LN10012X

Low-Noise 8W Single DC/DC Converter

$12V_{IN}$, 5 to $8V_{OUT}$@1A

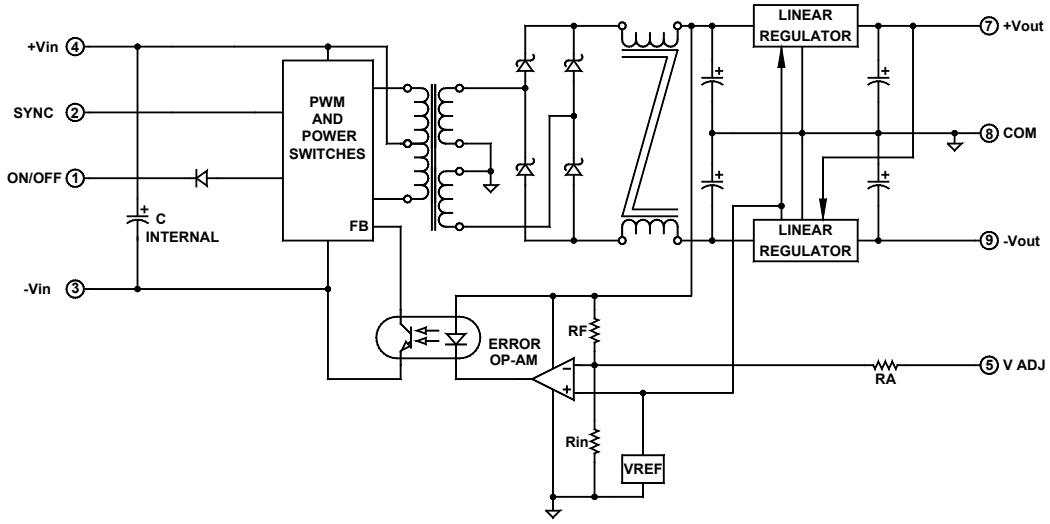
US Patent 5,777,519

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
- 5µS 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°C to +85°C.



