



LN10006

Low-Noise 3.5W DUAL DC/DC CONVERTER

$9-18V_{IN}$, $+15V_{OUT}@200mA$, $+5V_{OUT}@200mA$

US Patent 5,777,519

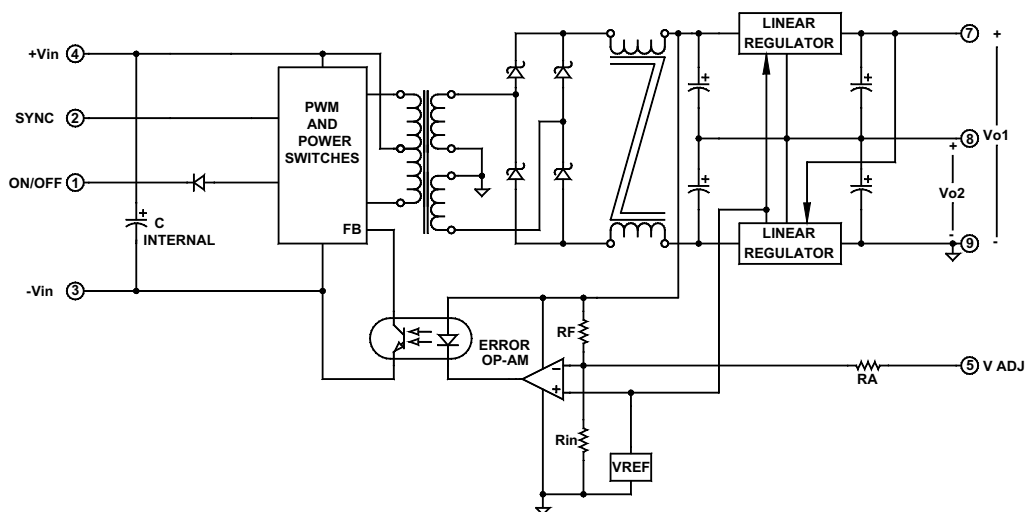
Key Features

- Wide input voltage range (2:1)
- Less than 5mV output noise
- Six-sided shielding
- Soft start
- Dual output
- Short circuit protection
- Adjustable output
- 750 μ A off state current
- 250mV dropout linear regulators
- Dual output tracking linear regulator
- 5 μ S transient response
- Industry pinouts



Functional Description

The LN10006 is a 3.5W dual positive, isolated DC/DC converter that accepts $9V_{IN}$ to $18V_{IN}$ and provides $+15V_{OUT}@200mA$ and $+5V_{OUT}@200mA$. The converter's design is based on Beta Dyne's patents and offers low noise and an operating temperature range from $-40^{\circ}C$ to $+70^{\circ}C$.



Typical Block Diagram of Dual Output Converter

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 | | 9 | 12 | 18 | Vdc |
| No Load Input Current | | | 40 | | mA |
| Full Load Input Current | V = 28V@FL (±250mA) | | 410 | | mA |
| Input Filter | C | | | | |
| Reverse Polarity Input Current | External series-blocking diode | | | 12 | A |
| Input Surge Current (20µS Spike) | | | | 10 | A |
| Short Circuit Current Limit | | | 150 | | % I _{IN} |
| Undervoltage Shutdown | | 4.5 | | | Vdc |
| Off State Current | | | 750 | | µA |
| 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 | | | | |
| Logic Compatibility | TTL Open Collector or CMOS Open Drain | | | | |

OUTPUT SPECIFICATIONS

| PARAMETER | CONDITION / NOTE | MIN | TYP | MAX | UNIT |
|---|--|-----|------|------|--------------------------|
| Output Voltage, V _{O1} | Pin 7 = +15Vdc, Pin 9 = Output Ground | | 15 | | Vdc |
| Output Voltage, V _{O2} | Pin 8 = +5Vdc, Pin 9 = Output Ground | | 5 | | Vdc |
| Output Voltage Accuracy | | | ±1 | ±1.5 | % |
| Output Voltage Adjustment | Reference to Pin 8 | | 3 | ±5 | % |
| Output Current, V _{O1} | | | 200 | | mA |
| Output Current, V _{O2} | | | 200 | | mA |
| Minimum Load | Not required | | | | |
| Ripple & Noise | See Figure 3 | | 5 | 10 | mV _{pp} |
| Line Regulation | Minimum V _{IN} to maximum V _{IN} | | 0.05 | 0.1 | % |
| Load Regulation | | | ±1 | | % |
| Temperature Coefficient @ FL | | | 0.02 | | %/°C of V _{OUT} |
| Transient Response Time (to within 0.5% of V _{OUT}) | 50% FL to FL to 50% FL, See Figure 1 | | 5 | | µS |
| Short Circuit Protection | All outputs, by input current limiting | | | | |

