1. DBS series

1.1 Pin configuration

Fig.1.1.1
Pin configuration
(bottom view)

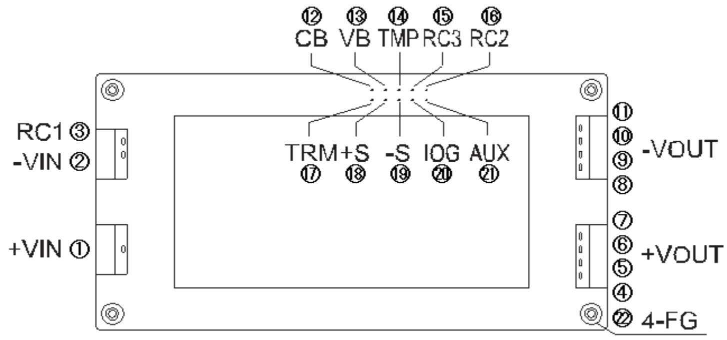


Table 1.1.1
Pin configuration and
function

Pin №	Pin Name	Function	Reference
①	+VIN	+DC input	1.3 Connection method for standard use
②	-VIN	-DC input	
③	RC1	Remote ON/OFF (input side)	1.7 Remote ON/OFF (1)
④⑤⑥⑦	+VOUT	+DC output	1.3 Connection method for standard use
⑧⑨⑩⑪	-VOUT	-DC output	
⑫	CB	Current balance	1.11 Parallel operation / Mater-slave operation
⑬	VB	Voltage balance	
⑭	TMP	Thermal detection signal	1.5 Protect circuit
⑮	RC3	Remote ON/OFF (output side)	1.7 Remote ON/OFF (2)
⑯	RC2		
⑰	TRM	Adjustment of output voltage	1.6 Adjustable voltage range
⑱	+S	+Remote sensing	1.8 Remote sensing
⑲	-S	-Remote sensing	
⑳	IOG	Inverter operation monitor	1.9 Inverter operation monitor
21	AUX	Auxiliary power supply	1.7 Remote ON/OFF (3)
22	FG	Mounting hole (FG)	1.3 Connection method for standard use

1.2 Do's and Don'ts for module

1.2.1 Isolation

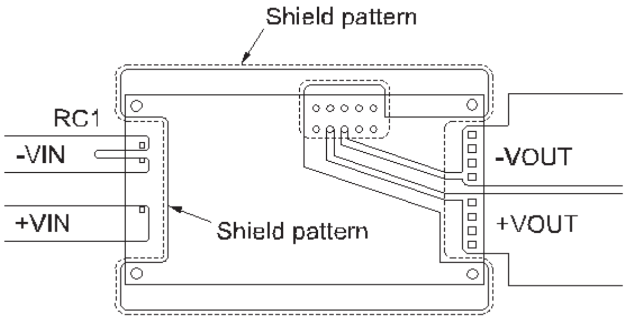
- For receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for start (shut down). Avoid using Hi-Pot tester with the time because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

1.2.2 Mounting method

- The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Aluminum base plate temperature around each power supply should not exceed the temperature range shown in derating curve.
- Avoid placing the DC input line pattern lay out underneath the unit, it will increase the line conducted noise. Make sure to leave an ample distance between the line pattern lay out 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.

- High-frequency noise radiates directly from the unit to the atmosphere. Therefore, design the shield pattern on the printed circuit board and connect its one to FG. The shield pattern prevents noise radiation. Fig.1.2.1 Examples of parallel operation when output voltage adjustment is not in use. TRM wiring, R1, R2 and VR are not necessary.

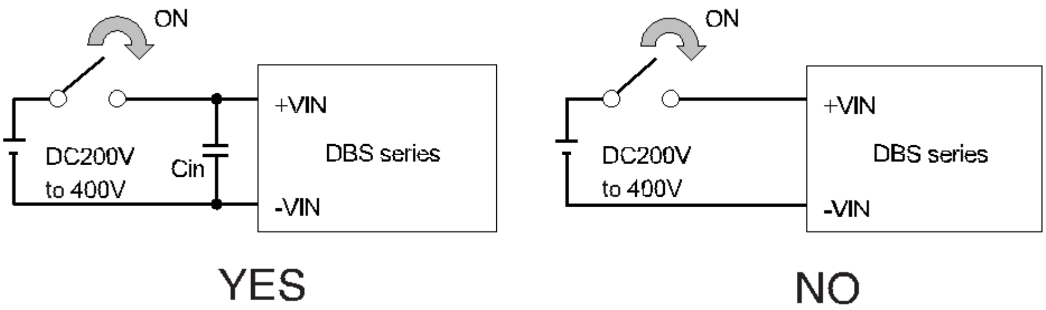
Fig.1.2.1
Shield pattern lay out
(bottom view)



1.2.3 External input capacitor

- When the line impedance is high or the input voltage rise quickly at start-up (less than 10μs), install capacitor Cin between +VIN and -VIN input pins (within 50mm from pins).

Fig.1.2.2
External input capacitor

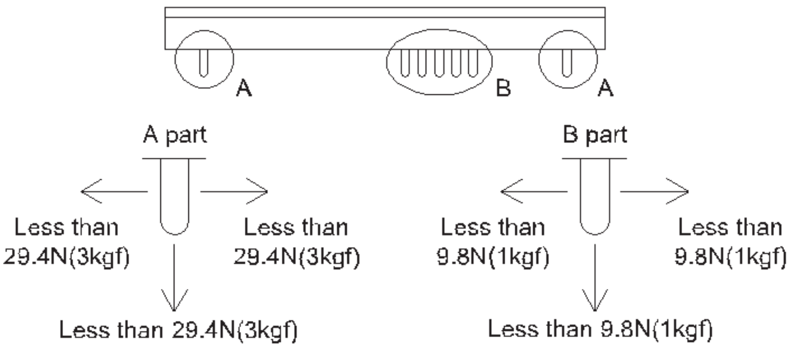


DBS100A/150A	:	47μF
DBS200B	:	22μF
DBS400B	:	47μF

1.2.4 Stress onto the pins

- When too much stress is applied to the pins of the power supply, the internal connection may be weakened. As shown in Fig.1.2.3 avoid applying stress of more than 29.4N (3kgf) on the input pins/output pins (A part) and more than 9.8N (1kgf) to the signal pins (B part).
- The pins are soldered on PCB internally, therefore, do not pull or bend them with abnormal forces.
- Fix the unit on PCB (fixing fittings) to reduce the stress onto the pins.

Fig.1.2.3
Stress onto the pins



1.2.5 Cleaning

- Clean it with a brash. Prevent fluid from getting inside the unit.
- Do not apply pressure to the lead and name plate with a brush or scratch it during the cleaning.
- After cleaning, dry them enough.

1.2.6 Soldering

- Flow soldering : 260°C less than 15 seconds.
- Soldering iron

  DC IN / DC OUT / RC1 : 450°C less than 5 seconds.

  Signal pins : 350°C less than 3 seconds (less than 20W).

1.2.7 Safety standard

- This unit must be used as a component of the end-use equipment.
- This unit must be provided with overall enclosure.
- Mounting holes must be connected to safety ground of the end-use equipment, as required for class I equipment.
- Input must be filtered and rectified.
- Safety approved fuse must be externally installed on input side.

1.3 Connection method for use

1.3.1 Connection for standard use

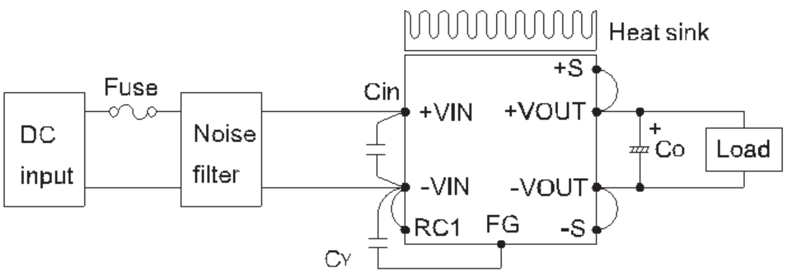
- In order to use the power supply, it is necessary to wire as shown in Fig.1.3.1.
- Short the following pins to turn on the power supply.

