

100-200VAC Input/12W Output

# Isolated AC/DC Converter

**BP5728**

## Absolute Maximum Ratings

| Parameter                   | Symbol     | Limits      | Unit |
|-----------------------------|------------|-------------|------|
| 6pin Input Voltage          | $V_D$      | 800         | V    |
| 2pin Input Voltage          | $V_{FB}$   | -0.2 to +6  | V    |
| 3pin Input Voltage          | $V_{DD}$   | 24          | V    |
| 3pin Input Current          | $I_{DD}$   | 8           | mA   |
| Allowable Loss              | $P_D$      | 0.64        | W    |
| Max Surface Temperature     | $T_{cmax}$ | 105         | °C   |
| Operating Temperature Range | $T_{opr}$  | -25 to +80  | °C   |
| Storage Temperature Range   | $T_{stg}$  | -25 to +105 | °C   |

## Electrical Characteristics

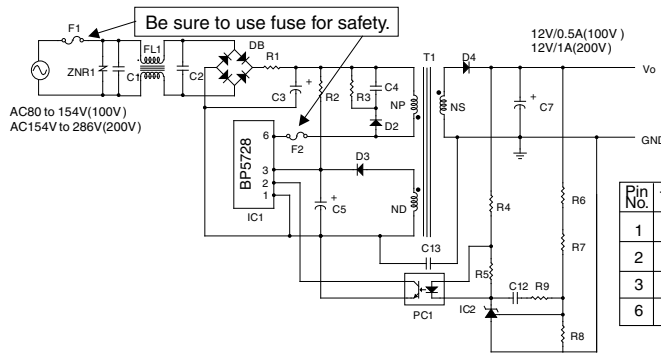
( $V_{DD}=15V, V_d=15V, I_{FB}=0.1mA, SW1=R1, T_a=25°C$ , unless otherwise specified)

| Parameter          | Symbol        | Min. | Typ. | Max. | Unit | Conditions                    |
|--------------------|---------------|------|------|------|------|-------------------------------|
| Input voltage      | $V_{DD}$      | 8.9  | 12   | 20   | V    | —                             |
| Output frequency   | $f_o$         | 59   | 65   | 71   | kHz  | $I_{FB}=0.5mA$                |
| Turn on voltage    | $V_{DD\ on}$  | 15.5 | 16.5 | 17.5 | V    | $V_{DD}=0 \rightarrow 17.5V$  |
| Turn off voltage   | $V_{DD\ off}$ | 7.7  | 8.3  | 8.9  | V    | $V_{DD}=17.5 \rightarrow 0V$  |
| Maximum Duty       | Duty MAX      | 68   | 75   | 82   | %    | $I_{FB}=0.5mA$                |
| Zero-Duty $I_{FB}$ | $I_{oz}$      | 0.85 | 1.15 | 1.45 | mA   | $I_{FB}=0 \rightarrow 1.55mA$ |

| Parameter                     | Symbol     | $V_{DD}$ | Min. | Typ. | Max. | Unit | Conditions                          |
|-------------------------------|------------|----------|------|------|------|------|-------------------------------------|
| Over drain current protection | $I_{dopc}$ | 10V      | 217  | 247  | 281  | mA   | $V_D=0 \rightarrow 15V$<br>$SW1=R2$ |
|                               |            | 15V      | 269  | 302  | 338  |      |                                     |
|                               |            | 20V      | 314  | 349  | 388  |      |                                     |

## Application Circuit (In case of 12V output)



| Pin No. | Terminal name | Terminal function                        |
|---------|---------------|--|
| 1       | COM           | Common terminal at primary side          |
| 2       | FB            | Feed back terminal                       |
| 3       | $V_{DD}$      | Power supply terminal for internal drive |
| 6       | $V_o$         | Drain terminal for built-in FET          |

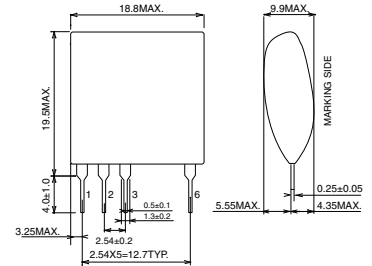
### Operating Principle

- When turned on : C5 is charged by R2 when the power is on, and the switching starts when the voltage at  $V_{DD}$  pin reaches the voltage threshold (17.5V max.)
- During operation :  $V_{DD}$  is supplied via Nd and FB current flows to PC1 once  $V_o$  exceeds the threshold voltage. Once PC1 turns ON a current  $I_{oz}$  flows through the transistor. Also, FB current runs to Pin 2 of BP5728 when  $V_o$  exceeds the designed voltage and the constant voltage control is executed.
- In overcurrent conditions : The input current will increase if the output power increases, and the overcurrent protection circuit will turn ON once the Drain current exceeds the specified value ( $I_{dopc}$ ).

