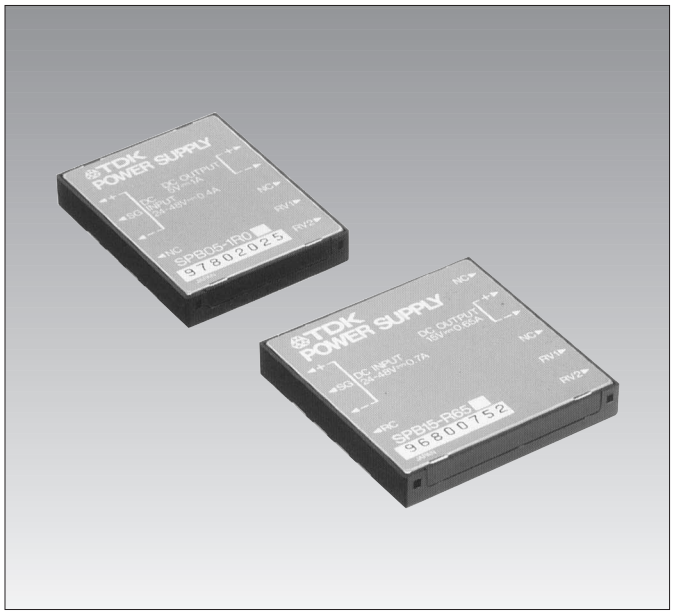
Super-thin type DC.24 to 48V wide input power supply

TDK Switching Power Supply

S SERIES SPB

[FEATURES]

- Wide-input (DC.20 to 56V) super-thin type single-output power supply.
- Plastic package, onboard type.
- Ultra-light.
- Input-output floating.



[SUMMARY]

The S series SPB products are wide-input super-thin type (9mm max.) available for the 24V and 48V types. The super-thin and ultra-light design has been realized by means of a high-density mounting method with surface-mounted components and an efficient radiator structure with a metal base PC board adopted.

PART NUMBERS AND RATINGS

Output voltage(V)	5W Type		10W Type	
	Current(A)	Part No.	Current(A)	Part No.
5	1	SPB05-1R0	2	SPB05-2R0
12	0.4	SPB12-R40	0.8	SPB12-R80
24	0.2	SPB24-R20	0.4	SPB24-R40

- The above products are only produced upon receipt of order. Please check a delivery date.