  -VIN ↔RC1, +VOUT ↔+S, -VOUT ↔-S

  Reference : 1.7 Remote ON/OFF

  1.8 Remote sensing

Fig.1.3.1
Connection for standard use



Cin : External capacitor on the input side

Co : External capacitor on the output side

C_Y : Primary decoupling capacitor

1.3.2 Input power source

(1) Operation with DC input

- The specification of input ripple voltage is shown as below.

Ripple voltage	DBS100A/150A : less than 10Vp-p
	DBS200B/400B : less than 20Vp-p

- Make sure that the voltage fluctuation, including the ripple voltage, will not exceed the input voltage range.
- Use a front-end unit with enough power, considering the start-up current Ip of this unit.

Fig.1.3.2
Input voltage ripple

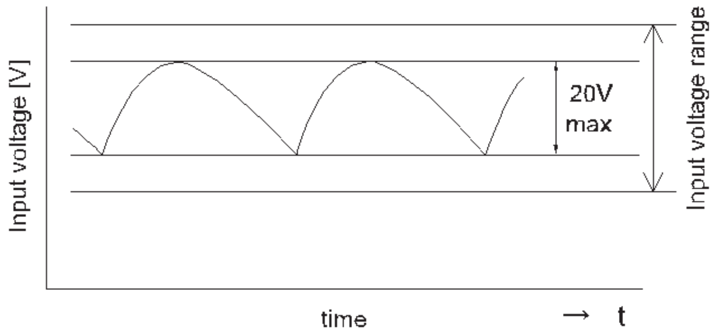
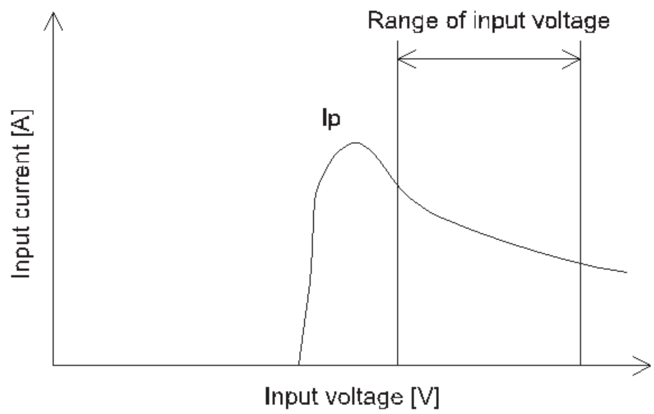


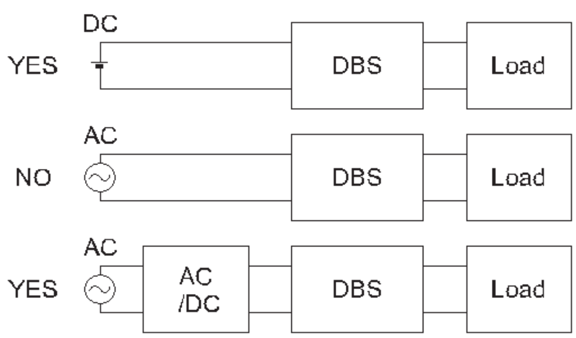
Fig.1.3.3
Input current characteristics



(2) Operation with AC input

- The DBS series handles only for the DC input. A front-end unit (AC/DC unit) is required when the DBS series is operated with AC input. In detail, Refer to 5. Input circuit.

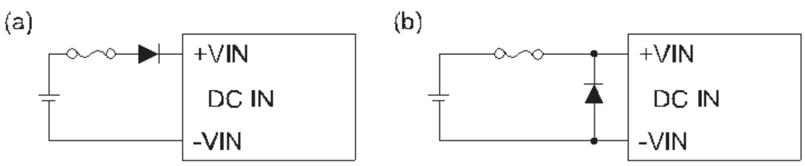
Fig.1.3.4
Operation with AC input



(3) Reverse input voltage protection

Avoid the reverse polarity input voltage. It will break the power supply. It is possible to protect the unit from the reverse input voltage by installing an external diode.

Fig.1.3.5
Reverse input voltage protection



1.3.3 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 a normal-blow type fuse in each unit.

Table 1.3.1
Recommended fuse
(normal-blow type)

MODEL	DBS100A	DBS150A	DBS200B	DBS400B
Rated current	5A	5A	3A	5A

1.3.4 Primary Y capacitor C_Y

- Install an external noise filter and a Y capacitor for low line-noise and for stable operation of the power supply.
- Install a correspondence filter, if a noise standard meeting is required or if the surge voltage may be applied to the unit.
- Install a primary Y capacitor, with more than 470pF, near the input pins (within 50mm from the pins).
- When the total capacitance of the primary Y capacitor is more than 8800pF, the nominal value in the specification may not be met by the Hi-Pot test between input and output. In this case, a capacitor should be installed between output and FG.

1.3.5 External capacitor on the input side Cin

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

Cin	DBS100A/150A	: more than 47μF
	DBS200B	: more than 0.1μF
	DBS400B	: more than 0.33μF

- Cin is within 50mm from pins. Make sure that ripple current of Cin should be less than rate.

1.3.6 External capacitor on the output side Co

- Install an external capacitor Co between +VOUT and -VOUT pins for stable operation of the power supply.
  Recommended capacitance of Co is shown in Table 1.3.2.
- Select the high frequency type capacitor. Output ripple and start-up waveform may be influenced by ESR/ ESL of the capacitor and the wiring impedance.
- When output current change sharply, make sure that ripple current of Co should be less than rating.
- Install a capacitor Co near the output pins (within 100mm from the pins).

Table 1.3.2
Recommended
capacitance Co

<table>
<tr><th>VOUT</th><th>3.3V</th><th>5V</th><th>7.5V</th><th>12V</th><th>13.8V</th><th>15V</th><th>18V</th><th>24V</th><th>28V</th></tr>
<tr><td>DBS100A</td><td>-</td><td>2200μF</td><td>-</td><td>-</td><td>1000μF</td><td colspan="4">-</td></tr>
<tr><td>DBS150A</td><td colspan="3">-</td><td>1000μF</td><td>-</td><td>1000μF</td><td>-</td><td>1000μF</td><td>-</td></tr>
<tr><td>DBS200B</td><td colspan="3">2200μF</td><td>1000μF</td><td colspan="5">-</td></tr>
<tr><td>DBS400B</td><td>6800μF</td><td colspan="2">4700μF</td><td>2200μF</td><td>-</td><td colspan="2">2200μF</td><td colspan="2">820μF</td></tr>
</table>

1.3.7 Thermal considerations

- Operate with the conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink).
  Reference : 8. Thermal considerations

1.4 Derating

1.4.1 Cooling

- Use with the conduction cooling (e.g. heat radiation by conduction from the aluminum base plate to the attached heat sink).
- Fig.1.4.1 shows the derating curve based on the aluminum base plate temperature. In the hatched area, the specification of ripple and ripple noise is different from other areas.
- The aluminum base plate temperature can be measured at point A or point B.

