

# AC / DC converter unit

## BP5040

The BP5040 is an AC / DC converter which can be used to supply +5V, 100mA DC output from a commercial power supply (200 to 230V AC). Using this unit enables simple, easy drive of microcomputers, LEDs, and other electronic components without using a transformer. It also allows set PCBs to be kept compact and lightweight, with extremely few attachments.

### ●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 hot water 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 358V DC for DC voltage conversion, 160 to 253V for AC voltage conversion)
- 3) DC power supplies can be easily configured, with few attachments.
- 4) Since no transformer is used, the power supply board is less vulnerable to splitting or cracking from impact or shock.
- 5) Hybridization of the IC reduces the number of labor hours in the assembly process.

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

Parameter	Symbol	Limits	Unit
Power supply voltage	V <sub>CC</sub>	358	V
Output current	I <sub>O</sub>	100	mA
Operating temperature	T <sub>opr</sub>	-25~+80	°C
Storage temperature	T <sub>stg</sub>	-25~+105	°C

### ●Recommended operating conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	V <sub>CC</sub>	226	282	358	V (DC)

●Electrical characteristics (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Input voltage	V <sub>I</sub>	226	282	358	V	DC
Output voltage	V <sub>O</sub>	4.7	5	5.3	V	V <sub>I</sub> =282V, I <sub>O</sub> =50mA
Output current	I <sub>O</sub>	0	—	100	mA	V <sub>I</sub> =282V *1
Line regulation	V <sub>r</sub>	—	0.05	0.15	V	V <sub>I</sub> =226V~358V, I <sub>O</sub> =50mA
Load regulation	V <sub>l</sub>	—	0.05	0.15	V	V <sub>I</sub> =282V, I <sub>O</sub> =0~50mA
Output ripple voltage	V <sub>p</sub>	—	0.05	0.15	V <sub>P-P</sub>	V <sub>I</sub> =282V, I <sub>O</sub> =50mA *2
Power conversion efficiency	$\eta$	35	48	—	%	V <sub>I</sub> =282V, I <sub>O</sub> =100mA

\*1 Maximum output varies depending on ambient temperature; please refer to derating curve.

\*2 Output ripple voltage does not include spike noise.

●Pin descriptions

Pin No.	Pin name
1	V <sub>OUT</sub>
2	Not used
3	N.C.
4	Not used
5	COMMON
6	Not used
7	N.C.
8	Not used
9	Not used
10	V <sub>IN</sub>
11	Not used
12	N.C.
13	Not used
14	N.C.

