



# LN10023

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

18-36 V<sub>IN</sub> 3.3/-3.3 VDC OUT @1.5A

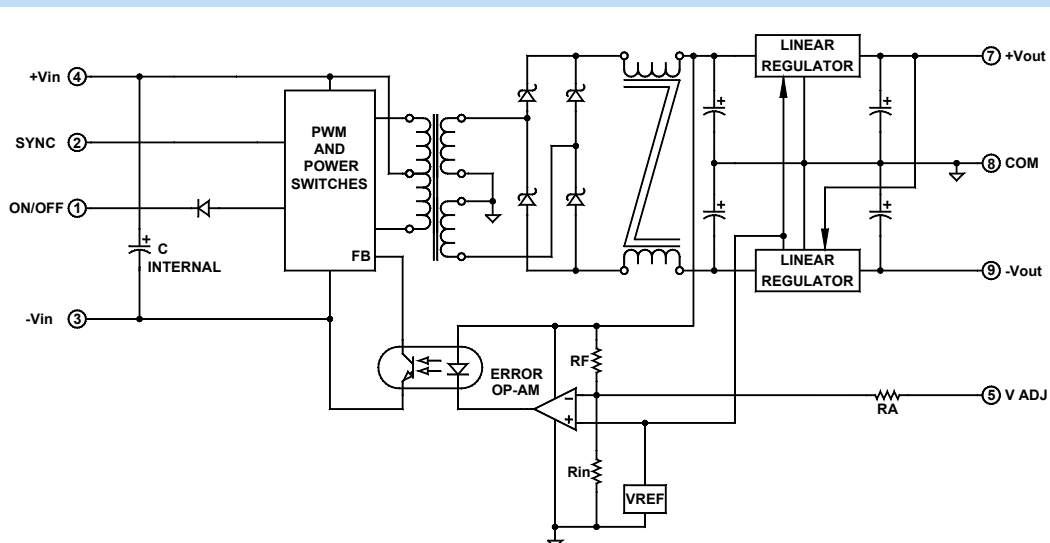
### Key Features

- Less than 10mV output noise
- Six-sided shielding
- Soft start
- Dual output
- Short circuit protection
- Adjustable output
- 750 $\mu$ A off state current
- 250mV dropout linear regulators
- Dual output tracking linear regulator
- 5 $\mu$ S transient response
- Industry pinouts



### Functional Description

The LN10023 is a dual output, isolated DC/DC converter that accepts 18 to 35V<sub>IN</sub>, and provides 3.3V<sub>OUT</sub>@1.5A and -3.3 V<sub>OUT</sub> @1.5A. The converter's design is based on Beta Dyne's patents and offers low noise and an extended operating temperature range from -25°C to +72°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		18	24	36	Vdc
No Load Input Current			30		mA
Full Load Input Current@ $V_{IN}=15V$	$V_{OUT}=6V @ 1.5A$ , $-V_{OUT}=-8V @ 200mA$		1600		mA
Input Filter	C				
Reverse Polarity Input Current	External series-blocking diode			12	A
Input Surge Current (20 $\mu$ S Spike)				10	A
Short Circuit Current Limit			150		% $I_{IN}$
Undervoltage Shutdown		4.5			Vdc
Off State Current			750		$\mu$ A
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 +Vo	Pin 7(+) to Pin 8 (-)		3.3		Vdc
Output Voltage -Vo	Pin 8 (+) to Pin 9 (-)		-3.3		Vdc
Output Voltage Accuracy			$\pm 1$	$\pm 1.5$	%
Output Voltage Adjustment			3	$\pm 5$	%
Voltage Balance, Dual <sup>1</sup>			$\pm 0.5$	$\pm 1.0$	%
Output Current +Vo	FL		1.5		A
Output Current -Vo			-1.5		mA
Minimum Load <sup>1</sup>		10			% of FL
Ripple & Noise	See Figure 3		10	20	mV <sub>PP</sub>
Line Regulation	Minimum $V_{IN}$ to maximum $V_{IN}$		0.05	0.1	%
Load Regulation <sup>2</sup>			$\pm 1$		%
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		$\mu$ S
Short Circuit Protection	All outputs, by input current limiting				

<sup>1</sup> 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.

