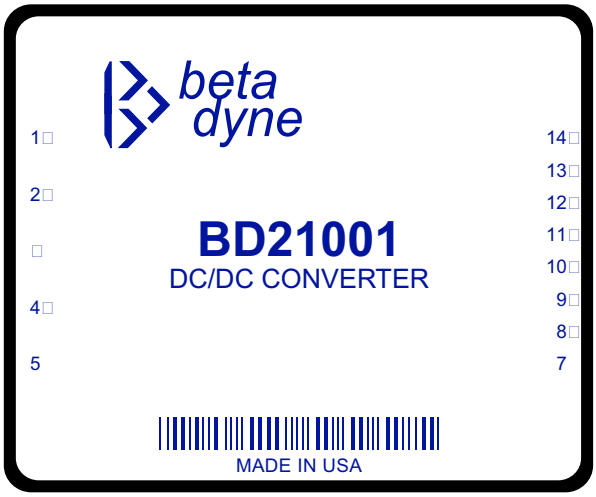
# BD21001

## 32W HIGH-VOLTAGE, ADJUSTABLE NON-ISOLATED DC/DC CONVERTER

*$12V_{IN}$, $0V_{OUT}$ to $400V_{OUT}$@80mA*

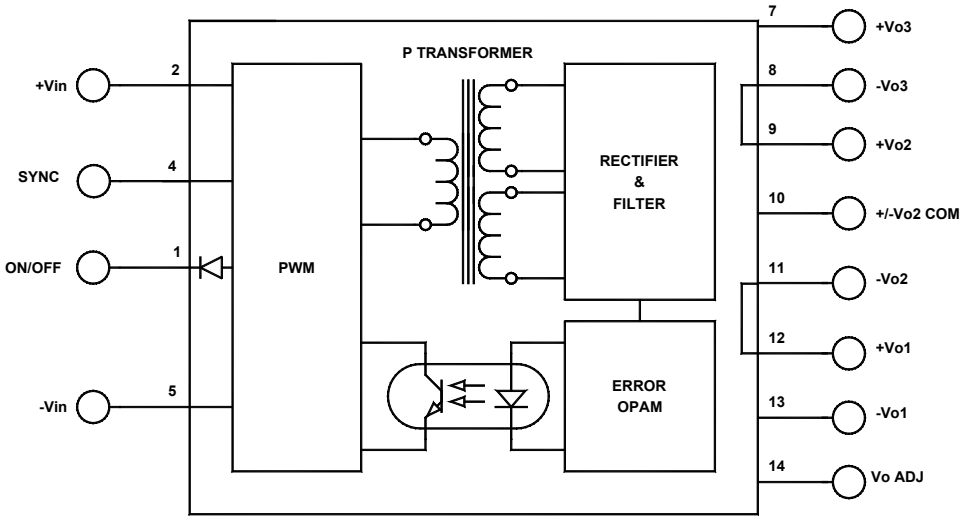
### *Key Features*

- 85% efficiency
- 0V to 400V adjustable
- Soft start
- Input LC filter
- Short circuit
- Six-sided EMI shielding




### *Functional Description*

The BD21001 is a 32W high-voltage, adjustable, non-isolated DC/DC converter in a 3.00×2.50×0.75-inch package that accepts $12V_{IN}$ and providies $0V_{OUT}$ to $400V_{OUT}$@80mA when the $V_O$ ADJ input is driven by a 1.25Vdc–0Vdc voltage source or with an external variable resistor from 1GΩ to 0Ω. All three outputs are connected internally in series, while the load is applied between $+V_{O3}$ (Pin 7 positive) and $-V_{O1}$ (Pin 13 negative). The converter will charge an output capacitor of 500µF@400Vdc in 3 to 5 seconds.