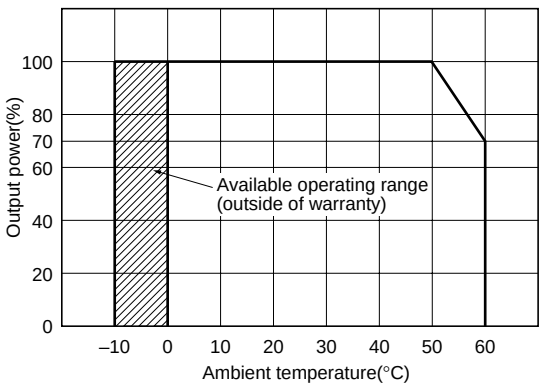
S SERIES SPB5W TYPE

SPECIFICATIONS AND STANDARDS

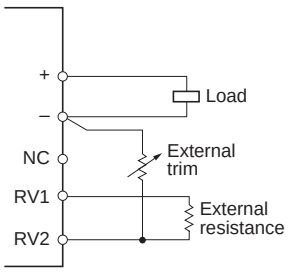
PART NO.			SPB05-1R0	SPB12-R40	SPB24-R20
Rated output voltage and current *1			5V • 1A	12V • 0.4A	24V • 0.2A
Maximum output power		W	5	4.8	4.8
INPUT CONDITIONS					
Input voltage Edc		V	20 to 56[Rating: 24 to 48]		
Input current		A	0.4max./0.2max.[DC.24/48V](Without built-in fuse)		
Efficiency[DC.24V/48V input]		%	75typ./73typ.	77typ./72typ.	77typ./71typ.
OUTPUT CHARACTERISTICS					
Output voltage Edc		V	5	12	24
Output voltage setting deviation		%	±5max.[Without external resistance and external trim]		
Voltage variable range*2		%	±10typ.[Without external resistance and variable with external trim]		
Maximum output current		A	1	0.4	0.2
Overvoltage threshold Edc		V	5.5 to 6.9	13.2 to 15.7	26.4 to 31.5
Overcurrent threshold		A	1.2 to 2	0.48 to 0.8	0.24 to 0.4
Voltage stability	Input variation	%	2max.(1typ.)[Within the input voltage range]	Total variation 5max.(2.5typ.)	
	Load variation	%	2max.(1typ.)[10 to 100% load]		
	Temperature variation	%	2max.(1typ.)[Ambient temperature: 0 to +50°C]		
	Drift	%	0.5max.(0.1typ.)[25°C, input and output ratings, after input voltage ON for 30min to 8h]		
	Dynamic load	%/ms	±4max./1ms[50 to 100% sudden load change]		
Ripple Ep-p		mV	100max.	200max.	300max.
Ripple noise Ep-p		mV	200max.	300max.	400max.
AUXILIARY FUNCTIONS					
Overvoltage protection			Voltage shut-down type, recovers upon reset.		
Overcurrent protection			Fixed current and voltage threshold type, automatic recovery.		
Remote ON-OFF			No		
Remote sensing			No		
CONSTRUCTIONS					
External dimensions		mm	8.5×50.8×39.8[H×W×L]		
Weight		g	30max.		
Mounting method			On board type		
Case material			Nonflammable resin[UL94V-0]		

*1 Current rating(maximum output current) is determined for 0 to +50°C. Derating is required when used outside this temperature range.

OUTPUT POWER-AMBIENT TEMPERATURE (DERATINGS)



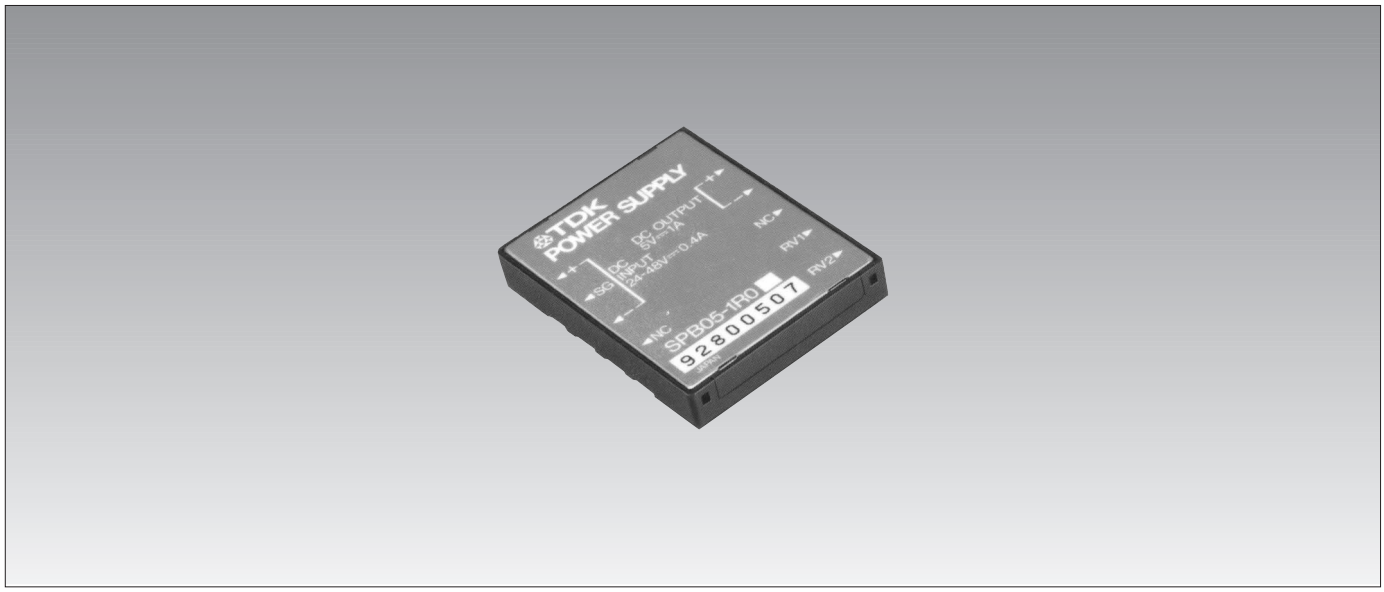
*2 Determination of output voltage



Output voltage rating(V)	5	12	24
External trim(Ω)	10k	10k	10k
External resistance(Ω)	390	8.2k	27k

