



# BD15004

## 15W DC/DC CONVERTER

Adjustable output:  $3.3V_{OUT}$  to  $5V_{OUT}$

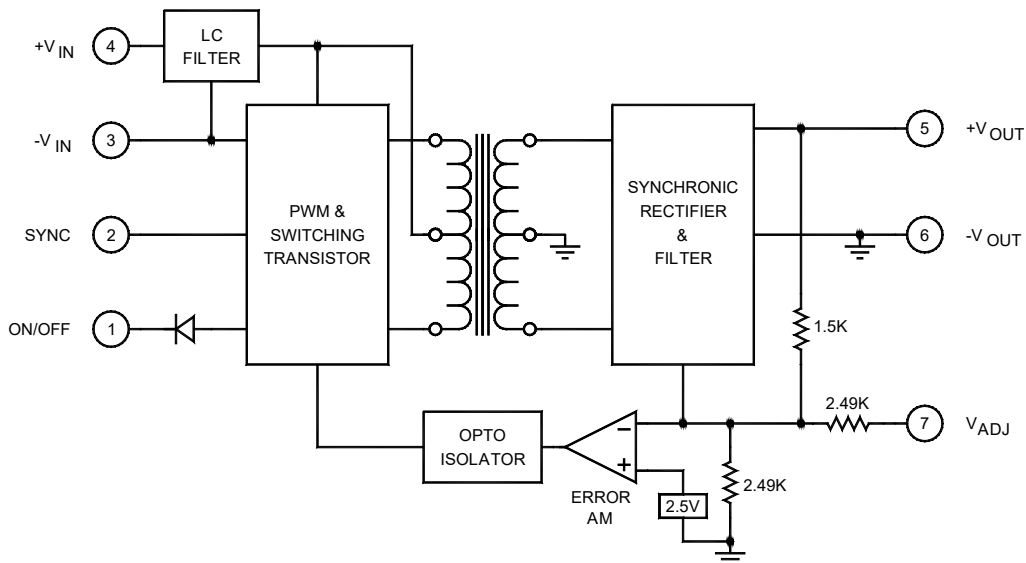
### Key Features

- $30V_{IN}$  to  $52V_{IN}$  range
- Efficiency up to 87%
- Input-to-output isolation
- Soft start
- Short circuit current limit
- 1mA off state current
- Multiple converter synchronization
- Output overvoltage protection (OVP)



### Functional Description

The BD15004 is a single adjustable output DC/DC converter with an input voltage range from  $30V_{IN}$  to  $52V_{IN}$  and an output voltage range from  $3.3V_{OUT}$  to  $5V_{OUT}$ . It features a 400kHz switching frequency, forward topology, and a case size of  $2 \times 1 \times 0.395$ -inch with industry standard pinout arrangement. Synchronous rectification improves efficiency, while the six-sided shielding, SMD and improved thermal techniques guarantee reliability.



Typical Block Diagram

## Electrical Specifications

### INPUT SPECIFICATIONS

Unless otherwise specified, all parameters are given under typical +25°C with nominal input voltage and under full output load conditions.

| PARAMETER                        | CONDITION / NOTE                                | MIN | TYP | MAX | UNIT                     |
|----------------------------------|---|-----|-----|-----|--------------------------|
| Input Voltage Range              |   | 30  | 42  | 52  | Vdc                      |
| Input Startup Voltage            | 42V <sub>IN</sub>                               | 7   |     |     | Vdc                      |
| Input Current, Full Load         | 42V <sub>IN</sub> , V <sub>OUT</sub> = 4V@3.75A |     | 420 |     | mA                       |
| Input Current, No Load           | 42V <sub>IN</sub>                               |     | 20  |     | mA                       |
| Undervoltage Shutdown            | 42V <sub>IN</sub>                               |     | 6   |     | Vdc                      |
| Input Filter                     | LC  |     |     |     |                          |
| Reverse Polarity                 | External series-blocking diode                  |     |     |     |                          |
| Input Surge Current (20µS Spike) |   |     |     | 10  | A                        |
| Short Circuit Current Limit      |   |     | 150 |     | % I <sub>N</sub> Nominal |
| Off State Current                |   |     | 1   |     | mA                       |
| Remote ON/OFF Control            |   |     |     |     |                          |
| Supply ON                        | Pin 1 Open (Open circuit voltage: 12V Max.)     |     |     |     |                          |
| Supply OFF                       |   | 0   |     | 0.8 | Vdc                      |
| Logic Input Reference            | -Input for ON/OFF and SYNC                      |     |     |     |                          |
| Logic Compatibility              | TTL Open Collector or CMOS Open Drain           |     |     |     |                          |

