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# AC / DC converter

## BP5041A / BP5041A5 / BP5041A15

The BP5041A, BP5041A5 and BP5041A15 are AC/DC converters which can be used to supply DC output from a commercial power supply (200 to 230V AC). Using these modules enable simple, easy drive of microcomputers, LEDs, and other electronic components without using a transformer. They also allow set PCBs to be kept compact and lightweight, with extremely few attachments.

These products can accommodate the 200V AC power supplies used as household power supplies in Asia and Europe, as well as in buildings and facilities in Japan.

### ●Applications

Power supply circuits for vacuum cleaners, refrigerators, washing machines, air conditioners, irons, electric carpets, cordless telephones, air purifiers, humidifiers, dehumidifiers, home bakery devices, electric crock pots and rice cookers, illumination devices and other small household appliances, as well as power supply circuits for gas leakage sensors, and other industrial products

### ●Features

- 1) Elimination of a transformer enables compact, lightweight power supply boards.
- 2) Wide input voltage range. (226 to 390V DC for DC voltage conversion, 160 to 276V for AC voltage conversion)
- 3) DC power supplies can be easily configured, with few attachments.
- 4) Because no transformer is used, the power supply board is less vulnerable to splitting or cracking from impact or shock.
- 5) Allow easy assemblage of components.

### ●List of the BP5041A series

Parameter	BP5041A5	BP5041A	BP5041A15	Unit
Power supply voltage	226~390	226~390	226~390	V
Output voltage	5	12	15	V
Output current	100	100	80	mA

### ●Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits			Unit
		BP5041A5	BP5041A	BP5041A15	
Power supply voltage	V <sub>IN</sub>	390	390	390	V
Output current	I <sub>o</sub>	100	100	80	mA
Operating temperature range	T <sub>opr</sub>	-25~+80	-25~+80	-25~+80	°C
Storage temperature range	T <sub>stg</sub>	-25~+105	-25~+105	-25~+105	°C

# BP5041A / BP5041A5 / BP5041A15

## Power Module

### ●Recommended operating conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	V <sub>IN</sub>	226	282	390	V <sub>(DC)</sub>

### ●Electrical characteristics (Unless otherwise noted, Ta = 25°C)

#### BP5041A

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Input voltage	V <sub>IN</sub>	226	282	390	V	DC
Output voltage	V <sub>O</sub>	11	12	13	V	V <sub>IN</sub> = 282V, I <sub>O</sub> = 50mA
Output current	I <sub>O</sub>	0	–	100	V	V <sub>IN</sub> = 282V *1
Line regulation	V <sub>r</sub>	–	0.02	0.15	V	V <sub>IN</sub> = 226V~390V, I <sub>O</sub> = 50mA
Load regulation	V <sub>l</sub>	–	0.05	0.15	V	V <sub>IN</sub> = 282V, I <sub>O</sub> = 0~+50mA
Output ripple voltage	V <sub>p</sub>	–	0.05	0.15	V <sub>PP</sub>	V <sub>IN</sub> = 282V, I <sub>O</sub> = 50mA *2
Conversion efficiency	η	50	62	–	%	V <sub>IN</sub> = 282V, I <sub>O</sub> = 100mA

#### BP5041A5

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Input voltage	V <sub>IN</sub>	226	282	390	V	DC
Output voltage	V <sub>O</sub>	4.7	5	5.3	V	V <sub>IN</sub> = 282V, I <sub>O</sub> = 50mA
Output current	I <sub>O</sub>	0	–	100	mA	V <sub>IN</sub> = 282V *1
Line regulation	V <sub>r</sub>	–	0.05	0.15	V	V <sub>IN</sub> = 226V~358V, I <sub>O</sub> = 50mA
Load regulation	V <sub>l</sub>	–	0.05	0.15	V	V <sub>IN</sub> = 282V, I <sub>O</sub> = 0~+50mA
Output ripple voltage	V <sub>p</sub>	–	0.05	0.15	V <sub>PP</sub>	V <sub>IN</sub> = 282V, I <sub>O</sub> = 50mA *2
Conversion efficiency	η	35	48	–	%	V <sub>IN</sub> = 282V, I <sub>O</sub> = 100mA