Fig.1.4.1
Derating curve

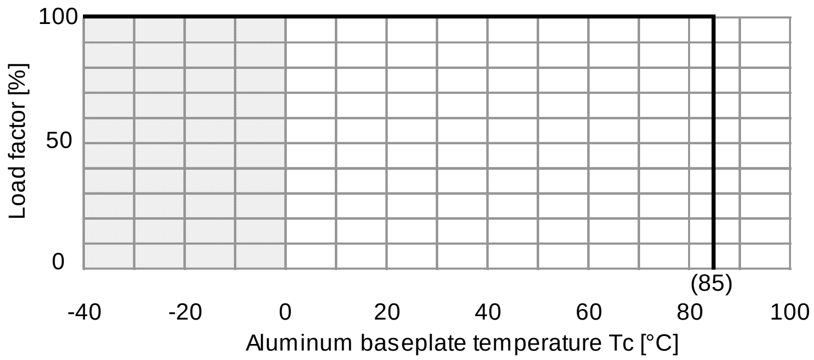
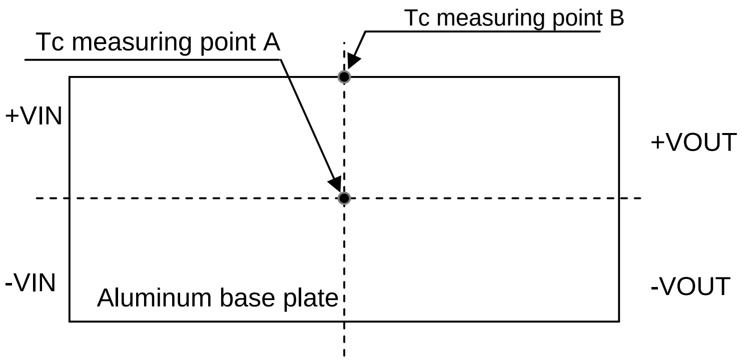


Fig.1.4.2
Measuring point



1.5 Protect circuit

1.5.1 Overvoltage protection

- The overvoltage protection circuit is built-in. The DC output should be shut down if overvoltage protection is activated. The minimum interval of DC ON/OFF for recovery is for 2 to 3 minutes.
  * The recovery time depends on input voltage and input capacity.
  ◆Remarks :
  Please note that devices inside the power supply might fail when voltage more than rated output voltage is applied to output terminal of the power supply. This could happen when the customer tests the overvoltage protection of the unit.

1.5.2 Overcurrent protection

- Overcurrent protection is built-in and activated at over 105% of the rated current.
  The unit automatically recovers when the fault condition is removed.
- Intermittent operation
  When the overcurrent protection is activated, the average output current is reduced by intermittent operation of power supply to reduce heat of load and wiring.

1.5.3 Thermal protection

- Thermal detection (TMP) and protection circuit are built-in.
- When overheat is detected, thermal detection signal (TMP) turns "L" from "H". TMP circuit is designed as shown in Fig.1.5.1, and specification is shown as in Table 1.5.1.
- When overheating continues after detecting TMP signal, the output will be shut down by the thermal protection circuit.
  When this function is activated, input voltage should be turned off, and remove all possible causes of overheat condition and cool down the unit to the normal level temperature.
- Overheat protection works around 100°C at the base plate.

Fig.1.5.1
TMP circuit

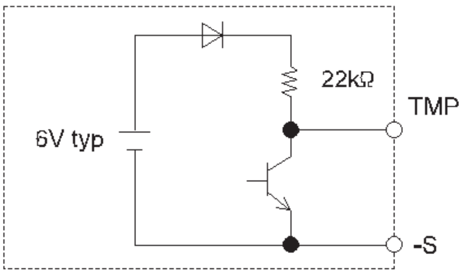


Table 1.5.1
Specification of TMP

№	Item	TMP
1	Function	Normal "H"
		Overheat "L"
2	Base pin	-S
3	Level voltage "L"	0.5V max at 5mA
4	Level voltage "H"	5V typ
5	Maximum sink current	10mA max
6	Maximum external voltage	35V max

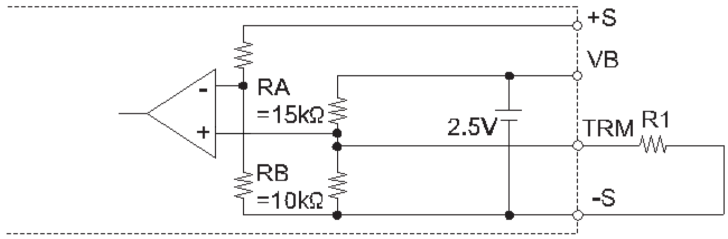
1.6 Adjustable voltage range

- Output voltage is adjustable by the external potentiometer or the external signal.
- When the output voltage adjustment is not used, leave the TRM pin and VB pin open.
- Do not set output voltage over 110% of rated, overvoltage protection might be activated.

1.6.1 Output voltage decreasing by external resistor

- By connecting the external resistor (R1) more than 1/10W, output voltage becomes adjustable to decrease as shown in Fig.1.6.1.

Fig.1.6.1
Output voltage control circuit



Output voltage is calculated by the following equation
Vn : Rated output voltage
Vo : Desire output voltage

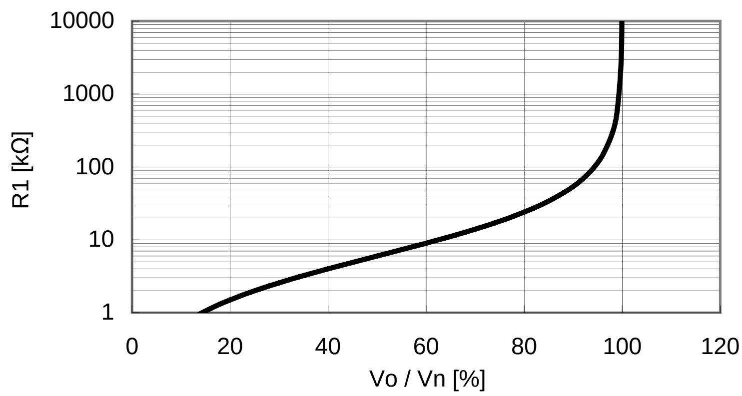
$$R1[k\Omega] = \frac{Vo}{Vn - Vo} \times 6.0$$

Example Vn = 5.0 [V]
Vo = 4.5 [V]

$$R1[k\Omega] = \frac{4.5}{5.0 - 4.5} \times 6.0$$

$$= 54[k\Omega]$$

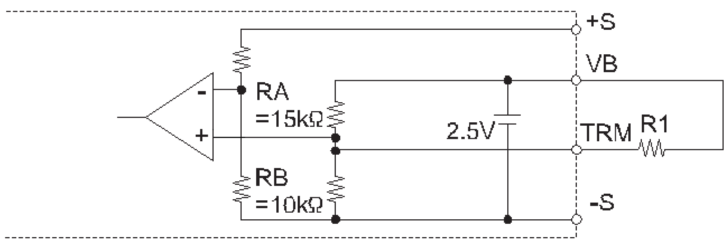
Fig.1.6.2
Resister selection for degreased output voltage



1.6.2 Output voltage increasing by external resistor

- By connecting the external resistor (R1) more than 1/10W, output voltage becomes adjustable to increase as shown in Fig.1.6.3.

Fig.1.6.3
Output voltage control circuit



Output voltage is calculated by the following equation.

Vn : Rated output voltage

Vo : Desire output voltage

$$R1[k\Omega] = \frac{2.5 \times Vn - Vo}{Vo - Vn} \times 6.0$$

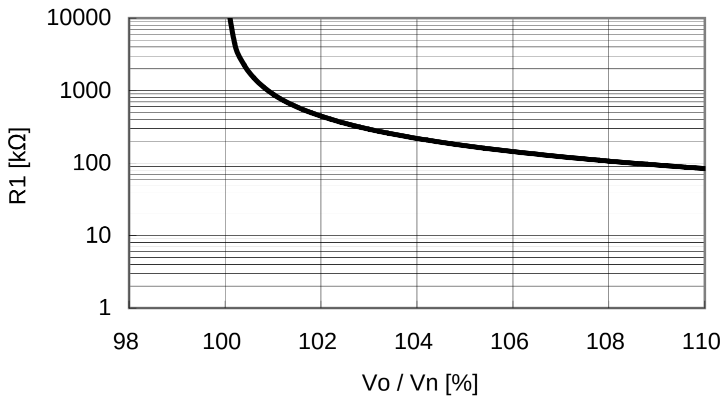
Example Vn = 5.0 [V]

Vo = 5.5 [V]

$$R1[k\Omega] = \frac{2.5 \times 5.0 - 5.5}{5.5 - 5.0} \times 6.0$$

$$= 84[k\Omega]$$

Fig.1.6.4
Resister selection for increased output voltage



1.6.3 Output voltage adjusting method by external potentiometer

- By connecting the external potentiometer (VR1) and resistors (R1, R2) more than 1/10W, output voltage becomes adjustable, as shown in Fig.1.6.5, recommended external parts are shown in Table 1.6.1.
- The wiring to the potentiometer should be as short as possible. The temperature coefficient becomes worse, depending on the type of a resistor and potentiometer. Following parts are recommended for the power supply.

