



# LN10019

## LOW-NOISE 10W SINGLE DC/DC CONVERTER

No Derating from  $-40^{\circ}\text{C}$  to  $+75^{\circ}\text{C}$

US Patent 5,777,519

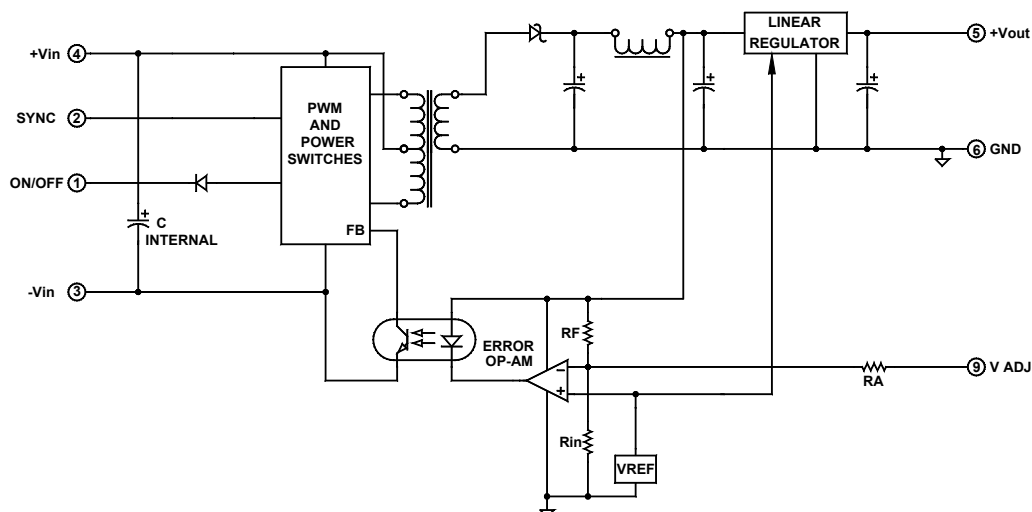
### Key Features

- Wide input voltage range (4:1)
- Less than 10mV output noise
- 75% efficiency
- Six-sided shielding
- Soft start
- Single output
- Short circuit protection
- Adjustable output
- 750 $\mu\text{A}$  off state current
- 250mV dropout linear regulators
- 5 $\mu\text{s}$  transient response
- Industry pinouts



### Functional Description

The LN10019 is an isolated, single DC/DC converter with an input voltage range from  $9V_{IN}$  to  $36V_{IN}$  and an output voltage of  $5V_{OUT}@2A$ . The converter's design is based on Beta Dyne's patents and offers low noise and an extended operating temperature range from  $-40^{\circ}\text{C}$  to  $+75^{\circ}\text{C}$ .



Typical Block Diagram of Single 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	24	36	Vdc
Input Filter	C				
No Load Input Current			10		mA
Full Load Input Current			560		mA
Reverse Polarity Input Current	External series-blocking diode			12	A
Input Surge Current (20µs Spike)				10	A
Short Circuit Current Limit			150		% I <sub>IN</sub>
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			5		Vdc
Output Voltage Accuracy			±1	±1.5	%
Output Voltage Adjustment			3	±5	%
Output Current			2		A
Ripple & Noise	See Figure 3		5	10	mV <sub>pp</sub>
Line Regulation	Minimum V <sub>IN</sub> to maximum V <sub>IN</sub>		0.05	0.1	%
Load Regulation	NL to FL		0.05	0.1	%
Temperature Coefficient @ FL			0.02		%/°C of V <sub>OUT</sub>
Transient Response Time (to within 0.5% of V <sub>OUT</sub> )	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			75		%
Isolation Voltage (1 min.)			1500		Vdc
Isolation Resistance			10 <sup>9</sup>		Ω
Isolation Capacitance			80		pF
Switching Frequency		300	320	333	kHz

