

**LT3002**

# Micropower No-Opto Isolated Flyback Converter with 65V/3.5A Switch

## DESCRIPTION

Demonstration circuit 3077A is a compact no-opto isolated flyback converter featuring the [LT®3002](#). The DC3077A outputs 12V and maintains tight regulation with a load current from 5mA up to 1.1A over an input voltage from 10V to 30V. The output current capability increases with the input voltage, as shown in the Performance Summary table.

Transformer leakage inductance causes a voltage spike on the primary side after the power switch turns off. The leakage inductance spike is limited within the MOSFET's voltage rating of 65V with an RC snubber and a TVS clamp which damp the ringing and clamp the MOSFET drain voltage to a safe level.

The Performance Summary table summarizes the performance of the demo board at room temperature. The DC3077A demo circuit can be easily modified for different applications with some pre-designed transformers.

The LT3002 data sheet gives a complete description of the part, operation and application information. The data sheet must be read in conjunction with this quick start guide for demo circuit 3077A.

**[Design files for this circuit board are available.](#)**

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## PERFORMANCE SUMMARY Specifications are at T<sub>A</sub> = 25°C

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage		10	12	30	V
Output Voltage	I <sub>OUT(MIN)</sub> = 5mA	11.4	12	12.6	V
Maximum Output Current	V <sub>IN</sub> = 10V	0.6			A
	V <sub>IN</sub> = 12V	0.7			A
	V <sub>IN</sub> = 24V	1.0			A
	V <sub>IN</sub> = 30V	1.1			A
Output Voltage Ripple (Peak to Peak)	V <sub>IN</sub> = 24V, I <sub>OUT</sub> = 1A		70		mV
Efficiency	V <sub>IN</sub> = 10V, I <sub>OUT</sub> = 0.6A		89.45		%
	V <sub>IN</sub> = 12V, I <sub>OUT</sub> = 0.7A		89.81		%
	V <sub>IN</sub> = 24V, I <sub>OUT</sub> = 1A		90.76		%
	V <sub>IN</sub> = 30V, I <sub>OUT</sub> = 1.1A		90.67		%

## QUICK START PROCEDURE

Demonstration circuit 3077A is easy to set up to evaluate the performance of the LT3002. Refer Figure 1re 1 for proper measurement equipment setup and follow the procedure below.

1. With power off, connect the input power supply to the board through  $V_{IN}$  (E1) and GND (E2) terminals. Connect the load to the terminals  $V_{OUT}^{+}$  (E3) and  $V_{OUT}^{-}$  (E4) on the board.

2. Turn on the power at the input. Increase  $V_{IN}$  slowly to 10V.

**NOTE:** Make sure that the input voltage is always within spec. To operate the board with higher input/output voltage, input capacitor, output capacitor and output diode with higher voltage ratings might be needed.

3. Check for the proper output voltages. The output should be regulated at 12V ( $\pm 5\%$ ).

**NOTE:** The LT3002 requires very small minimum load to maintain a good output voltage regulation. A Zener diode is placed on the output to clamp the voltage to 13V. This Zener can be replaced with a 2.4k resistor at the trade-off of slightly lower efficiency.

4. Once the proper output voltage is established, adjust the input voltage and load current within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters.

**NOTE:** When measuring the input or output voltage ripples, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage ripple by touching the probe tip directly across the  $V_{IN}$  (E1) and GND (E2), or  $V_{OUT}^{+}$  (E3) and  $V_{OUT}^{-}$  (E4) terminals. See Figure 2 for proper scope probe technique.

