AC / DC converter unit

BP5034A5

The BP5034A5 is an AC / DC converter that provides a direct current (5V) from commercial power supply (100V, AC), with a small number of external components required. Using this IC, a compact microcontroller-based device can be configured without a transformer.

●Applications

Power supplies for vacuum cleaners, rice cookers, electric pots, steam irons, telephones, electric heaters, lighting equipment, gas leakage alarms, and sensors

●Features

1) Smaller and lighter than transformers.
2) Wide range of input voltage (80 ～ 120V, AC).
3) Few external components required.
4) Power supply board is resistant to impacts because a transformer is not used.
5) The hybrid IC allows easy assemblage of components.

●Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	V_I	170	V
Operating temperature	Topr	−25～+80	℃
Storage temperature	Tstg	−25～+105	℃

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Input voltage	V_I	113	141	170	V	DC
Output voltage	Vo	4.7	5	5.3	V	Io=50mA, V_I=141V
Output current	Io	0	—	100	mA	V_I=141V ＊1
Line regulation	Vr	—	0.03	0.1	V	Io=50mA, V_I=113～170V
Load regulation	Vl	—	0.05	0.15	V	Io=0～50mA, V_I=141V
Output ripple voltage	Vp	—	0.05	0.15	V_{P-P}	Io=50mA, V_I=141V ＊2
Power conversion efficiency	η	35	46	—	%	Io=100mA, V_I=141V

＊1 Based on the derating curve.

＊2 Output ripple voltage does not include spike noise.

●Measurement circuit

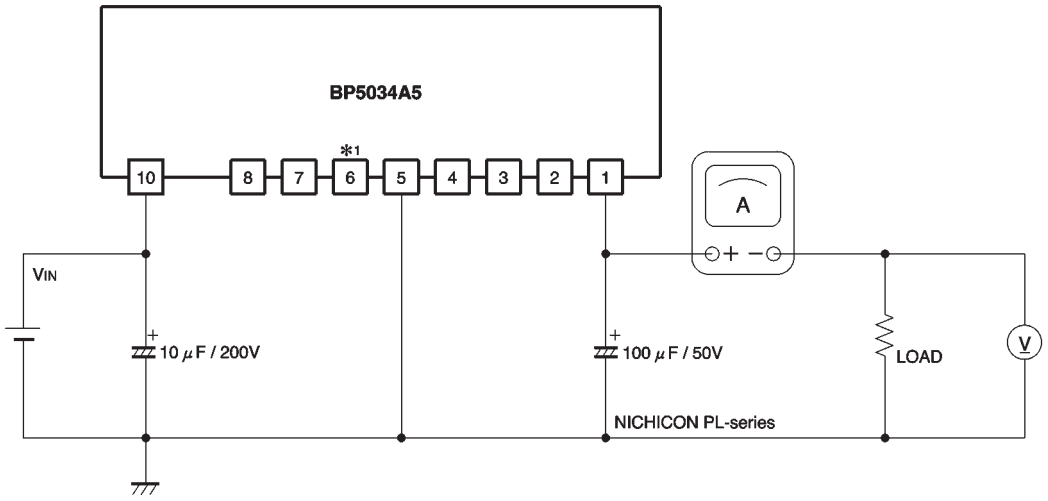

Fig.1

Pin No.	Pin name
1	VOUT
2	N.C.
3	Internally connected
4	N.C.
5	COMMON
6	COMMON *1
7	Internally connected
8	N.C.
10	VIN

Pin 9 is removed.

*1 Pin 6 is the COMMON pin and is connected internally to pin 5. Use eitcher both, or one or the other, as the COMON pin. Keep open the other pins that are not used.