### ENVIRONMENTAL SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Operating Temperature, Extended (X)		-40		+75	°C
Storage Temperature Range		-55		+125	°C
Thermal Resistance			3.5	4	°C/W <sub>DISS</sub>
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 <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	1.04 oz. (30g)				
Case Material	Coated metal				
Shielding Connection	- Input (Pin 3)				

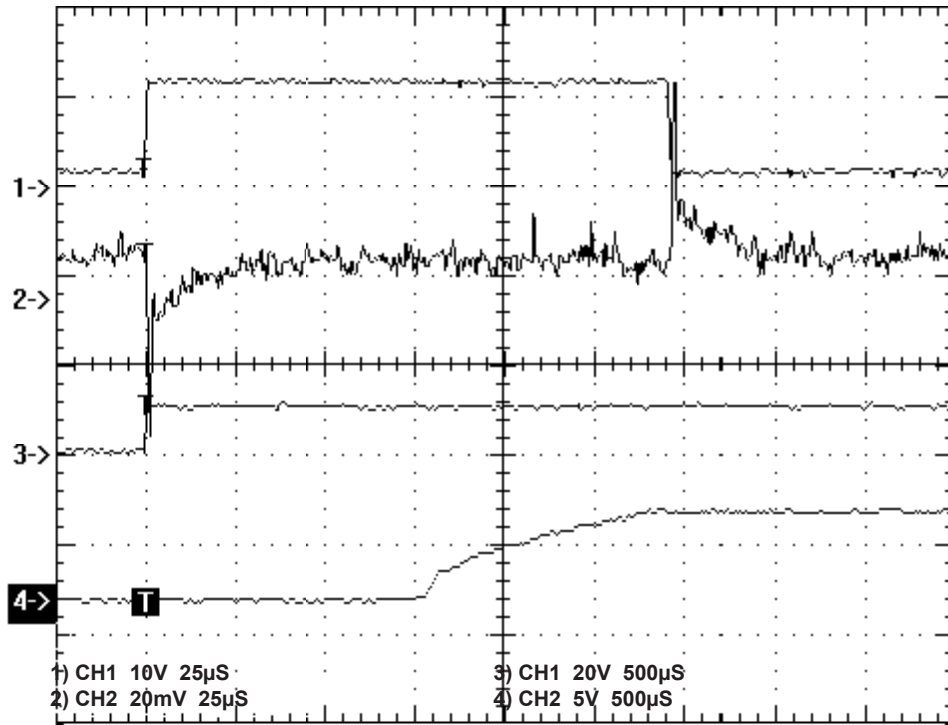


FIGURE 1. Transient response and turn on delay with soft start

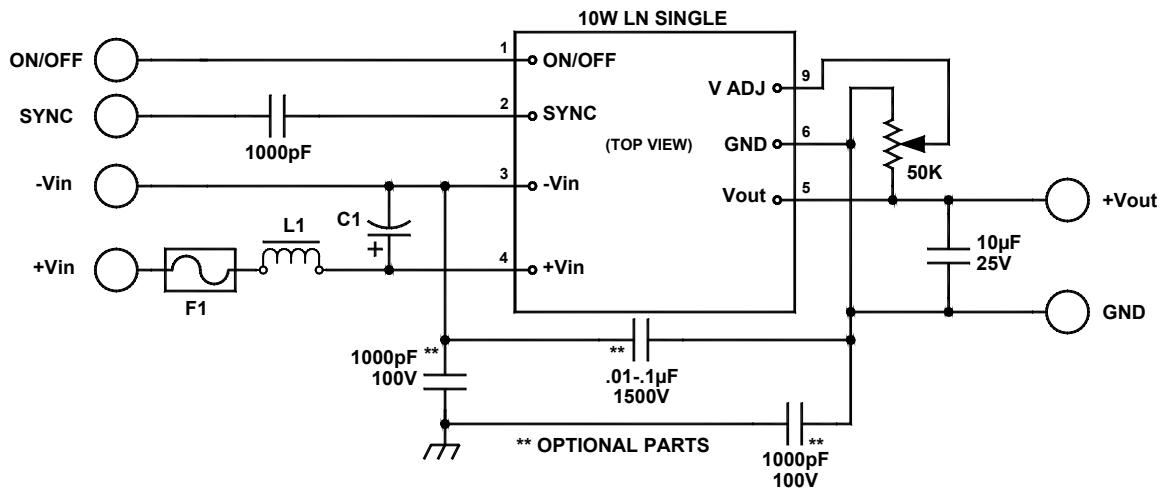
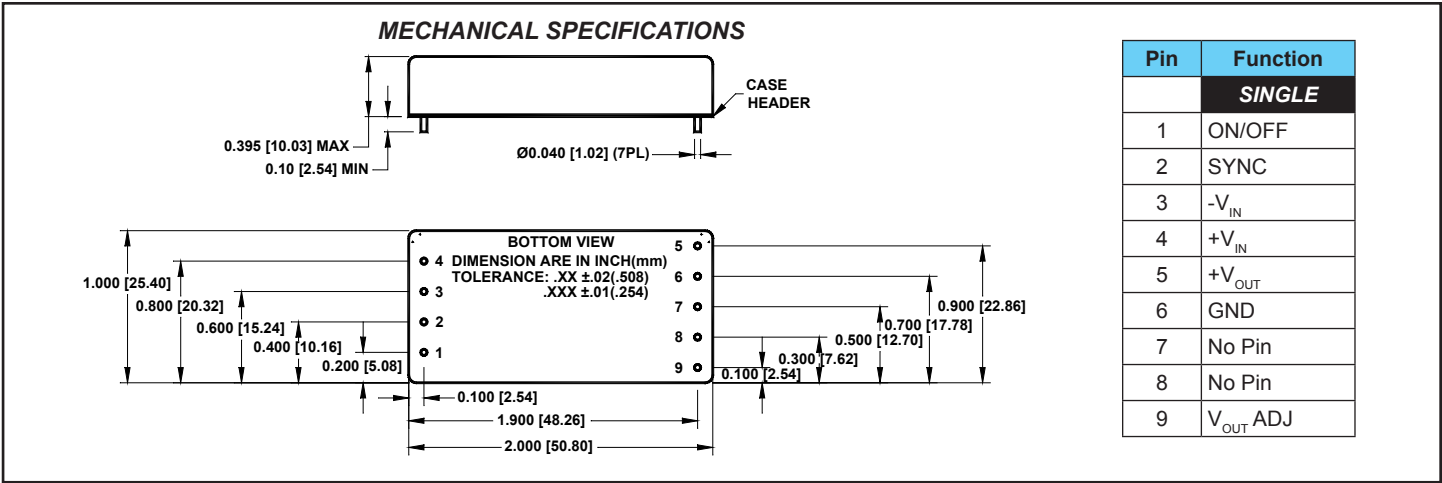


FIGURE 2. Typical connection diagram of Low-Noise 10W Single DC/DC Converter



**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<sub>OUT</sub> (Pin 6) and V<sub>OUT</sub> Adjust (Pin 9) for the singles, and COM (Pin 8) and V<sub>OUT</sub> Adjust (Pin 5) for the duals. To trim the output voltage low, connect a 1% resistor (50kΩ–500kΩ range) between +V<sub>OUT</sub> (Pin 5) and V<sub>OUT</sub> Adjust (Pin 9) for the singles,

and +V<sub>OUT</sub> (Pin 7) and V<sub>OUT</sub> Adjust (Pin 5) for the duals.

With the wiper connected to the V<sub>OUT</sub> Adjust pin, a variable resistor (potentiometer) can also be used for V<sub>OUT</sub> adjustment by connecting each end to +V<sub>OUT</sub> and -V<sub>OUT</sub> for the singles, and +V<sub>OUT</sub> 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.