### OUTPUT SPECIFICATIONS

| PARAMETER                     | CONDITION / NOTE                                   | MIN | TYP  | MAX | UNIT                                 |
|-------------------------------|--|-----|------|-----|--------------------------------------|
| Voltage Ratings               |  | 3.3 | 4    | 5   | Vdc                                  |
| Current Ratings               |  |     |      | 3   | A                                    |
| Output Voltage Accuracy       |  |     | ±1   |     | %                                    |
| Output Voltage Adjustment     |  | -18 |      | +25 | %                                    |
| Minimum Load                  | 0% for Single output                               |     |      |     | % of FL                              |
| Ripple & Noise                |  |     | 1    | 2   | %V <sub>PP</sub> of V <sub>OUT</sub> |
| Line Regulation               | Minimum V <sub>IN</sub> to maximum V <sub>IN</sub> |     | ±0.5 | 1   | %                                    |
| Load Regulation               | NL to FL   |     | ±1   |     | %                                    |
| Temperature Coefficient @ FL  |  |     | 0.02 |     | %/°C                                 |
| Transient Response Time       | 50% FL to FL to 50% FL, See Figure 3               |     | 100  | 150 | µS                                   |
| Short Circuit Protection      | All outputs, by input current limiting             |     |      |     |                                      |
| Turn On Delay with Soft Start | See Figure 3                                       |     | 2    |     | mS                                   |
| Output Overvoltage Protection |  |     | 130  | 150 | % of V <sub>OUT</sub>                |

### GENERAL SPECIFICATIONS

| PARAMETER                                   | CONDITION / NOTE | MIN | TYP             | MAX | UNIT |
|---|------------------|-----|-----------------|-----|------|
| Efficiency                                  | 5V@3A            |     | 87              |     | %    |
| Efficiency                                  | 4V@3.75A         |     | 85              |     | %    |
| Efficiency                                  | 3.3V@4.5A        |     | 80              |     | %    |
| Isolation Voltage (1 min.), Input to Output |                  |     | 1500            |     | Vdc  |
| Isolation Resistance                        |                  |     | 10 <sup>9</sup> |     | Ω    |
| Isolation Capacitance                       |                  |     | 500             |     | pF   |
| Switching Frequency                         |                  |     | 400             |     | kHz  |

## ENVIRONMENTAL SPECIFICATIONS

| PARAMETER                                   | CONDITION / NOTE                         | MIN | TYP                 | MAX  | UNIT                 |
|---|--|-----|---------------------|------|----------------------|
| Operating Temperature, Industrial (Ambient) | See Figure 1                             | -40 |                     | +71  | °C                   |
| Operating Temperature, Extended             |  | -55 |                     | +85  | °C                   |
| Storage Temperature Range                   |  | -55 |                     | +125 | °C                   |
| Thermal Resistance                          |  |     |                     | 7.4  | °C/W <sub>DISS</sub> |
| Maximum Operating Case Temperature          |  |     |                     | 100  | °C                   |
| Derating                                    | See Figure 1                             |     |                     |      |                      |
| Humidity                                    | Up to 95% non-condensing                 |     |                     |      |                      |
| Cooling                                     | Free-air convection                      |     |                     |      |                      |
| EMI/RFI                                     | Six-sided continuous shielded metal case |     |                     |      |                      |
| MTBF  | per MIL-HNBK-217F (Ground benign, +25°C) |     | 1.1×10 <sup>6</sup> |      | hours                |

## PHYSICAL CHARACTERISTICS

| PARAMETER            | CONDITION / NOTE                          | MIN | TYP | MAX | UNIT |
|----------------------|---|-----|-----|-----|------|
| Dimensions (L×W×H)   | 2.00×1.00×0.395 in. (50.80×25.40×10.03mm) |     |     |     |      |
| Weight               | 1.06 oz. (30.3g)                          |     |     |     |      |
| Case Material        | Coated metal                              |     |     |     |      |
| Shielding Connection | +V <sub>IN</sub> Input (Pin 4)            |     |     |     |      |

## EXTERNAL SYNCHRONIZATION

The converter can be synchronized to an external TTL or CMOS clock signal. Insert a 470pF to 1000pF ceramic capacitor between the driving clock signal and the SYNC pin (Pin 2) of the convertor. The frequency of the signal must be between 390kHz and

430kHz, with a duty cycle of 50% and an amplitude between 3Vdc minimum and 5Vdc typical.