GENERAL SPECIFICATIONS

| PARAMETER | CONDITION / NOTE | MIN | TYP | MAX | UNIT |
|----------------------------|---------------------|-----|-----------------|-----|------|
| Efficiency | V = 28V, I = ±250mA | | 71 | | % |
| Isolation Voltage (1 min.) | | | 1500 | | Vdc |
| Isolation Resistance | | | 10 ⁹ | | Ω |
| Isolation Capacitance | | | 80 | | pF |
| Switching Frequency | | 300 | 320 | 333 | kHz |

ENVIRONMENTAL SPECIFICATIONS

| PARAMETER | CONDITION / NOTE | MIN | TYP | MAX | UNIT |
|------------------------------------|--|-----|-------------------|------|----------------------|
| Operating Temperature | | -40 | | +70 | °C |
| Storage Temperature Range | | -55 | | +125 | °C |
| Thermal Resistance | | | 3.5 | 4 | °C/W _{DISS} |
| Maximum Operating Case Temperature | | | | 105 | °C |
| 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) | | 1×10 ⁶ | | 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 | 1.04 oz. (30g) | | | | |
| Case Material | Coated metal | | | | |
| Shielding Connection | -Input (Pin 3) | | | | |

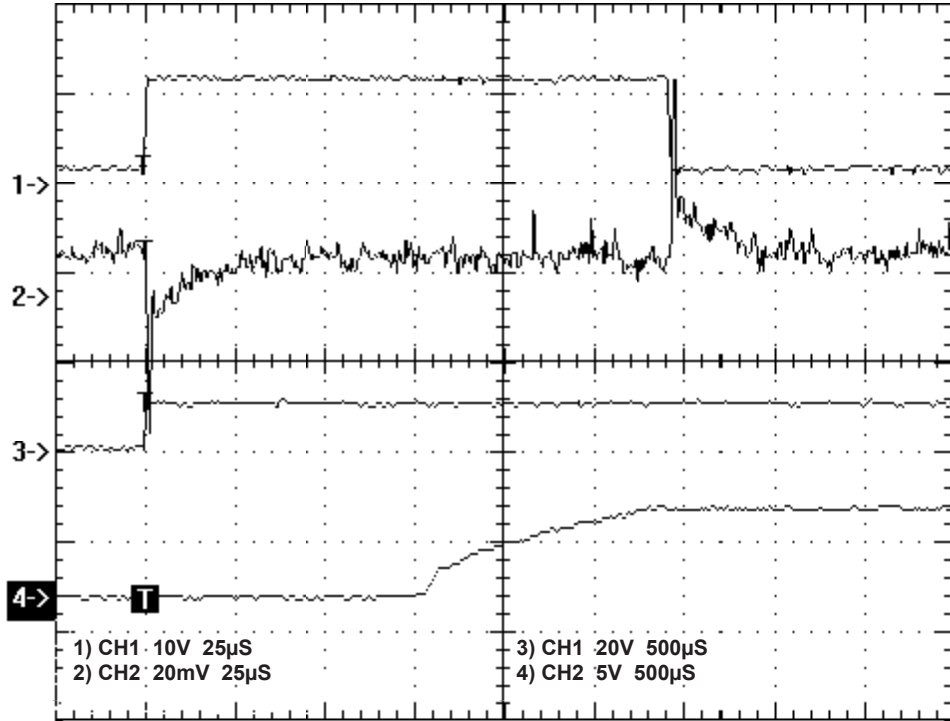


FIGURE 1. Transient response and turn on delay with soft start

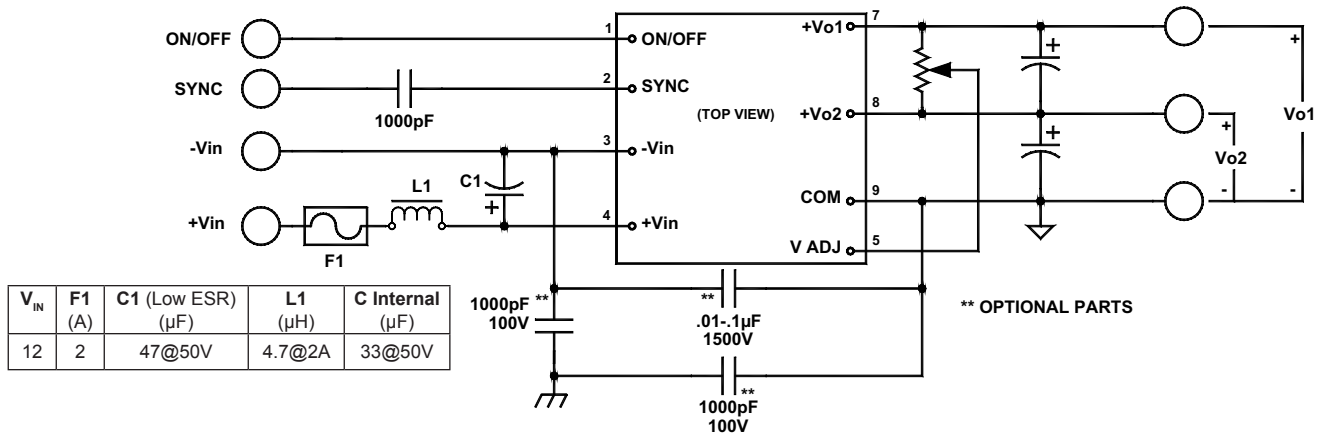
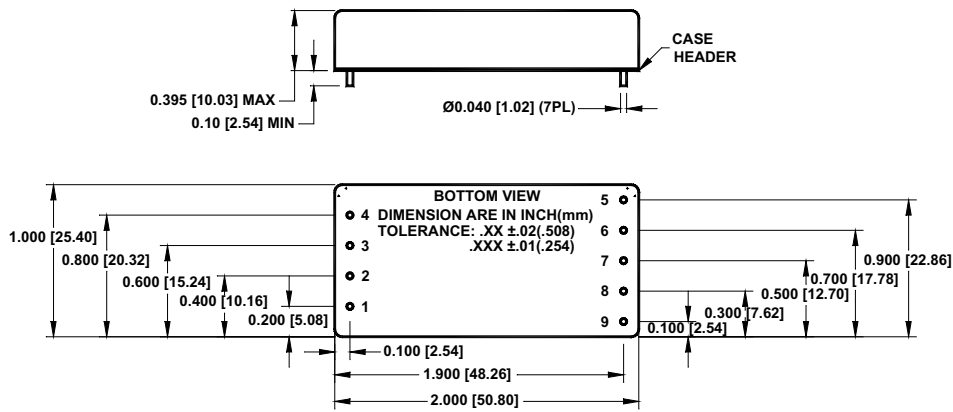


FIGURE 2. Typical connection diagram of Low-Noise 10W Dual DC/DC Converter

MECHANICAL SPECIFICATIONS



| Pin | Function |
|-----|-------------------------|
| | DUAL |
| 1 | ON/OFF |
| 2 | SYNC |
| 3 | -V _{IN} |
