency
(BRFS100/BRDS100)
at 25℃



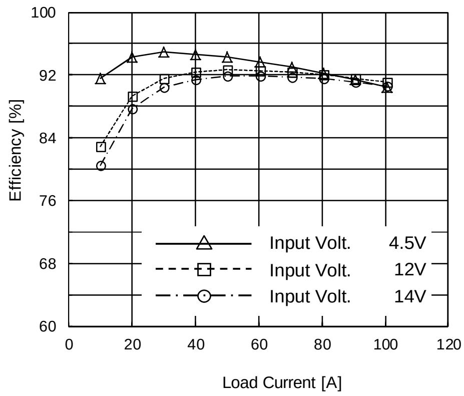
Vout = 0.7V



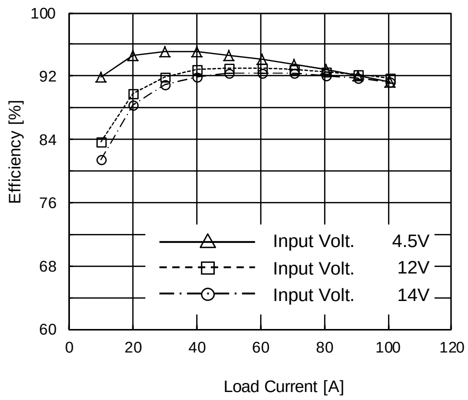
Vout = 1.0V



Vout = 1.2V



Vout = 1.8V



Vout = 2.0V

4.2 Dynamic Load Response

4.2.1 Wave Form

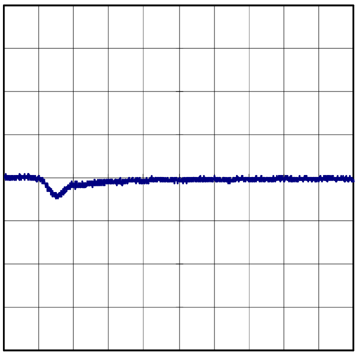
1)BRFS30

Vin 12V, Vout 1.2V, Cin 22μF×4, Cout 4000μF
Testing Circuitry Fig.4.2.3.1

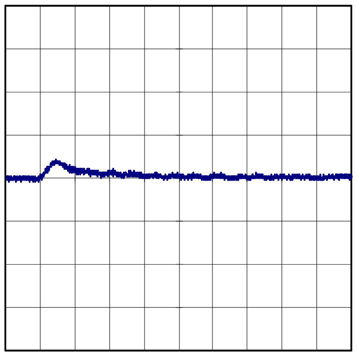
Fig.4.2.1.1
Dynamic Load
Response

Min. Load (0A) ←→
Load 50% (15A)

100 mV/div



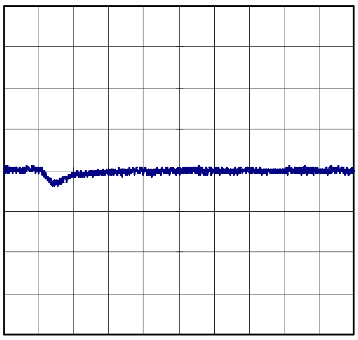
100 μs/div



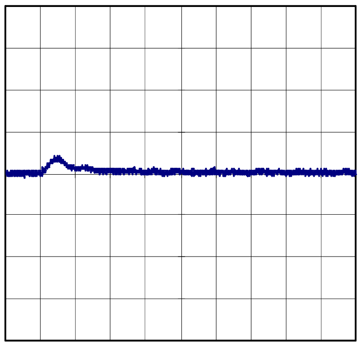
100 μs/div

Load50% (15A) ←→
Load 100% (30A)

100 mV/div



100 μs/div

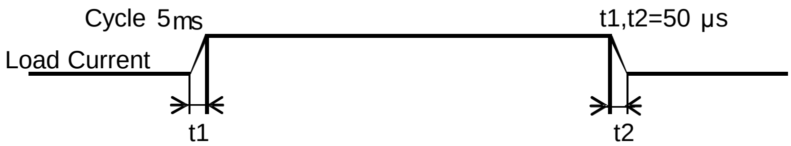


100 μs/div

2)BRFS40 , BRDS40

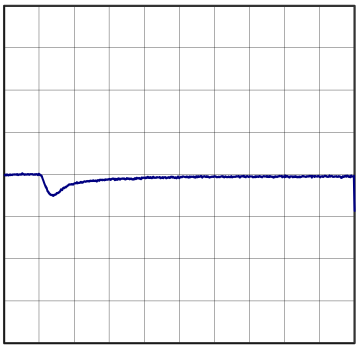
Vin 12V, Vout 1.2V Cin 22μF×4, Cout 4000μF
Testing Circuitry Fig 4.2.3.1

Fig 4.2.1.2
Dynamic Load
Response

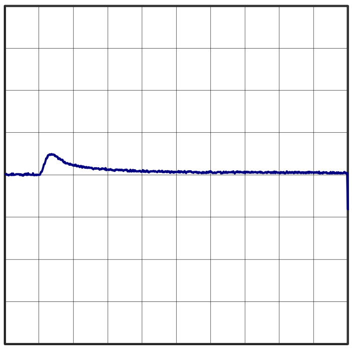


Min. Load(0A)←→
Load 50% (20A)

100 mV/div



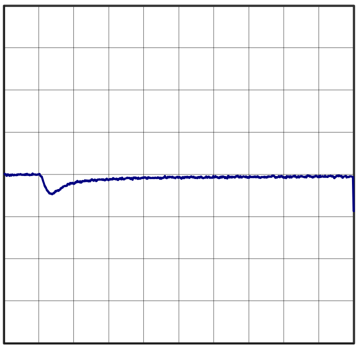
100 μs/div



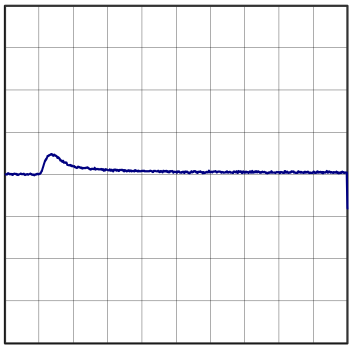
100 μs/div

Load 50% (20A) ←→
Load 100% (40A)

100 mV/div



100 μs/div

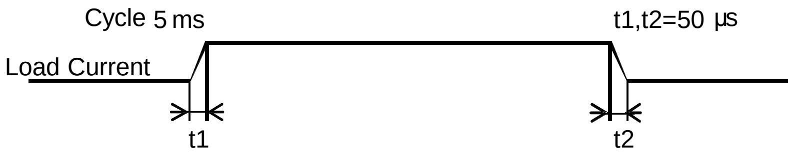


100 μs/div

3)BRFS50

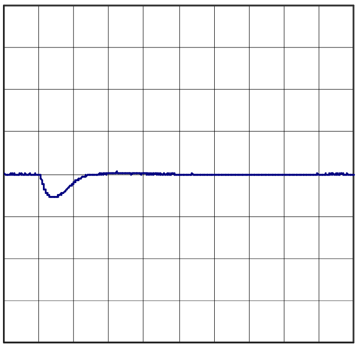
Vin 12V, Vout 1.2V, Cin 22μF×4, Cout 4000μF
Testing Circuitry Fig.4.2.3.1

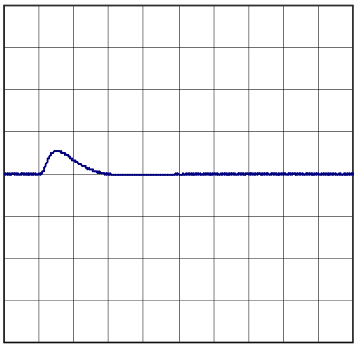
Fig.4.2.1.3
Dynamic Load
Response



Min. Load(0A)←→
Load 50% (25A)

100 mV/div



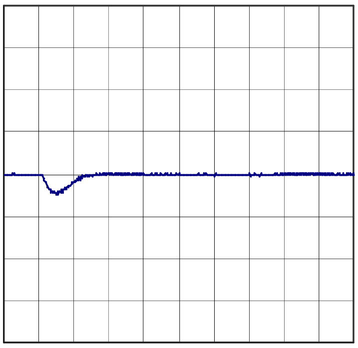


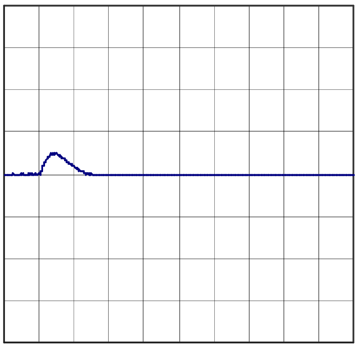
100 μs/div

100 μs/div

Load 50% (25A) ←→
Load 100% (50A)

100 mV/div





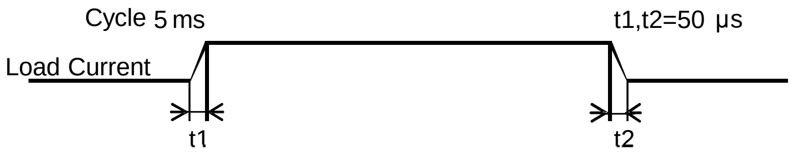
100 μs/div

100 μs/div

4) BRFS60,BRDS60

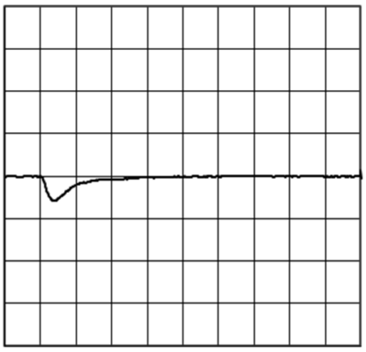
Vin 12V, Vout 1.2V, Cin 22μF×4, Cout 4000μF
Testing Circuitry Fig.4.2.3.1

Fig.4.2.1.4
Dynamic Load
Response

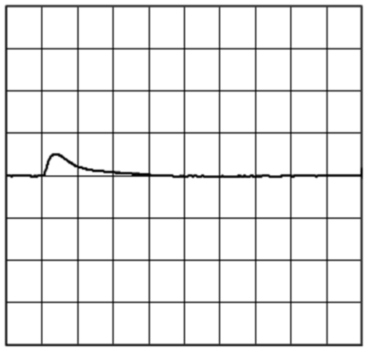


Min. Load(0A)←→
Load 50% (30A)

100 mV/div



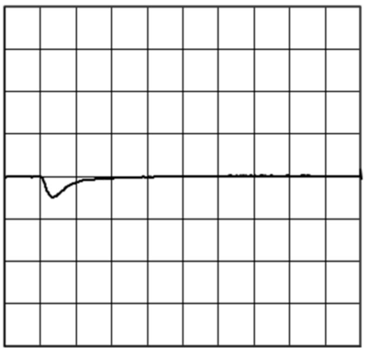
100 μs/div



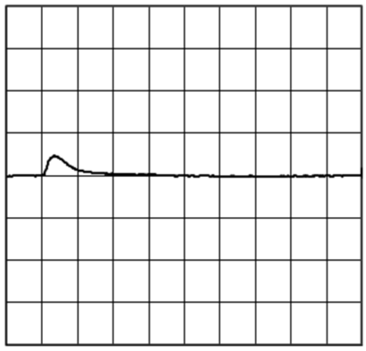
100 μs/div

Load 50% (30A) ←→
Load 100% (60A)

100 mV/div



100 μs/div

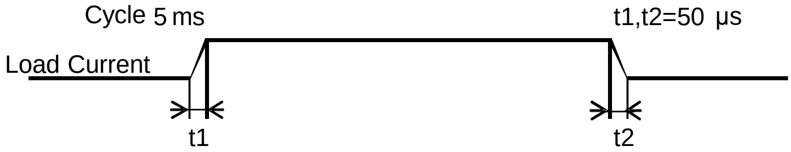


100 μs/div

5)BRFS100,BRDS100

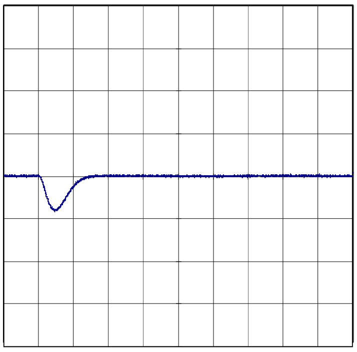
Vin 12V, Vout 1.2V, Cin 22μF×4, Cout 8000μF
Testing Circuitry Fig.4.2.3.1

Fig.4.2.1.5
Dynamic Load
Response

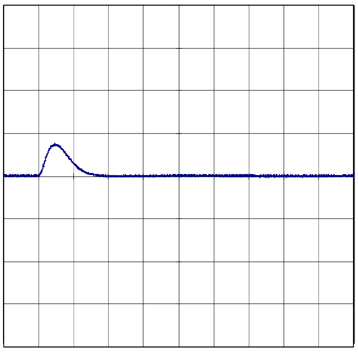


Min. Load(0A)←→
Load 50% (50A)

100 mV/div



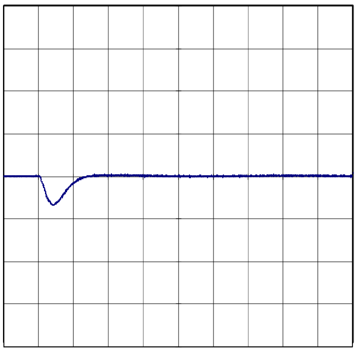
100 μs/div



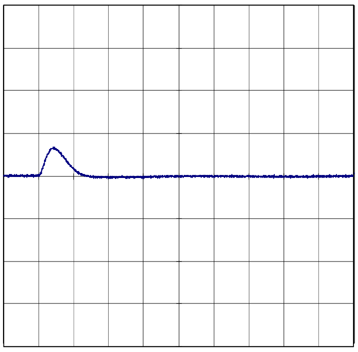
100 μs/div

Load 50% (50A)⟷
Load 100% (100A)

100 mV/div



100 μs/div



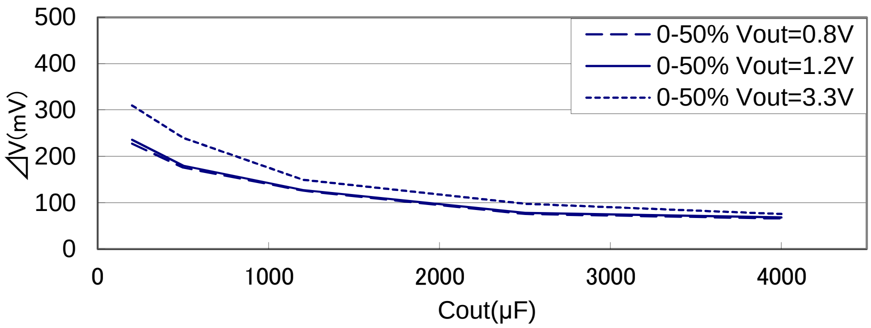
100 μs/div

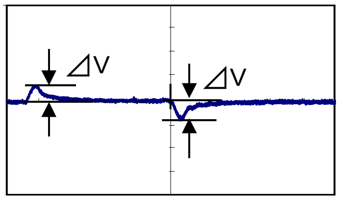
4.2.2 Capacitance - Dynamic Load Response characteristics