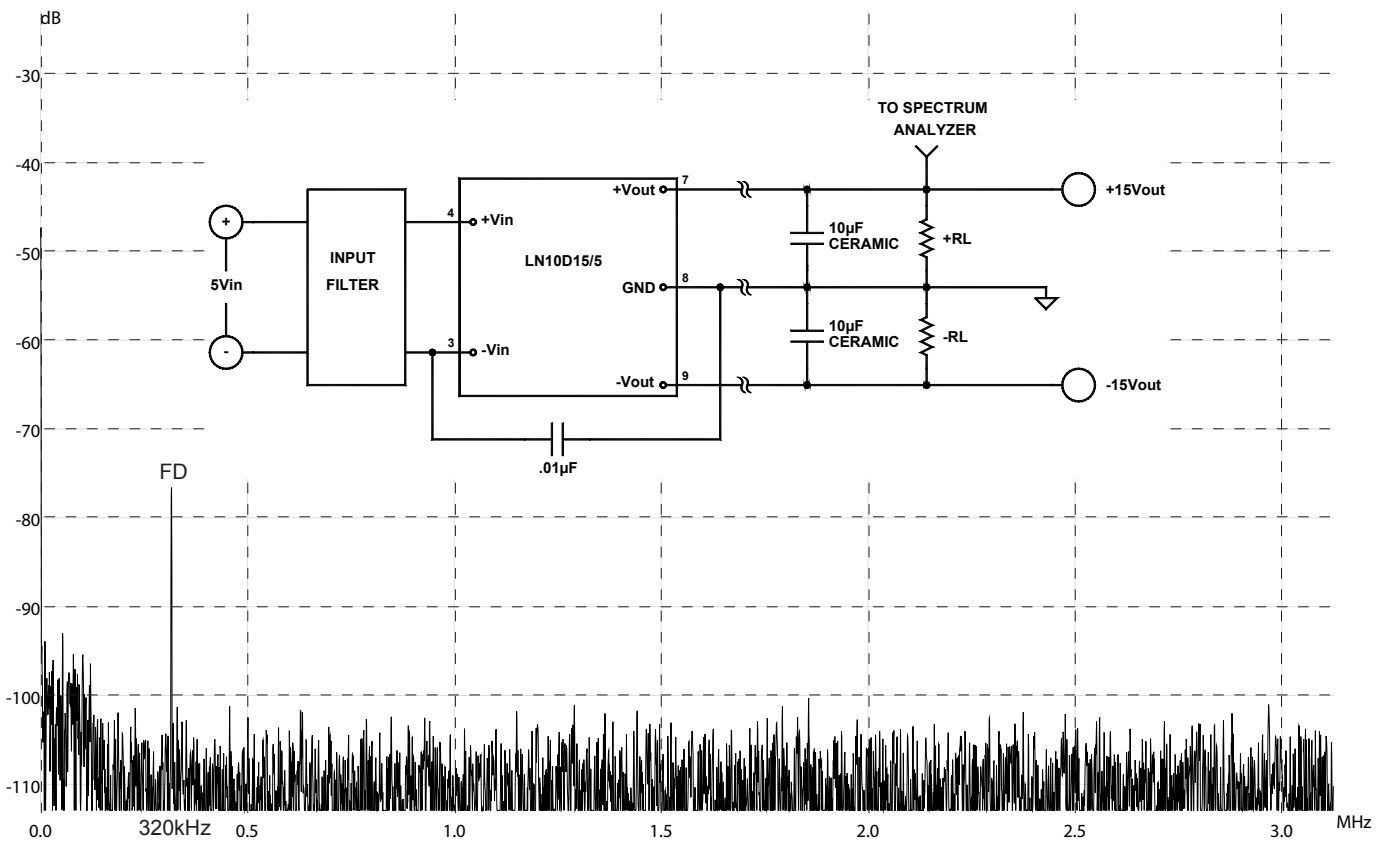


FIGURE 3. Setup and reading for output voltage noise spectrum