## ● Measurement circuit

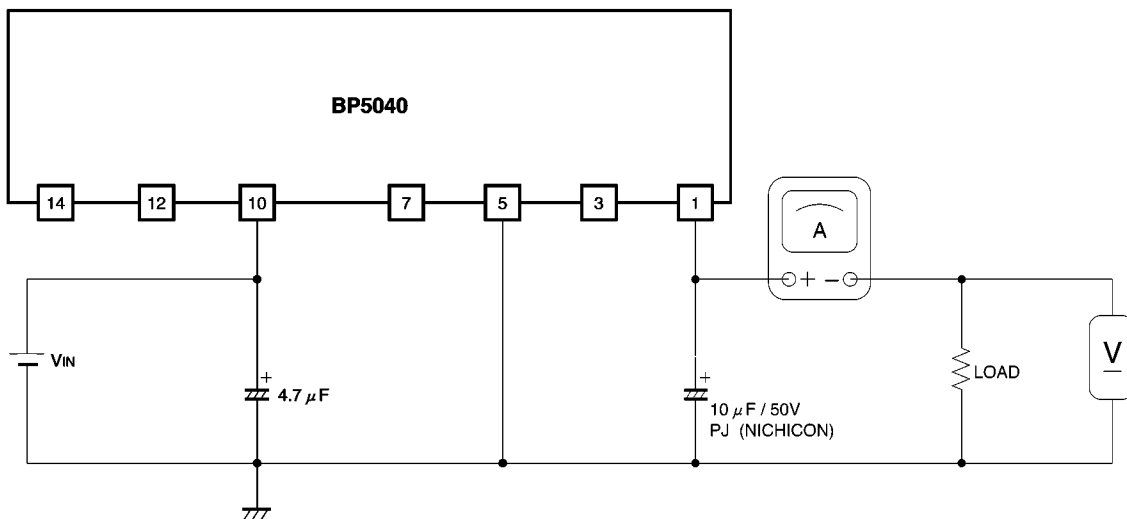


Fig.1

## ● Basic power supply circuit

## Half wave rectification circuit

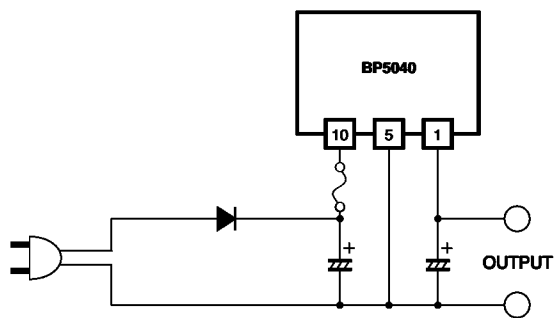


Fig.2

## Full wave rectification circuit

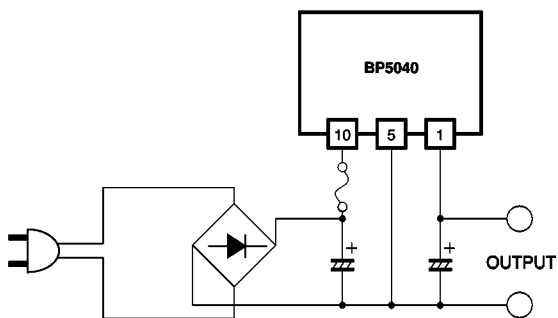


Fig.3

### ●Application example

Example showing product used in vacuum cleaner

The diode bridge is used to extract zero cross signals.

Consequently, if zero cross signals are not required, no diode bridge is required.

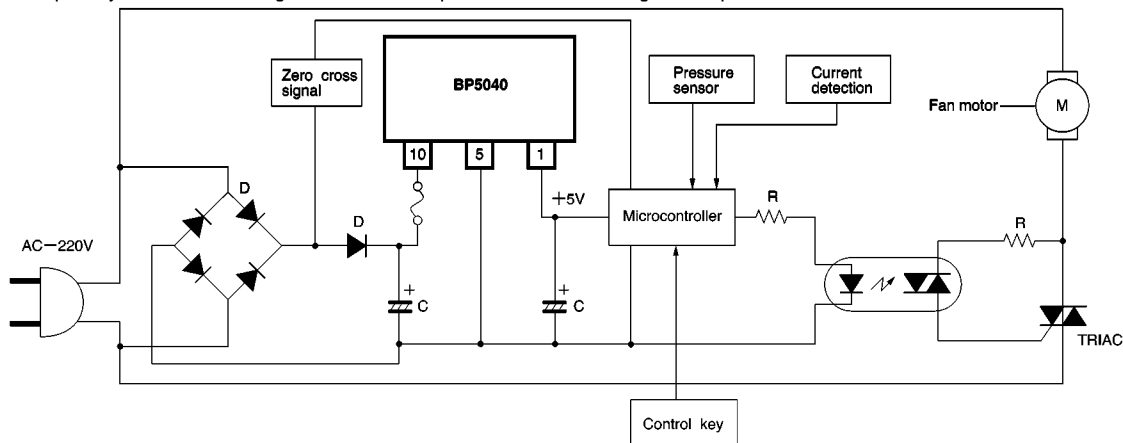


Fig.4

### ●Selecting attached components

#### (1) Diodes

The rectifying diodes used should fulfill the following conditions.

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

#### (2) Capacitor for input voltage smoothing

A capacitor with a larger capacitance produces a more stable output voltage, but increases the surge current when the power supply is turned on. A capacitor of between 3.3 $\mu$ F and 10 $\mu$ F is recommended. The capacitor should have a withstand resistance of at least 400V.

#### (3) Capacitor for output voltage smoothing

This capacitor should have a low ESR. Capacitors designed for low-impedance switching power supplies are especially suitable. The ESR of the capacitor affects the output ripple voltage. Please refer to the table below for the names of products made by various manufacturers.

Maker	Product
Nichicon	PJ series
Matsushita electric	Model A FA series

### ●Operation notes

(1) The output current needs to be reduced as the ambient temperature rises.

(2) Lead pins should be securely soldered. Avoid subjecting this product to strong impact.

(3) Excessive current and shorted loads

The excessive current limit is a drooping model of approximately 160mA. At 25°C, if excessive output current of higher than 100mA is produced intermittently, or is produced continuously for a total of one minute or longer, the product is vulnerable to damage. If there is any danger of the load being shorted or excessive current being produced, always use a protective device such as a fuse. The fuse should have a fusion current of 0.5A.

(4) Regulations governing electrical products

As a stand-alone product, this product is 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

This product is not insulated on the primary and secondary sides, and there is a danger of electrical shock if it is touched.

(6) Connections with other devices

Devices using this product should not be connected to other devices. If connected, insulation should be provided.