Vin 12V, Cin 22μF×4, SR 1A/μs, Testing Circuitry Fig.4.2.3.2

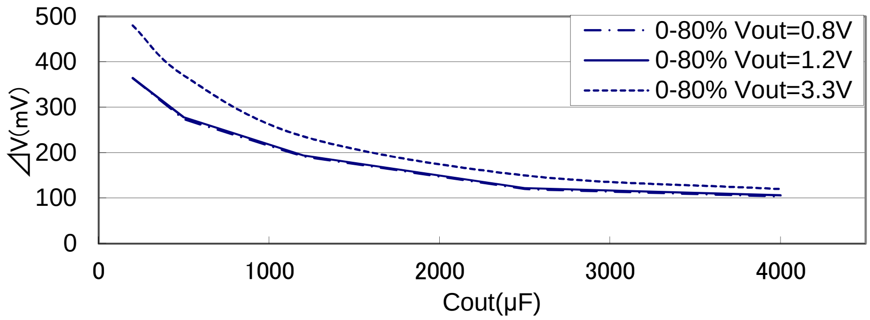
1)BRFS30

Fig.4.2.2.1
Capacitance - Dynamic Load Response characteristics (BRFS30)



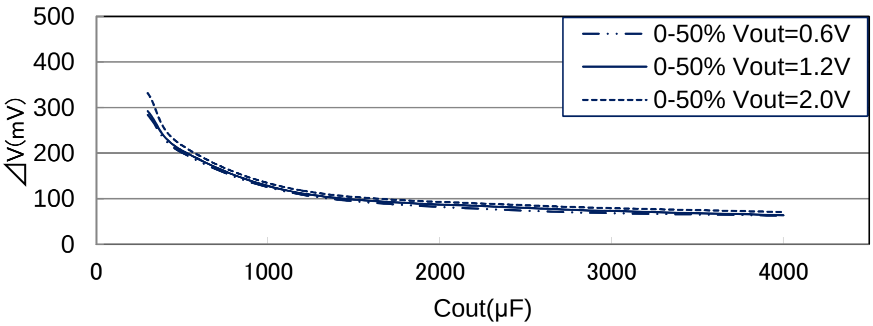


$\Delta V=\Delta V_A(\Delta V_A>\Delta V_B)$
or $\Delta V_B(\Delta V_A<\Delta V_B)$

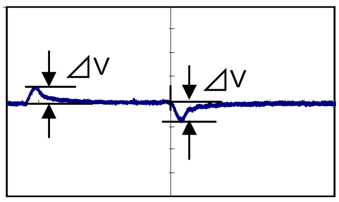


2)BRFS40,BRDS40

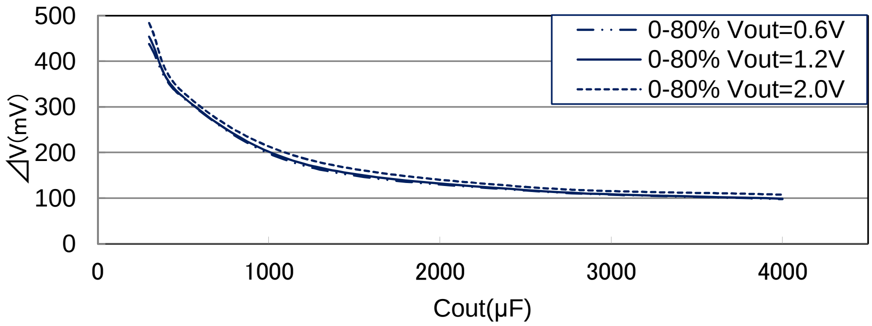
Fig 4.2.2.2
Capacitance - Dynamic Load Response characteristics (BRFS40,BRDS40)



.

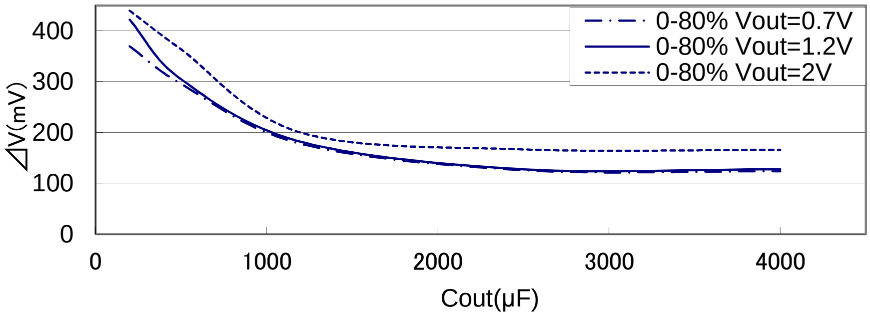


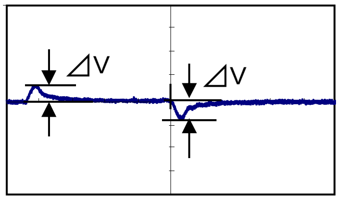
$\Delta V=\Delta V_A(\Delta V_A>\Delta V_B)$
or $\Delta V_B(\Delta V_A<\Delta V_B)$



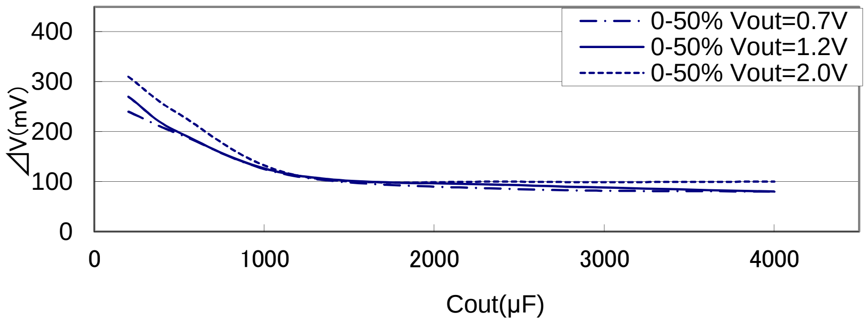
3)BRFS50

Fig 4.2.2.3
Capacitance - Dynamic Load Response characteristics (BRFS50)



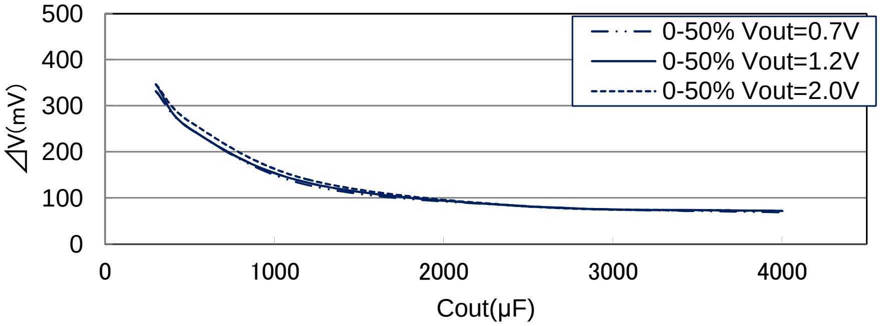


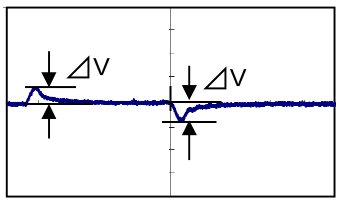
$\Delta V=\Delta V_A(\Delta V_A>\Delta V_B)$
or $\Delta V_B(\Delta V_A<\Delta V_B)$



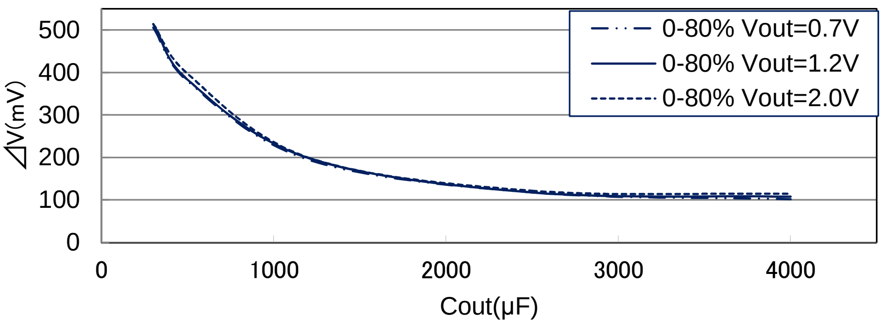
4)BRFS60/BRDS60

Fig 4.2.2.4
Capacitance - Dynamic Load Response characteristics (BRFS60/BRDS60)



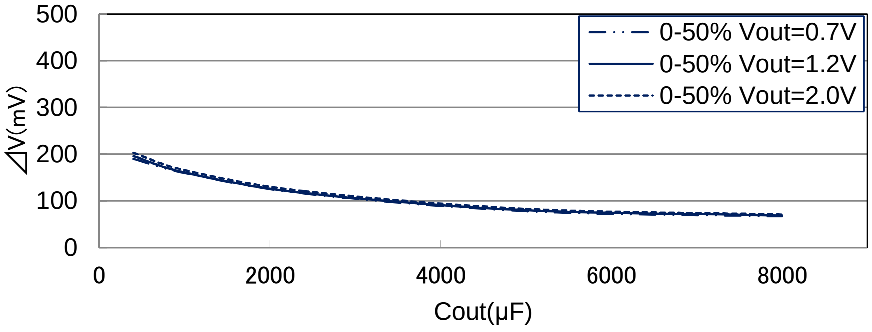


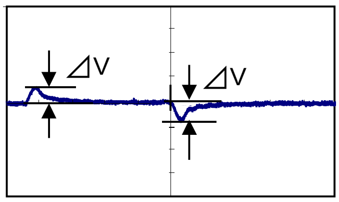
$\Delta V=\Delta V_A(\Delta V_A>\Delta V_B)$
or $\Delta V_B(\Delta V_A<\Delta V_B)$



5) BRFS100/BRDS100

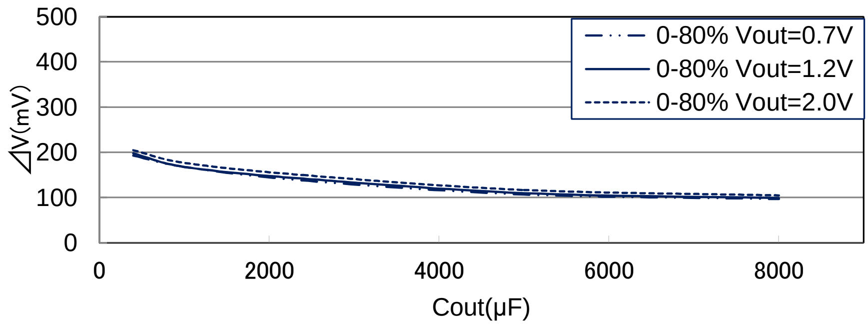
Fig 4.2.2.5
Capacitance - Dynamic Load Response characteristics (BRFS100/BRDS100)





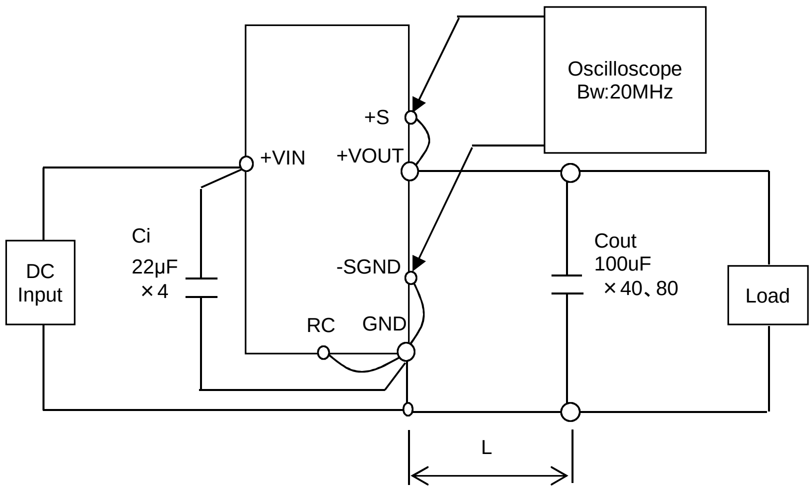
$\varDelta V = \varDelta V_A (\varDelta V_A > \varDelta V_B)$

or $\varDelta V_B (\varDelta V_A < \varDelta V_B)$



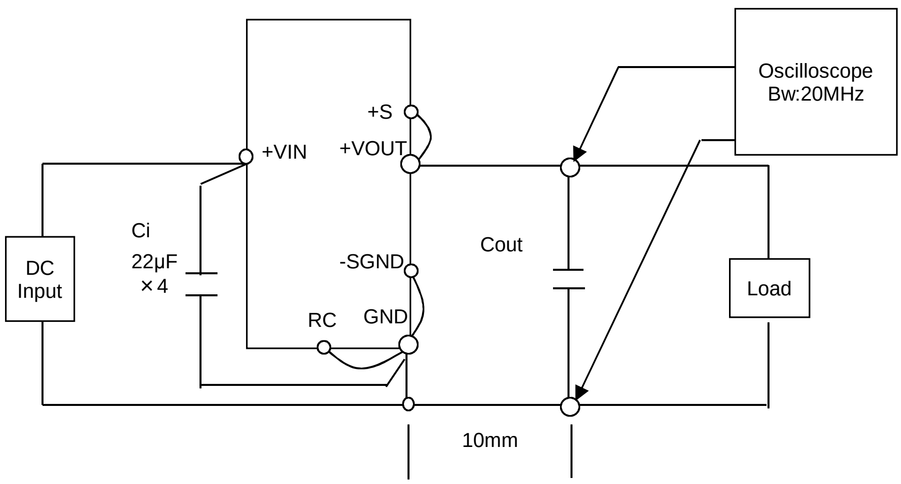
4.2.3 Figure

Fig.4.2.3.1
Measuring method
of Dynamic Load
Response



No.	Model	L	Cout
1	BRFS30	10mm	4,000μF
2	BRFS40/BRDS40	10mm	4,000μF
3	BRFS50	50mm	4,000μF
4	BRFS60/BRDS60	50mm	4,000μF
5	BRFS100/BRDS100	50mm	8,000μF