Resistor : Metal film type, coefficient of less than ±100ppm/°C

Potentiometer : Cermet type, coefficient less than ±300ppm/°C

Fig.1.6.5
Output voltage control circuit

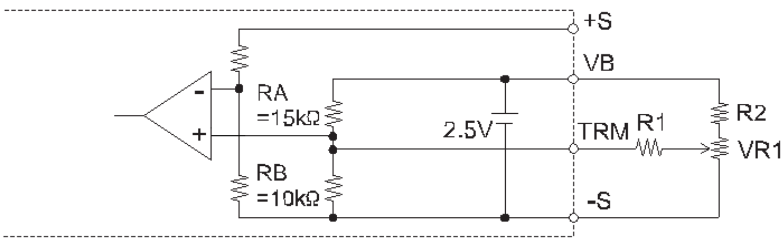


Table 1.6.1
Recommended value of external potentiometer and resistors (more than 1/10W)

№	Adjustable range [%]	Number of unit	External parts value [Ω]		
			VR1	R1	R2
1	±5	Single	5k	75k	1k
2		2 sets		36k	
3		3 sets		24k	
4	±10	Single	5k	36k	910
5		2 sets		18k	
6		3 sets		12k	

1.6.4 Adjusting method by applying external voltage

- By applying the voltage externally at TRM, output voltage becomes adjustable. Output voltage is calculated by the following equation.

Output voltage = (Applied voltage externally) x (Rated output voltage)

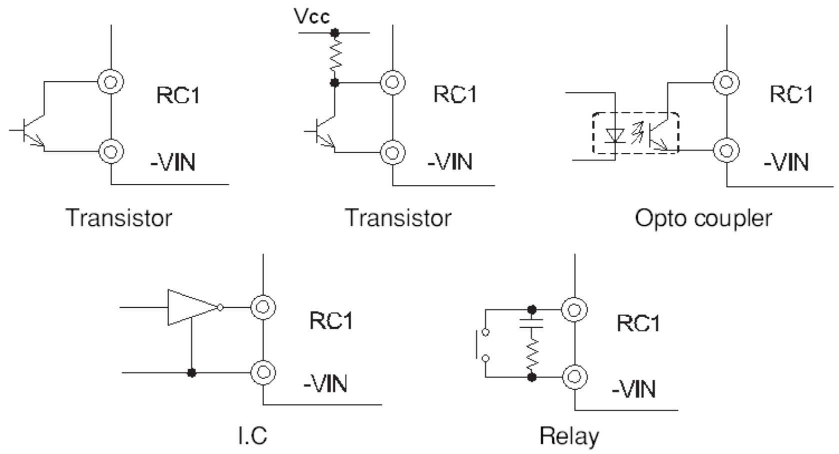
1.7 Remote ON/OFF

- Remote ON/OFF circuit is built-in on both input (RC1) and output (RC2, RC3) side.

(1) Input side remote ON/OFF (RC1)

- The ground pin of input side remote ON/OFF circuit is "-VIN" pin.
  - ◆ Between RC1 and -VIN : Output voltage is ON at "Low" level or short circuit (0 - 1.0V).
  - ◆ Between RC1 and -VIN : Output voltage is OFF at "High" level or applied voltage (3.5 - 7.0V).
- When RC1 is low level, fan out current is 0.3mA typ.
- When Vcc is applied, use 3.5 ~ 7V.
- When remote ON/OFF function is not used, please connect between RC1 and -VIN.

Fig.1.7.1
RC connection example



(2) Output side remote ON/OFF (RC2, RC3)

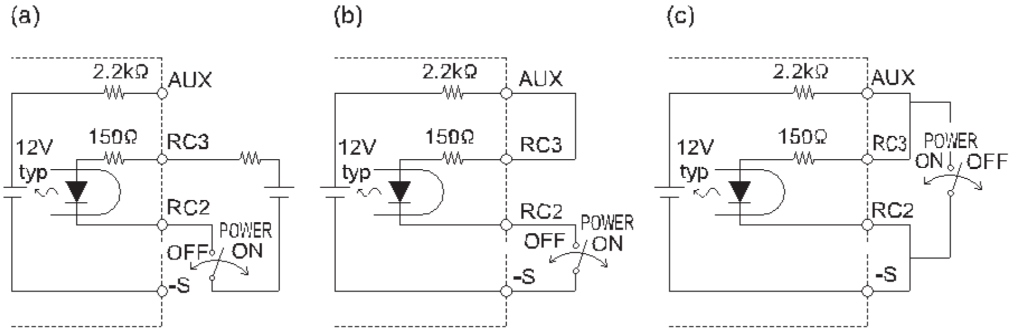
- Either "Low active" or "High active" is available by connecting method as following table.

Table 1.7.1
Output remote ON/OFF (RC2, RC3)

№	Item	RC2, RC3		
1	Wiring method	Fig.3.7.2 (a)	Fig.3.7.2 (b)	Fig.3.7.2 (c)
2	Function	Power ON "H"	Power ON "H"	Power ON "L"
3	Base pin	RC2	-S	-S and RC2
4	Power ON	Open (0.1mA max)		Short (0.5V max)
5	Power OFF	Short (3mA min)		Open (0.1mA max)

- Make sure that sink current of output side remote ON/OFF circuit should be less than 12mA.

Fig.1.7.2
Output side remote
ON/OFF (RC2, RC3)



(3) Auxiliary power supply for remote ON/OFF (AUX)

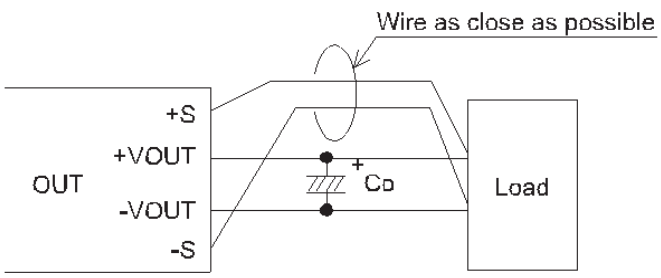
- AUX is built-in for operating the output side remote ON/OFF (RC2, RC3).
- If AUX is not used for RC2, RC3, AUX can be used for IOG or TMP signal output using opt-coupler.
- Short protection resistance (2.2kΩ) is built-in.
- AUX voltage at open circuit : 15V max.

1.8 Remote sensing

- This function compensate line voltage drop.

1.8.1 When the remote sensing function is in use

Fig.1.8.1
Connection when
the remote sensing
is in use



- Twisted-pair wire or shield wire is recommended 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 0.3V. Voltage between +VOUT and -VOUT should be remained within the output voltage adjustment range.
- The remote sensing leads must not be used to carry load current. Doing so will damage the module by drawing heavy current. Fuses or resistors should be fitted close to a load to prevent the module from this kind of failure.

(1) Case of long distance between load and power supply

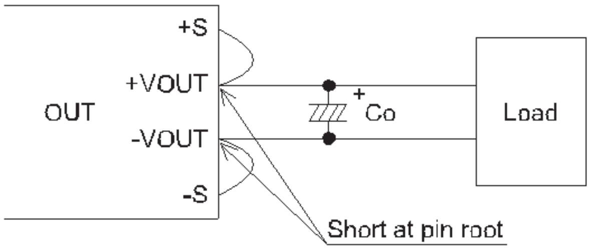
- Output voltage might become unstable because of impedance of wiring and load condition when length of wire is exceeding 3m.

(2) When using remote sensing in parallel

- Connect the sensing line and the power line at one point connect each power supply's sensing line together first then (+S, -S).

1.8.2 When the remote sensing function is not in use

Fig.1.8.2
Connection when
the remote sensing
is not in use



- When the remote sensing function is not in use, Make sure that pins are shorted between +S and +VOUT and between -S and -VOUT are connected.
- Connect between +S and +VOUT and between -S and -VOUT directly.
  No loop wiring.
  This power supply might become unstable by the noise coming from poor wiring.