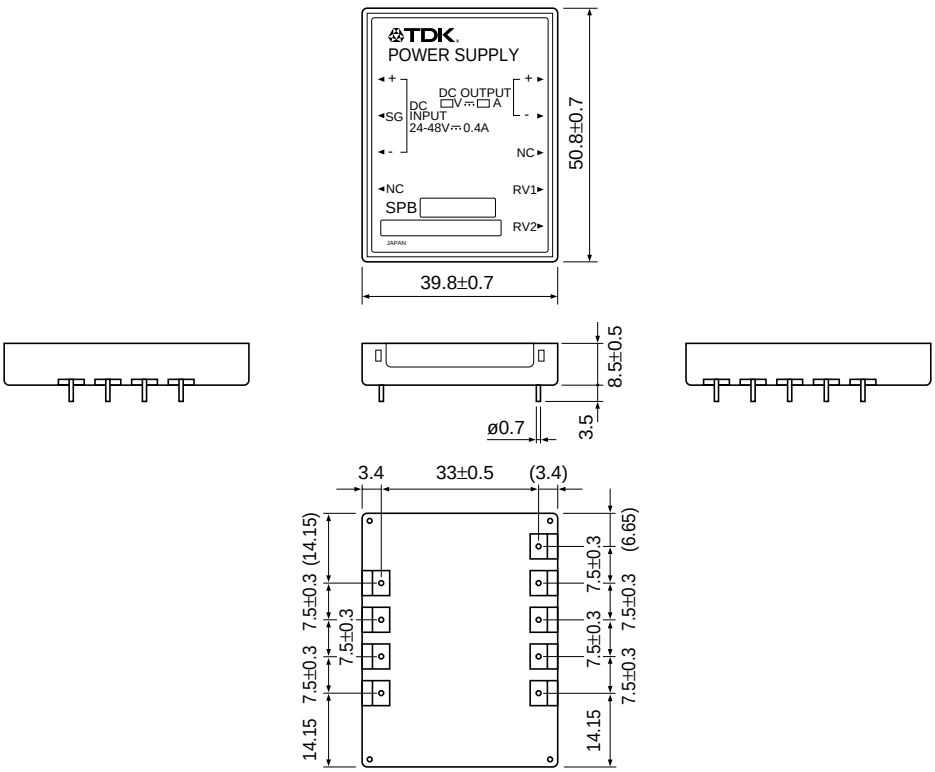
(1/4W)