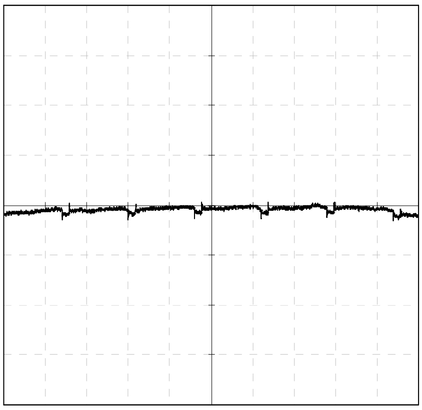
Fig.4.2.3.2
Measuring method
of Dynamic Load
Response



No.	Model	Cout
1	BRFS30	300uF ～ 4,000μF
2	BRFS40/BRDS40	300uF ～ 4,000μF
3	BRFS50	200uF ～ 4,000μF
4	BRFS60/BRDS60	200uF ～ 4,000μF
5	BRFS100/BRDS100	400uF ～ 8,000μF

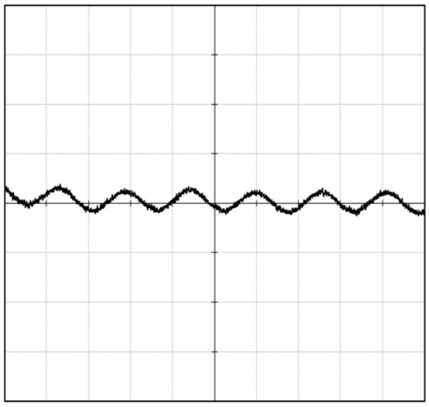
4.3 Ripple Voltage

Fig.4.3.1
Ripple Voltage
of BRFS/BRDS



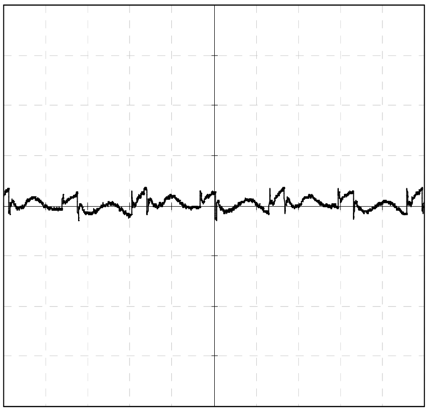
Vin 12V
Vout1.2V
Load Cuurent 30A
Cin 22μF×4
Cout 100μF×3
(Cout=Co2,Co3,Co4)

(a) BRFS30



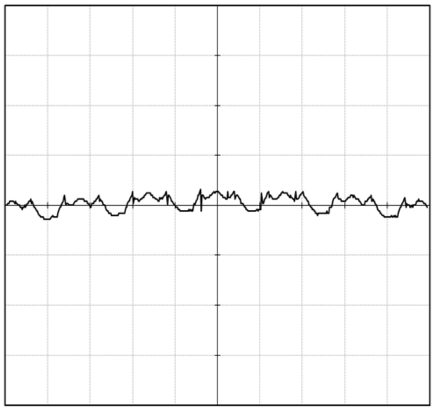
Vin 12V
Vout1.2V
Load Cuurent 40A
Cin 22μF×4
Cout 100μF×4
(Cout=Co0,Co2,Co3,Co4)

(b) BRFS40/BRDS40



Vin 12V
Vout1.2V
Load Cuurent 50A
Cin 22μF×4
Cout 100μF×2
(Cout=Co3,Co4)

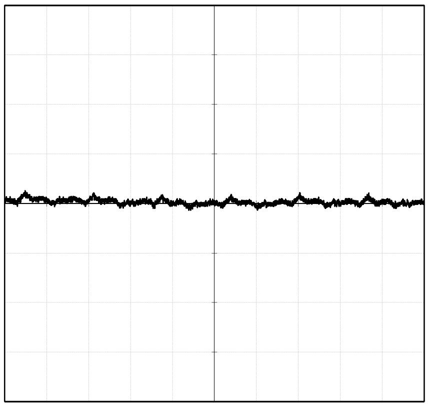
(c) BRFS50



Vin 12V
Vout1.2V
Load Cuurent 60A
Cin 22μF×4
Cout 100μF×2
(Cout=Co3,Co4)

(d) BRFS60/BRDS60

10 mV/div

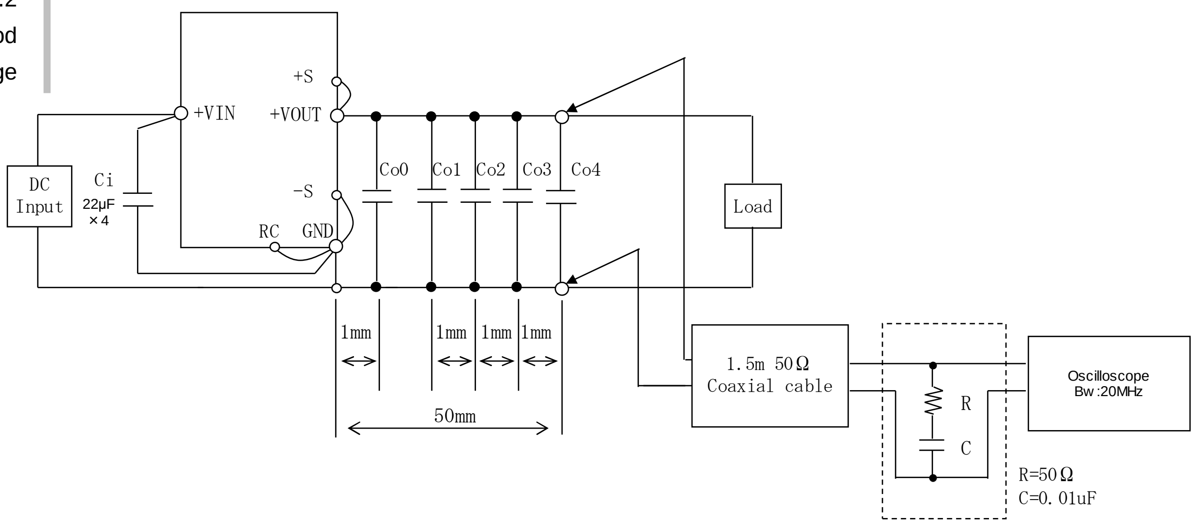


Vin 12V
Vout1.2V
Load Cuurent 100A
Cin 22μF×4
Cout 100μF×4
(Cout=Co1,Co2,Co3,Co4)

2 μs/div

(e) BRFS100/BRDS100

Fig.4.3.2
Measuring method
of Ripple Voltage



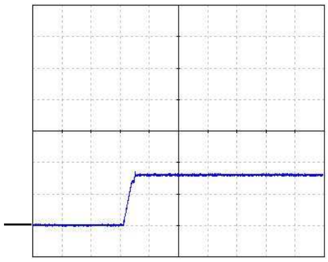
No.	Model	Co0	Co1	Co2	Co3	Co4
1	BRFS30	–	–	100μF	100μF	100μF
2	BRFS40,BRDS40	100μF	–	100μF	100μF	100μF
3	BRFS50/50L/60,BRDS60	–	–	–	100μF	100μF
4	BRFS100,BRDS100	–	100μF	100μF	100μF	100μF

4.4 Rise time

Vin : 12V , Load current:0A , Cin:22uFx4

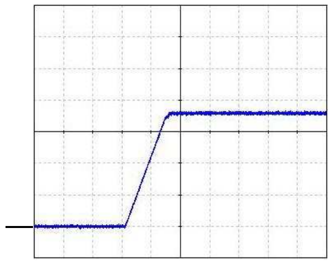
Fig. 4.4.1
BRFS30
Cout:300uF

500mV/div



5ms/div
Rise time: 1.0ms
(a) Vout : 0.8V

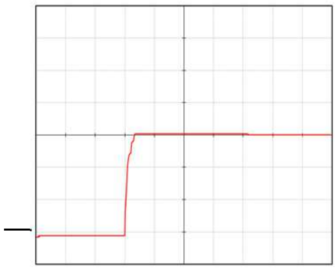
1V/div



5ms/div
Rise time: 5.5ms
(b) Vout : 3.63V

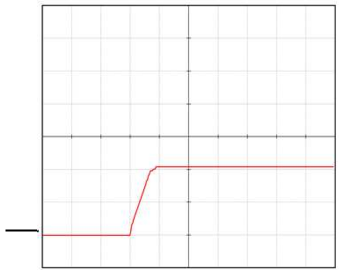
Fig. 4.4.2
BRFS40,BRDS40
Cout:300uF

200mV/div



5ms/div
Rise time: 1.0ms
(a) Vout : 0.6V

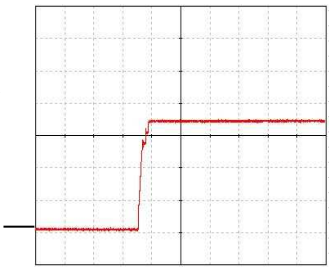
1V/div



5ms/div
Rise time: 3.0ms
(b) Vout : 2.0V

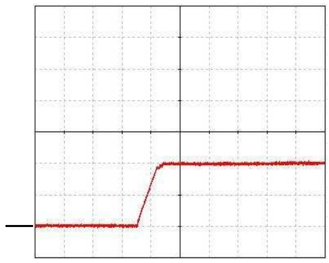
Fig. 4.4.3
BRFS50
Cout:200uF

200mV/div



5ms/div
Rise time: 1.0ms
(a) Vout : 0.7V

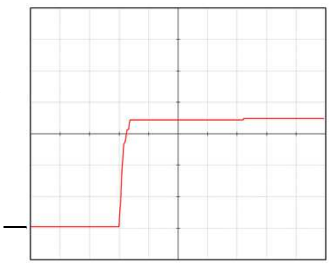
1V/div



5ms/div
Rise time: 3.0ms
(b) Vout : 2.0V

Fig. 4.4.4
BRFS60,BRDS60
Cout:200uF

200mV/div

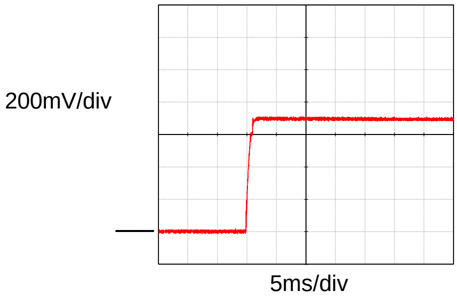


5ms/div
Rise time: 1.0ms
(a) Vout : 0.7V

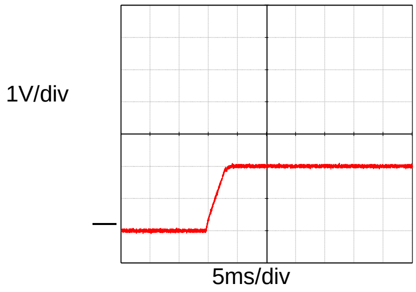
1V/div

5ms/div
Rise time: 3.0ms
(b) Vout : 2.0V

Fig. 4.4.5
BRFS100,BRDS100
Cout:400uF



Rise time: 1.0ms
(a) Vout : 0.7V



Rise time: 3.0ms
(b) Vout : 2.0V

4.5 Derating

■ Make sure the temperatures measurement locations shown from Fig.4.5.2 and Fig.4.5.3 below are on or under the derating curve in Fig.4.5.1.
Ambient temperature must be kept at 85℃ or under.

Fig.4.5.1
Derating curve
for BRFS

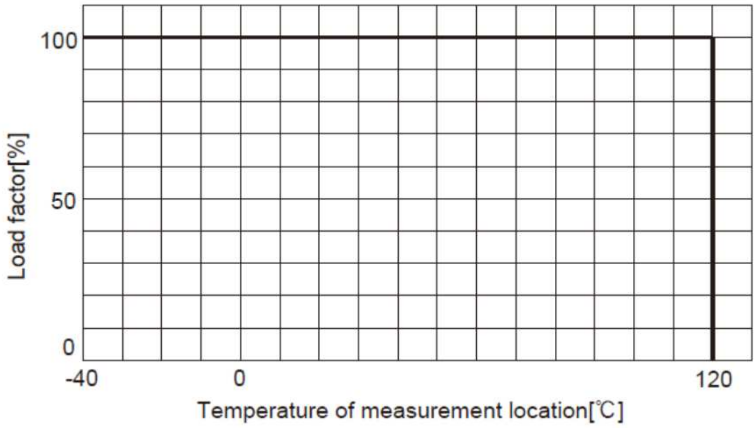
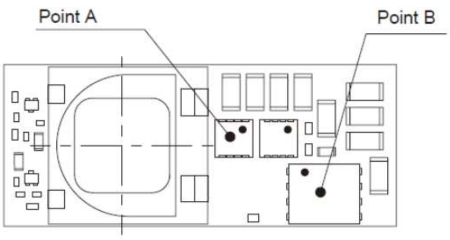
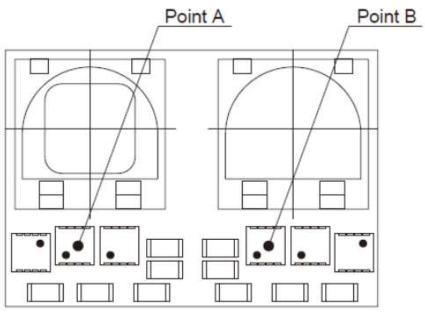


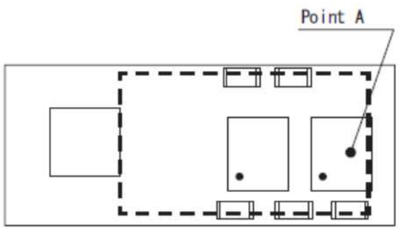
Fig.4.5.2
Temperature
measurement
location



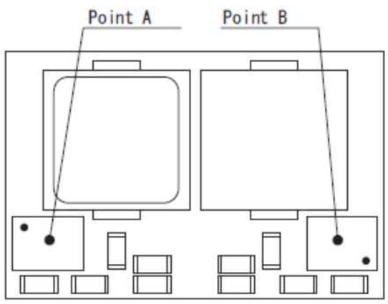
(a) BRFS30



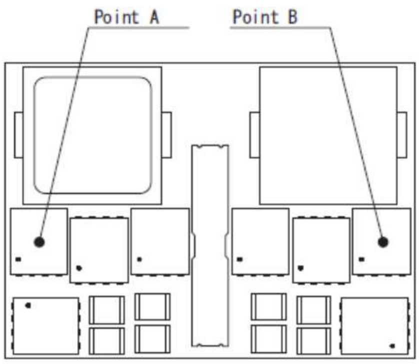
(b) BRFS50



(c) BRFS40/BRDS40



(c) BRFS60/BRDS60



(c) BRFS100/BRDS100

■ Fig.4.5.5 ~ 4.5.10 show the derating curve in the condition that is measured as shown in Fig.4.5.4.
Verify final design by actual temperature measurement.
The temperature measurement location as shown in Fig.4.5.2 and Fig.4.5.3 must keep below 120℃.