See Application Note DC-005: Synchronization.

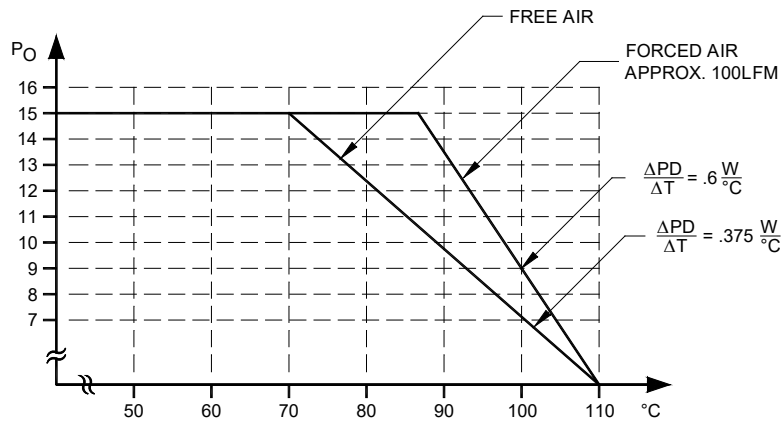


FIGURE 1. Worst case derating of BD15004

TABLE 1. Minimum input operating voltage range for BD15004

| V <sub>IN</sub> (V <sub>ADJ</sub> ) | V <sub>O</sub> |
|-------------------------------------|----------------|
| 0.00                                | 5.512          |
| 1.00                                | 4.910          |
| 2.00                                | 4.308          |
| 3.00                                | 3.706          |
| 3.67                                | 3.300          |

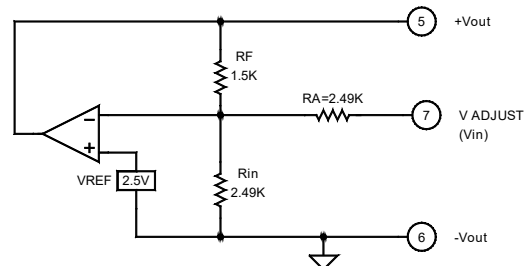


FIGURE 2. Error amplifier of BD15004

V<sub>REF</sub>=2.5V; R<sub>F</sub>, R<sub>IN</sub>, R<sub>A</sub> have 1% accuracy

V<sub>O</sub> = 5.512 - 0.602V<sub>IN</sub> (V<sub>ADJ</sub>)