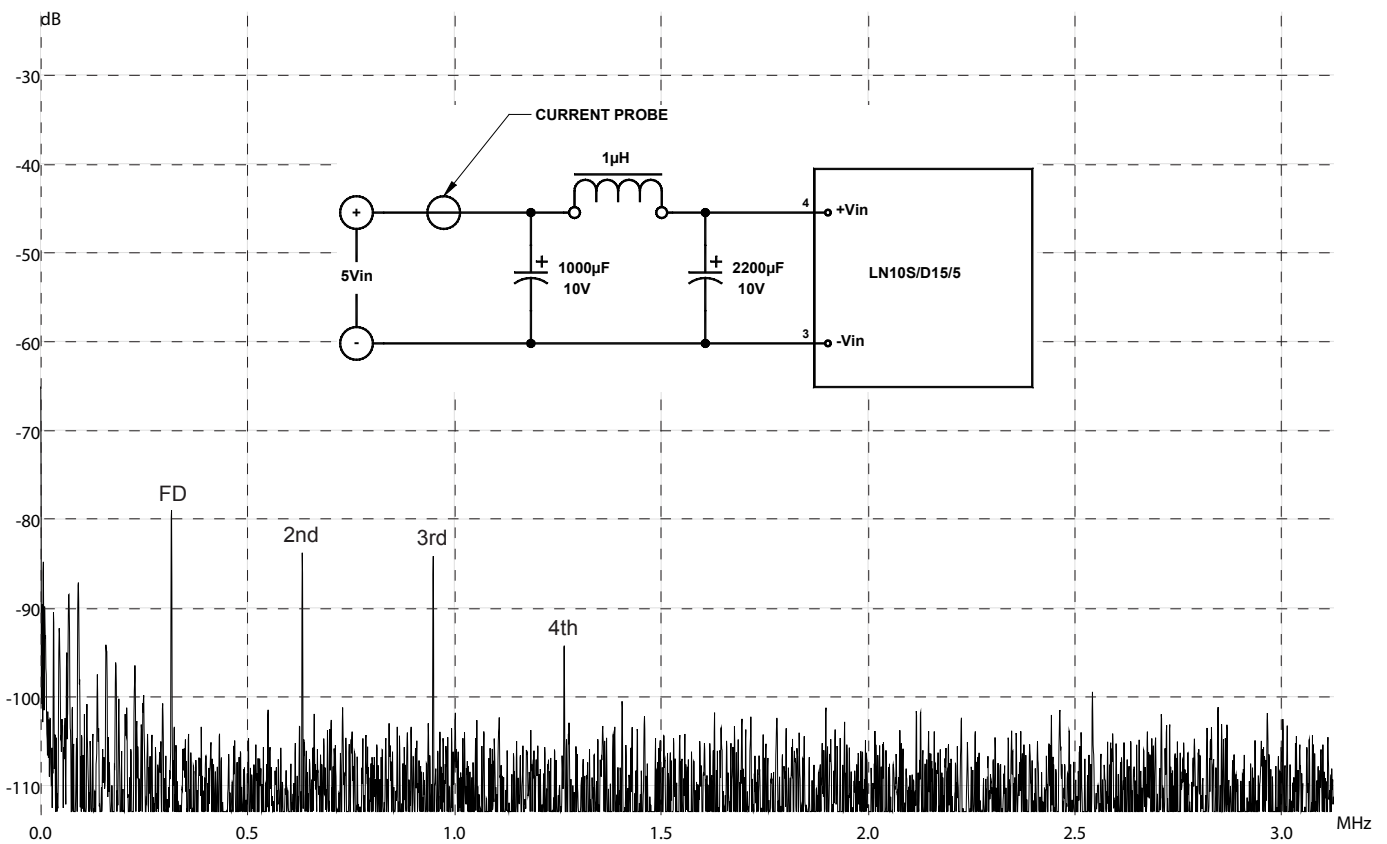


FIGURE 4. Setup and reading for reflected ripple current