Fig.4.5.4
Measuring method

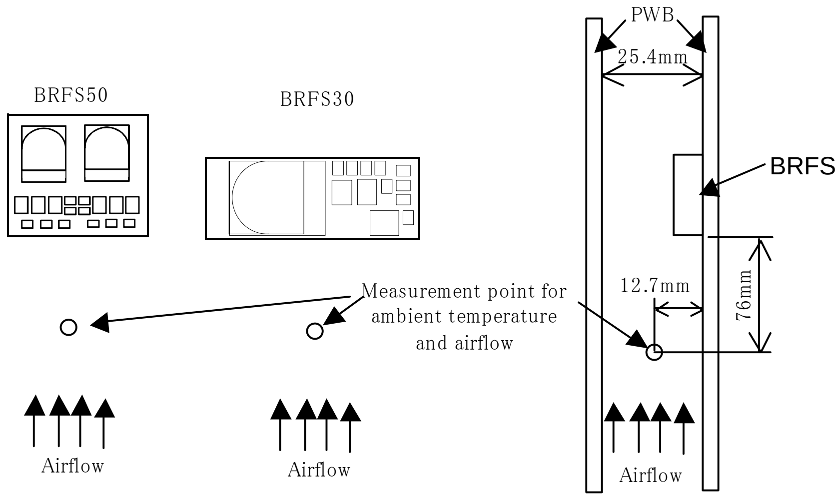


Fig.4.5.5
Derating curve
for BRFS30
at 12Vin 0.8Vout

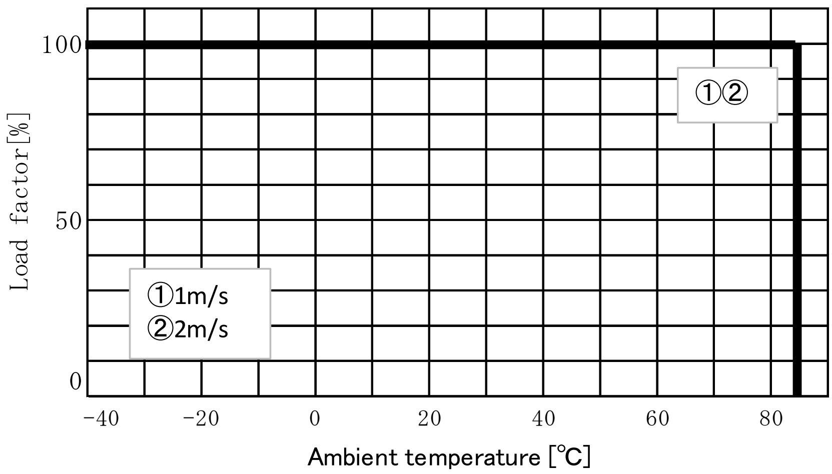


Fig.4.5.6
Derating curve
for BRFS30
at 12Vin 1.2Vout

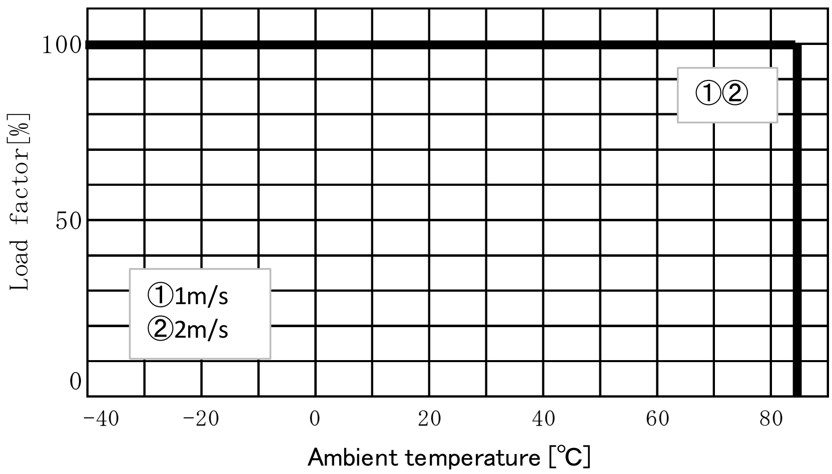


Fig.4.5.7
Derating curve
for BRFS30
at 12Vin 3.3Vout

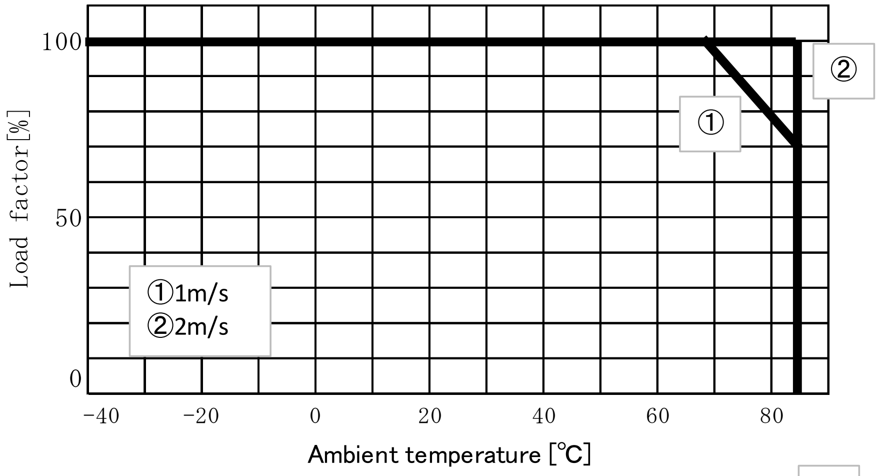


Fig.4.5.8
Derating curve
for BRFS50
at 12Vin 0.7Vout

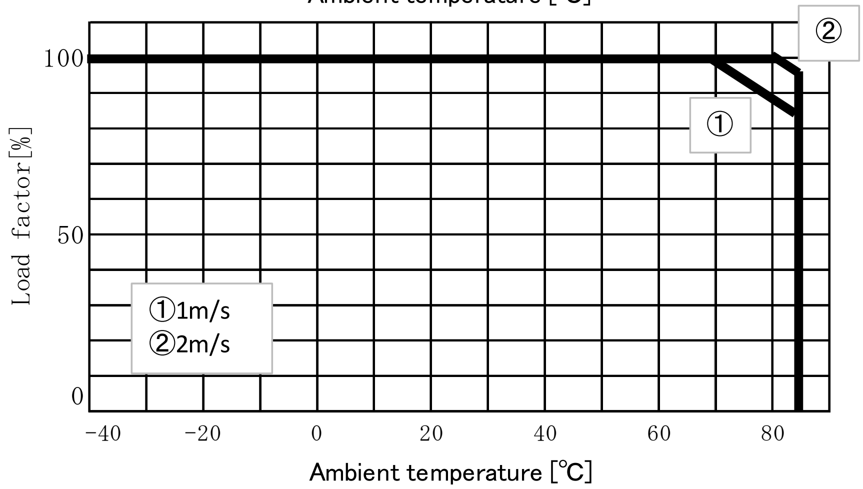


Fig.4.5.9
Derating curve
for BRFS50
at 12Vin 1.2Vout

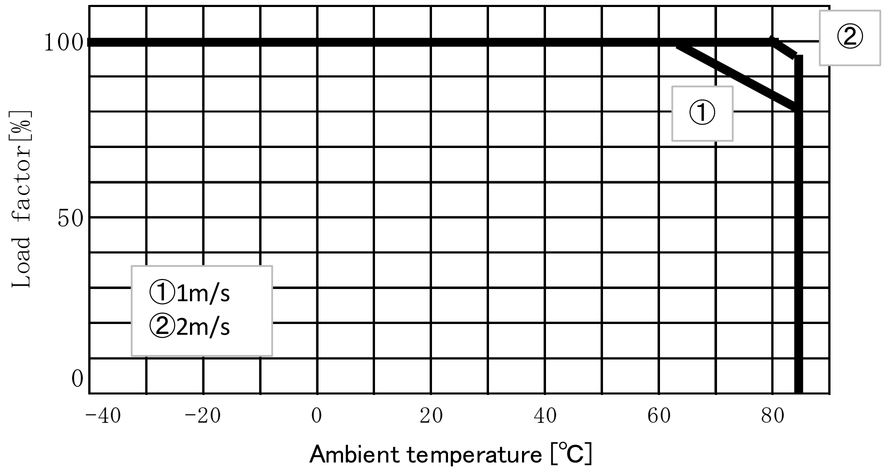


Fig.4.5.10
Derating curve
for BRFS50
at 12Vin 2.0Vout

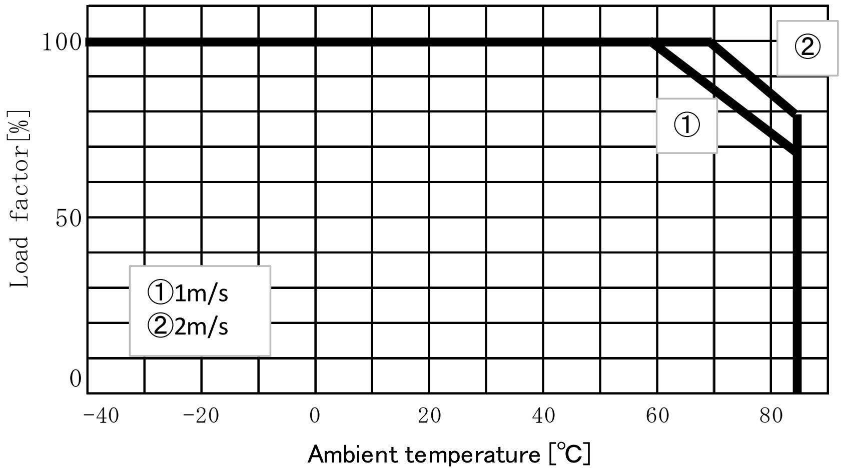


Fig.4.5.8
Derating curve
for BRFS40/BRDS40
at 12Vin 0.7Vout

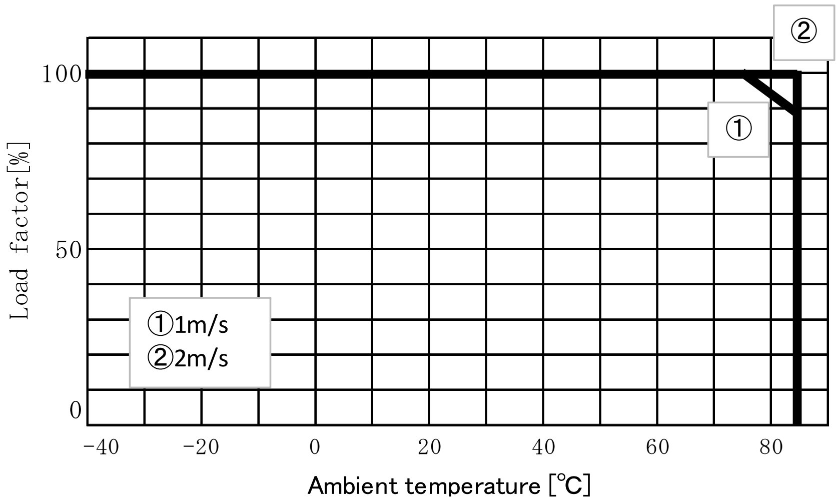


Fig.4.5.9
Derating curve
for BRFS40/BRDS40
at 12Vin 1.2Vout

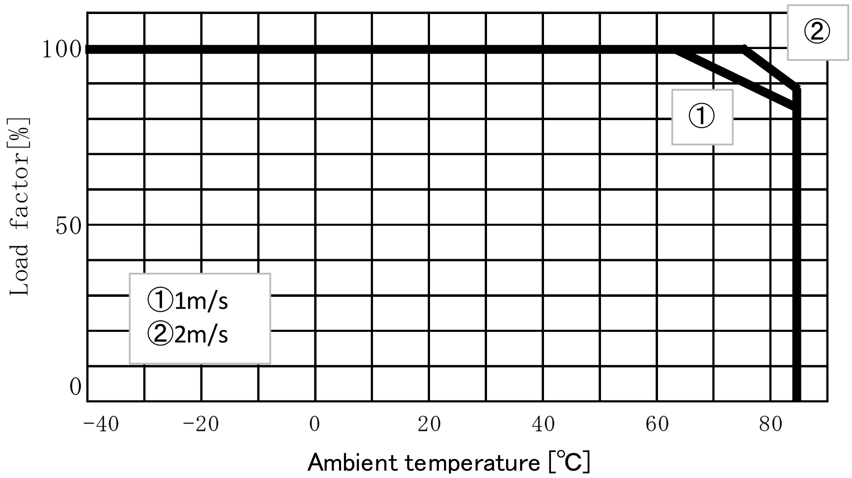


Fig.4.5.10
Derating curve
for BRFS40/BRDS40
at 12Vin 2.0Vout

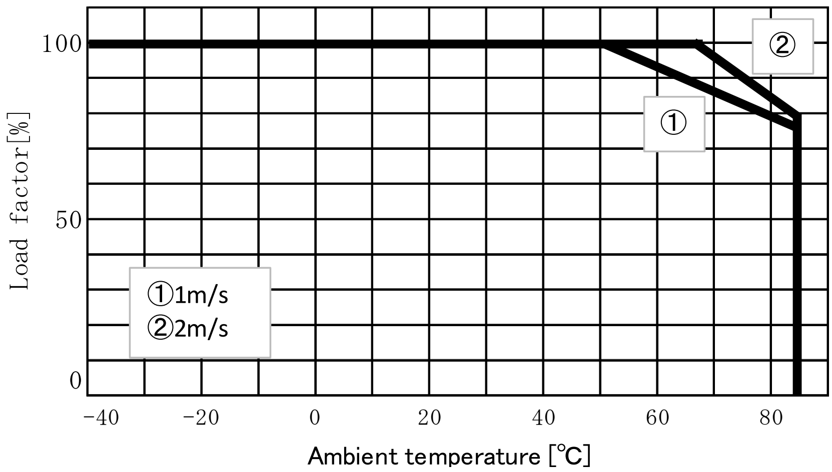


Fig.4.5.8
Derating curve
for BRFS60/BRDS60
at 12Vin 0.7Vout

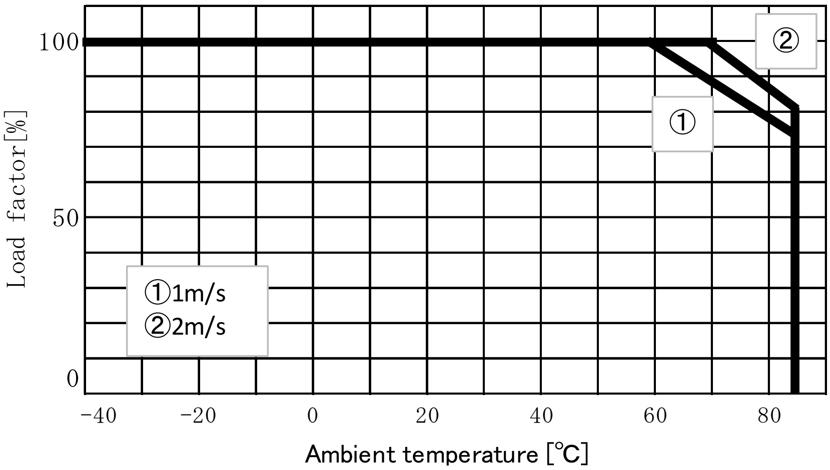


Fig.4.5.9
Derating curve
for BRFS60/BRDS60
at 12Vin 1.2Vout

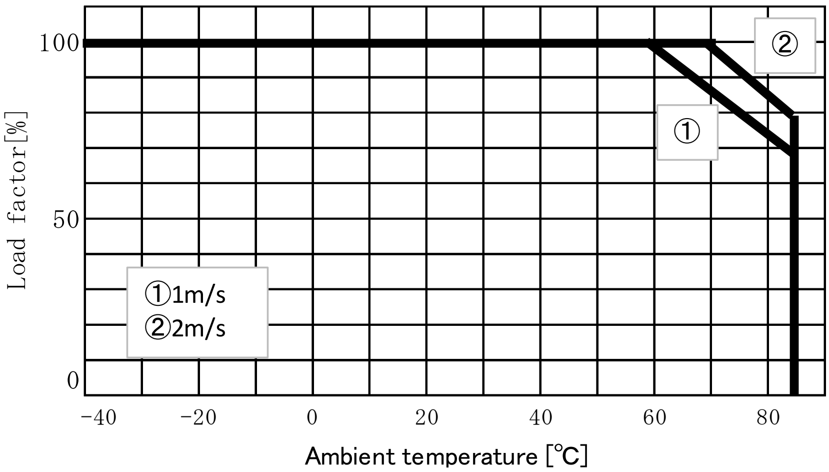


Fig.4.5.10
Derating curve
for BRFS60/BRDS60
at 12Vin 2.0Vout

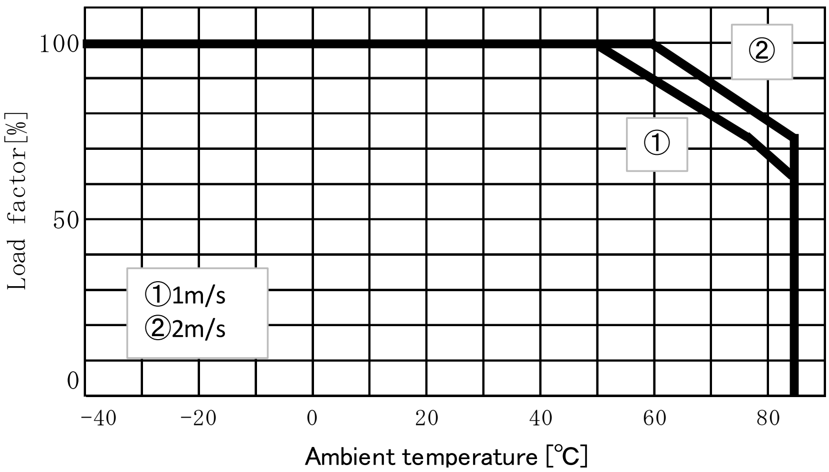


Fig.4.5.8
Derating curve
for BRFS100/BRDS100
at 12Vin 0.7Vout

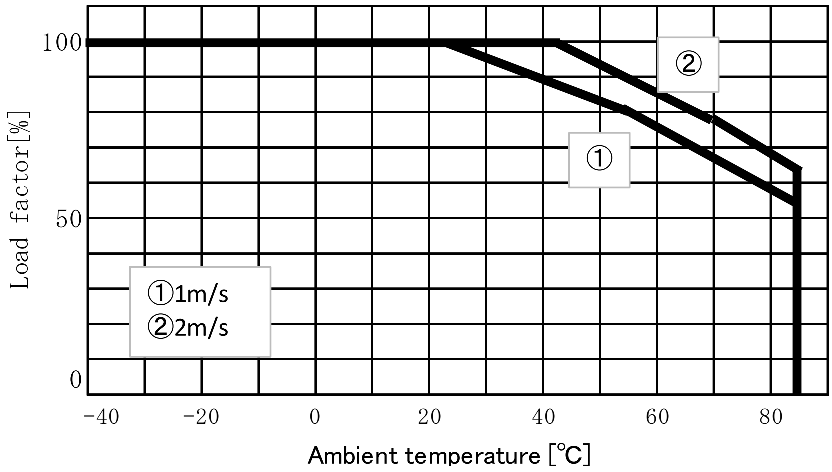


Fig.4.5.9
Derating curve
for BRFS100/BRDS100
at 12Vin 1.2Vout

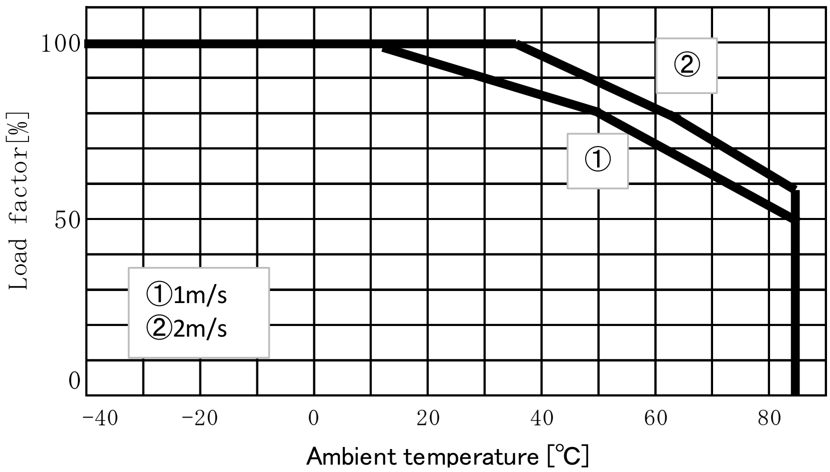
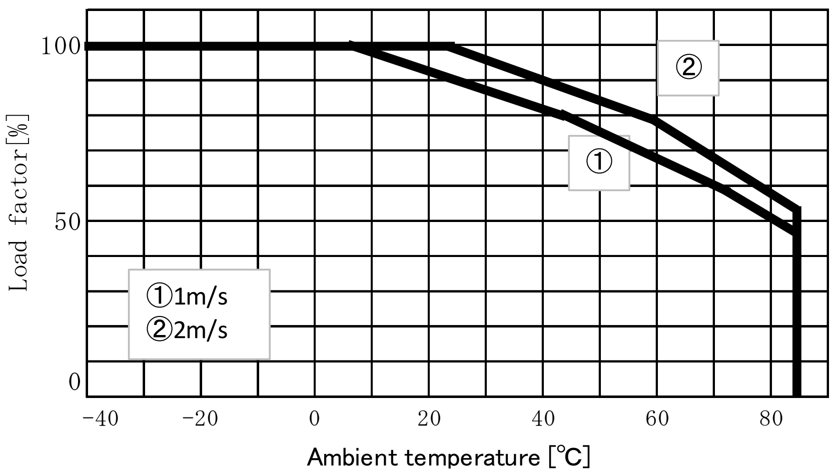


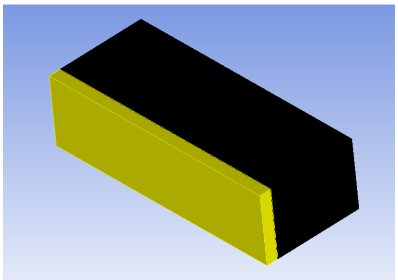
Fig.4.5.10
Derating curve
for BRFS100/BRDS100
at 12Vin 2.0Vout



4.6 Thermal simulation model

■ We offers a thermal simulation model that can be used for thermal design.
It shows the simulation model and the simulation example of BRFS30 and BRFS50 below.
These model will enable thermal design on simulation using ANSYS icepack.
Please contact our customer support for more information or request of the simulation model.

Fig.4.6.1
Thermal simulation model


(a) BRFS30 model

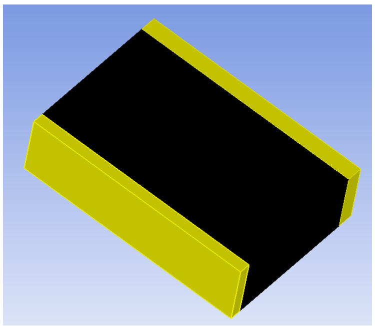