1.9 Inverter operation monitor (IOG)

- Use IOG to monitor operation of the inverter. In the case of abnormal operation, status is changed from "L" to "H" within one second.
- IOG circuit is designed as shown in Fig.1.9.1 and specification is shown in Table 1.9.1.

Fig.1.9.1
IOG circuit

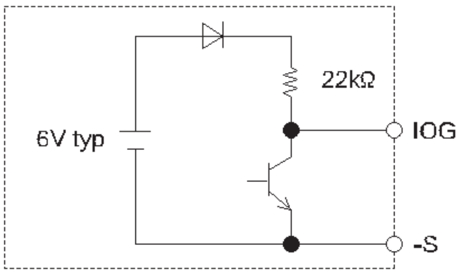


Table 1.9.1
Specification of IOG

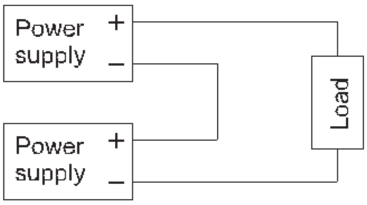
№	Item	TMP
1	Function	Normal "L"
		Inverter failure "H"
2	Base pin	-S
3	Level voltage "L"	0.5V max at 5mA
4	Level voltage "H"	5V typ
5	Maximum sink current	10mA max
6	Maximum external voltage	35V max

1.10 Series operation

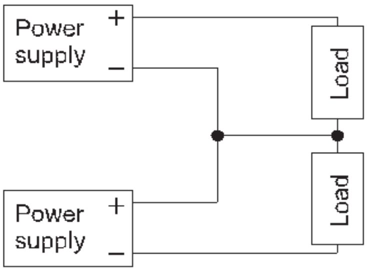
- Series operation is available by connecting the outputs of two or more power supplies, as shown Fig.1.10.1. Output current in series connection should be lower than the lowest rated current in each power supply.

Fig.1.10.1
Examples of serial operation

(a)



(b)



1.11 Parallel operation / Master-slave operation

- Parallel operation is available by connecting the units as shown Fig.1.11.1; also Master-slave operation adjust output voltage in parallel operation, is available.
  When output voltage adjustment is not in use, TRM wiring, R1, R2 and VR are not necessary.
- As variance of output current draw from each power supply is maximum 10%, the total output current must not exceed the value determined by following equation.
  (output current in parallel operation) = (the rated current per unit) x (number of unit) x 0.9
- In parallel operation, the maximum operative number of units is 11.

Fig.1.11.1
Example of parallel operation

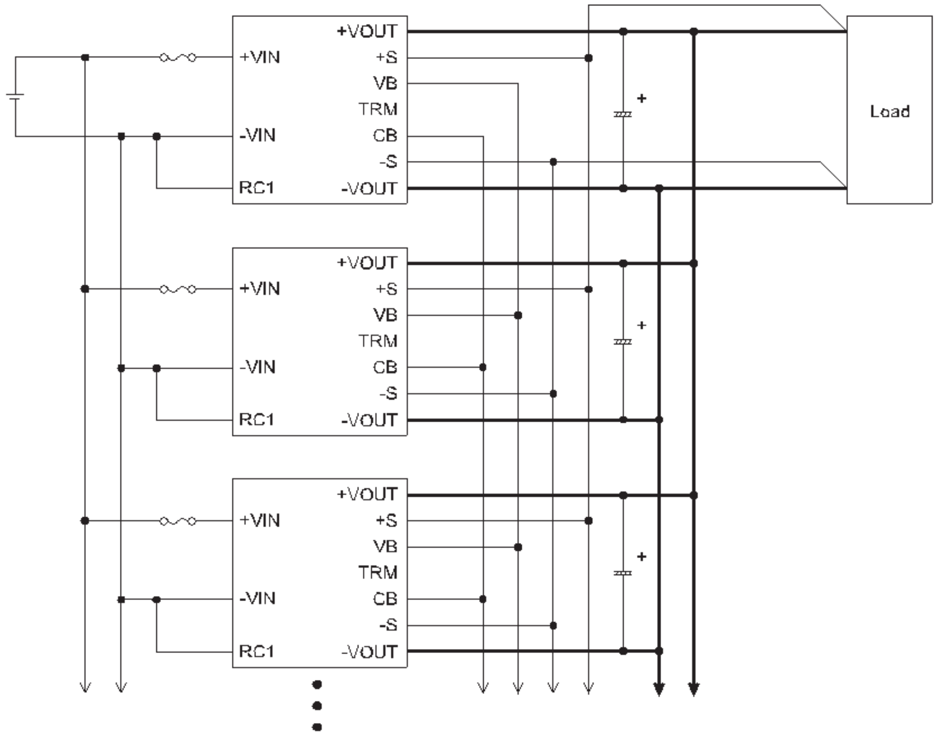
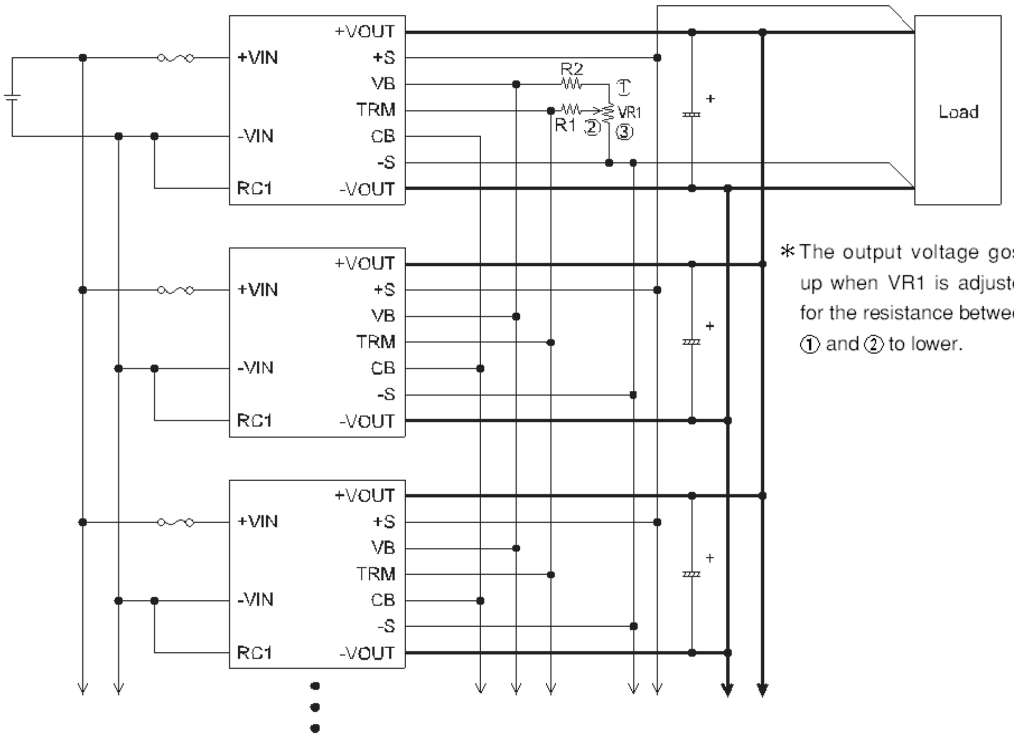


Fig.1.11.2
Example of master-slave operation



*The output voltage gose up when VR1 is adjusted for the resistance between ① and ② to lower.

(1) Wiring

- When the output-line impedance is high, the power supply become unstable. Use same length and thickness (width) wire (pattern) for the current balance improvement.
- Connect each input pin for the lowest possible impedance. When the number of the units in parallel operation increases, input current increases. Adequate wiring design is required for input circuitry such as circuit pattern, wiring and load current for equipment is required.
- Connect the sensing line and the power line at one point connect each power supply's sensing line together first then (+S, -S). In multiple operation, sensing wires should be connected same terminal in each unit.