Approximate values are given in Table 2

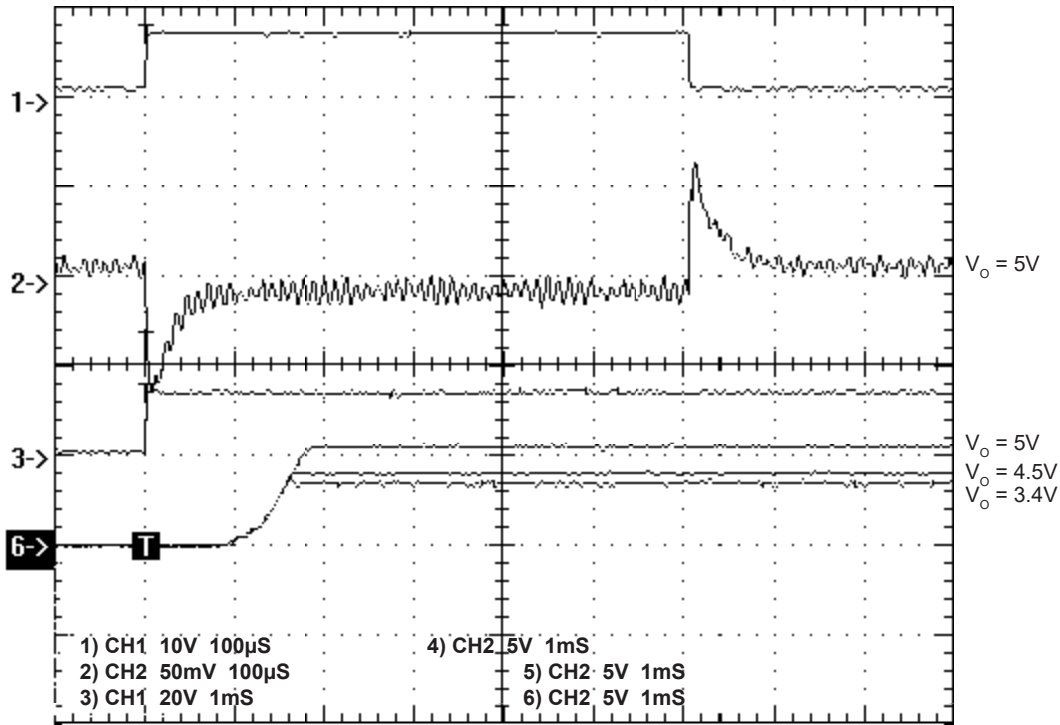


FIGURE 3. Transient response and turn on delay with soft start of BD15004

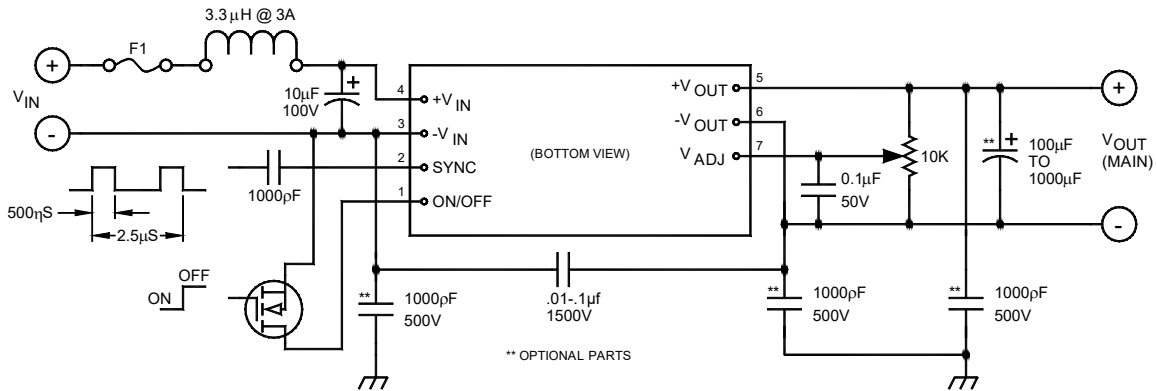
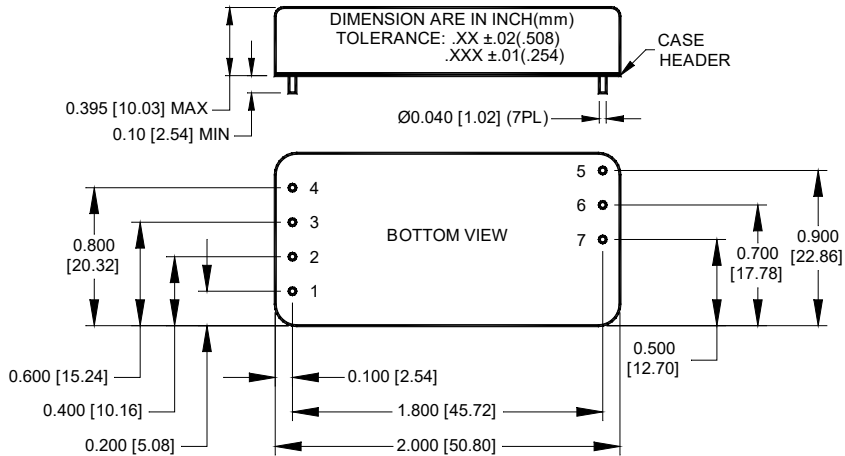


FIGURE 4. Typical connection diagram of a BD15004 single output DC/DC converter

**MECHANICAL SPECIFICATIONS**



| Pin | Function          |
|-----|-------------------|
| 1   | ON/OFF            |
| 2   | SYNC              |
| 3   | -V <sub>IN</sub>  |
| 4   | +V <sub>IN</sub>  |
| 5   | +OUTPUT           |
| 6   | -OUTPUT           |
| 7   | +V <sub>ADJ</sub> |
| 8   | No Pin            |
| 9   | No Pin            |