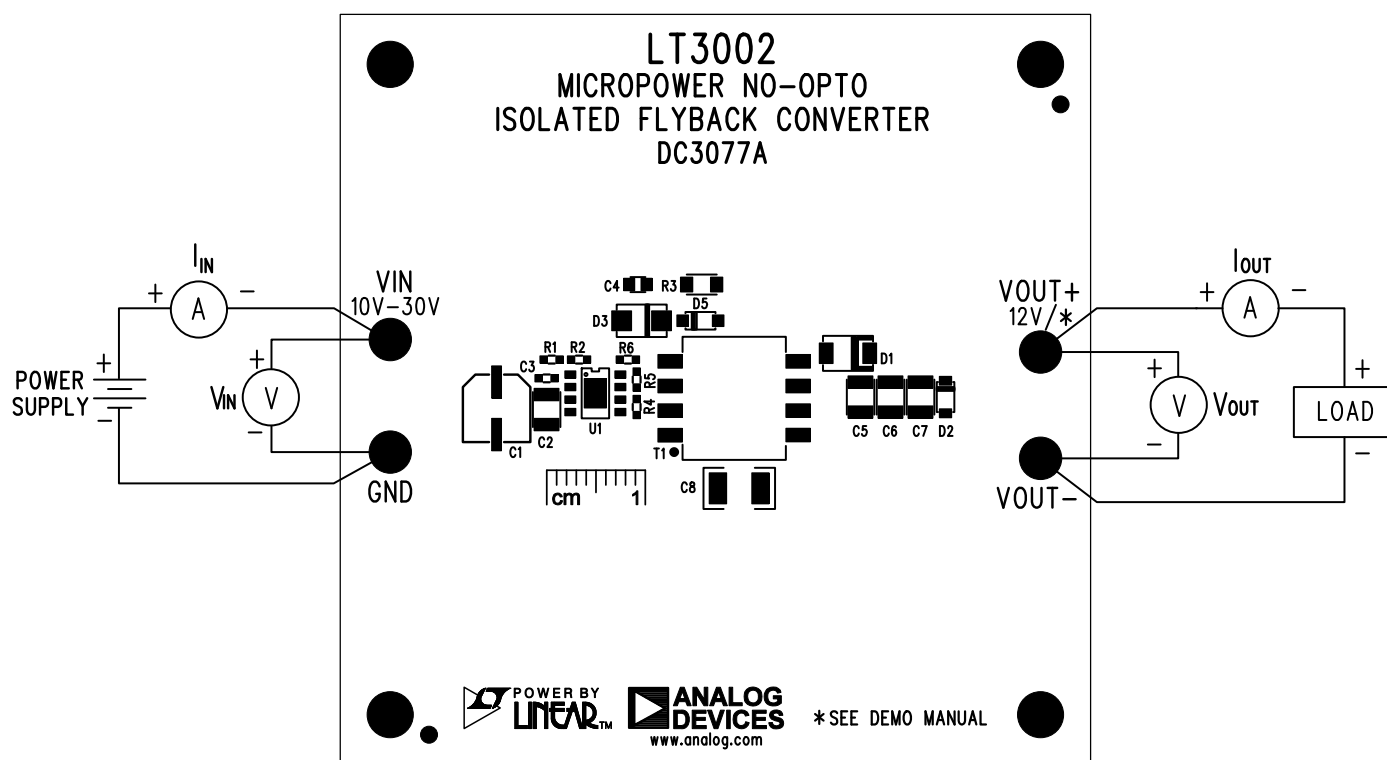


Figure 1. Proper Measurement Equipment Setup

# QUICK START PROCEDURE

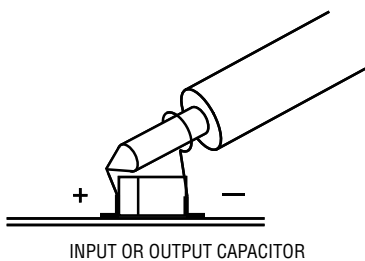


Figure 2. Proper Scope Probe Placement for Measuring Input or Output Ripple

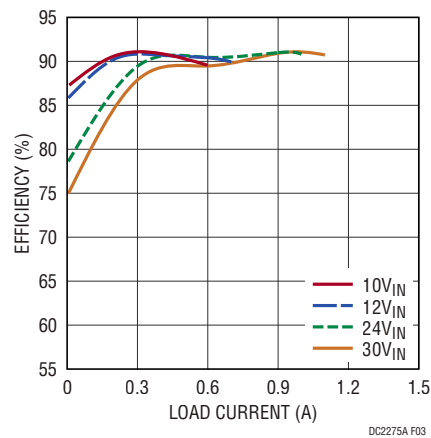


Figure 3. Typical Efficiency Curves

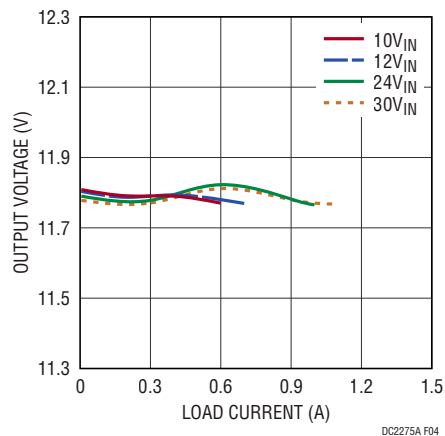


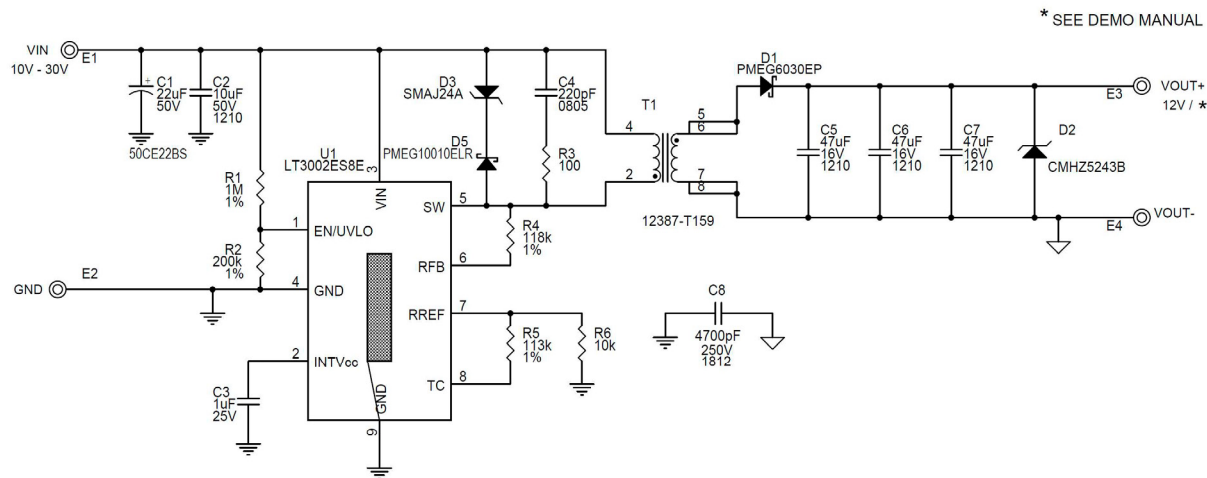
Figure 4. Regulation Curves

# DEMO MANUAL DC3077A

## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	1	C1	CAP, 22 $\mu$ F, ALUM, 50V, 20%, SMD 6.3mm $\times$ 6.0mm	SUN ELECTRONIC, 50CE22BS
2	1	C2	CAP, 10 $\mu$ F, X7R, 50V, 10%, 1210	AVX, 0603YD225MAT2A
3	1	C3	CAP, 1 $\mu$ F, X7R, 25V, 10%, 0603	TAIYO YUDEN, TMK107B7105KA-T
4	1	C4	CAP, 220pF, C0G, 50V, 5%, 0805	AVX, 08055A221JAT2A
5	3	C5, C6, C7	CAP, 47 $\mu$ F, X5R, 16V, 10%, 1210	AVX, 1210YD476KAT2A
6	1	C8	CAP, 4700pF, X7R, 250V, 10%, 1812	MURATA, GA343DR7GD472KW01L
7	1	D1	DIODE, SCHOTTKY, 60V, 3A,S OD-128, AEC-Q101	NEXPERIA, PMEG6030EP115
8	1	D2	DIODE, ZENER, 13V, 500mW, SOD-123	CENTRAL SEMI., CMHZ5243B
9	1	D3	DIODE, TVS, UNI-DIRECT, 24V, 400W, SMA	DIODES INC., SMAJ24A-13-F