**Typical Block Diagram**

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

## *Electrical Specifications*

### *INPUT SPECIFICATIONS*

| PARAMETER | CONDITION / NOTE | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Input Voltage Range | | 10.8 | 12 | 13.2 | Vdc |
| Input Current, No Load | | | 40 | | mA |
| Input Current, Full Load | | | 3137 | | mA |
| Short Circuit Current | Input Current Limit | $I_{IN}$ FL | | | |
| Input Reflected Ripple | $C_{IN}$ = 100µF | | 250 | | $mA_{PP}$ |
| Start Up Threshold | | 10.8 | | | Vdc |
| Under Voltage Shutdown | | | 10 | | Vdc |
| Input Filter Type | LC | | | | |
| Off State Current | | | *TBD* | | µA |
| Turn On Delay and Soft Start | $C_O$ = 500µF, RL = 5K, $V_O$ = 400Vdc; See Figure 2 | | 3 | 5 | sec |
| Remote ON/OFF Control | | | | | |
| Converter ON | Open (Open circuit voltage at Pin 1: 10V Max.) | | | | |
| Converter OFF | | -0.6 | 0 | 0.2 | Vdc |
| Logic Input Reference | -Input (Pin 5) | | | | |
| Logic Compatibility | TTL Open Colllector or CMOS Open Drain | | | | |

### *OUTPUT SPECIFICATIONS*

| PARAMETER | CONDITION / NOTE | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Output Voltage | Pin 7 = $+V_{O3}$, Pin 13 = GND ($-V_{O1}$) | 0 | | 400 | Vdc |
| Output Current | | | 80 | | mA |
| Short Circuit Protection | Input current limit | | | | |
| Load Step Response within 1% of $V_{OUT}$ | 50% FL to FL to 50% FL | | 1 | | mS |
| Turn On Delay | | | 8 | | mS |
| Output Ripple & Noise | 20MHz bandwidth, See Figure 1 | | ±1 | ±2 | % of VOUT |
| Load Regulation | Minimum to Full Load | | ±1 | ±2 | % of $V_O$ |
| Line Regulation | Minimum to maximum input voltage | | ±1 | ±2 | % |
| Temperature Coefficient | Nominal line | | ±0.01 | ±0.02 | %/°C |
| Efficiency | Full Load | | 84 | | % |
| Transient Response | 50% FL to FL to 50% FL to within 1% of $V_{OUT}$ | | 200 | | µS |

### *ENVIRONMENTAL SPECIFICATIONS*

| PARAMETER | CONDITION / NOTE | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Operating Temperature Range | | -25 | | +60 | °C |
| Thermal Resistance | | | | 1.2 | °C/W |
| MTBF | per MIL-HDBK-217F (Ground benign, +25°C) | | 300,000 | | hours |

### *GENERAL SPECIFICATIONS*

| PARAMETER | CONDITION / NOTE | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Efficiency | | | 85 | | % |
| Switching Frequency | PWM frequencies | | 200 | | kHz |

### *PHYSICAL CHARACTERISTICS*

| PARAMETER | CONDITION / NOTE | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Dimensions (L×W×H) | 3.00×2.54×0.77 in. (76.20×64.52×19.43mm) | | | | |
| Weight | 7.48 oz. (212g) | | | | |
| Case Material | Coated metal | | | | |
| Case Connection | Case & header are floating and have no connection to either input or output pins | | | | |

[1] The input power may have to be recycled after thermal turn off.