#### BP5041A15

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Input voltage	V <sub>IN</sub>	226	282	390	V	DC
Output voltage	V <sub>O</sub>	14	15	16	V	V <sub>IN</sub> = 282V, I <sub>O</sub> = 50mA
Output current	I <sub>O</sub>	0	–	80	mA	V <sub>IN</sub> = 282V *1
Line regulation	V <sub>r</sub>	–	0.02	0.15	V	V <sub>IN</sub> = 226V~358V, I <sub>O</sub> = 50mA
Load regulation	V <sub>l</sub>	–	0.05	0.15	V	V <sub>IN</sub> = 282V, I <sub>O</sub> = 0~+50mA
Output ripple voltage	V <sub>p</sub>	–	0.05	0.15	V <sub>PP</sub>	V <sub>IN</sub> = 282V, I <sub>O</sub> = 50mA *2
Conversion efficiency	η	50	64	–	%	V <sub>IN</sub> = 282V, I <sub>O</sub> = 80mA

\*1 Maximum output current varies depending on ambient temperature; please refer to derating curve.  
 \*2 Spike noise is not included in output ripple voltage.

# BP5041A / BP5041A5 / BP5041A15

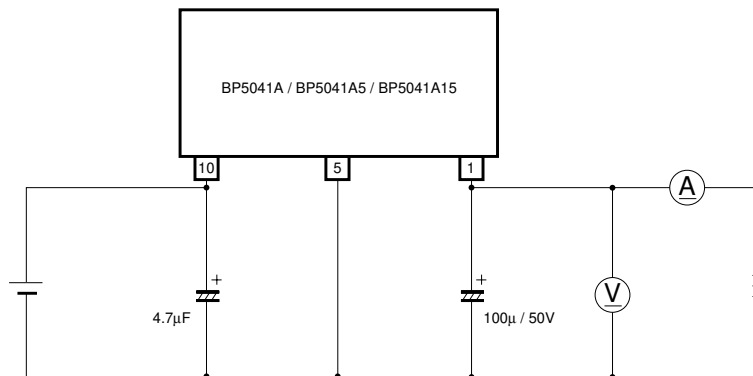
## Power Module

### ● Pin descriptions

Pin No.	Pin name
1	V <sub>OUT</sub>
3	N.C.
5	COMMON
7	N.C.
10	V <sub>IN</sub>

Pins 2, 4, 6, 8, 9 are removed.

### ● Measurement circuit

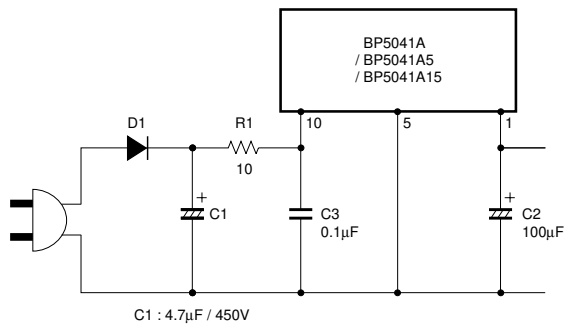


Use a low-impedance product for switching power supplies for the output capacitor.

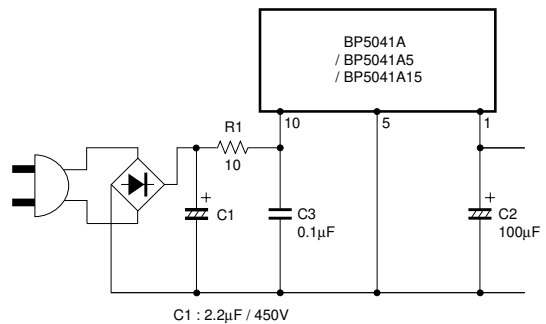
Fig.1

### ● Application example

#### Half wave rectifier circuit



#### Full wave rectifier circuit



C1, C2 (Low-impedance capacitors)