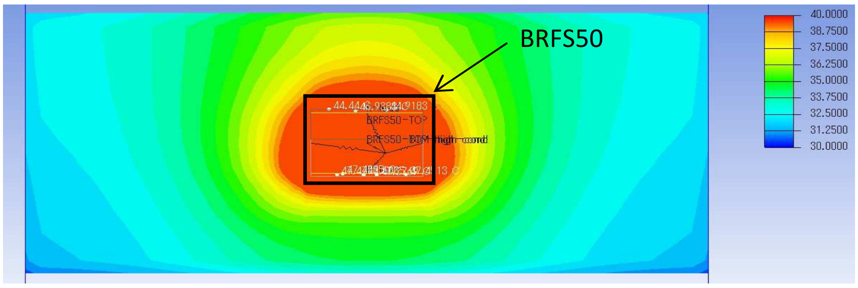
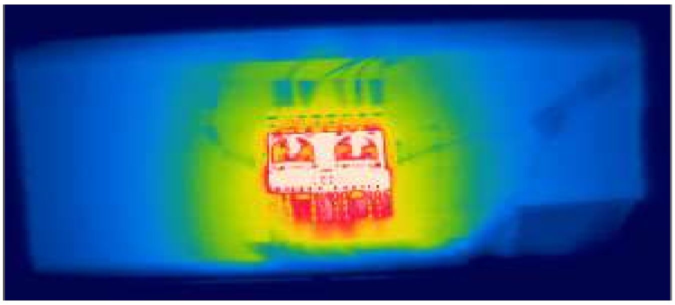

(b) BRFS50 model

Fig.4.6.2
Simulation example (BRFS50)



(a) Simulation(BRFS50)


(b) Actual measurement(BRFS50)

5. Adjustable voltage range

- Output voltage is adjustable by the external resistor.
- The temperature coefficient 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 the minimum.
- R_{TRM} is calculated in the following expressions.

$$R_{TRM} = \frac{8}{VOUT - 0.8}[k\Omega]$$

(a)BRFS30

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

(b)BRFS40/BRDS40

$$R_{TRM} = \frac{14}{VOUT - 0.7}[k\Omega]$$

(c)Other models

Table.5.1.1
Calculation result

(a)BRFS30

No	VOUT	RTRM
1	0.8	OPEN
2	1.0	40.0kΩ
3	1.2	20.0kΩ
4	1.5	11.429kΩ
5	1.8	8.0kΩ
6	2.5	4.706kΩ
7	3.3	3.2kΩ

(b)BRFS40/BRDS40

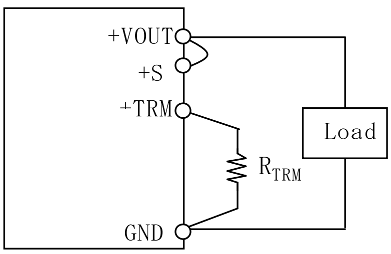
No	VOUT	RTRM
1	0.6	OPEN
2	1.0	30.0kΩ
3	1.2	20.0kΩ
4	1.5	13.3kΩ
5	1.8	10.0kΩ

(c)Other models

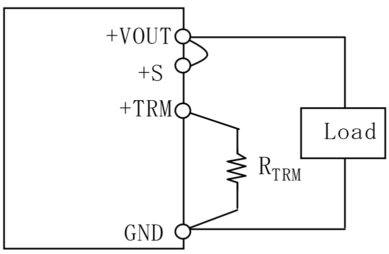
No	VOUT	RTRM
1	0.7	OPEN
2	1.0	46.6kΩ
3	1.2	28kΩ
4	1.5	17.5kΩ
5	1.8	12.7kΩ

Fig.5.1.1
Connecting

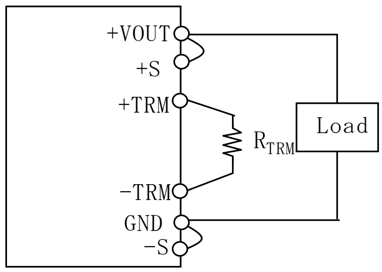
(a)BRFS30



(b)BRFS40/BRDS40



(c)Other models



6. Protect circuit

6.1 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(1.2sec typ).

6.2 Thermal protection

- When the power supply temperature is kept above 120℃, the thermal protection will be activated and simultaneously shut down the output.
  The output voltage of the power supply will recover automatically when the unit is cool down.

7. Remote ON/OFF

- The remote ON/OFF function is incorporate in the input circuitry and operated with RC and -Vin. If positive logic control is required , order the power supply with "-R" option.
- When remote on/off function is not used, please short GND and RC.

Table 7.1.1 Specification of Remote ON/OFF

	ON/OFF logic	Between RC and GND	Output voltage
Standard	Negative	L level(-0.2 - 0.6V) or short	ON
		H level(3.0 - VIN) or open	OFF
Optional "-R"	Positive	L level(-0.2 - 0.6V) or short	OFF
		H level(3.0 - VIN) or open	ON

*Source current from RC pin is 0.5mA(max).