<sup>2</sup> For dual converters if only the  $-V_{OUT}$  is loaded. A 10% FL must be connected from  $+V_{OUT}$  to Ground.

### GENERAL SPECIFICATIONS

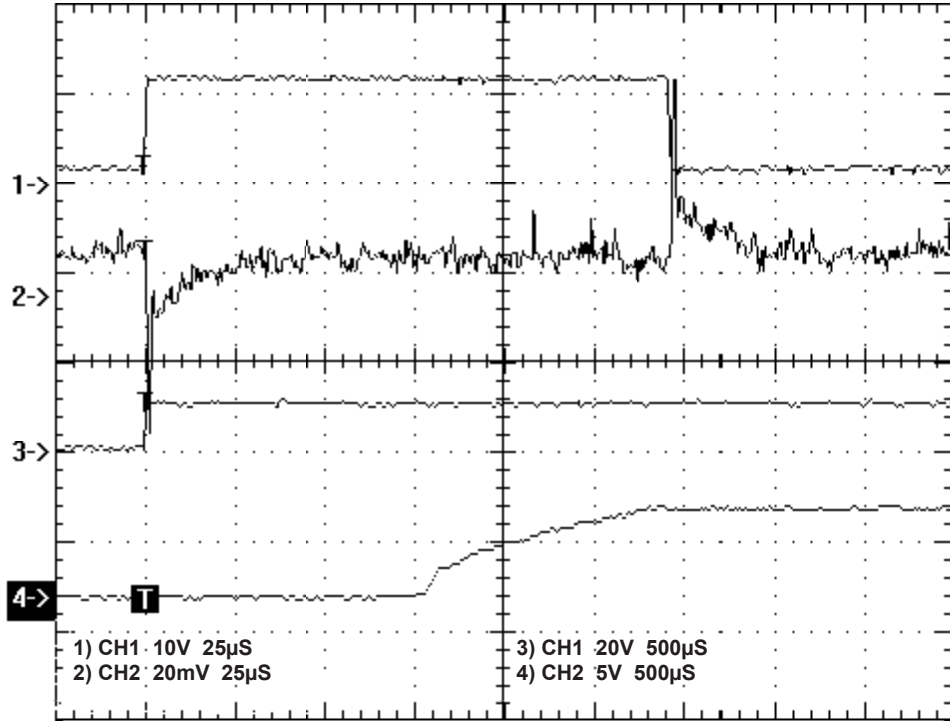
PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Efficiency	$V=28V$ , $I=\pm 250mA$		70		%
Isolation Voltage (1 min.)			1500		Vdc
Isolation Resistance			$10^9$		$\Omega$
Isolation Capacitance			80		pF
Switching Frequency		300	320	333	kHz