10	1	D5	DIODE, SCHOTTKY, 100V, 1A, SOD-123W, AEC-Q101	NEXPERIA, PMEG10010ELR
11	1	R1	RES., 1M $\Omega$ , 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW06031M00FKEA
12	1	R2	RES., 200k, 1%, 1/10W, 0603	VISHAY, CRCW0603200KFKEA
13	1	R3	RES., 100 $\Omega$ ,1%,1/4W,1206,AEC-Q200	VISHAY, CRCW1206100RFKEA
14	1	R4	RES., 118k, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW0603118KFKEA
15	1	R5	RES., 113k, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW0603113KFKEA
16	1	R6	RES., 10k, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW060310K0FKEA
17	1	T1	TRANSFORMER, 1:1:1, Np: 8V – 36V, Ns: 12V, SMD, CEP1110	SUMIDA, 12387-T159 (CEP1110)
18	1	U1	IC, ISOLATED FLYBACK CONVERTER, SOIC-8	ANALOG DEVICES, LT3002ES8E#TRPBF
<b>Hardware</b>				
19	4	E1, E2, E3, E4	TEST POINT, TURRET, 0.094" MTG. HOLE, PCB 0.062" THK	MILL-MAX, 2501-2-00-80-00-00-07-0
20	4	MP1, MP2, MP3, MP4	STANDOFF, NYLON, SNAP-ON, 0.375"	KEYSTONE, 8832

## SCHEMATIC DIAGRAM



# DEMO MANUAL DC3077A

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## ESD Caution

**ESD (electrostatic discharge) sensitive device.** Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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