



LN10012X

LOW-NOISE 8W SINGLE DC/DC CONVERTER

$12V_{IN}$, 5 to $8V_{OUT}@1A$
US Patent 5,777,519

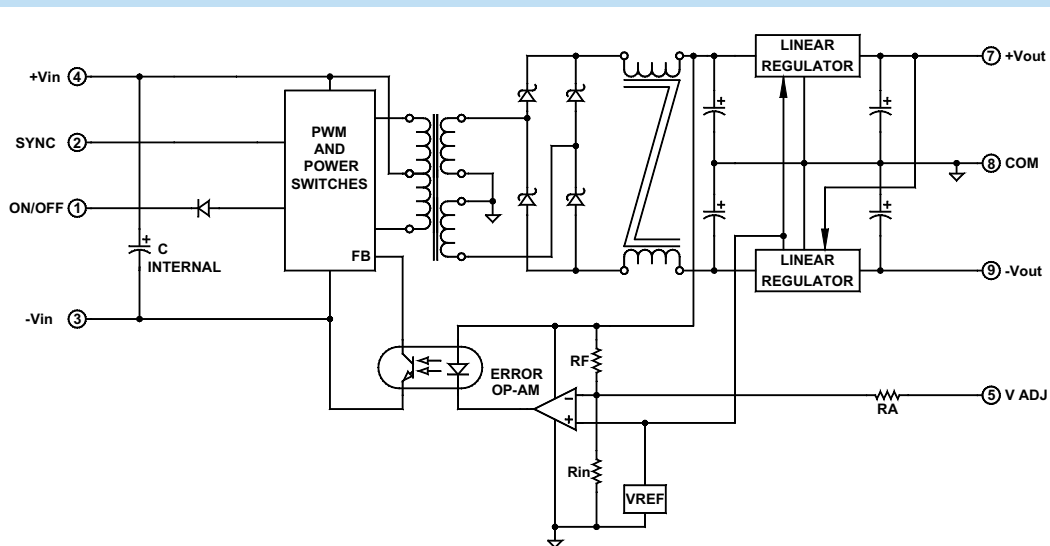
Key Features

- Wide input voltage range (2:1)
- Less than 5mV output noise
- Efficiency up to 79%
- Six-sided shielding
- Soft start
- Single/Dual output
- Short circuit protection
- Adjustable output
- 1mA off state current
- 250mV dropout linear regulators
- Dual output tracking linear regulator
- 5 μ S transient response
- Industry pinout



Functional Description

The LN10012X is a low-noise, single output isolated DC/DC converter that accepts $12V_{IN}$ and provides an adjustable output from $5V_{OUT}$ to $8V_{OUT}$. The converter incorporates low switching noise techniques at its input and output sections. Low dropout linear regulators reduce the output noise to $5mV_{pp}$, while a patented control circuit maintains minimum constant dropout voltage over line, load, temperature and output adjust ranges. The converter is designed to operate from $-40^{\circ}C$ to $+85^{\circ}C$.



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 | | 9.5 | 12 | 18 | Vdc |
| Input Filter | C | | | | |
| Reflected Ripple | With 100µF input capacitor | | 100 | | mA _{PP} |
| Reverse Polarity Input Current | External series-blocking diode | | | 12 | A |
| Input Surge Current (20µS Spike) | | | | 10 | A |
| Short Circuit Current Limit | | | 150 | | % I _{IN} |
| No Load Input Current | | | 30 | | mA |
| Full Load Input Current | V _{OUT} = 8V, I _{OUT} = 1A | | 844 | | mA |
| 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 Range | | 5 | 6.5 | 8 | Vdc |
| Output Voltage Accuracy | | | ±1 | ±1.5 | % |
| Output Voltage Adjustment | | | 3 | ±5 | % |
| Minimum Load ² | | 10 | | | % of FL |
| Ripple & Noise | See Figure 4 | | 5 | 10 | mV _{PP} |
| Line Regulation | Minimum V _{IN} to maximum V _{IN} | | 0.05 | 0.1 | % |
| Load Regulation | NL to FL | | 0.05 | 0.1 | % |
| 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 _{OUT} = 8V, I _{OUT} = 1A | | 79 | | % |
| Isolation Voltage (1 min.) | | | 1500 | | Vdc |
| Isolation Resistance | | | 10 ⁹ | | Ω |
| Isolation Capacitance | | | 80 | | pF |
| Switching Frequency | | 300 | 320 | 333 | kHz |

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) | | | | |

¹ Measured without external filter. When the recommended filter is used, a reduction by a factor of 5 or more is achieved. See Figure 5.