Fig.2

Power Module

Application example for inventor lighting

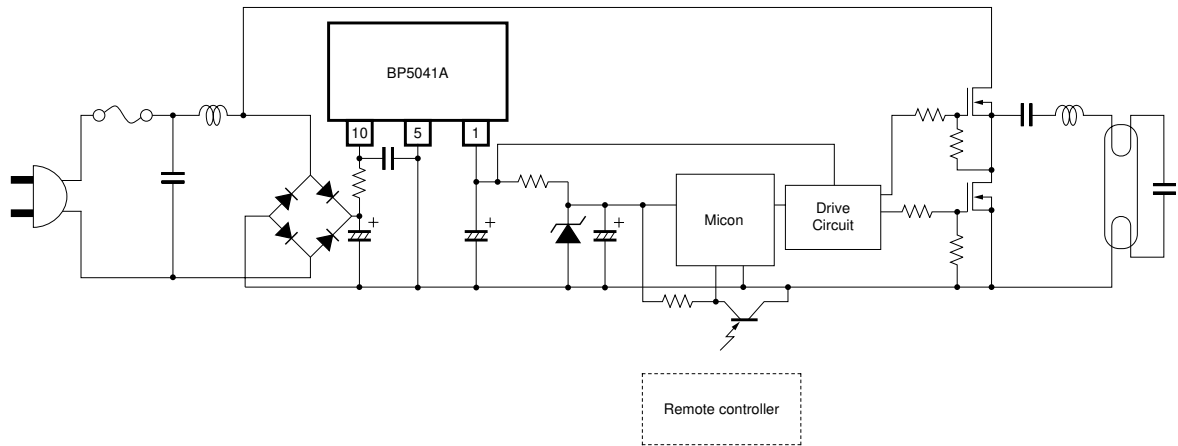


Fig.3

●Selecting attachments

(1) Diodes

The rectifying diodes used should fulfill the following conditions.

In the absolute maximum ratings, the reverse peak voltage should be 700V or higher, the average rectifying current should be 0.5A or higher, and the forward peak surge current should be 20A or higher.

(2) Smoothing capacitor for input pin

A capacitor with a larger capacitance produces a more stable output voltage. A capacitor of between 3.3 $\mu$ F and 10 $\mu$ F is recommended. The capacitor should have a withstanding voltage of at least 400V.

(3) Smoothing capacitor for output pin

This capacitor should have a low ESR. Low-impedance capacitors designed for switching power supplies are especially suitable. The ESR of the capacitor affects the output ripple voltage.

(4) CR filter should be placed between R1 and C3 in order to lower the fine-noise voltage; R1 should be 1/4W and 10 $\Omega$  ~ 22 $\Omega$ , C3 should be a film capacitor and 400V or higher. Make sure to place C3 as near as possible to the modules.

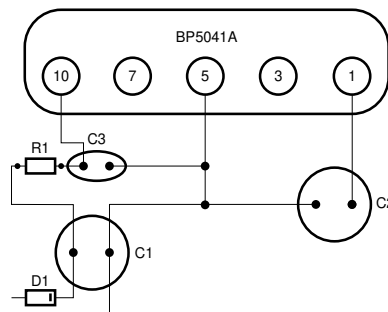


Fig.4

Power Module

(5) Pin noise voltage

The measurement circuit diagram below (Fig.6) was used in the test whose results are shown in Fig.5.