| 4 | +V _{IN} |
| 5 | V _{OUT} ADJ |
| 6 | No Pin |
| 7 | +15V (V _{O1}) |
| 8 | +5V (V _{O2}) |
| 9 | OUTPUT GND |

OUTPUT VOLTAGE ADJUSTMENT

For both single and dual models, the output reference voltage is referenced to the output ground: Pin 6 for singles and Pin 8 for duals. To trim the output voltage high, connect a 1% resistor (0k Ω –200k Ω range) between -V_{OUT} (Pin 6) and V_{OUT} Adjust (Pin 9) for the singles, and COM (Pin 8) and V_{OUT} Adjust (Pin 5) for the duals. To trim the output voltage low, connect a 1% resistor (50k Ω –500k Ω range) between +V_{OUT} (Pin 5) and V_{OUT} Adjust (Pin 9) for the singles,

and +V_{OUT} (Pin 7) and V_{OUT} Adjust (Pin 5) for the duals.

With the wiper connected to the V_{OUT} Adjust pin, a variable resistor (potentiometer) can also be used for V_{OUT} adjustment by connecting each end to +V_{OUT} and -V_{OUT} for the singles, and +V_{OUT} and COM for the duals. A potentiometer between 50k Ω –100k Ω can be used. Avoid using a low resistance potentiometer or a high temperature coefficient such as wound wire.

EXTERNAL SYNCHRONIZATION

This series of converters can be synchronized to an external system clock of 320kHz -2% to 10%. The external clock is AC-coupled to the input SYNC terminal (Pin 2) through a coupling capacitor

from 220pF to 1000pF. The required amplitude is 3.3V to 5V and its duty cycle is 50% \pm 20%. Please refer to *Application Note DC-005: Synchronization* for more information.