●Basic circuits

Half wave rectification circuit

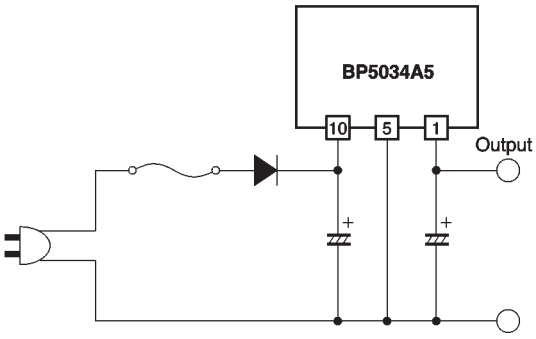

Fig.2

Full wave rectification circuit

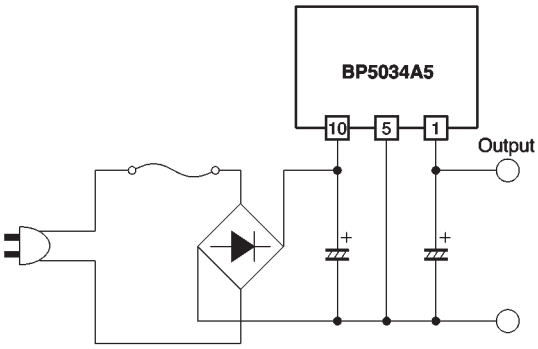

Fig.3

●Application example

Example of a vacuum cleaner application

The diode bridge, which draws out a zero-cross signal, is not required if a zero-cross signal is not used.

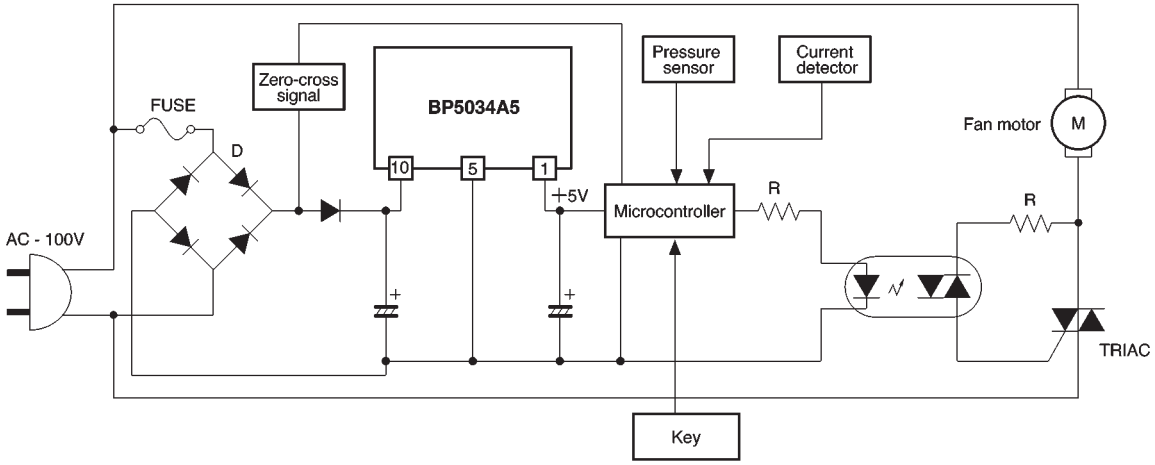

Fig. 4

Example of a rice cooker application

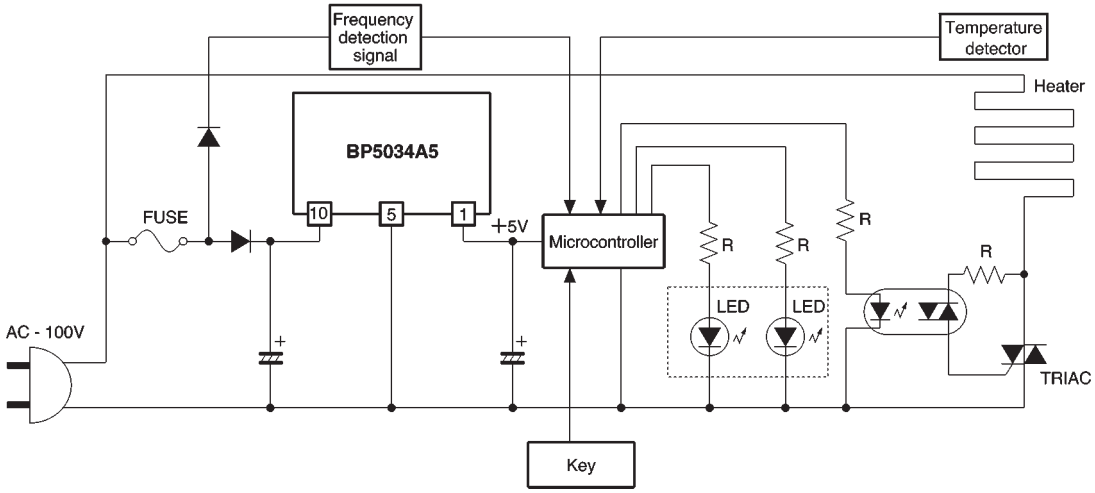

Fig.5

●Selecting attached components

(1) Diodes

Use rectifier diodes with the following absolute maximum ratings: minimum peak reverse voltage is 400V, the mean rectifying current is more than 0.5V, and minimum peak forward surge current is 20A. For example, 1SR35-400A is recommended.