### ENVIRONMENTAL SPECIFICATIONS

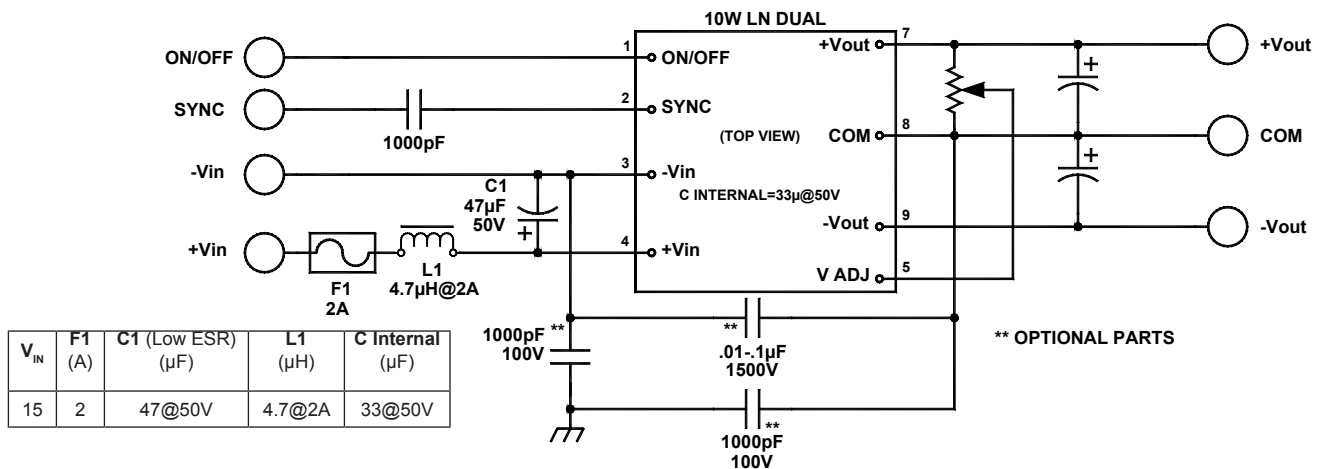
PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Operating Temperature, Extended (X)		-25		+72	°C
Storage Temperature Range		-55		+125	°C
Thermal Resistance			3.5	4	°C/W <sub>DISS</sub>
Maximum Operating Case Temperature				105	°C
Humidity	Up to 95% non-condensing				
Cooling	Free-air convection				
EMI/RFI	Six-sided continuous shielded metal case				
MTBF	per MIL-HNBK-217F (Ground benign, +25°C)		$1 \times 10^6$		hours

**PHYSICAL CHARACTERISTICS**

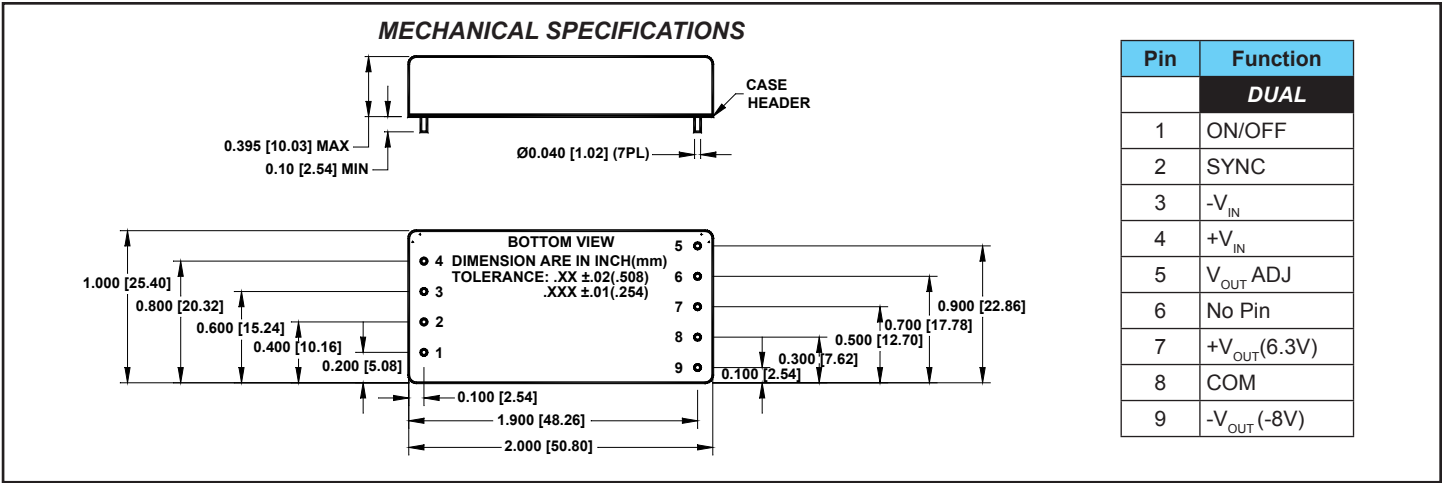
PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Dimensions (L×W×H)	2.00×1.00×0.395 in. (50.80×25.40×10.03mm)				
Weight	1.04 oz. (30g)				
Case Material	Coated metal				
Shielding Connection	-Input (Pin 3)				



