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 | Cumbal | | Unit | | | |
|-----------------------------|--------|----------|----------------------------|----------|-------|--|
| | Symbol | BP5041A5 | BP5041A5 BP5041A BP5041A15 | | Offit | |
| Power supply voltage | Vin | 390 | 390 | 390 | V | |
| Output current | lo | 100 | 100 | 80 | mA | |
| Operating temperature range | Topr | -25~+80 | -25~+80 | -25~+80 | °C | |
| Storage temperature range | Tstg | -25~+105 | -25~+105 | -25~+105 | °C | |

Recommended operating conditions

| Parameter | Symbol | Min. | Тур. | Max. | Unit |
|----------------------|--------|------|------|------|-------|
| Power supply voltage | Vin | 226 | 282 | 390 | V(DC) |

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

BP5041A

| Parameter | Symbol | Min. | Тур. | Max. | Unit | Conditions |
|-----------------------|--------|------|------|------|-----------------|--------------------------------------------------|
| Input voltage | Vin | 226 | 282 | 390 | V | DC |
| Output voltage | Vo | 11 | 12 | 13 | V | V _{IN} = 282V, I _O = 50mA |
| Output current | lo | 0 | - | 100 | V | V _{IN} = 282V *1 |
| Line regulation | Vr | _ | 0.02 | 0.15 | V | V _{IN} = 226V~390V, Io = 50mA |
| Load regulation | VI | _ | 0.05 | 0.15 | V | V _{IN} = 282V, I _O = 0~+50mA |
| Output ripple voltage | Vp | _ | 0.05 | 0.15 | V _{PP} | V _{IN} = 282V, I _O = 50mA *2 |
| Conversion efficiency | η | 50 | 62 | _ | % | V _{IN} = 282V, Io = 100mA |

BP5041A5

| Parameter | Symbol | Min. | Тур. | Max. | Unit | Conditions |
|-----------------------|--------|------|------|------|-----------------|--------------------------------------------------|
| Input voltage | VIN | 226 | 282 | 390 | V | DC |
| Output voltage | Vo | 4.7 | 5 | 5.3 | V | V _{IN} = 282V, Io = 50mA |
| Output current | lo | 0 | _ | 100 | mA | V _{IN} = 282V *1 |
| Line regulation | Vr | _ | 0.05 | 0.15 | V | V _{IN} = 226V~358V, Io = 50mA |
| Load regulation | VI | _ | 0.05 | 0.15 | V | V _{IN} = 282V, I _O = 0~+50mA |
| Output ripple voltage | Vp | _ | 0.05 | 0.15 | V _{PP} | V _{IN} = 282V, Io = 50mA *2 |
| Conversion efficiency | η | 35 | 48 | _ | % | V _{IN} = 282V, Io = 100mA |

BP5041A15

| Parameter | Symbol | Min. | Тур. | Max. | Unit | Conditions |
|-----------------------|--------|------|------|------|-----------------|----------------------------------------|
| Input voltage | VIN | 226 | 282 | 390 | V | DC |
| Output voltage | Vo | 14 | 15 | 16 | V | V _{IN} = 282V, Io = 50mA |
| Output current | lo | 0 | _ | 80 | mA | V _{IN} = 282V *1 |
| Line regulation | Vr | _ | 0.02 | 0.15 | V | V _{IN} = 226V~358V, Io = 50mA |
| Load regulation | VI | - | 0.05 | 0.15 | V | V _{IN} = 282V, Io = 0~+50mA |
| Output ripple voltage | Vp | - | 0.05 | 0.15 | V _{PP} | V _{IN} = 282V, Io = 50mA *2 |
| Conversion efficiency | η | 50 | 64 | _ | % | V _{IN} = 282V, Io = 80mA |

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

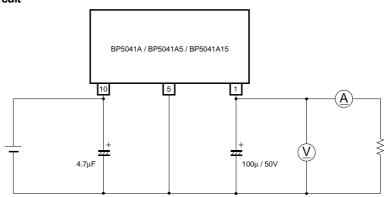
C1, C2 (Low-impedance capacitors)

Pin descriptions

| Pin No. | Pin name |
|---------|----------|
| 1 | Vouт |
| 3 | N.C. |
| 5 | COMMON |
| 7 | N.C. |
| 10 | Vin |