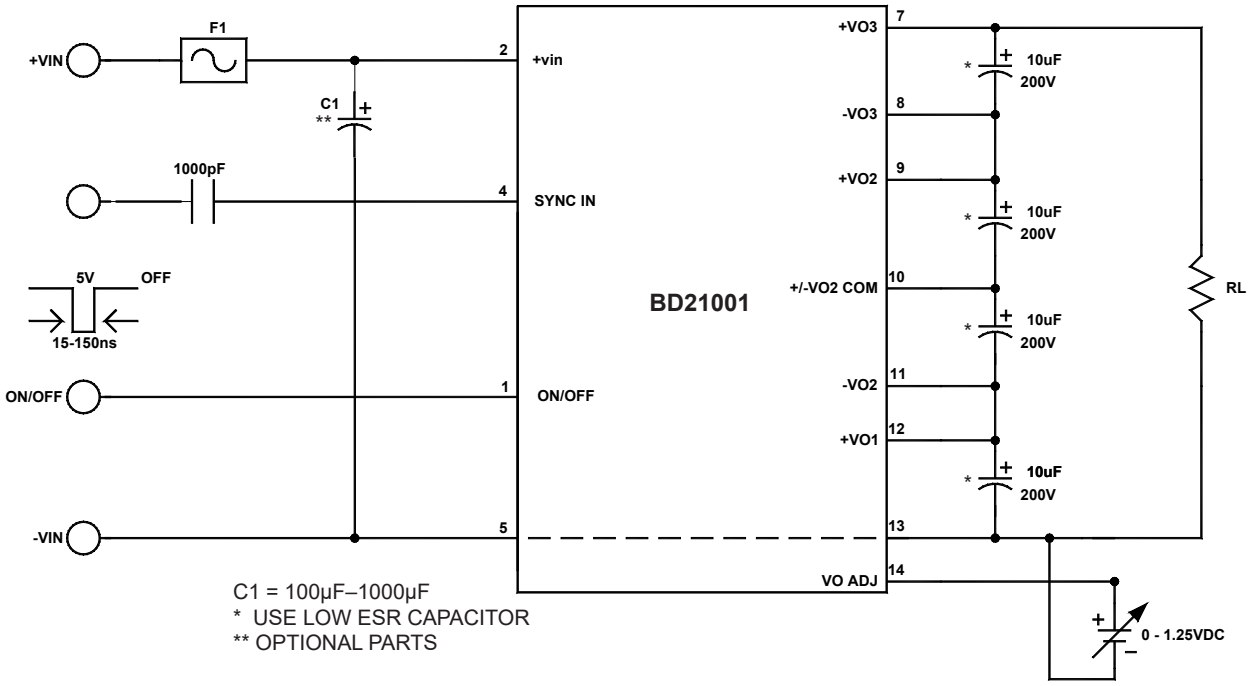
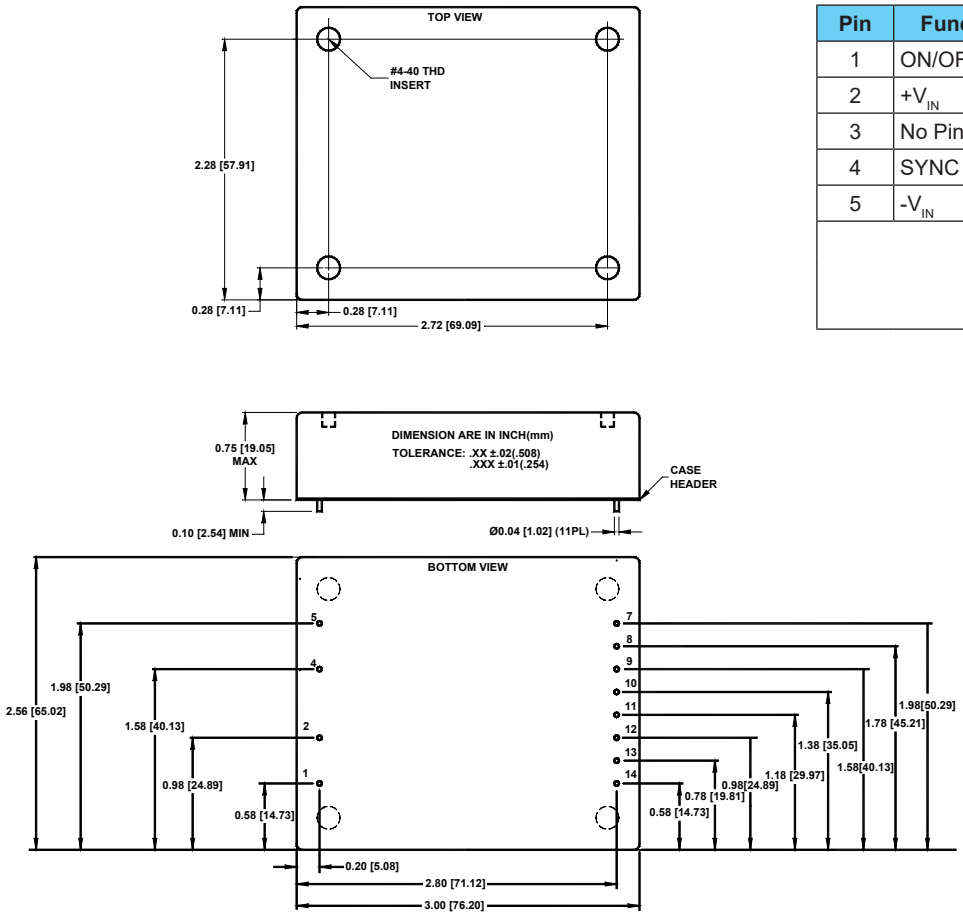