S SERIES SPB5W TYPE



SHAPES AND DIMENSIONS
SPB5W TYPE

Dimensions in mm
±0.5mm : without specified dimensions



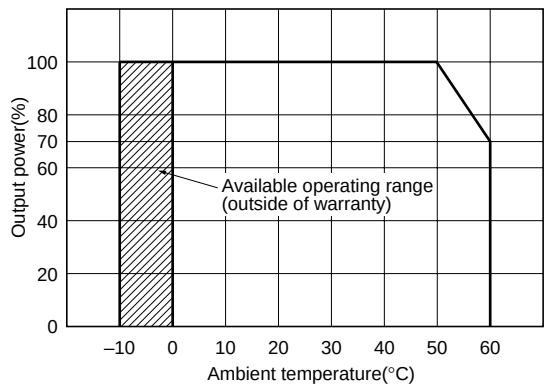
S SERIES SPB10W TYPE

SPECIFICATIONS AND STANDARDS

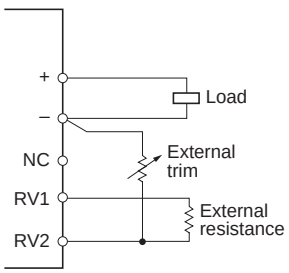
PART NO.			SPB05-2R0	SPB12-R80	SPB24-R40
Rated output voltage and current*1			5V • 2A	12V • 0.8A	24V • 0.4A
Maximum output power		W	10	9.6	9.6
INPUT CONDITIONS					
Input voltage Edc		V	20 to 56[Rating: 24 to 48]		
Input current		A	0.7max./0.4max.[DC.24/48V](Without built-in fuse)		
Efficiency[DC.24V/48V input]		%	81typ./80typ.	82typ./80typ.	80typ./76typ.
OUTPUT CHARACTERISTICS					
Output voltage Edc		V	5	12	24
Output voltage setting deviation		%	±5max.[Without external resistance and external trim]		
Voltage variable range*2		%	±10typ.[Without external resistance and variable with external trim]		
Maximum output current		A	2	0.8	0.4
Overvoltage threshold Edc		V	5.5 to 6.9	13.2 to 15.7	26.4 to 31.5
Overcurrent threshold		A	2.4 to 4	1 to 1.6	0.5 to 0.8
Voltage stability	Input variation	%	2max.(1typ.)[Within the input voltage range]	Total variation 5max.(2.5typ.)	
	Load variation	%	2max.(1typ.)[10 to 100% load]		
	Temperature variation	%	2max.(1typ.)[Ambient temperature:0 to +50°C]		
	Drift	%	0.5max.(0.1typ.)[25°C, input and output ratings, after input voltage ON for 30min to 8h]		
	Dynamic load	%/ms	±4max./1ms[50 to 100% sudden load change]		
Ripple Ep-p		mV	200max.	200max.	300max.
Ripple noise Ep-p		mV	250max.	300max.	400max.
AUXILIARY FUNCTIONS					
Overvoltage protection			Voltage shut-down type, recovers upon reset.		
Overcurrent protection			Fixed current and voltage threshold type, automatic recovery.		
Remote ON-OFF			Yes		
Remote sensing			No		
CONSTRUCTIONS					
External dimensions		mm	8.5×50.8×50.8[H×W×L]		
Weight		g	40max.		
Mounting method			On board type		
Case material			Nonflammable resin[UL94V-0]		

*1 Current rating(maximum output current) is determined for 0 to +50°C. Derating is required when used outside this temperature range.

OUTPUT POWER-AMBIENT TEMPERATURE (DERATINGS)



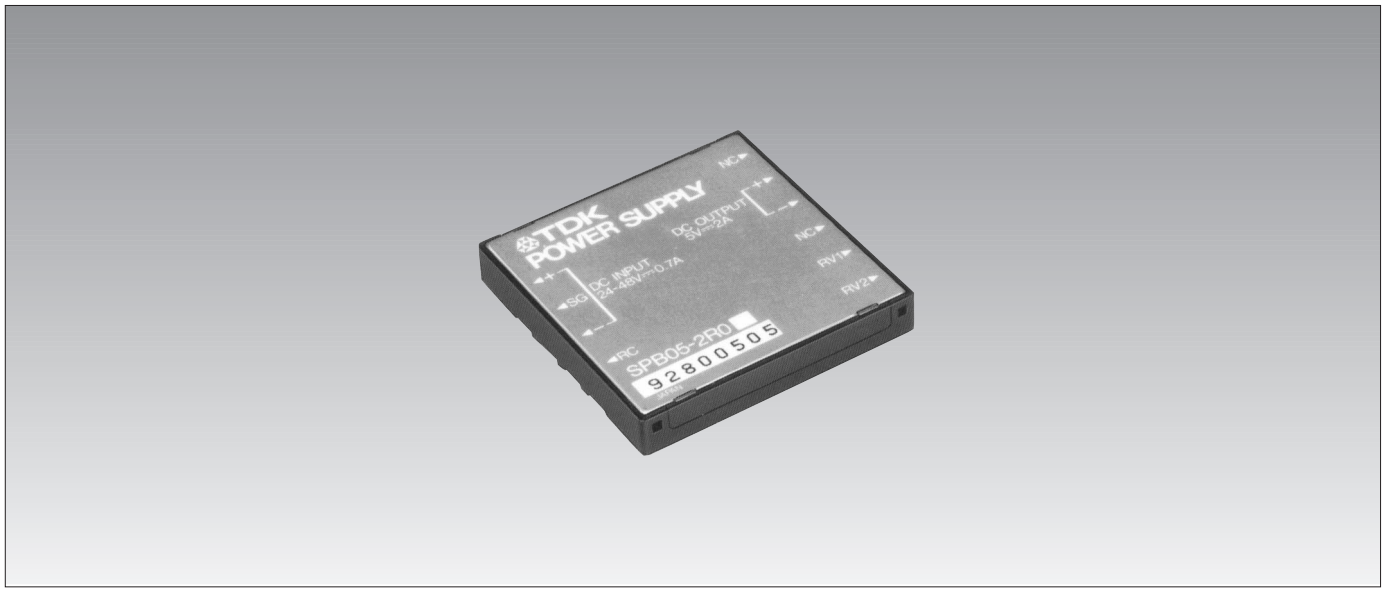
*2 Determination of output voltage



Output voltage rating(V)	5	12	24
External trim(Ω)	5k	10k	10k
External resistance(Ω)	270	8.2k	33k