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

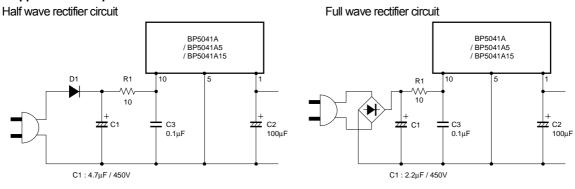


Fig.2

Application example for inventor lighting

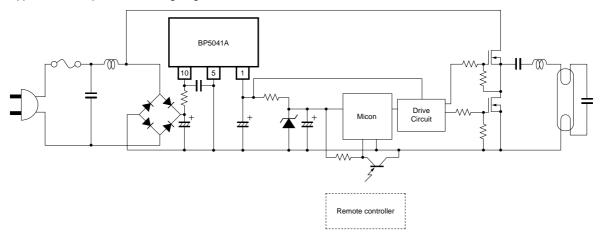


Fig.3

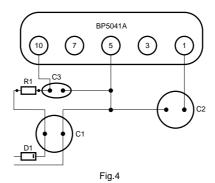
Selecting attachments

(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 $10\Omega \sim 22\,\Omega$, C3 should be a film capacitor and 400V or higher. Make sure to place C3 as near as possible to the modules.



(5) Pin noise voltage

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

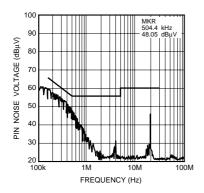
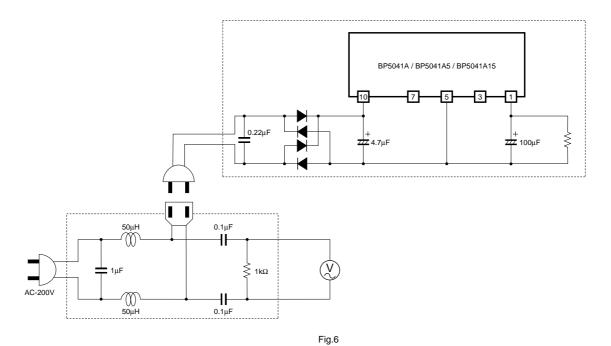


Fig.5 Pin noise voltage



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

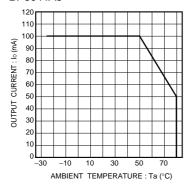


Fig.7 Derating curve

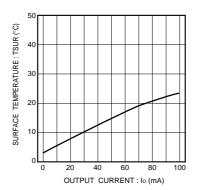


Fig.8 Surface temperature rise

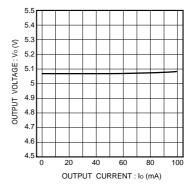


Fig.9 Output characteristic

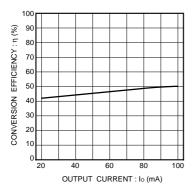


Fig.10 Conversion efficiency

BA5041A

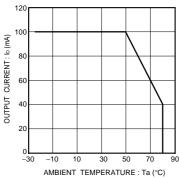


Fig.11 Derating curve

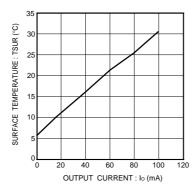


Fig.12 Surface temperature rise

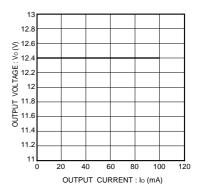


Fig.13 Output characteristic

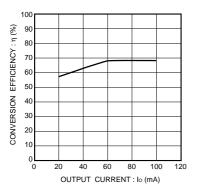


Fig.14 Conversion efficiency

BA5041A15

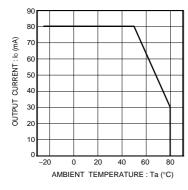


Fig.15 Derating curve

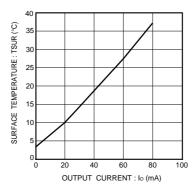


Fig.16 Surface temperature rise

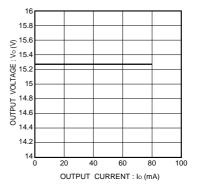


Fig.17 Output characteristic

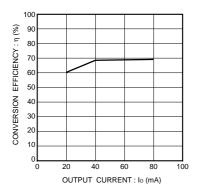
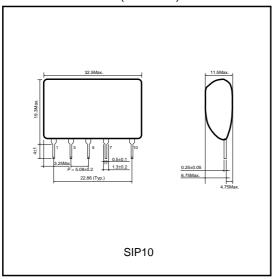


Fig.18 Conversion efficiency

●External dimensions (Units : mm)



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