(2) Input voltage smoothing capacitor

When the capacitance of this capacitor is increased, the output voltage is stabilized but the start-up rush current is increased. The waveforms of rush currents for capacitance values of 3.3µF (Fig. 5) and 10µF (Fig. 7) are shown in Figs. 6 and 8, respectively. The recommended capacitance is plotted against the output current in Fig. 9. The capacitor must have a withstand voltage of at least 200V.

(3) Output voltage smoothing capacitor

Use a capacitor with a small ESR. Specifically, a low-impedance capacitor for power supply switching is recommended. The capacitor's ESR affects the output ripple voltage. Capacitor products are listed below for reference.

Manufacturer	Product
Nichicon	PJ series
Matsushita electronic components	A type FA series

Application circuit 1 (C_{IN} = 3.3µF)

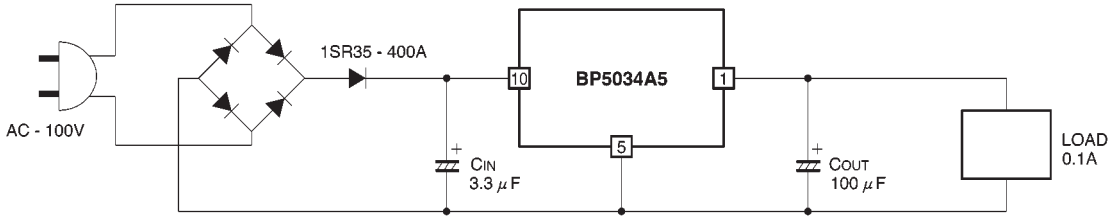

Fig.6

Rush current waveform

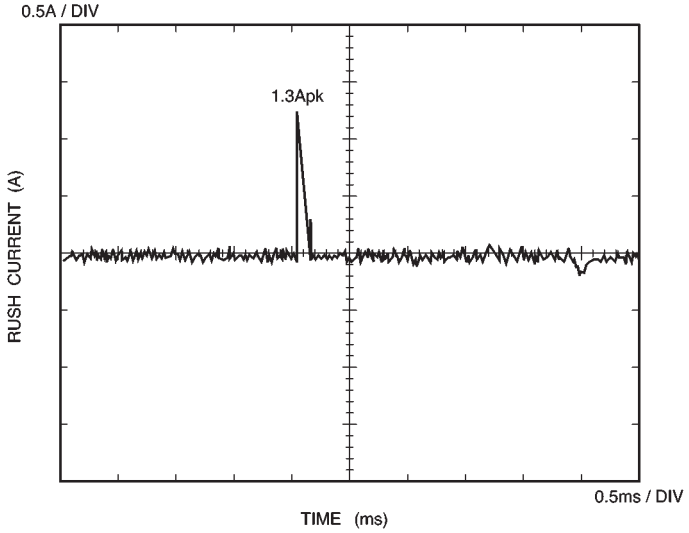

Fig.7

Application circuit 2 (C_{IN} = 10μF)