(2) Thermal management of Base Plate

- If aluminum base plate temperature is different in each power supply, fluctuation of output voltage will be larger than nominal. Make sure to keep base plate temperature even by using one heat sink for all units.

(3) IOG signal

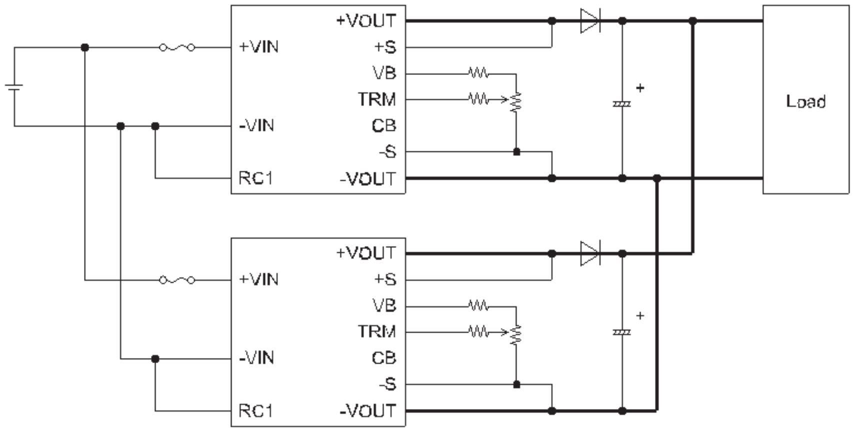
- Output current should be 10% or more of the total of the rated output current in parallel operation. If less than 10%, the IOG signal might become unstable, and output voltage slightly increase (5% max).
- IOG signal might be unstable for one second when the units are turned on in parallel operation.

1.12 Redundant operation

1.12.1 Redundant operation

- Connecting method for external diode on the output side.
- In parallel operation, please connect diode to the +side of the output circuit. If the diode is connected to the - side, it will damage the unit or/and the balancing function will not work.

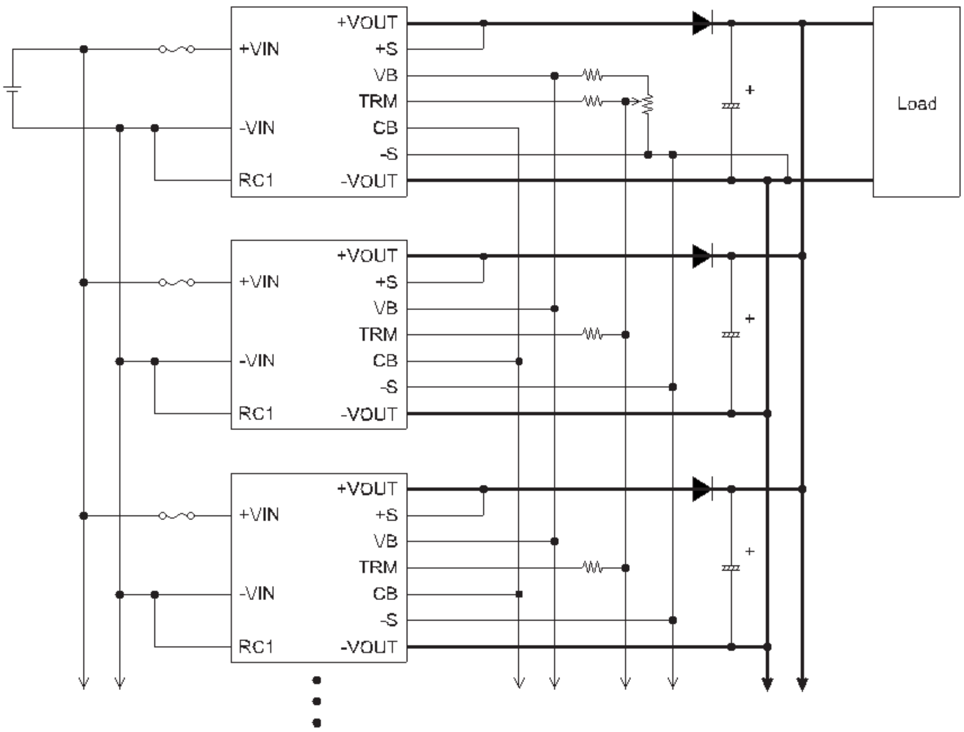
Fig.1.12.1
Example of redundant operation



1.12.2 N+1 Redundant operation

- It is possible to set N+1 redundant operation for improving reliability of power supply system.
- Purpose of redundant operation is to ensure stable operation in the event of single power supply failure. Since extra power supply is reserved for the failure condition, so total power of redundant operation equal to N.

Fig.1.12.2
Example of N+1
redundant operation



1.13 EMC consideration

1.13.1 Line conducted noise

(1) Overview of the conducted noise

- The switch mode power supply generates the conducted noise to the input lines.
  The conducted noise can be categorized into the common mode noise and the differential mode noise.
  CISPR and FCC standards have been used as a world wide benchmark especially for line conducted interference levels.
  If an EMI specification such as CISPR standard must be met, additional filtering may be needed.

- The common mode noise exists between the input terminals and CASE pin.
  The most effective way to reduce common mode noise are to bypass from the input lines to CASE pin with Y capacitor (C_Y) and the common mode choke (L1).
  Fig.1.13.1 shows the overview of the path of the common mode noise.
- The differential mode noise exists between the input terminals.
  The most effective means to reduce differential mode noise are to bypass the input lines with X capacitors (Cx3, Cx4) and the normal mode choke (L2).
  Fig.1.13.2 shows the overview of the path of the differential mode noise.

Fig.1.13.1
Common mode
noise path

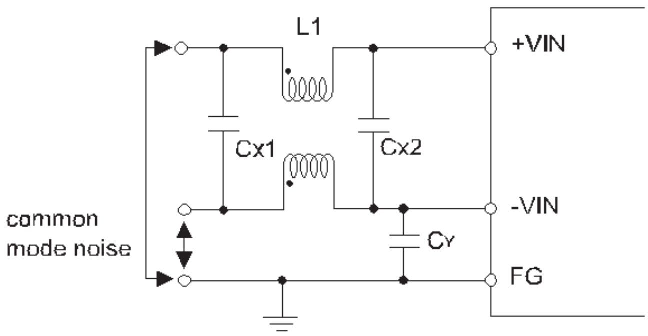
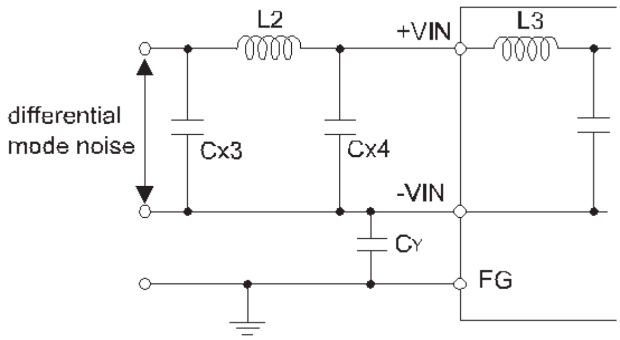


Fig.1.13.2
Differential mode
noise path

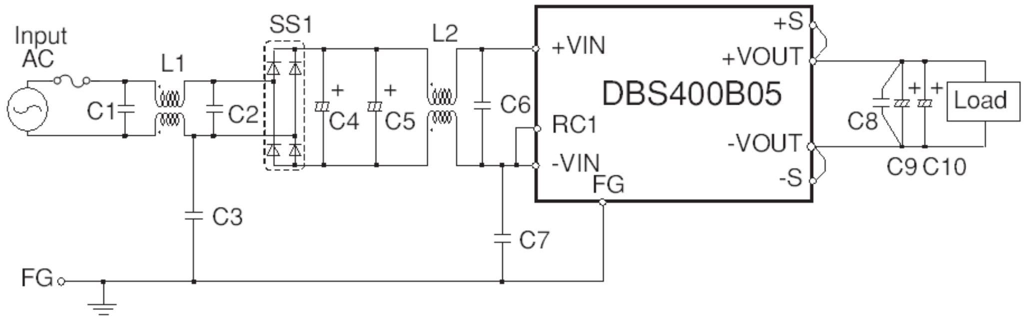


- The DBS provide the normal mode choke (L3) to reduce the differential mode noise.
  Install the capacitor (Cx4) to reduce the differential mode noise.
  The most effective way to reduce the differential mode noise are to install since X capacitor (Cx3) and the normal mode choke (L2).
- The leakage inductance of the common mode choke (L1) works as the normal mode choke.
  The normal mode choke (L2) is not necessary.