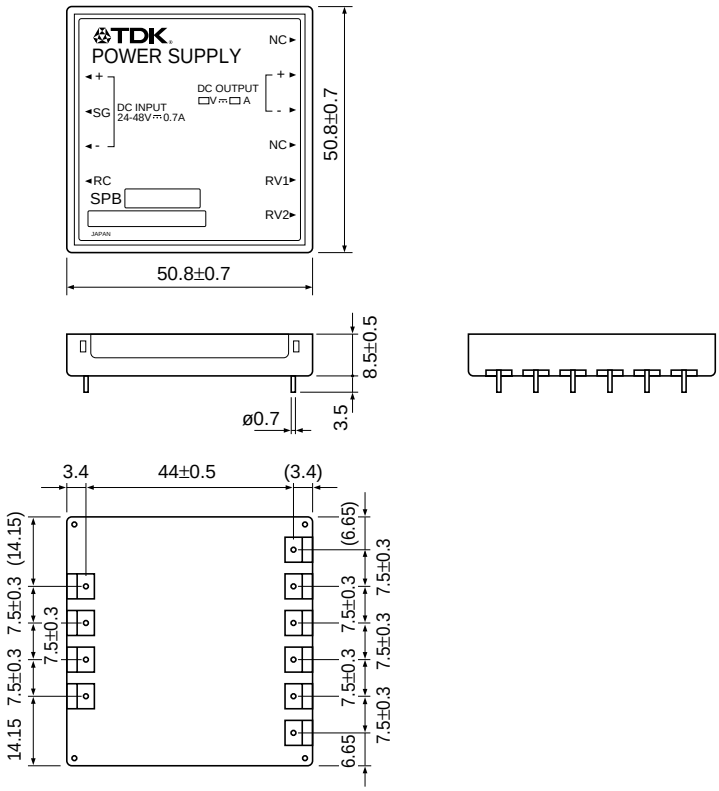
(1/4W)