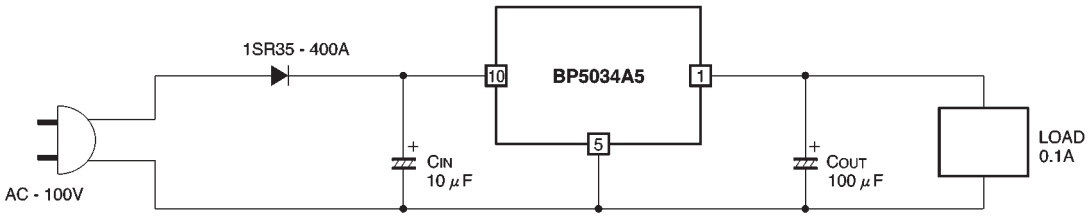

Fig.8

Rush current waveform

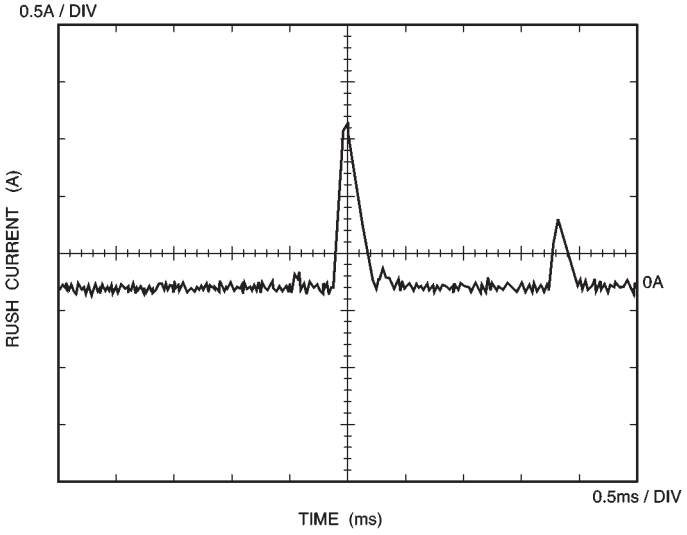

Fig.9

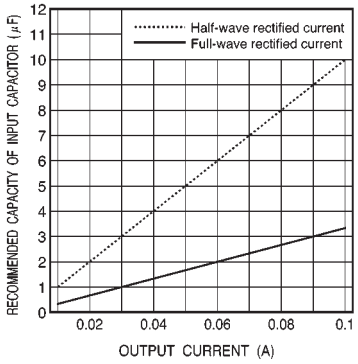

Fig.10

●Operation notes

(1) Output current should be reduced with increasing ambient temperature.

(2) Pins 3 and 7 are internally connected. Use the IC with these pins OPEN.

(3) Overcurrent and short-circuit load

The overcurrent protection circuit limits the current to about 160mA with a curve shape of “inverted -L” in the voltage-current graph. The IC may be damaged if the duration of intermittent overcurrent flows of more than 100mA exceeds 1 minute in total at 25°C. Be sure to take safety measures such as fusing if short-circuit loads or overcurrent is probable. Though a 0.5A continuous break fuse is recommended, careful selection should be made according to the loading condition.

(4) Regulations governing electrical products

A single IC (BP5034A5) unit is not subject to the Regulations on Electrical Appliances. An application for approval should be based on an assembled unit.

(5) Surge tolerance

Results of electrostatic breakdown tests are shown in Fig. 11. The test methods are based on EIAJ ED-4071 and C-111.

Conditons A R2 = 0 (Ω), C = 200pF

−2kV	−1kV	Pin no.	1kV	2kV
		1		
		2		
		3		
		4		
		5		
		6		
		7		
		8		
		10		

Conditions B R2 = 1.5 (kΩ), C = 100pF

−2kV	−1kV	Pin no.	1kV	2kV
		1		
		2		
		3		
		4		
		5		
		6		
		7		
		8		
		10		

Measurement circuit

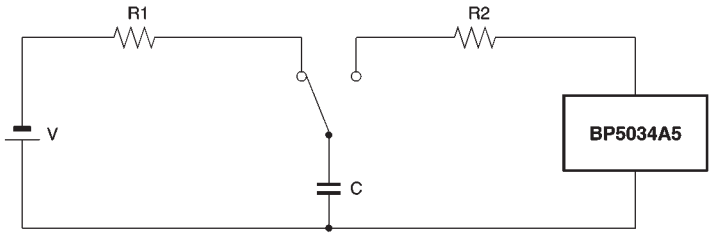

Fig.11

(6) Pin noise voltage

Results obtained by using the Measurement circuit of Fig. 13 are shown in Fig. 12.