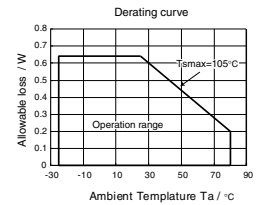
### External Component Specifications

|                                     |                                 |                              |  |
|-------------------------------------|---------------------------------|------------------------------|--|
| C1, C2 : Noise reduction capacitors | Rated at 300VAC or higher       | IC2 : Shunt regulator        | $V_{ref}=2.495V$   |
| C3 : Input smoothing capacitor      | 0.1 to 0.22 $\mu F$             | FL1 : Noise reduction filter | Use if necessary   |
| C4 : Noise reduction capacitor      | 22 $\mu F$ / 450V               | R1 : Resistor                | 0 $\Omega$   |
| C5 : $V_{DD}$ smoothing capacitor   | 2200pF / 1kV                    | R2 : Resistor                | 750k $\Omega$ 0.5W / 600V  |
| C7 : Output capacitor               | 10 $\mu F$ / 50V                | R3 : Resistor                | 200k $\Omega$ / 3W   |
| C12 : Phase compensation capacitor  | 470 $\mu F$ / 35V low impedance | R4 : Resistor                | 51 $\Omega$ / 0.125W   |
| C13 : Noise reduction capacitor     | 0.1 $\mu F$ / 50V               | R5 : Resistor                | 1k $\Omega$ / 0.1W   |
| D2 : Rectifier diode                | 2200pF / AC250V                 | R6 : Resistor                | 15k $\Omega$ / 0.1W  |
| D3 : Rectifier diode                | FRD 800V / 0.5A                 | R7 : Resistor                | 3k $\Omega$ / 0.1W   |
| D4 : Rectifier diode                | 80V / 0.1A                      | R8 : Resistor                | 4.7k $\Omega$ / 0.1W   |
| DB : Diode bridge                   | SBD 90V / 3A                    | R9 : Resistor                | 1k $\Omega$ / 0.1W   |
| F1, F2 : Fuse                       | 800V / 1A                       | PC1 : Photo coupler          | PC817  |
| IC1 : BP5728                        | Use for safety<br>BP5728        | T1 : Switching transformer   | SRW25ES-47V015(TDK)  |
|                                     |                                 | ZNR1 : Varistor              | A varistor is required to protect against lightning surges and static electricity. |

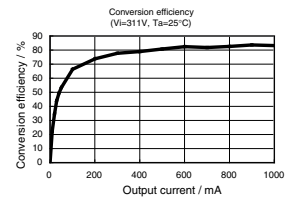
## Dimensions (Unit : mm)



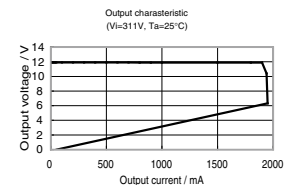
## Derating Curve



## Conversion Efficiency (In case of 12V output)



## Load Regulation (In case of 12V output)



# Power Module Usage Precautions

## Safety Precautions

- 1) The products are designed and manufactured for use in ordinary electronic equipment (i.e. AV/OA/telecommunication/amusement equipment, home appliances). Please consult with the Company's (ROHM) sales staff if intended for use in devices requiring high reliability (e.g. medical/transport/aircraft/spacecraft equipment, nuclear power/fuel controllers, automotive/safety devices) and whose malfunction may result in injury or death. In this case, failsafe measures must be taken, including the following:
  - [a] Installation of protection circuits in order to improve system safety
  - [b] Incorporation of redundant circuits in the case of single-circuit failure
- 2) The products are designed for use under normal conditions. Application in special environments can cause a deterioration in product performance. Therefore, verification and confirmation of product performance, prior to use, is recommended. The following environments are considered to be 'special':
  - [a] Outdoors, exposed to direct sunlight or dust
  - [b] In contact with liquids, such as water, oils, chemicals, or organic solvents
  - [c] In areas where exposure to the sea air or corrosive gases (i.e. Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, NO<sub>2</sub>) can occur
  - [d] In places where the products may be in contact with static electricity or electromagnetic waves
  - [e] In proximity to heat-producing items, plastic cords, or flammable materials
  - [f] In contact with sealing or coating products, such as resin
  - [g] In contact with unclean solder or exposed to water or water-soluble cleaning agents used after soldering
  - [h] In areas where dew condensation occurs
- 3) The products are not designed to be radiation resistant
- 4) The Company is not responsible for any problems resulting from use of the products under conditions not recommended herein.
- 5) The Company should be notified of any product safety issues. Moreover, product safety issues should be periodically monitored by the customer.

## Application Notes

- 1) A sufficient margin must be allowed if changes are made to the peripheral circuit due to variations in the inherent tolerances of the external components as well as transient and static characteristics. In addition, please be aware that the Company has not conducted investigations on whether or not particular changes in the example application circuits would result in patent infringement.
- 2) The application examples, their constants, and other types of information contained herein are applicable only when the products are used in accordance with standard methods. Therefore, if mass production is intended, sufficient consideration to external conditions must be made.

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