S SERIES SPB10W TYPE



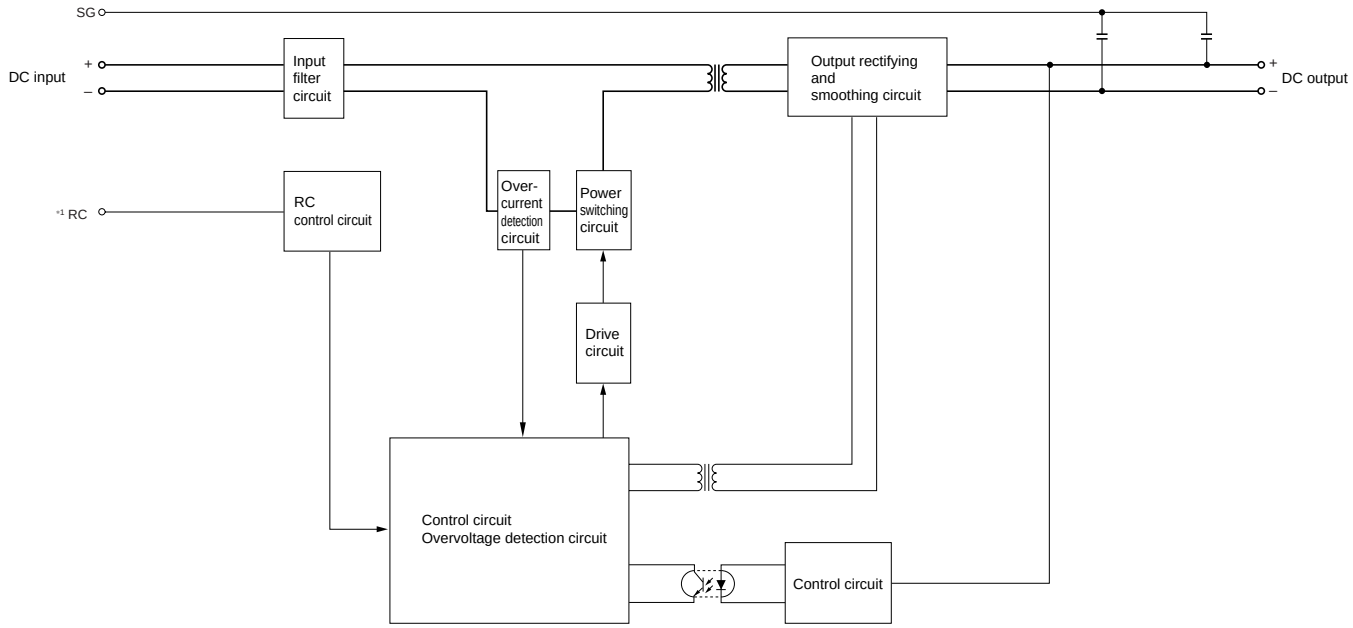
SHAPES AND DIMENSIONS
SPB10W TYPE

Dimensions in mm
±0.5mm : without specified dimensions



Characteristics, Functions, and Applications

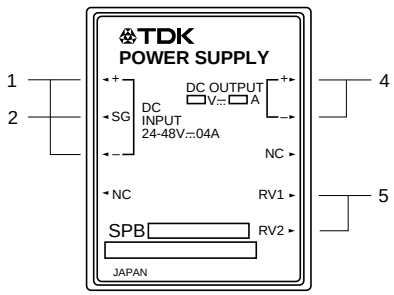
BLOCK DIAGRAM



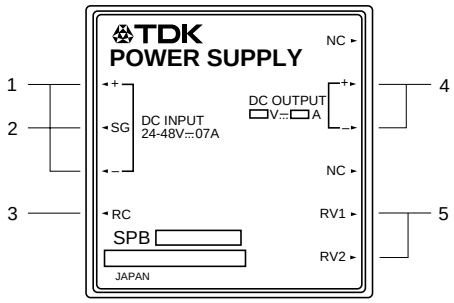
*1 RC(Remote ON-OFF) is floated between the input and output(10W Type only).

TERMINAL DESIGNATIONS AND FUNCTIONS

5W TYPE



10W TYPE



1 DC input terminals(DC INPUT)
Connected to the DC input line.

2 Signal ground terminal(SG)
Be sure to connect this terminal to one of the (+) and (–) DC input terminals. This terminal is short-circuited with the metal portion of the top surface of the case.

3 Remote ON-OFF terminal(RC) (10W type only)
The output voltage can be turned on or off by applying a voltage of a TTL level to a portion between these RC terminals and the input terminal.
Between RC and input (–): Turned on at high level (2.4 to 5V) or in open condition.
Between RC and input (–): Turned off at low level (0 to 0.4V) or in short circuit.
The RC terminal is pulled up inside the power supply and therefore it should be opened when not in use.

4 DC output terminals(+, –)
Connected to a load line.

5 Output voltage external variable terminals(RV1, RV2)
The output voltage is externally variable within a range of approx. ±10% of the rated output voltage when a resistance is connected between the RV1 and RV2 terminals and between the RV2 and output (–) terminals.

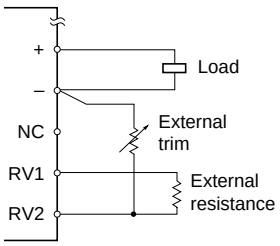
Characteristics, Functions, and Applications

COMMON SPECIFICATIONS

Temperature and humidity		
Temperature range	Operating(°C)	0 to +60 Derating is necessary when operating environment temperature exceed 50°C.
	Storage(°C)	–25 to +75
Humidity range	Operating(%)RH	20 to 95[Maximum wet-bulb temperature: 35°C, without dewing]
	Storage(%)RH	
Amplitude and vibration		
Amplitude	5 to 10Hz	All amplitude 10mm[3 directions, each 1h]
	10 to 55Hz	Acceleration 19.6m/s^2 [2G, 3 directions, each 1h]
Vibration	Acceleration	196m/s^2 [20G, 3 directions, each 3 times]
	Vibration time	11±5ms
Withstand voltage and insulation resistance		
Withstand voltage	Input terminal to output terminal	Edc(V)500, 1min[Normal temperature, normal humidity, cutout current 5mA]
Insulation resistance	Input terminal to output terminal	Edc(V)500, 100MΩ min. [Normal temperature, normal humidity]
	Output terminal to Signal ground terminal	

OUTPUT VOLTAGE ADJUSTMENT

While this product can be used without an external resistance, the output voltage can be adjusted within a range of approx. ±10% of the rated output voltage when a resistance is connected between the RV1 and RV2 terminals and between the RV2 and output (–) terminals.