Fig. 7.1.1 Internal circuitrys of Remote ON/OFF

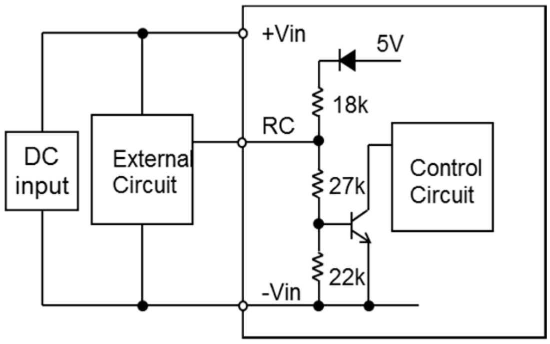
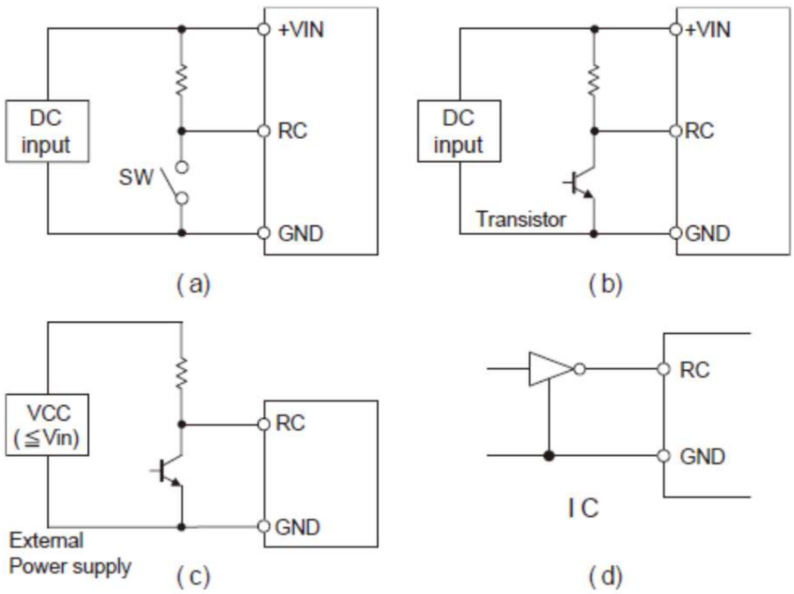


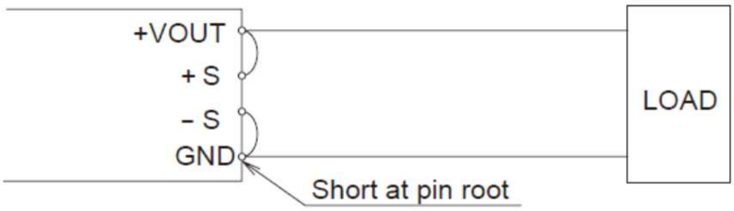
Fig. 7.1.2 RC connection example



8. Remote sensing

8.1 When the remote sensing function is not in use

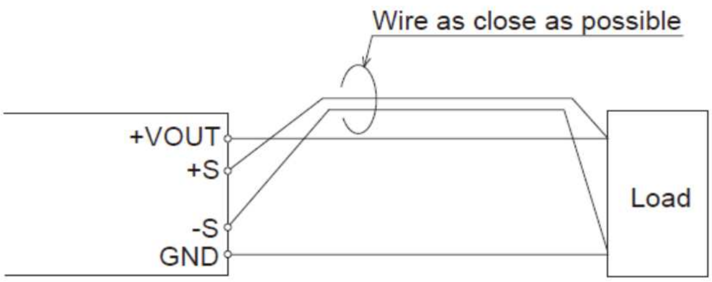
Fig. 8.1.1
Connection
when the remote
sensing is not in use



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

8.2 When the remote sensing function is in use

Fig. 8.2.1
Connection
when the remote
sensing is in use

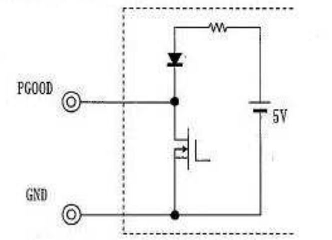


- Twisted-pair wire or shield wire should be used for sensing wire.
- Thick wire should be used for wiring between the power supply and a load.
  Line drop should be less than 0.5V.
  Voltage between +VOUT and GND should remain within the output voltage adjustment range.
- If the sensing patterns are 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.

9.Power Good

- Power Good is built-in, internal circuitry as shown in Fig.9.1.1.
- Power Good pin becomes low state(0.3V max), when output becomes condition such as overcurrent or output voltage ±12.5%(Typ) outside the set point value.
- The sink current of Power Good pin is 10mA max.

Fig. 9.1.1
Internal circuitry of
PGOOD



- When the input voltage is less than the start-up voltage, Power Good pin voltage is undefinec
- The voltage of Power Good is shown in Fig.9.1.2.
- Power Good cannot be used in the area of undefined.

Fig. 9.1.2
Voltage of
PGOOD

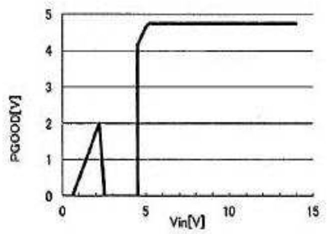
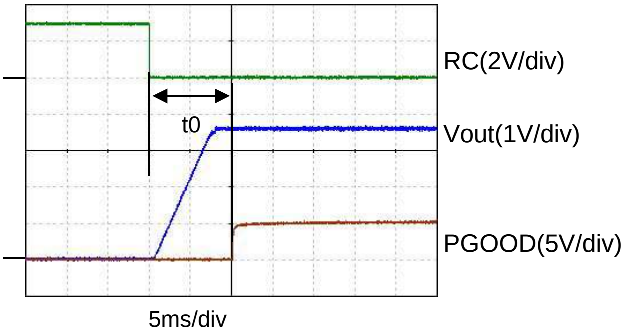


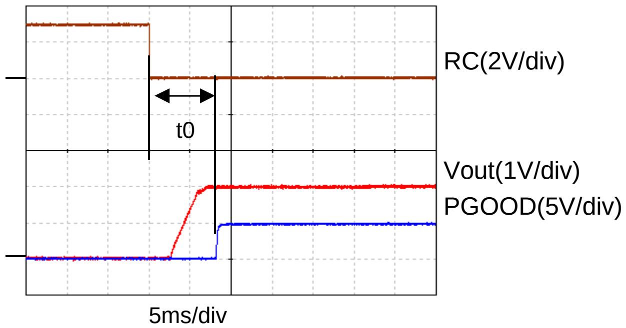
Fig.9.1.3
BRFS30-I
PGOOD



Vin:12V
Vout:3.63V
load current:0A
Cin:22uFx4
Cout : 300uF

t0: 12ms(Max)

Fig.9.1.4
BRFS50
PGOOD



Vin:12V
Vout:2.0V
load current:0A
Cin:22uFx4
Cout : 200uF

t0: 9ms(Max)

10. Series operation / Parallel operation

10.1 Series operation

■ Series operation is not possible.

10.2 Parallel operation

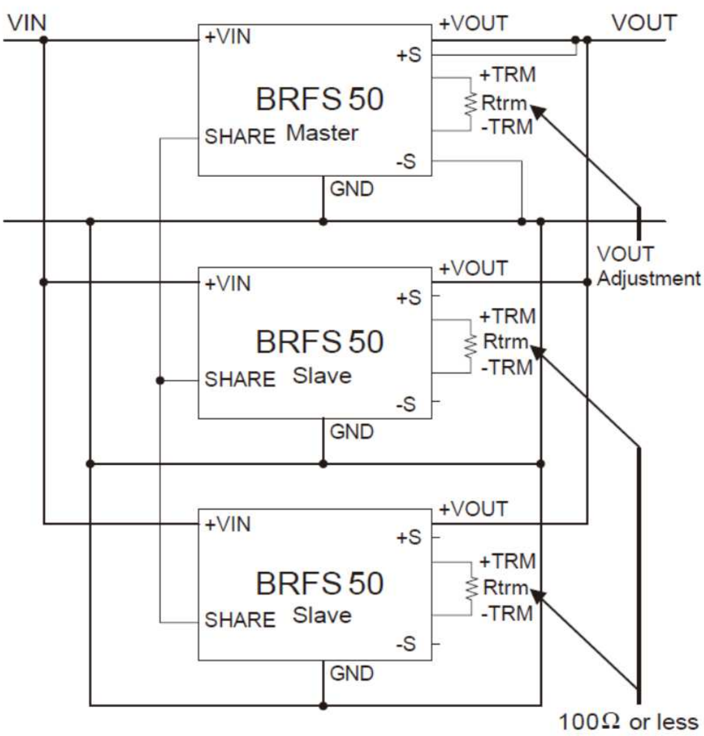
1)The basic note

■ Parallel operation is impossible BRFS30,BRFS40*1.
*1 BRFS40-P can be parallel operation.
■ Parallel operation is impossible different series.
■ Total number of units should be no more than 5 pieces.
■ Rating output current at parallel operation
= Rating current per unit × number of unit ×0.9

2)Wiring

■ The wiring of the parallel operation in Fig10.2.1.
■ TRM terminal of slave should be connect to GND(100Ω or less) .
■ Sensing terminal of the slave to open.
■ Connect all SHARE terminal.
■ When controlling the rise time by SEQ is possible to connect all SEQ pin.
■ RC terminal of the slave to connected GND or connect to the master of the RC terminal.
■ Input power should be supplied from the same power supply.
■ BRFS40-P and BRDS40 is required inductance of more than 0.1uH to the Vin line.

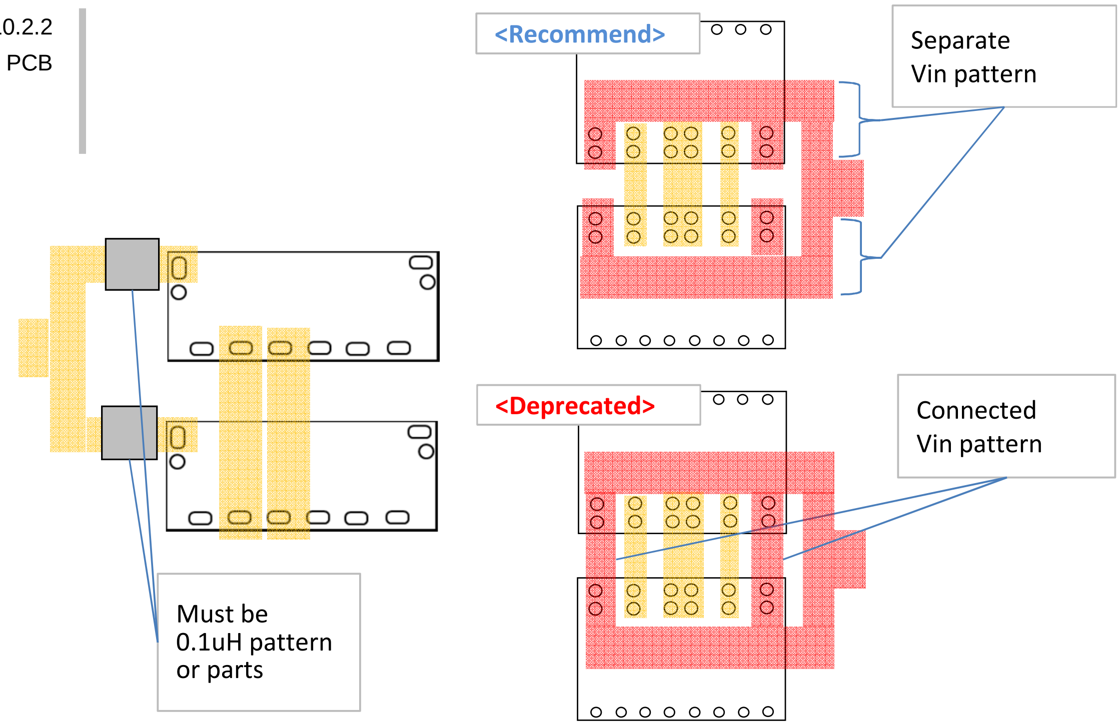
Fig. 10.2.1
Example of wiring method in parallel operation



3)Patterning of the PCB

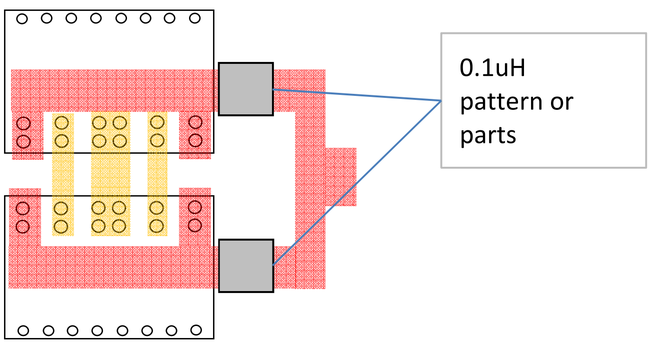
- Input and output pattern should be the same width and length.
- Voltage drop from the output terminal to remote sensing point must be less than 0.2V.
- ESR from the slave of the output terminal to remote sensing point must be 10mΩ or less
- Parallel operation should be separated Vin line of each BRxS(Fig 10.2.2)
- The beat noise reduction of parallel operation, it is effective to put the input CH(Fig 10.2.3)

Fig. 10.2.2
Patterning of the PCB



(a) BRxS40 (b) Other models

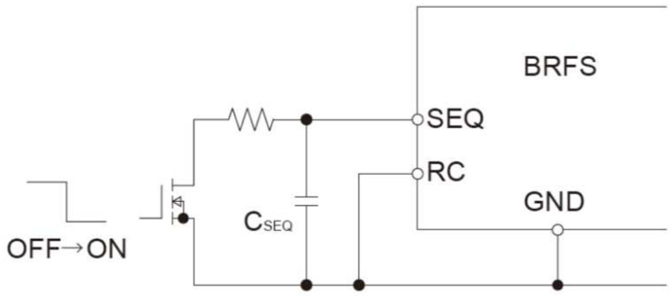
Fig. 10.2.3
Beat noise reduction



11. Sequence

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

Fig.11.1.1
Example of
soft start circuitry



■ When the voltage is applied to the terminal SEQ , the output voltage tracks this voltage until the output reaches the set-point voltage .
SEQ terminal voltage vs output voltage is calculated the following formula .

$$C_{SEQ}[\mu F] = (0.284 \div Vo[V] - 0.06) \times T[ms]$$

(Vo min ≦ Vo ≦ 2.0V) Vo min : 0.6V(only BRxS40) or 0.7V

$$C_{SEQ}[\mu F] = (0.284 \div Vo[V] - 0.047) \times T[ms]$$

(2.0 < Vo ≦ 3.63V only BRFS30)

Avoid SEQ terminal voltage is set below the set voltage output by Rtrim , the output voltage dose not rise to set output voltage . Maximum applicable voltage of terminal SEQ is Vin .
When the function is not used , open terminal SEQ .

Fig.11.1.2
SEQ > Vout setting

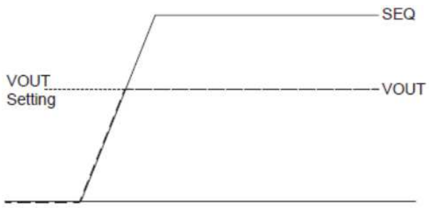
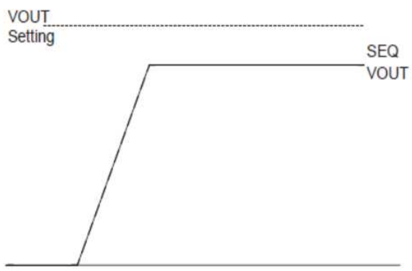
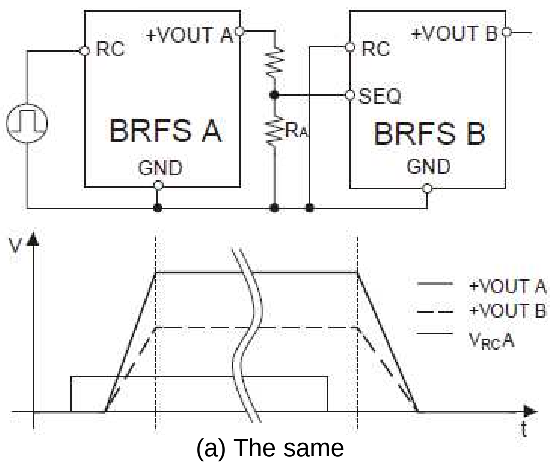


Fig.11.1.3
SEQ < Vout setting
(not recommended)

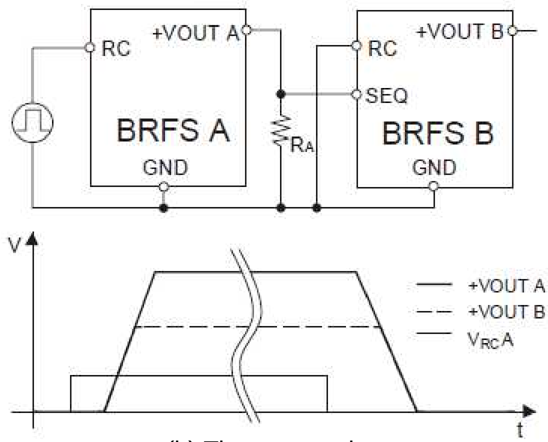


■ With the voltage to input into SEQ pin , you can control a start sequence of plural BRFS/BRDS .