² In applications where the -V_{OUT} is loaded more than +V_{OUT}, a minimum load is required between +V_{OUT} and GND. If the load is connected between +V_{OUT} and -V_{OUT}, no minimum load is required.

³ Contact factory for -55° to +85°C operating temperature range.

⁴ The maximum input current at any given input range measured at minimum input voltage is given as 1.6*I_{NOMINAL}. Nominal input current is the typical value measured at the input of the converter under full-load room temperature and nominal input voltage (12V_{IN}).

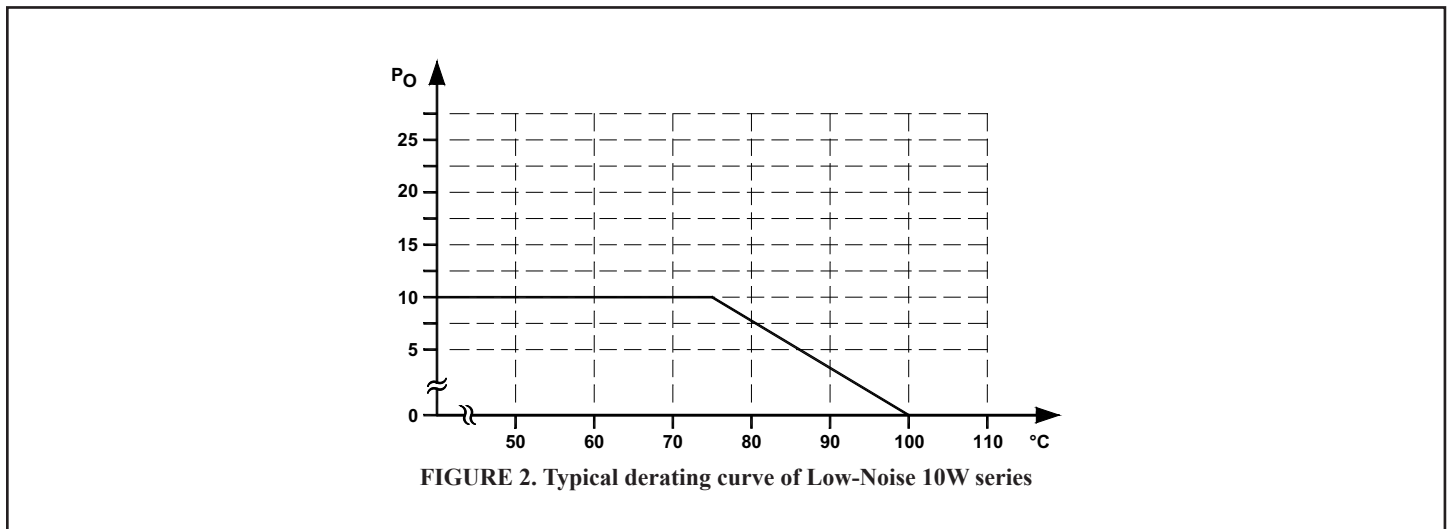
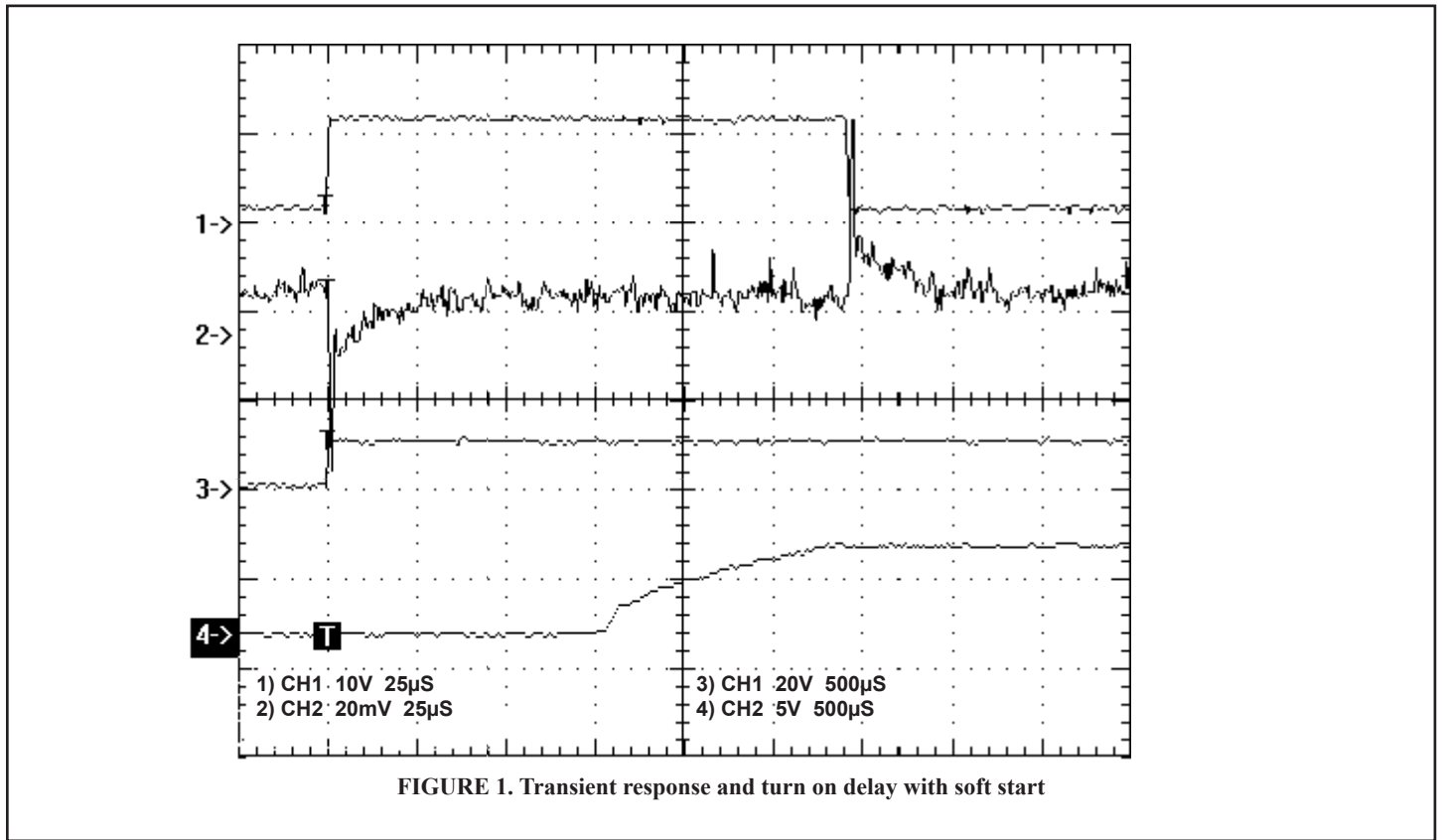
⁵ Adequate insulation is to be provided to the converters at the end usage as per applicable requirements.