SPB(5W type)

Output voltage rating(V)	5	12	24
External trim(Ω)	10k	10k	10k
External resistance(Ω)	390	8.2k	27k

(1/4W)

SPB(10W type)

Output voltage rating(V)	5	12	24
External trim(Ω)	5k	10k	10k
External resistance(Ω)	270	8.2k	33k

(1/4W)

REMOTE ON-OFF(10W TYPE)

The output voltage can be turned on or off by applying a voltage of a TTL level to a portion between these RC terminals and the input terminal.

- Between RC and input (–): Turned on at high level (2.4 to 5V) or in open condition.
- Between RC and input (–): Turned off at low level (0 to 0.4V) or in short circuit.

The RC terminal is pulled up inside the power supply and therefore it should be opened when not in use.

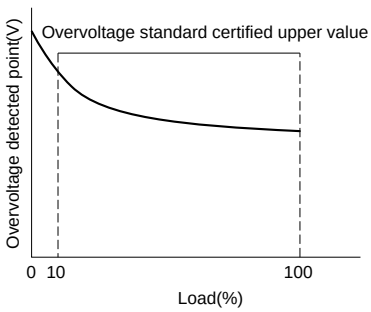
OVERCURRENT PROTECTION CIRCUIT

The overcurrent protection circuit is provided to protect a power supply circuit from a short-circuit of a load or other troubles. If the load current exceeds the rated value, it operates to decrease the output voltage. The voltage recovers after removing the cause.

OVERVOLTAGE PROTECTION CIRCUIT

If the output voltage of the power supply exceeds the overvoltage detected value for some reason, the overvoltage protection circuit halts the output of the power supply. A normal voltage is secured by resetting the power supply after removing the cause (Note that, however, this circuit does not operate when an overvoltage is applied externally).

• The overvoltage detected point for the load is as shown below.



OV: Overvoltage

In case of any trouble caused by a rise of the overvoltage detected point at a light load, add a dummy load of about 10%.

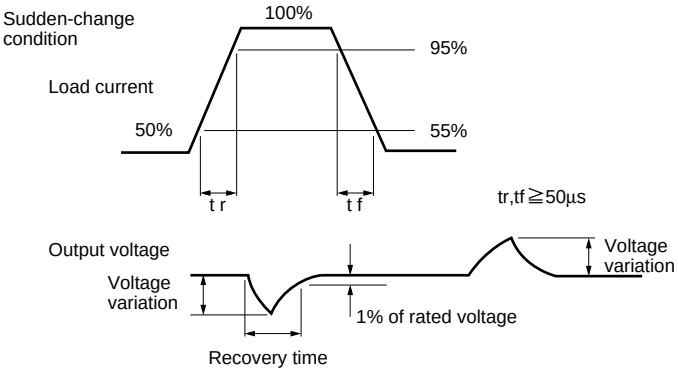
OUTPUT CAPACITOR

An external output capacitor is not particularly needed. For countermeasures against noise, a film or ceramic capacitor is recommended to be attached. If an aluminum electrolytic capacitor or a tantalum electrolytic capacitor is attached, the capacity should be suppressed to the following level or lower. In case of exceeding these capacity levels, please consult TDK.

(Unit: µF)

Output voltage	5V	12V	24V
SPB5W	2200	390	100
SPB10W	3900	470	120

DYNAMIC LOAD



Characteristics, Functions, and Applications

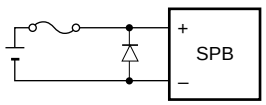
INPUT TERMINAL CONNECTION
Connect the SG terminal with the (–) input terminal for the (+) input voltage and connect the SG terminal with the (+) input terminal for the (–) input voltage. The connection between the terminals should be thick and short with a low impedance pattern.

PARALLEL OPERATION
It is impossible to use a parallel operation (parallel connection of power supply output terminals) for increasing output current. It is possible, however, to perform a parallel operation (backup) within the range of each output power.