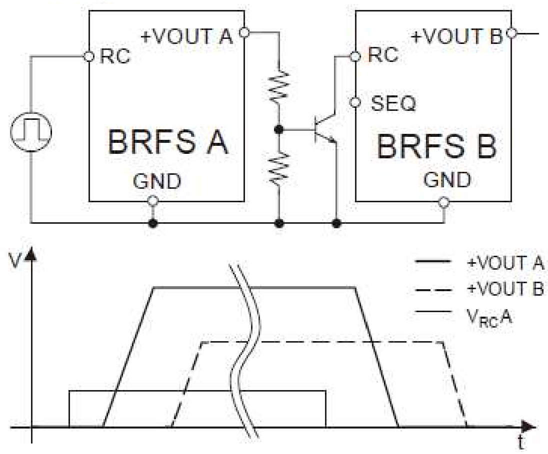
Fig.11.1.4
Example of
sequence control



(a) The same



(b) The same voltage



(c) The time lag

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

12. Package Information

- Please refer to Fig.12.1.1 ~ Fig.12.1.3 for Package form (Reel).
- The packed number is shown in Table 12.

Table.12.1.1
Packed number

Model	Capacity of reel
BRFS30/40,BRDS40	200 pcs
BRFS50/50L/60,BRDS60	100 pcs
BRFS100,BRDS100	80 pcs

Fig 12.1.1
Taping dimensions
of BRFS30/BRFS40
/BRDS40

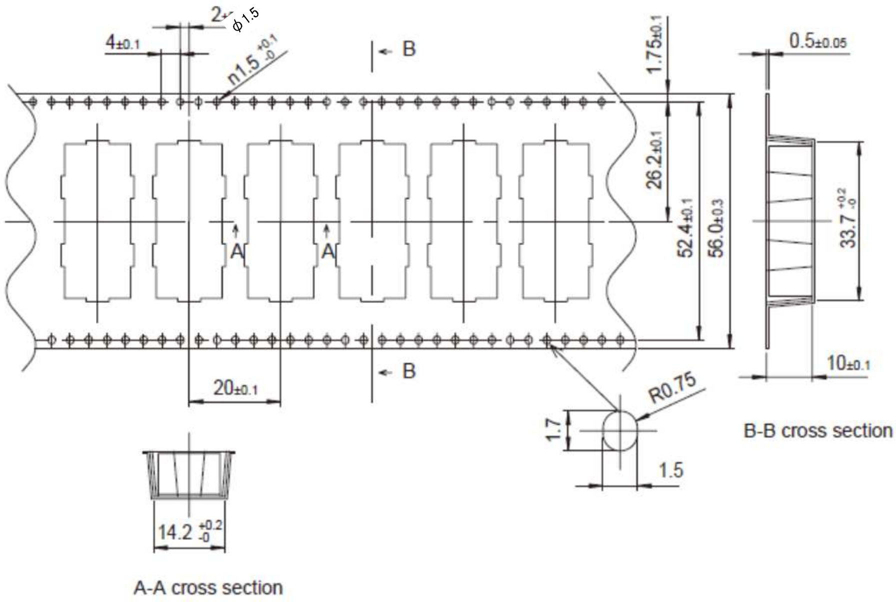


Fig 12.1.2
Taping dimensions
of BRFS50/BRFS50L/
BRFS60/BRDS60

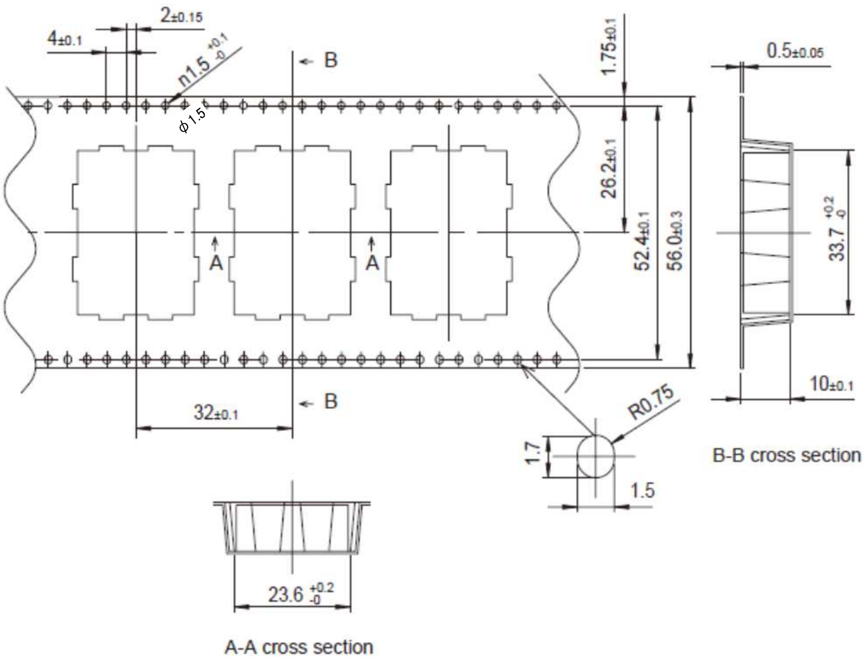


Fig 12.1.3
Taping dimensions
of BRFS100/BRDS100

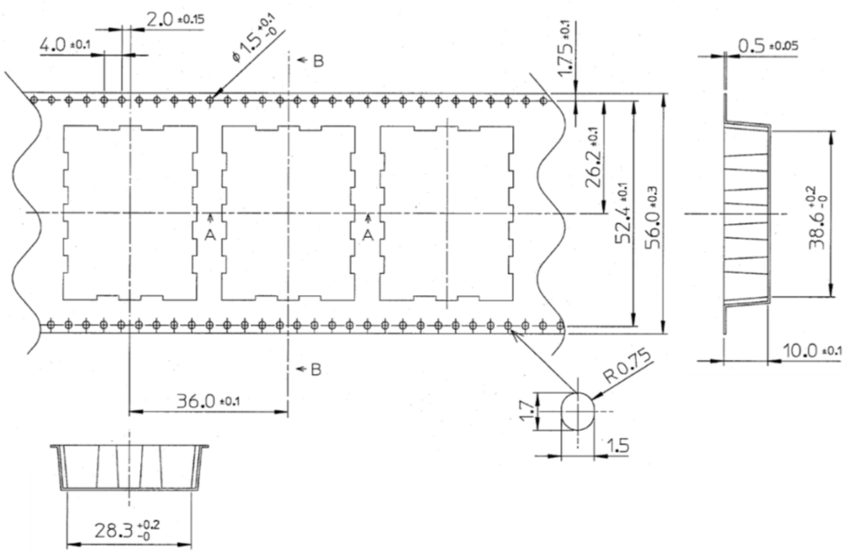
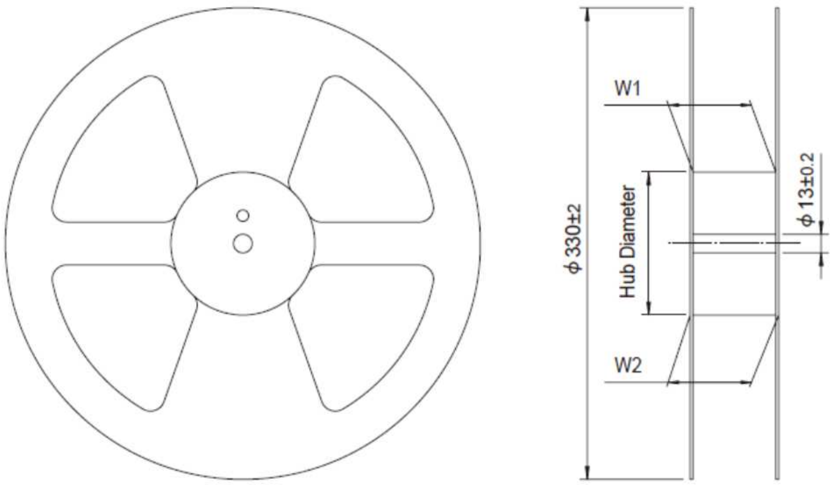


Fig 12.1.3
Reel dimensions
of BRFS/BRDS

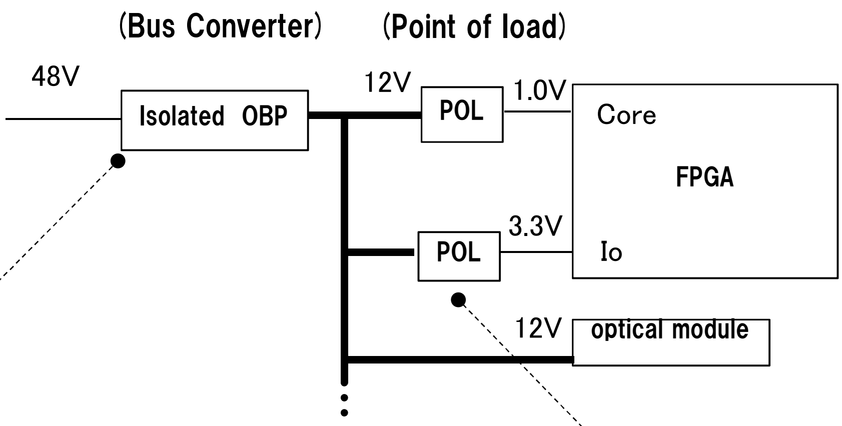


No.	Model	Tape Width[mm]	Hub Diameter	W1[mm]	W2[mm]
1	BRFS30/40,BRDS40	56	100	57.4±1.0	61.4±1.0
2	BRFS50/50L/60,BRDS60	56	150	57.5±1.0	61.5±1.0
3	BRFS100,BRDS100	56	150	57.5±1.0	61.5±1.0

CHS series and BR series

1. Power Supply of Cosel for Intermediate Bus Architecture

Fig.1.1.1
Intermediate Bus
Architecture



CHS series

● CHS80

- CHS80483R3
- CHS804805
- CHS804812

● CHS200

- CHS200483R3
- CHS2004805
- CHS2004812

● CHS300

- CHS3004810
- CHS3004812
- CHS3004812H

● CHS400/500

- CHS4004810
- CHS4004812
- CHS4004812H
- CHS5004812

BR series

● BRNS6/12/20

● BRFS30

● BRFS40/BRDS40

● BRFS50/50L/60,BRDS60

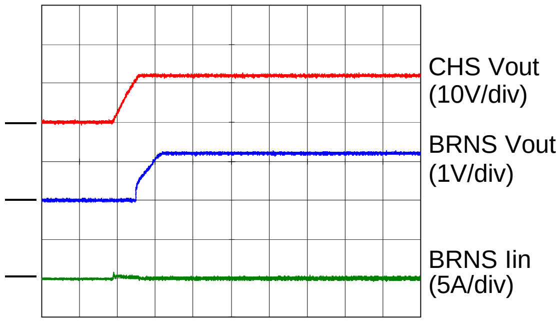
● BRFS100/BRDS100

2. Applications data

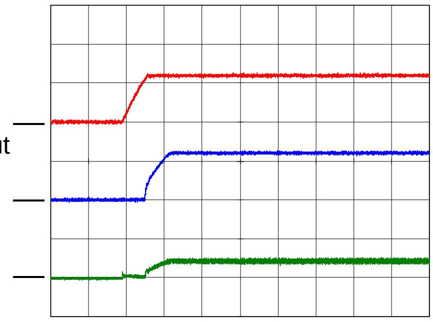
2.1 Startup Sequence

2.1.1 CHS4004812 and BRNS20

Fig.2.1.1
Startup Sequence of
CHS4004812
and BRNS20



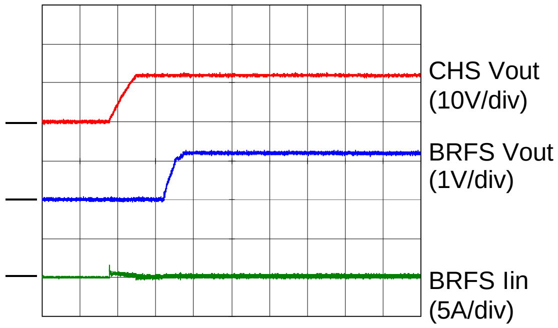
(a) BRNS20 Iout=0%(0A)



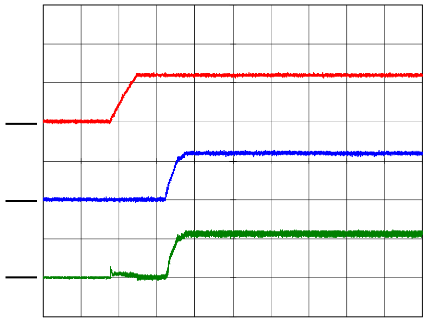
(b) BRNS20 Iout=100%(20A)

2.1.2 CHS4004812 and BRFS50

Fig.2.1.2
Startup Sequence of
CHS4004812
and BRFS50

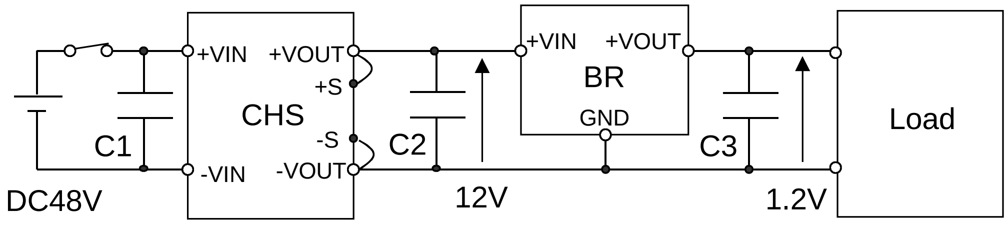


(a) BRFS50 Iout=0%(0A)