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



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



**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.

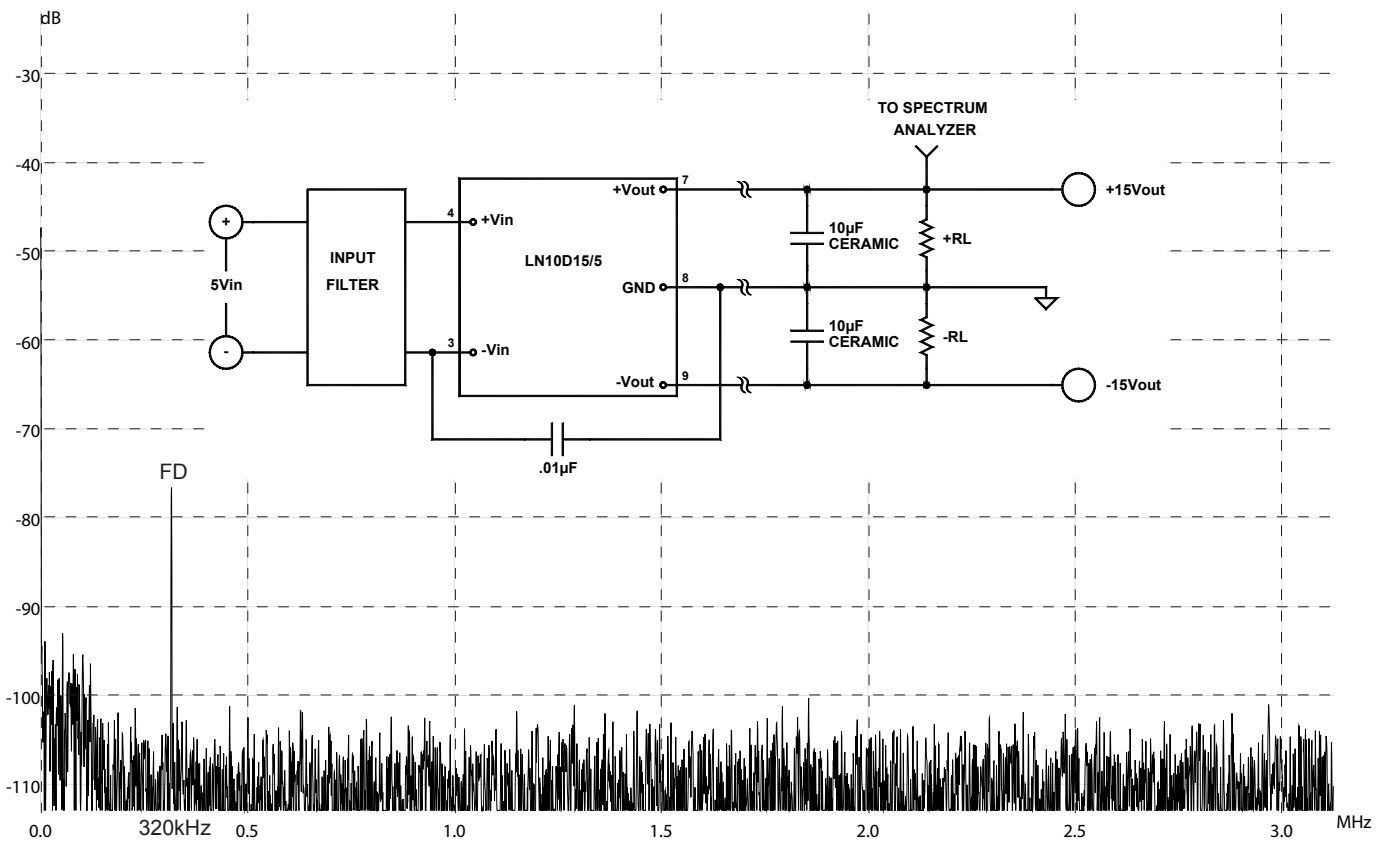