SERIAL OPERATION
In case of an insufficient output voltage, a serial connection of power supplies secures the predetermined voltage. The maximum current corresponds to the lowest output current value among those of the power supplies in series. This connection, however, requires a reverse voltage application preventive diode.
(For details, refer to “Switching Power Supply Technical Manual.”)

IN CASE OF A LOAD SHORT-CIRCUITED BY MISTAKE
In case of an occurrence of a short circuit of a load for several minutes, the power supply is protected by an operation of a protection circuit. It should be noted, however, if it continues for a long period of time, the life of the power supply may be significantly reduced due to a deterioration of components.

INPUT REVERSE CONNECTION COUNTERMEASURES
This product contains no protection circuit against a reverse connection of an input power supply. If there is a possibility of a reverse connection or for an abnormality countermeasures, add diode and a fuse to the input terminal as shown below.



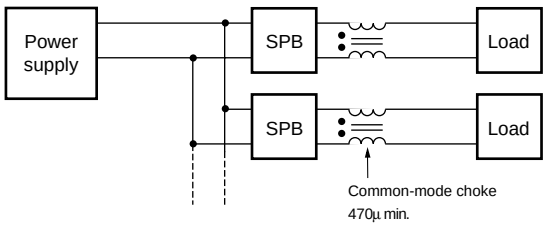
Select a diode having twice or three times forward current of the fuse rated current as the above diode.

Rated current of fuse
5W type: Rated current 1A (Normal melting type)
10W type: Rated current 1.5A (Normal melting type)

FOR LONG INPUT LINE
If the input line is too long (about 20cm or longer), a malfunction may be caused by noise. Connect a capacitor of approx. 100µF in a position closest to a terminal between the input terminals.

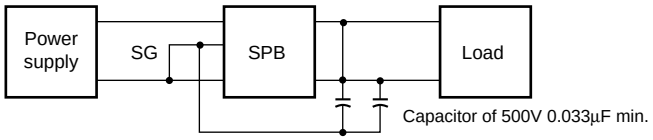
FOR MULTIPLE OPERATIONS
If two or more units (SPB series) are connected to an identical power supply, a long load line may result in a malfunction caused by mutual interference. In such a case, take a common mode noise countermeasure.

Example of countermeasure

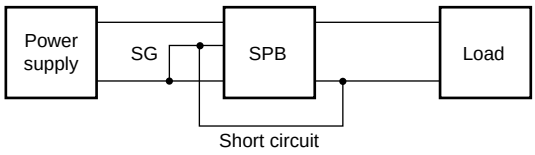


FOR EXTERNAL NOISE
In case of a malfunction caused by external noise, take countermeasures as follows.

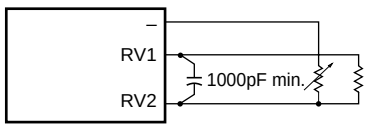
1. For use with insulation between input and output



2. For use with non-insulation between input and output

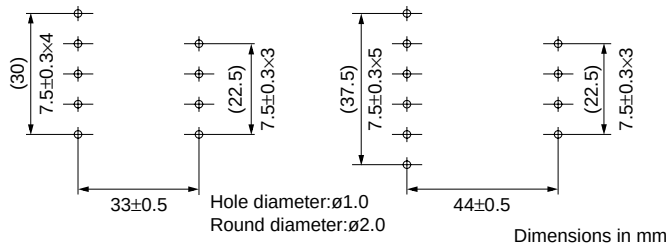


FOR LONG WIRING TO RV TERMINAL
When an output voltage is varied by using an external resistance, too long wiring (about 20cm or longer) may cause a malfunction. Connect a capacitor of approx. 1000pF max. in a position closest to the RV terminals (between the RV1 and RV2 terminals).



MOUNTING METHOD
• Recommended pin pattern

5W type 10W type



Dimensions in mm

• Recommended soldering conditions
Dip: 230±5°C, 5s

• Recommended cleaning conditions
Solvent: IPA
Method: Brush cleaning

OTHERS
1. Unless conditions are otherwise specified in the specifications or standards, 25°C and rated input-output should be applied.
2. Ripple and noise (50MHz max.) are determined for 0 to +50°C temperature range and 10 to 100% load.

TDK