(b) BRFS50 Iout=100%(50A)

Fig.2.1.3
Measuring method of
Startup Sequence

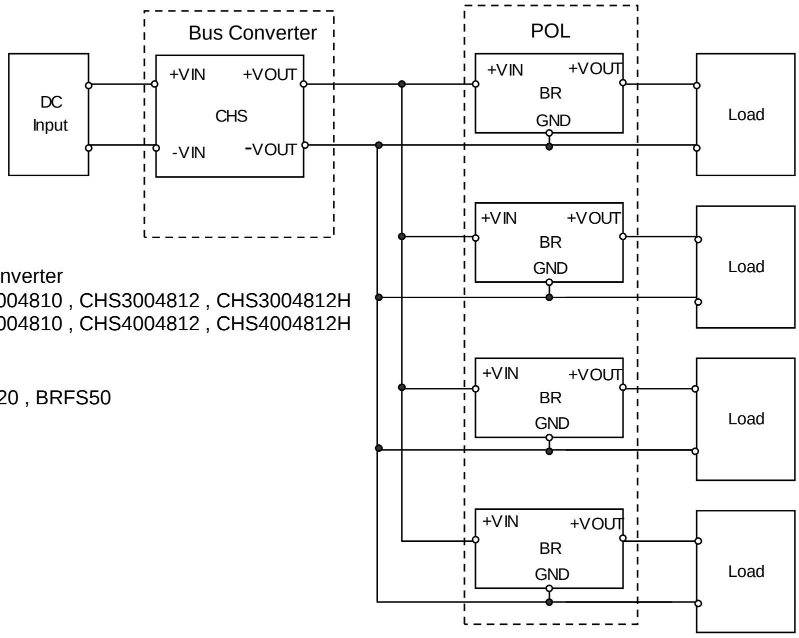


No.	Model	C1	C2	C3
1	CHS4004812 and BRNS20	100uFx3	22uFx3	100uFx2
2	CHS4004812 and BRFS50	100uFx3	22uFx4	100uFx2

2.2 Efficiency of the combination of CHS and BR

- When used in a 10V bus voltage, the efficiency of the device is higher than the bus voltage 12V.
- When using CHS300/4004812H, the efficiency of the device is higher than using CHS300/4004812.

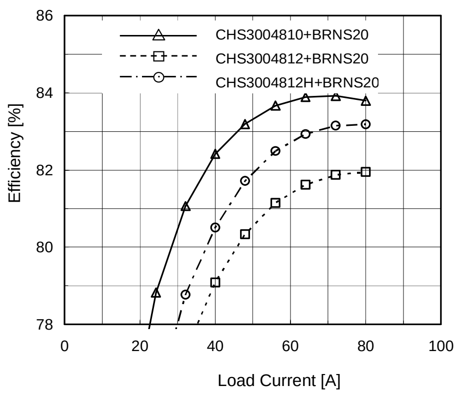
Fig.2.2.1
Test circuitry



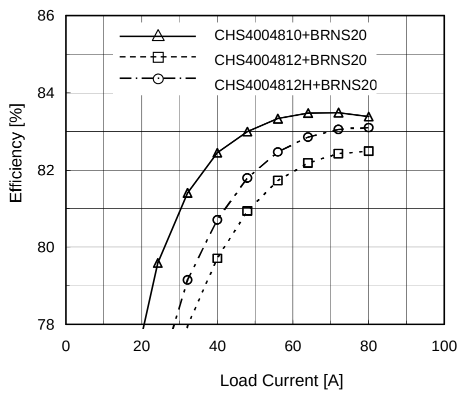
●Bus Converter
CHS3004810 , CHS3004812 , CHS3004812H
CHS4004810 , CHS4004812 , CHS4004812H

●POL
BRNS20 , BRFS50

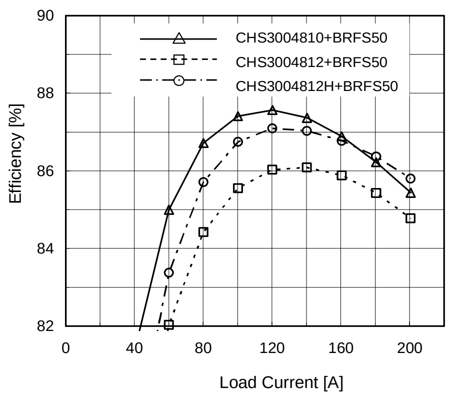
Fig.2.2.2
The efficiency of a combination of CHS and BR at 25℃



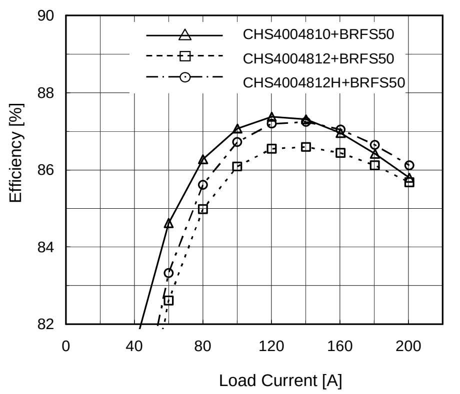
(a) Efficiency(CHS300 + BRNS20 x 4)
CHS300 Vin=48V , BRNS20 Vo=1.2V



(b) Efficiency(CHS400 + BRNS20 x 4)
CHS400 Vin=48V , BRNS20 Vo=1.2V

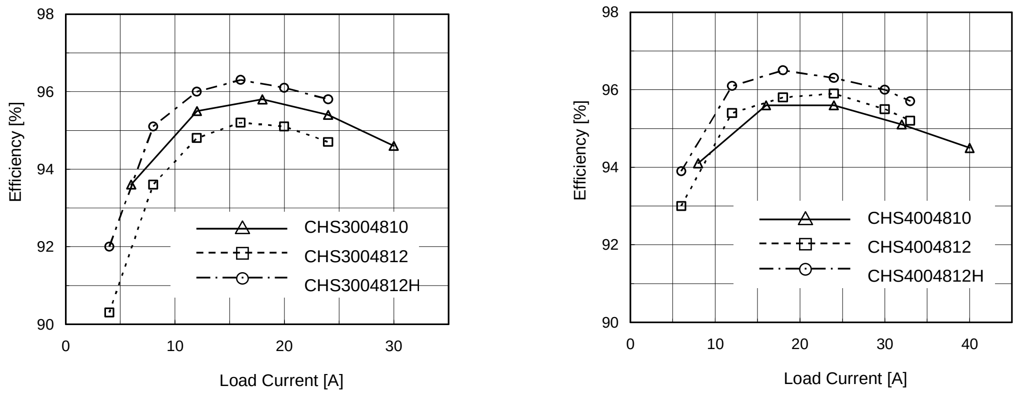


(c) Efficiency(CHS300 + BRFS50 x 4)
CHS300 Vin=48V , BRFS50 Vo=1.2V



(d) Efficiency(CHS400 + BRFS50 x 4)
CHS300 Vin=48V , BRNS20 Vo=1.2V

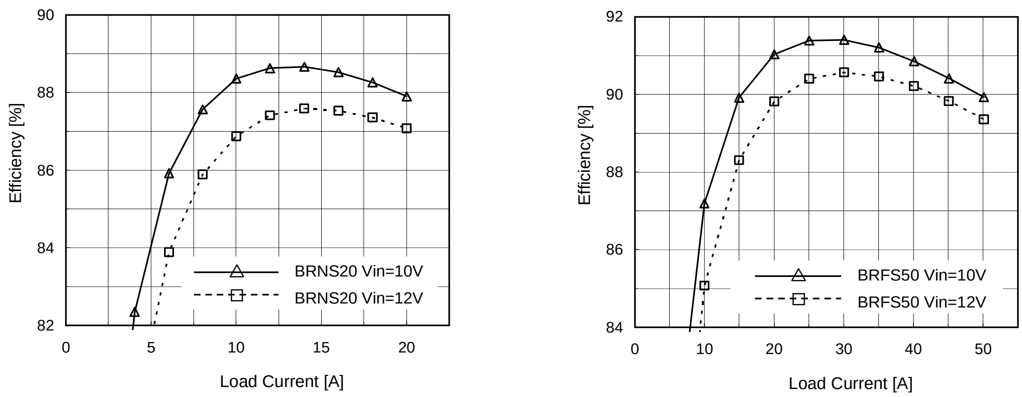
Fig.2.2.3
The efficiency of CHS300/400 at 25℃



(a) Efficiency (CHS300)
CHS300 Vin=48V

(b) Efficiency (CHS400)
CHS400 Vin=48V

Fig.2.2.4
The efficiency of BRNS20/BRFS50 at 25℃

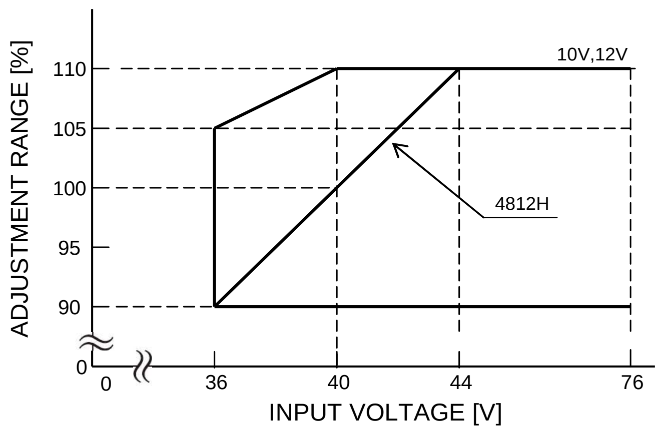


(a) Efficiency (BRNS20)
BRNS20 Vo=1.2V

(b) Efficiency (BRFS50)
BRFS50 Vo=1.2V

Remarks :
For CHS300/400 the output voltage adjustment range becomes as shown in Fig.2.2.5 When input voltage is 36-44VDC.

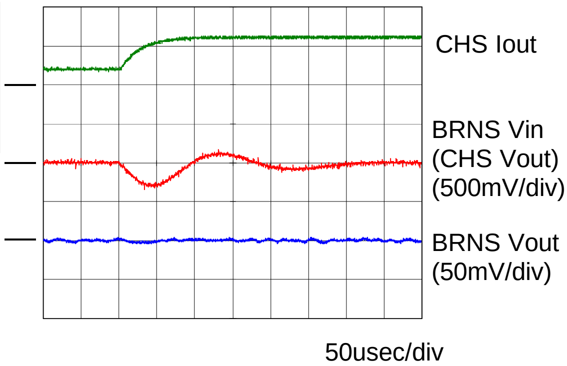
Fig.2.2.5
CHS300/400 Input voltage derating



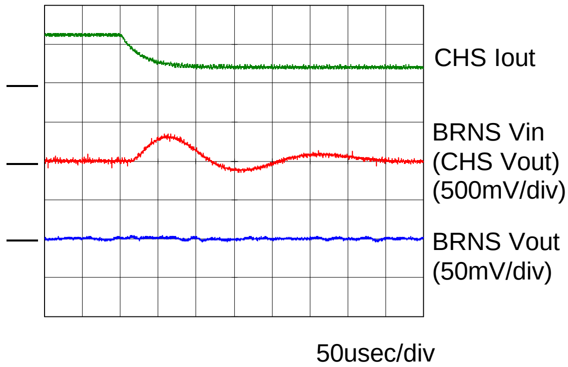
2.3 Dynamic Input Response

2.3.1 CHS4004812 and BRNS20

Fig.2.3.1
Dynamic Input Response
of CHS4004812
and BRNS20



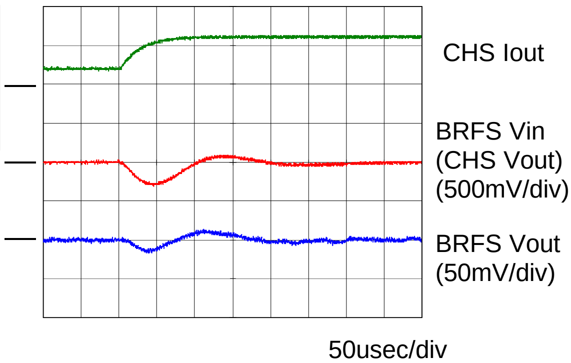
(a) Dynamic Input Response
Load 25%(8.25A)→Load 75%(24.75A)／50us



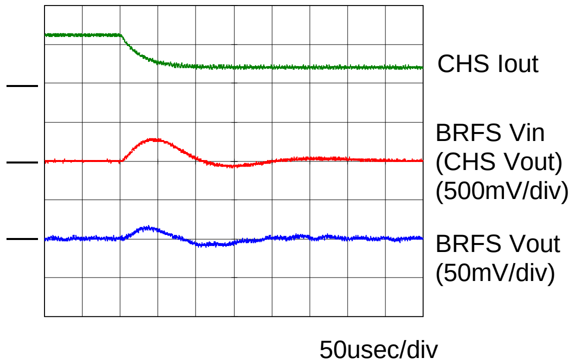
(b) Dynamic Input Response
Load 75%(24.75A)→Load 25%(8.25A)／50us

2.3.2 CHS4004812 and BRFS50

Fig.2.3.2
Dynamic Input Response
of CHS4004812
and BRFS50

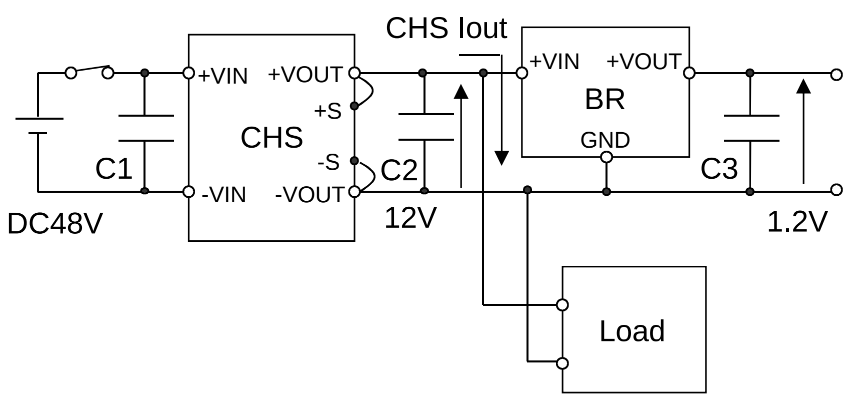


(a) Dynamic Input Response
Load 25%(8.25A)→Load 75%(24.75A)／50us



(b) Dynamic Input Response
Load 75%(24.75A)→Load 25%(8.25A)／50us

Fig.2.3.3
Measuring method
of Dynamic Input
Response



No.	Model	C1	C2	C3
1	CHS4004812 and BRNS20	100uFx3	22uFx3	100uFx2
2	CHS4004812 and BRFS50	100uFx3	22uFx4	100uFx2