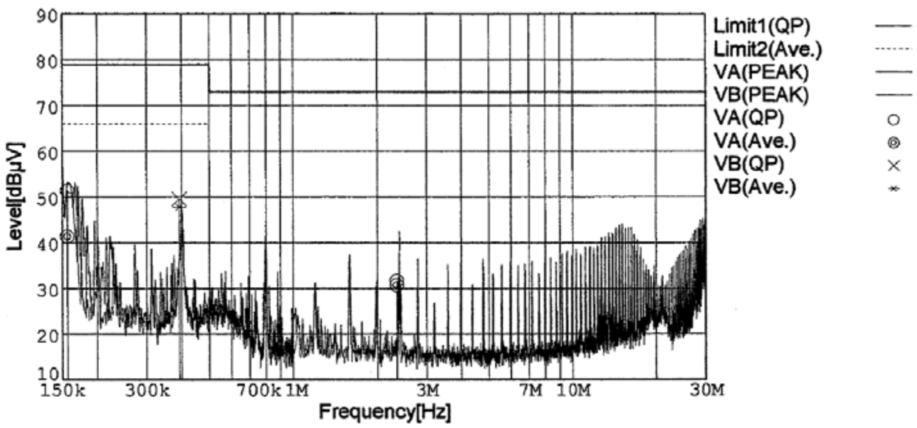
(2) Recommended of noise-filter

- Fig.1.13.3 shows the recommended circuit of noise-filter which meets CISPR Pub. 22 Class A and the noise level.
  DBS400B05 : AC230V INPUT, 5V80A OUTPUT

Fig.1.13.3
Recommended circuit
and noise level
(CISPR Pub.22 Class A)



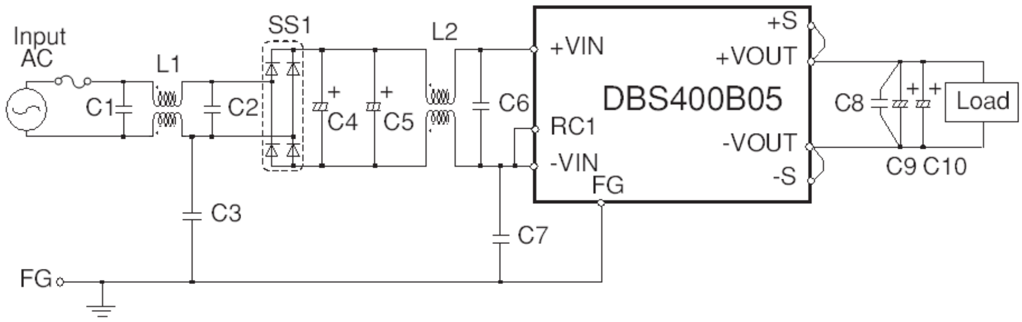
L1=2mH (SC-05-20J : NEC TOKIN)
L2=1mH (SC-03-10GJ : NEC TOKIN)
C1, C2=0.47μF (CFJC22E474M : NITSUKO ELECTRONICS)
C3, C7=AC250V3300pF (KH series : MURATA)
C4, C5=400V220μF (KMM series : NIPPON CHEMI-CON)
C6=0.22μF (CFJC22E224M : NITSUKO ELECTRONICS)
C8=50V0.1μF (MDD21H104M : NITSUKO ELECTRONICS)
C9, C10=10V2200μF (LXZ series : NIPPON CHEMI-CON)



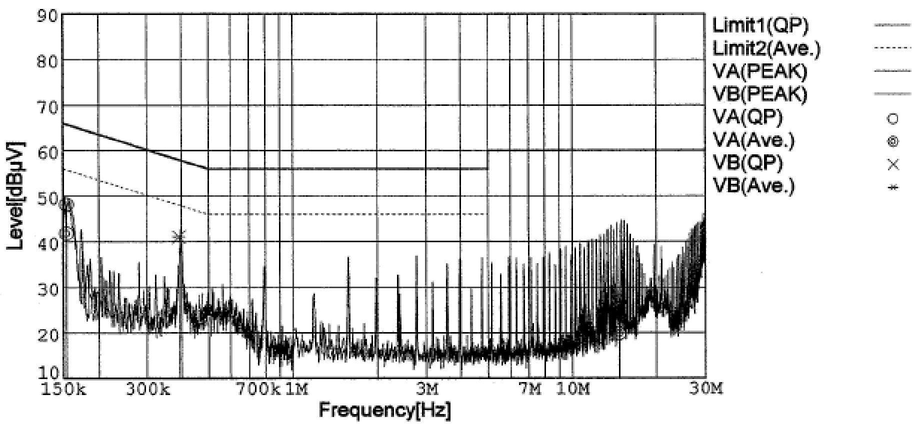
Frequency [MHz]	Meter Reading (QP) [dBμV]	Meter Reading (Ave.) [dBμV]	Factor [dB]	Level (QP) [dBμV]	Level (Ave.) [dBμV]	Line	Limit (QP) [dBμV]	Limit (Ave.) [dBμV]	Margin (QP)[dB]	Margin (Ave.) [dB]
0.1564	41.6	31.5	9.8	51.4	41.3	VA	79.0	66.0	27.6	24.7
2.3509	21.7	20.8	9.9	31.6	30.7	VA	73.0	60.0	41.4	29.3
0.3924	39.8	38.0	9.8	49.6	47.8	VB	79.0	66.0	29.4	18.2

- Fig.1.13.4 shows the recommended circuit of noise-filter which meets CISPR Pub. 22 Class B and the noise level.
  DBS400B05 : AC230V INPUT, 5V80A OUTPUT

Fig.1.13.4
Recommended circuit
and noise level
(CISPR Pub.22 Class B)



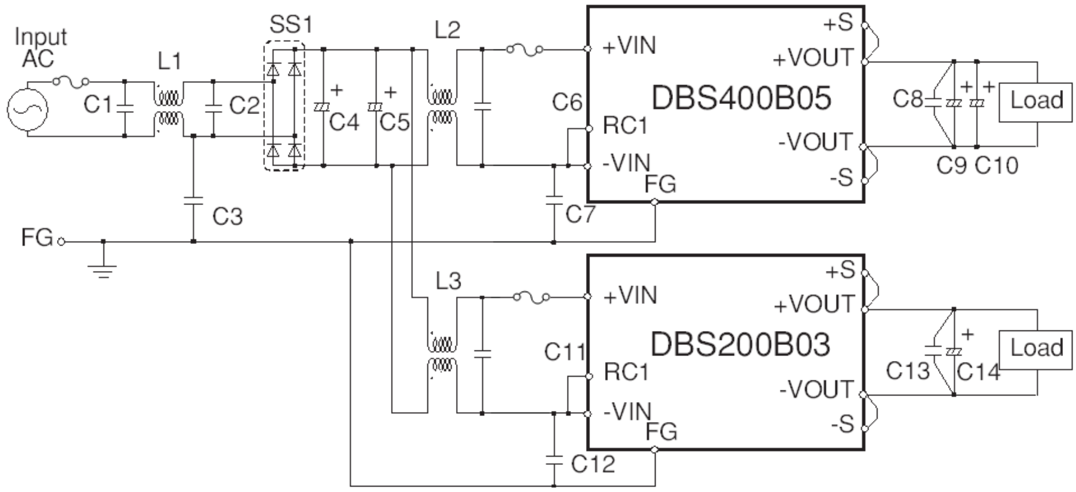
L1=2mH (SC-05-20J : NEC TOKIN)
L2=4.5mH (SS28H-25045 : NEC TOKIN)
C1, C2=0.47mF (CFJC22E474M : NITSUKO ELECTRONICS)
C3, C7=AC250V3300pF (KH series : MURATA)
C4, C5=400V220mF (KMM series : NIPPON CHEMI-CON)
C6=0.22mF (CFJC22E224M : NITSUKO ELECTRONICS)
C8=50V0.1mF (MDD21H104M : NITSUKO)
C9, C10=10V2200mF (LXZ series : NIPPON CHEMI-CON)