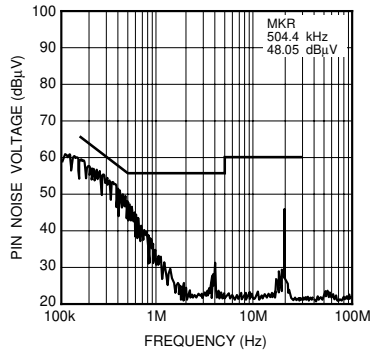


Fig.5 Pin noise voltage

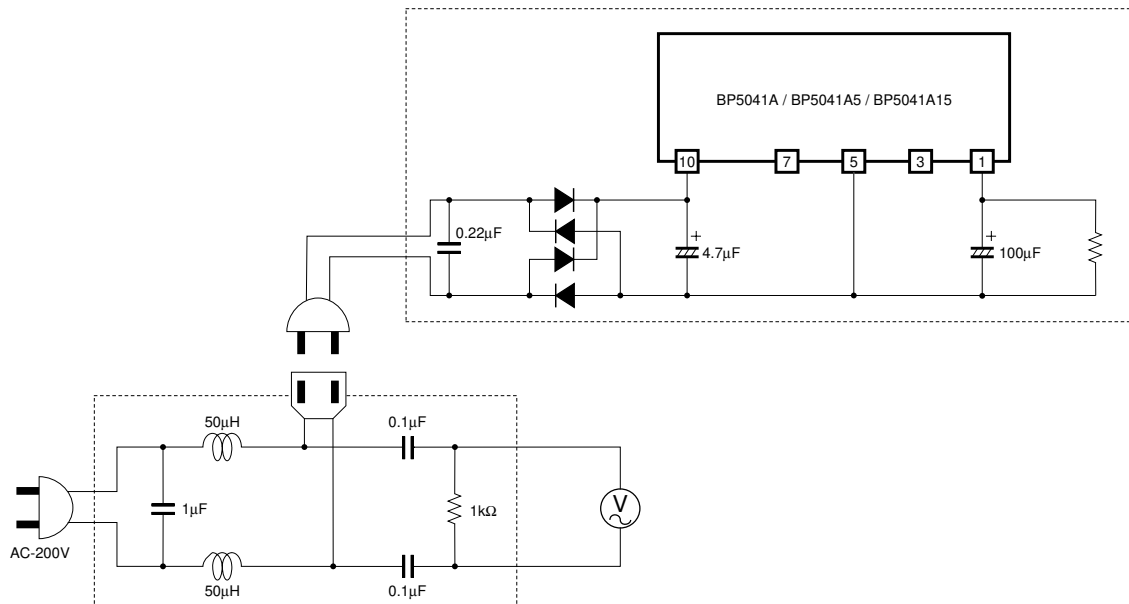


Fig.6

Power Module

●Operation notes

- (1) The output current needs to be reduced as the ambient temperature rises.
- (2) Lead pins should be securely soldered. Avoid subjecting these products to strong impact.
- (3) Over current and shorted circuit
 

The over current limit is a drooping model of approximately 130mA. At 25°C, if over output current of higher than 100mA is produced intermittently, or is produced continuously for a total of one minute or longer, these products are vulnerable to damage. If there is any danger of the load being shorted or over current being produced, always use a protective device such as a fuse. The fuse should have a fusion current of 0.5A.
- (4) Regulations on Electrical Appliances
 

As stand-alone products, they are not subject to regulations governing electrical appliances. Please be aware, therefore, that applications must be submitted for sets and not for individual products.
- (5) Insulation
 

These products are not insulated on the primary and secondary sides, and there is a danger of electrical shock if they are touched.
- (6) Connections with other devices
 

Devices using these products should not be connected to other devices. If connected, insulation should be provided.
- (7) I / O external capacitors should be placed as near as possible to the connection pins.