⁶ Temperature rise on the case of the converters is to be considered during the end usage as per applicable requirements.

ENVIRONMENTAL SPECIFICATIONS

| PARAMETER | CONDITION / NOTE | MIN | TYP | MAX | UNIT |
|--|--|-----|-------------------|------|----------------------|
| Operating Temperature, Industrial (Ambient)* | See Figure 2 | -40 | | +85 | °C |
| Storage Temperature Range | | -55 | | +125 | °C |
| Thermal Resistance | | | 3.5 | 4 | °C/W _{DISS} |
| Maximum Operating Case Temperature | | | | 105 | °C |
| Derating | See Figure 2 | | | | |
| 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 |

* See footnotes 3, 4, 5 and 6



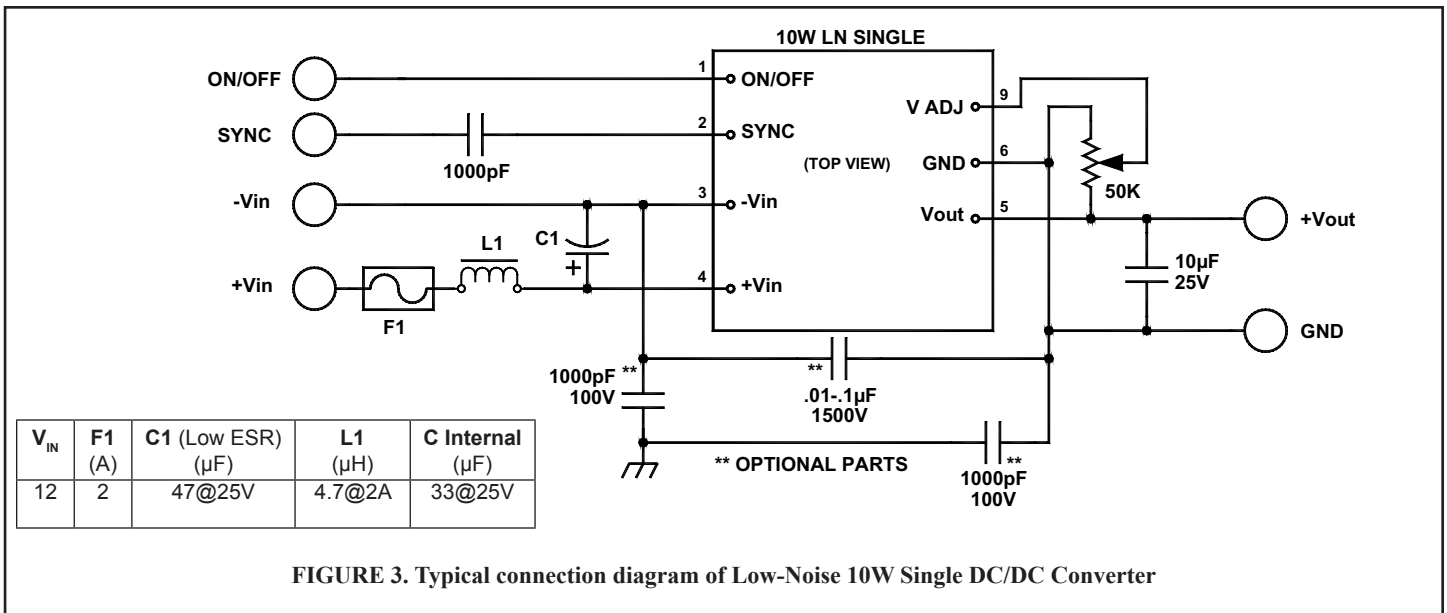
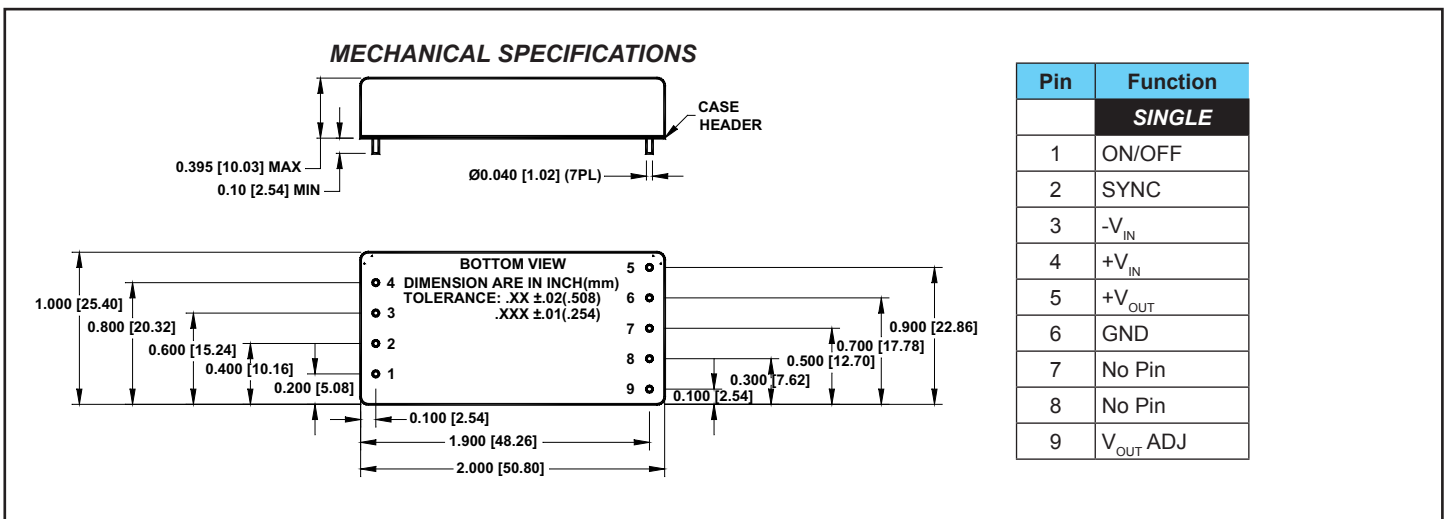


FIGURE 3. Typical connection diagram of Low-Noise 10W Single DC/DC Converter



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 (0kΩ–200kΩ 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 (50kΩ–500kΩ 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 50kΩ–100kΩ 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% ±20%. Please refer to *Application Note DC-005: Synchronization* for more information.