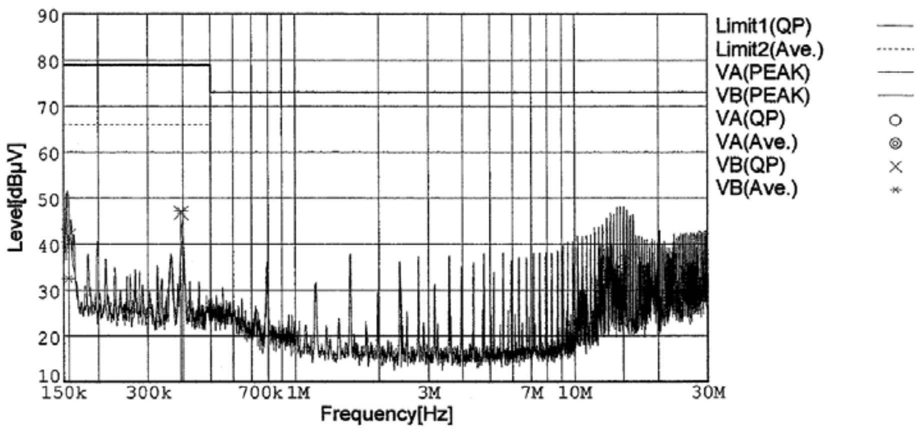
Frequency [MHz]	Meter Reading (QP) [dBμV]	Meter Reading (Ave.) [dBμV]	Factor [dB]	Level (QP) [dBμV]	Level (Ave.) [dBμV]	Line	Limit (QP) [dBμV]	Limit (Ave.) [dBμV]	Margin (QP)[dB]	Margin (Ave.) [dB]
0.1542	38.3	32.0	9.8	48.1	41.8	VA	65.8	55.8	17.7	14.0
14.8011	16.5	9.5	10.2	26.7	19.7	VA	60.0	50.0	33.3	30.3
0.3910	31.2	31.3	9.8	41.0	41.1	VB	58.1	48.1	17.1	7.0

- Fig.1.13.5 shows the recommended circuit of noise-filter which meets CISPR Pub. 22 Class A and the noise level with two modules.
  DBS400B05 : AC230V INPUT, 5V80A OUTPUT
  DBS200B03 : AC230V INPUT, 3.3V50A OUTPUT

Fig.1.13.5
Recommended circuit
and noise level with
two modules
(CISPR Pub.22 Class B)



L1=2mH (SC-05-20J : NEC TOKIN)
L2, L3=4.5mH (SS28H-25045 : NEC TOKIN)
C1, C2=0.47μF (CFJC22E474M : NITSUKO ELECTRONICS)
C3, C7, C12=AC250V3300pF (KH series : MURATA)
C4, C5=400V220μF (KMM series : NIPPON CHEMI-CON)
C6, C11=0.22μF (CFJC22E224M : NITSUKO ELECTRONICS)
C8, C13=50V0.1μF (MDD21H104M : NITSUKO ELECTRONICS)
C9, C10, C14=10V2200μF (LXZ series : NIPPON CHEMI-CON)



Frequency [MHz]	Meter Reading (QP) [dBμV]	Meter Reading (Ave.) [dBμV]	Factor [dB]	Level (QP) [dBμV]	Level (Ave.) [dBμV]	Line	Limit (QP) [dBμV]	Limit (Ave.) [dBμV]	Margin (QP)[dB]	Margin (Ave.) [dB]
14.9952	25.8	23.8	10.2	36.0	34.0	VA	73.0	60.0	37.0	26.0
0.1563	32.0	22.7	9.8	41.8	32.5	VB	79.0	66.0	37.2	33.5
0.3923	37.0	37.4	9.8	46.8	47.2	VB	79.0	66.0	32.2	18.8

1.13.2 Radiated noise

- High-frequency noise is radiated directly from the module, the input lines and the output lines to the atmosphere.
  The noise-filter (EMC component) is required to reduce the radiated noise.
- The effective ways to reduce the radiated noise are to cover units with the metal plate or film.

1.13.3 Output noise

- Install an external capacitor Co between +VOUT and -VOUT for stable operation and low output noise.
  Recommended capacitance of Co is shown in Table1.13.1.
- Install a capacitor Cn=0.1μF (film or ceramic capacitor) for low output high-frequency noise.
- Install a capacitor C_Y, with more than 2200pF, for stable operation and low output noise.

Fig.1.13.6
Measuring method of
the output noise

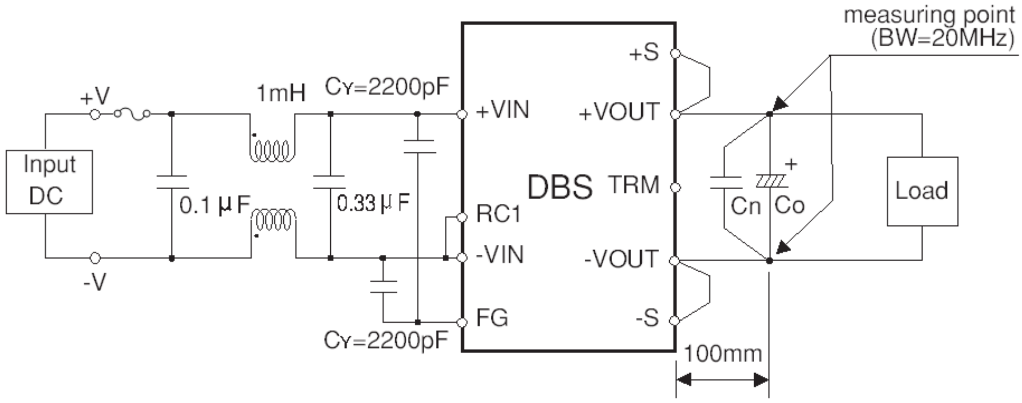


Table1.13.1
Recommended
capacitance Co

VOUT	3.3V	5V	7.5V	12V	13.8V	15V	18V	24V	28V
DBS100A	-	2200μF	-	-	1000μF	-			
DBS150A	-			1000μF	-	1000μF	-	1000μF	-
DBS200B	2200μF			1000μF	-				
DBS400B	6800μF	4700μF		2200μF	-	2200μF		820μF	

- Fig.1.13.7 and Fig.1.13.8 show the output noise level.
  DBS400B05 : DC280V INPUT

Fig.1.13.7
Output noise level
(Cn none)

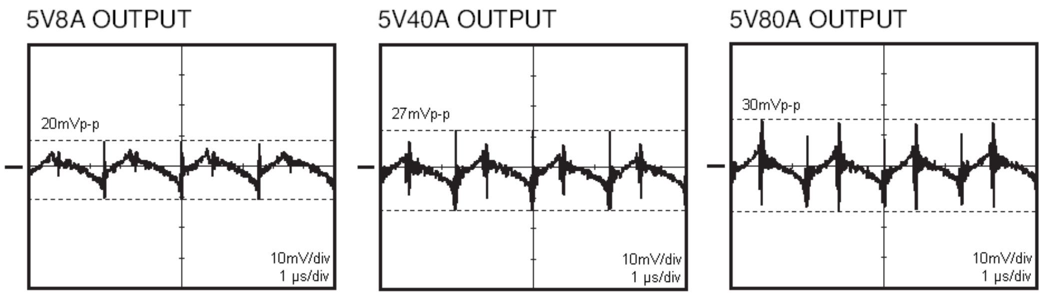


Fig.1.13.8
Output noise level
(Cn=0.1μF)