## (7) Pin noise voltage

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

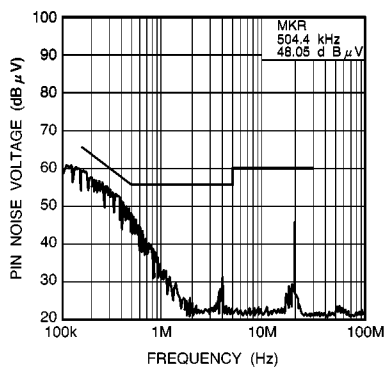


Fig.5 Pin noise voltage

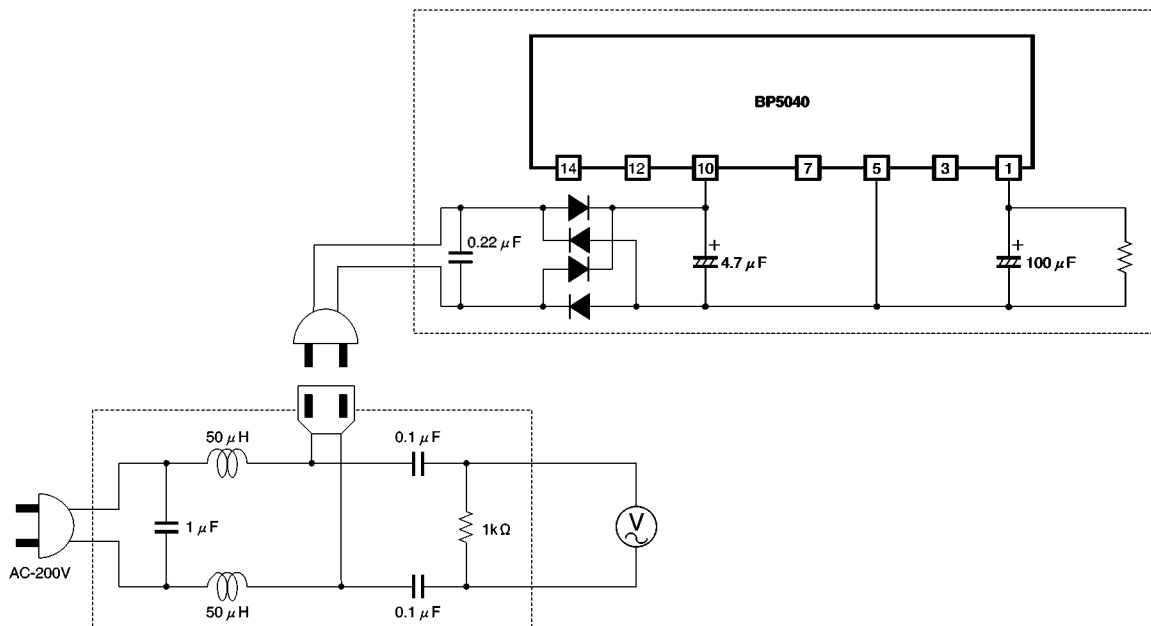


Fig.6 Test circuit

●Electrical characteristic curves

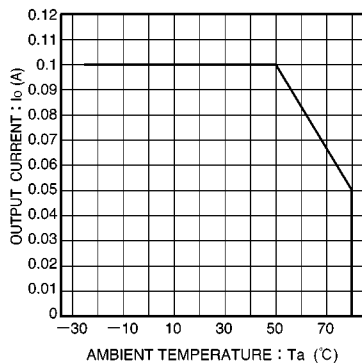


Fig.7 Derating curve

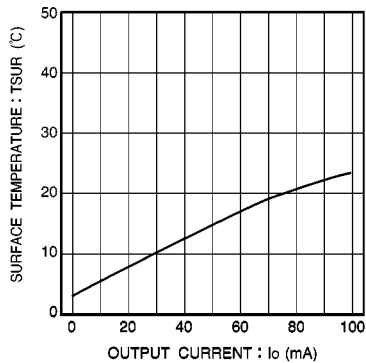


Fig.8 Surface temperature rise

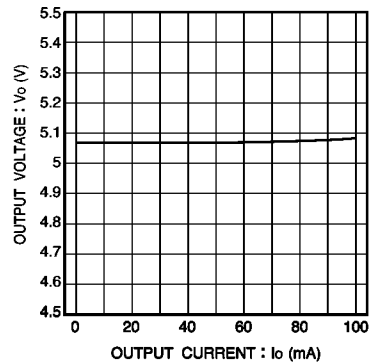


Fig.9 Output characteristic

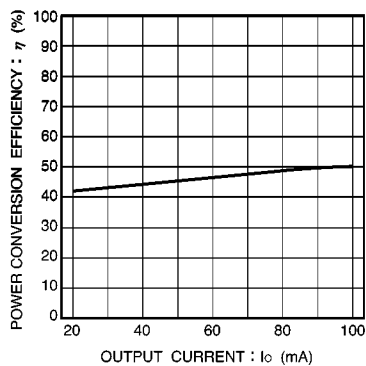


Fig.10 Power conversion efficiency

●External dimensions (Units: mm)