**FIGURE 1. Connection diagram**

## *MECHANICAL SPECIFICATIONS*




| Pin | Function | Pin | Function |
|---|---|---|---|
| 1 | ON/OFF | 7 | $+V_{O3}$ |
| 2 | $+V_{IN}$ | 8 | $-V_{O3}$ |
| 3 | No Pin | 9 | $+V_{O2}$ |
| 4 | SYNC | 10 | $\pm V_{O2}$ |
| 5 | $-V_{IN}$ | 11 | $-V_{O2}$ |
| | | 12 | $+V_{O1}$ |
| | | 13 | $-V_{O1}$ |
| | | 14 | $V_O$ ADJ |

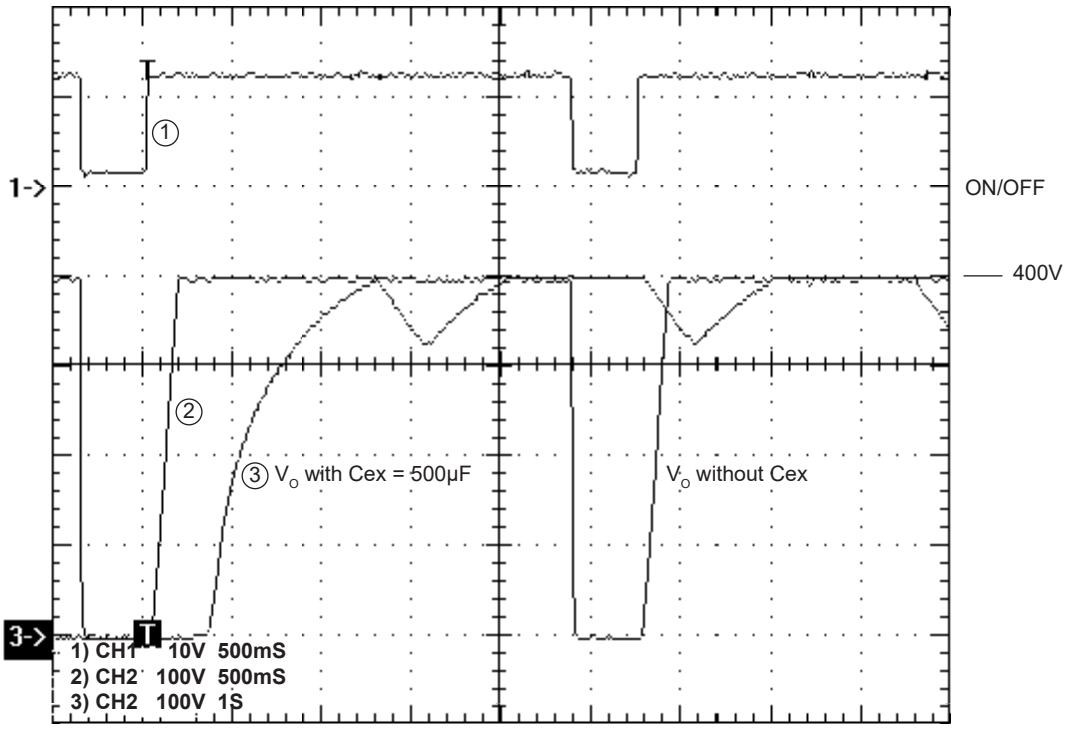



**FIGURE 2. Turn on delay with soft start**
**1) ON/OFF, 2) $V_O$ without Cex, 3) $V_O$ with Cex = 500µF**

### *EXTERNAL SYNCHRONIZATION*

The converter can be synchronized to an external clock. The external clock MUST have a higher frequency than that of the converter's switching frequency. The amplitude of the external clock pulse must be 3.7 volts or greater and its duration between 15nS to 150nS for sync pulse detection.