●Electrical characteristic curves

BP5041A5

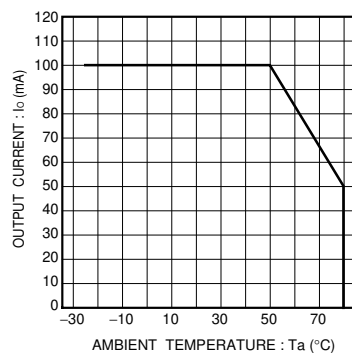


Fig.7 Derating curve

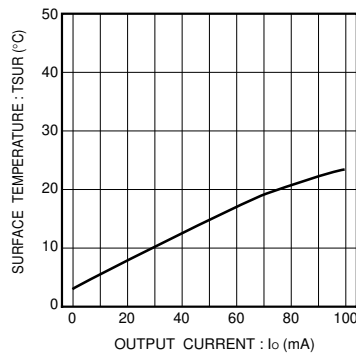


Fig.8 Surface temperature rise

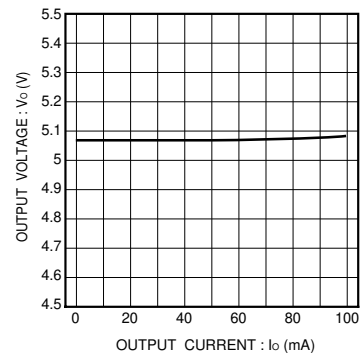


Fig.9 Output characteristic

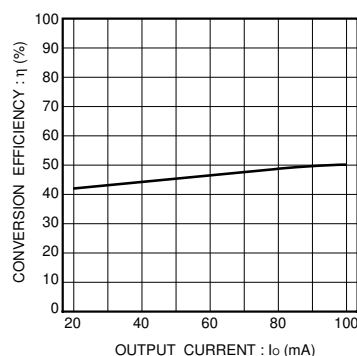


Fig.10 Conversion efficiency

Power Module

BA5041A

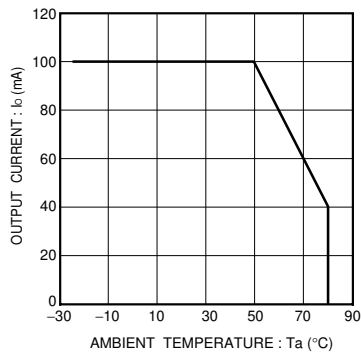


Fig.11 Derating curve

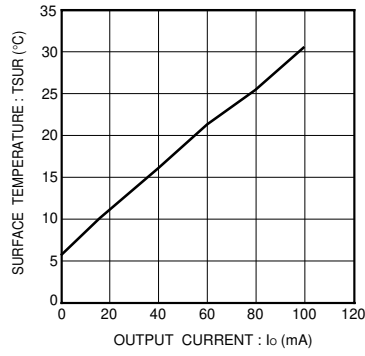


Fig.12 Surface temperature rise

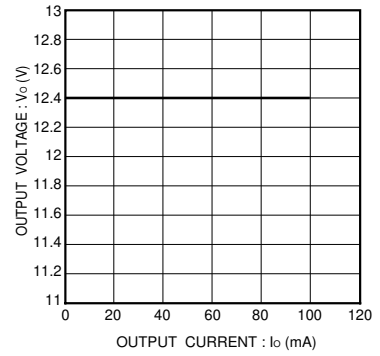


Fig.13 Output characteristic

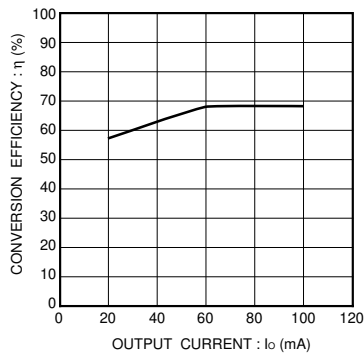


Fig.14 Conversion efficiency

BA5041A15

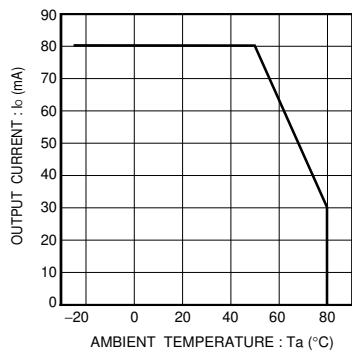


Fig.15 Derating curve

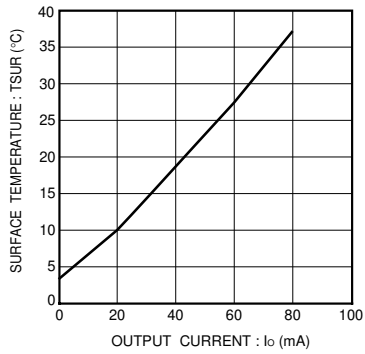


Fig.16 Surface temperature rise

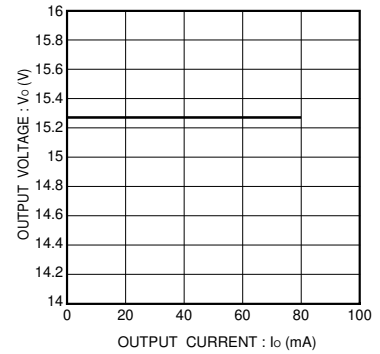


Fig.17 Output characteristic



Power Module

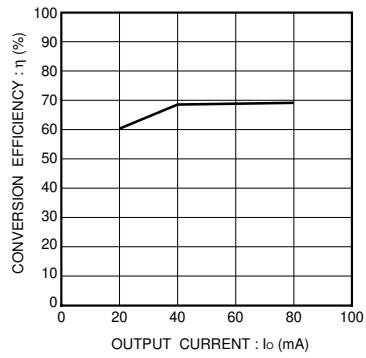
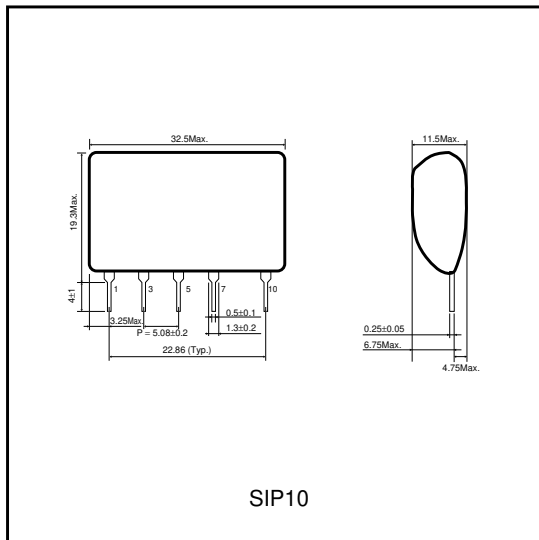


Fig.18 Conversion efficiency

●External dimensions (Units : mm)



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