Typical Block Diagram

Electrical Specifications

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

INPUT SPECIFICATIONS

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

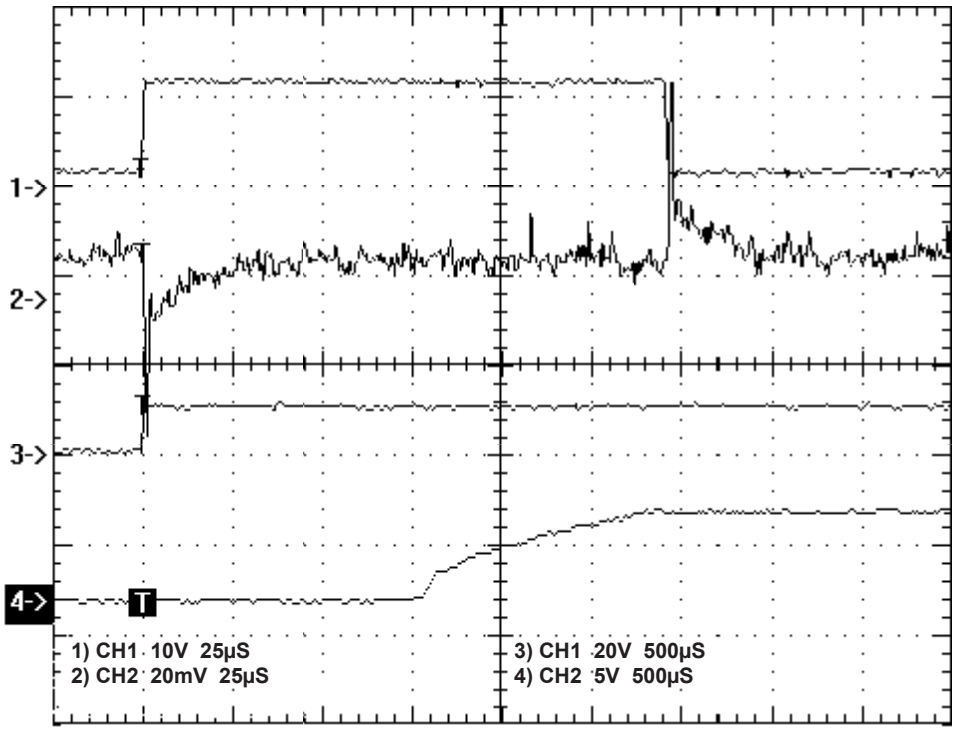


FIGURE 1. Transient response and turn on delay with soft start

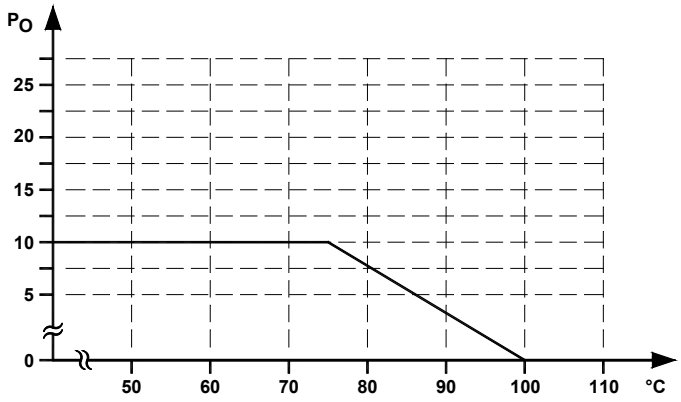
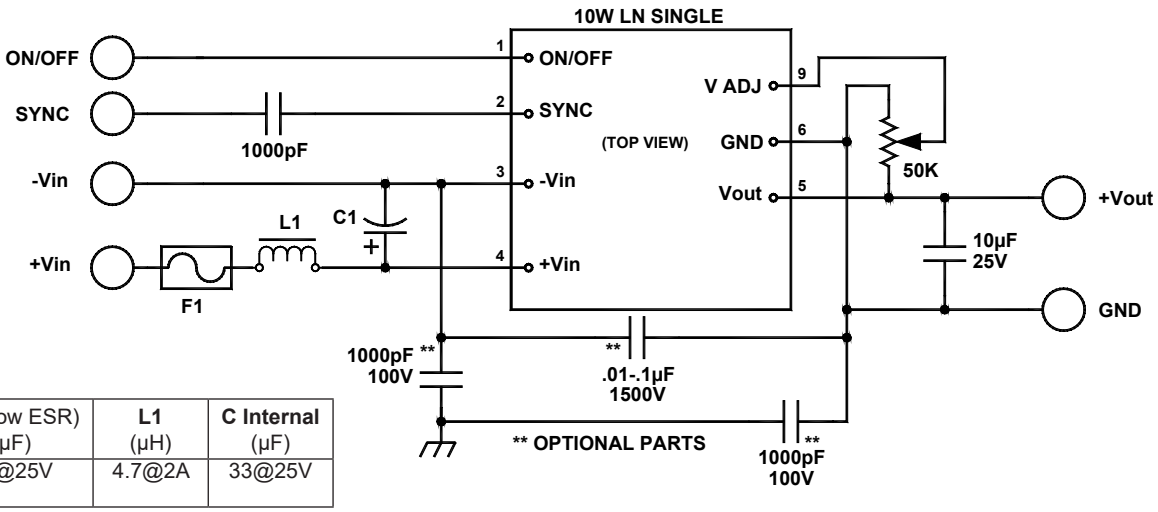


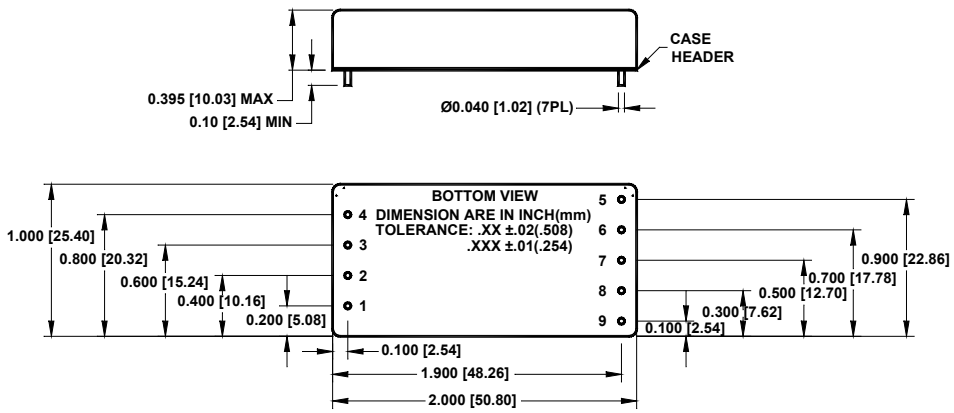
FIGURE 2. Typical derating curve of Low-Noise 10W series



V_{IN}	F1 (A)	C1 (Low ESR) (µF)	L1 (µH)	C Internal (µF)
12	2	47@25V	4.7@2A	33@25V

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

MECHANICAL SPECIFICATIONS



Pin	Function
	SINGLE
1	ON/OFF
2	SYNC
3	$-V_{IN}$
4	$+V_{IN}$
5	$+V_{OUT}$
6	GND
7	No Pin
8	No Pin
9	V_{OUT} ADJ

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.