The circuit in Figure 3 can be used to produce a 50nS to 150nS pulse from a square wave. The circuit will be turned on by the negative edge of the square wave and will stay on for approximately 50nS (depending on the R2*C1 time constant) (See Figure 4).

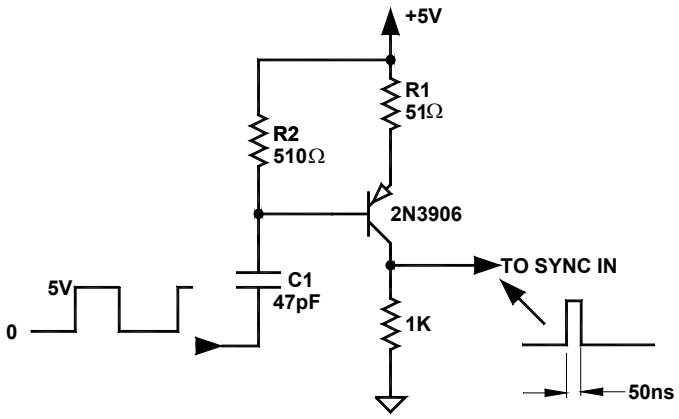



**FIGURE 3. 50nS pulse generator from a square wave TTL/5V CMOS clock**

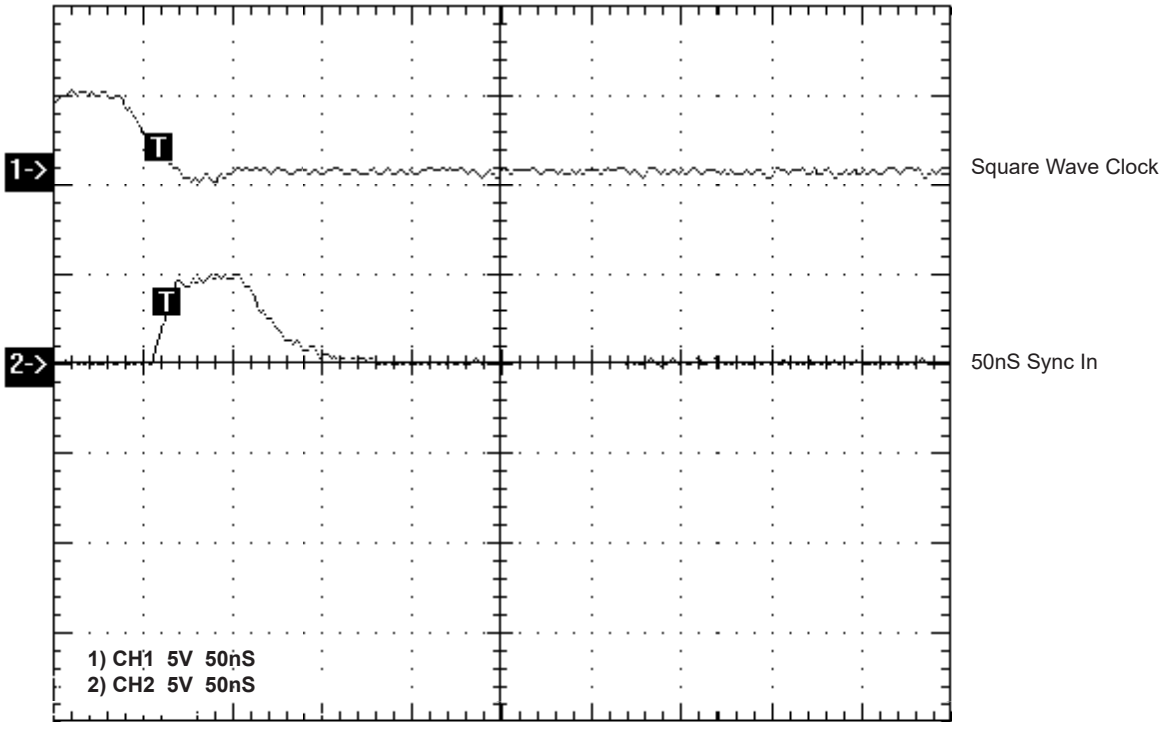



**FIGURE 4. Waveforms generated from Figure 3**