FIGURE 3. Setup and reading for output voltage noise spectrum

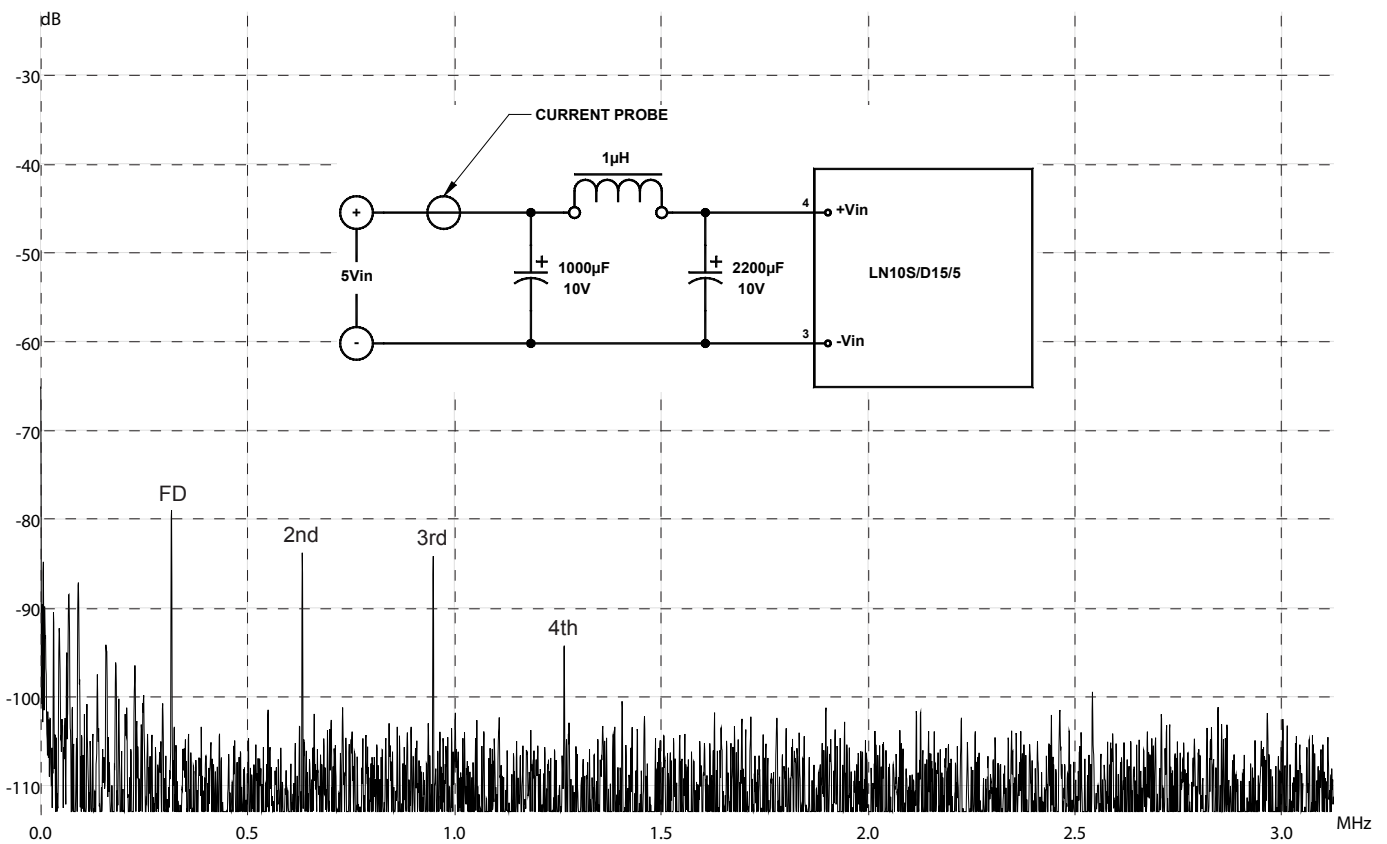


FIGURE 4. Setup and reading for reflected ripple current