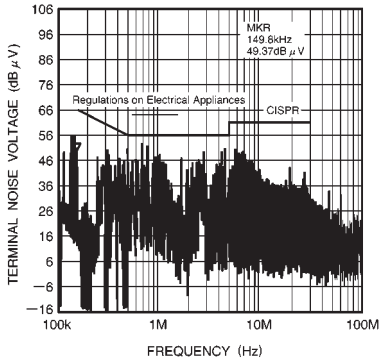

Fig.12

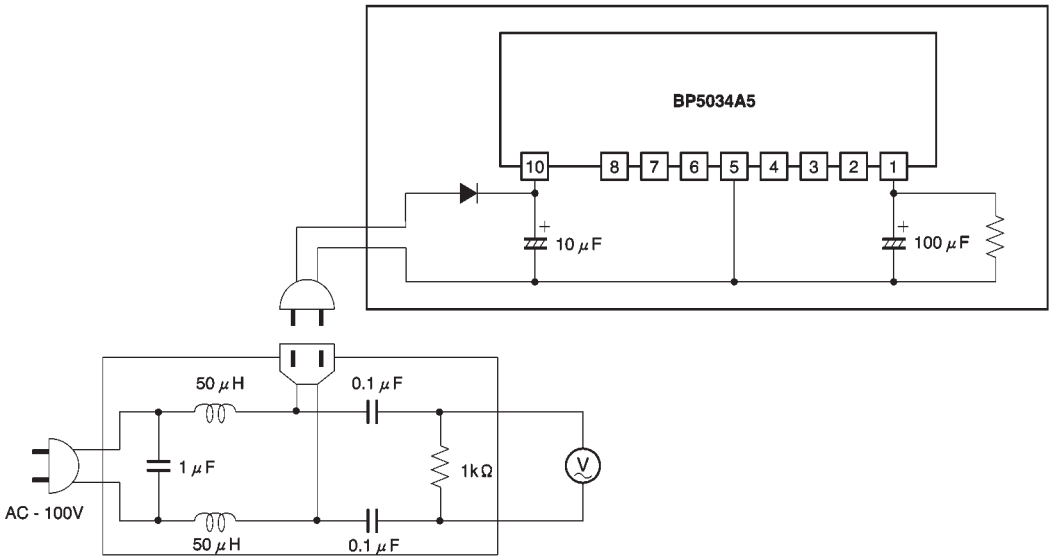

Fig.13

●Electrical characteristic curves (Measurement circuit is Fig. 8)

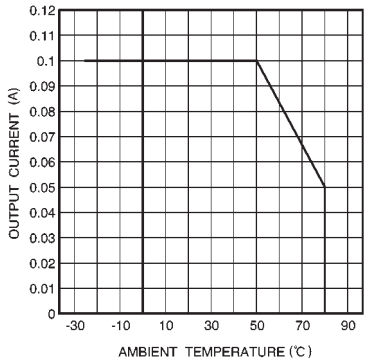

Fig.14 Derating curve

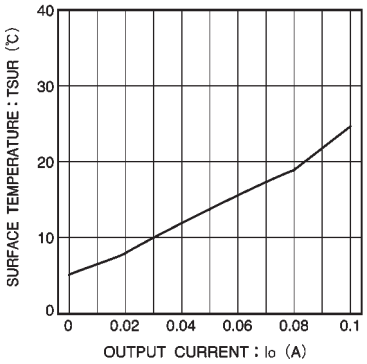

Fig.15 Surface temperature rise

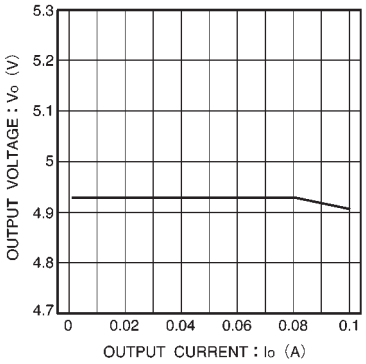

Fig.16 Output characteristic

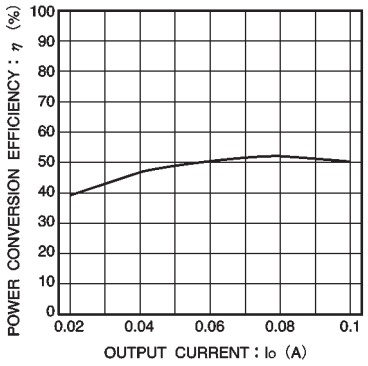

Fig.17 Power conversion efficiency

●External dimensions (Units: mm)